Gordon Site

MacLellan Site

LYNN LAKE GOLD PROJECT

ENVIRONMENTAL IMPACT STATEMENT

MAY 2020

VOLUME 2:

EIS

10.0 - Fish and Fish Habitat
11.0 - Vegetation and Wetlands
12.0 - Wildlife and Wildlife Habitat
13.0 - Labour and Economy
14.0 - Community Services and Infrastructure
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Alamos Gold Inc.

Stantec

Lynn Lake Gold Project Environmental Impact Statement Chapter 10 - Assessment of Potential Effects on Fish and Fish Habitat

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Acronyms and Abbreviations

Alamos	Alamos Gold Inc.
BC	British Columbia
BMI	benthic macroinvertebrate
CCME	Canadian Council of Ministers of the Environment
CEQG	Canadian environmental quality guidelines
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPUE	catch per unit effort
DFO	Fisheries and Oceans Canada
ECCC	Environment and Climate Change Canada
EEM	environmental effects monitoring
EIS	Environmental Impact Statement
EPT	Ephemeroptera, Plecoptera, and Trichoptera
ETMA	East Tailings Management Area
HDPE	high-density polyethylene
HSI	hepatosomatic index
ISQG	interim sediment quality guidelines
LAA	Local Assessment Area
LiDAR	light detection and ranging
LLGP/the Project	Lynn Lake Gold Project
MAD	mean annual discharge
MCC	Manitoba Conservation and Climate
MDMER	Metal and Diamond Mining Effluent Regulations
MMER	Metal Mining Effluent Regulations

MRSA	mine rock storage area
MSD	Manitoba Sustainable Development (now MCC)
MWQSOG	Manitoba Water Quality Standards, Objectives, and Guidelines
NTS	national topographic system
NTU	nephelometric turbidity units
PDA	Project Development Area
PEL	probable effect levels
POPC	parameters of potential concern
RAA	Regional Assessment Area
SARA	*Species at Risk Act*
SE	standard error
TK	traditional knowledge
TLRU	traditional land and resource use
TMF	tailings management facility
TSS	total suspended solids
US EPA	United States Environmental Protection Agency
VC	valued component
WUA	weighted useable area
w/w	wet weight

10.0 ASSESSMENT OF POTENTIAL EFFECTS ON FISH AND FISH HABITAT

Fish and Fish Habitat was selected as a valued component (VC) because fish and fish habitat, and the productivity of the fisheries that they support, are valued by Indigenous communities, the public, and other stakeholders and are protected in Canada by the *Fisheries Act*. Fish and fish habitat provide cultural, economic, recreational, and aesthetic values to the surrounding communities. Fish and fish habitat also contribute to biodiversity and are indicators of aquatic ecosystem health. The Project may affect fish and fish habitat because of potential changes to water quantity and quality, and habitat quantity and quality. These changes could affect fish community composition, population abundance and individual fish health directly or indirectly through effects to lower trophic communities.

For this assessment, 'fish' are defined as all parts and life history stages of fish, crustaceans, and shellfish, as defined in the *Fisheries Act*, and 'fish habitat' as water frequented by fish and any other areas on which fish depend, directly or indirectly, to carry out their life processes, including spawning grounds, and nursery, rearing, food supply and migration areas.

Fish and fish habitat are linked to other VCs, including:

- Surface water (Chapter 9): changes in surface water quantity and quality may affect fish health and fish habitat area or quality and fish health and mortality. Surface water is linked to Groundwater (Chapter 8).
- Land and resource use (Chapter 14): and traditional land and resources (Chapter 16): changes in fish and fish habitat may affect fish harvesting for commercial, recreational, and/or Indigenous subsistence and cultural purposes.
- Human health (Chapter 17): changes in fish tissue metals concentrations, which may result from releases of contact water and sediment from mine rock or tailings stockpiles, may affect the health of human consumers of fish. Potential effects of changes to fish tissue metals concentrations on fish health and mortality (lethal and sub-lethal effects) are assessed in this chapter.

10.1 SCOPE OF ASSESSMENT

The scope of the assessment of potential effects to the Fish and Fish Habitat VC was guided by the federal Environmental Impact Statement (EIS) Guidelines (Appendix 4A), the Manitoba Sustainable Development (now Manitoba Conservation and Climate; MCC) *Environment Act* Proposal Report Guidelines, as well as the relevant federal and provincial laws, regulations, and guidelines protecting fish and fish habitat in Canada and Manitoba.

In addition to regulations, policies, and guidelines, this section describes how engagement with the public and local Indigenous communities has influenced the scope of the assessment; the understanding of potential effects and pathways between the Project and fish and fish habitat during all phases of the Project;

measurable parameters to be used to quantify potential effects of the Project on fish and fish habitat; spatial and temporal boundaries of the assessment; and the approach for characterizing and determining the significance of residual effects.

10.1.1 Regulatory and Policy Setting

The following sections describe the federal and provincial regulations and guidelines that govern the management and protection of fish and fish habitat in Canada and Manitoba.

10.1.1.1 Federal

Fisheries Act

The federal *Fisheries Act* is administered by Fisheries and Oceans Canada (DFO) except where noted. The purpose of the *Fisheries Act* is to provide a framework for the "proper management and control of fisheries and the conservation and protection of fish and fish habitat, including by preventing pollution". To do so, the Fisheries Act includes the following prohibitions:

- Sections 34(2) provides provisions for maintaining adequate flow and passage of fish.
- Section 34.4(1) of the *Fisheries Act* prohibits any work, undertaking or activity, other than fishing, that results in the death of fish"
- Section 35(1) of the *Fisheries Act* prohibits the carrying on of a work, undertaking or activity that results in the harmful alteration, disruption, or destruction (HADD) of fish habitat
- Section 36(3) of the Fisheries Act prohibits the deposit of deleterious substances of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance may enter such water

The Fish and Fish Habitat Protection Policy Statement (DFO 2019a) provides guidance on how DFO interprets and implements the fish and fish habitat protection provisions in the *Fisheries Act*. The Policy applies to proponents of existing or proposed works, undertakings, or activities that may result in harmful impacts to fish or fish habitat, specifically the death of fish by means other than fishing or the harmful alteration, disruption, or destruction of fish habitat.

Metal and Diamond Mining Effluent Regulations

Section 36 of the federal *Fisheries Act* prohibits the deposition of deleterious substances into waters frequented by fish in Canada unless authorized by regulation. The Metal and Diamond Mining Effluent Regulation (MDMER), promulgated under the *Fisheries Act,* regulates the deposit of deleterious mine effluents, tailings, and waste rock into waters frequented by fish and is administered on behalf of DFO by Environment and Climate Change Canada (ECCC), the MDMER defines mine effluent as:

> *"(a) hydrometallurgical facility effluent, milling facility effluent, mine water effluent, tailings impoundment area effluent, treatment pond effluent or treatment facility effluent other than effluent*

> *from a sewage treatment facility; or (b) any seepage or surface runoff containing any deleterious substance that flows over, through or out of the site of a mine."*

The MDMER applies to metal and diamond mines with an effluent flow rate of greater than 50 m^3/d based on effluent deposited from all final discharge points of the mine. For these mines, the MDMER allows the discharge of mine effluent containing deleterious substances as long as the effluent is not acutely lethal, the pH is equal to or greater than 6.0, but not greater than 9.5, and concentrations of deleterious substances do not exceed concentration limits identified in Schedule 4 of the MDMER at the final discharge point(s). Schedule 4 of the MDMER prescribes "end-of-pipe" discharge limits for arsenic, copper, cyanide, lead, nickel, zinc, total suspended solids (TSS), and radium-226 in metal and diamond mine effluent in Canada. The current and future MDMER effluent limits for new mines are provided in Chapter 9, Table 9-1. Also pursuant to the MDMER, all mines and recognized closed mines are required to conduct acute lethality testing of final effluent, effluent characterization, and Environmental Effects Monitoring (EEM) in the downstream receiving environment in three-year cycles.

The MDMER includes the phasing-in of more stringent effluent discharge limits than the previous *Metal Mine Effluent Regulations* (MMER) for deleterious substances for new and existing mines, a new effluent discharge limit for unionized ammonia, and the requirement that effluent be non-acutely lethal to *Daphnia magna*, all of which come into force on June 1, 2021. Existing mines are metal and diamond mines (not recognized closed mines) that were subject to MMER after June 6, 2002 and have continued commercial operation. New mines are metal and diamond mines that begin commercial operation within three years of the amended MDMER coming-into-force on June 1, 2021 (i.e., mines which begin operation on or after June 1, 2018) or, in the case of a recognized closed mine, that return to commercial operation on or after June 1, 2021. The more stringent future effluent limits for new mines have been considered in this assessment based on the assumption that the Project will not be in commercial operation before June 1, 2021.

Deposition of acutely lethal mine effluent, tailings, and waste rock into waterbodies frequented by fish is prohibited by the *Fisheries Act* unless those waterbodies are designated as a Mine Waste Disposal Area by the Parliament of Canada and listed in Schedule 2 of the MDMER. Amendment of Schedule 2 of the MDMER is not anticipated for the Project. This is because the tailings management facility (TMF) and mine rock storage areas (MRSA) have been sited away from fish-bearing waterbodies and watercourses.

Species at Risk Act

The federal *Species at Risk Act* (SARA) provides protection and mandates recovery strategies and action plans for extirpated, endangered, or threatened species in Canada, while managing species of special concern to prevent further declines. DFO administers SARA for aquatic species listed on SARA Schedule 1. Species at risk are added to Schedule 1, the official list of species at risk, through a federal government process after receiving scientific information and recommendations from the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Each species is classified as extirpated, endangered, threatened, or special concern. Species listed on Schedule 1 are subject to protection and recovery measures.

The upper Churchill River populations of lake sturgeon are part of the western Hudson Bay populations of lake sturgeon that are classified as “endangered” by COSEWIC. However, they are not currently included under SARA Schedule 1 (Government of Canada 2019) or listed by the Manitoba Conservation Data Centre (MB CDC 2015).

Canadian Environmental Quality Guidelines

The Canadian Council of Ministers of the Environment (CCME) maintains the Canadian Environmental Quality Guidelines, which include tissue residue guidelines for the protection of wildlife that consume fish. There are guidelines for methylmercury and four organic compounds. The fish tissue guideline for methylmercury for the protection of wildlife that consume fish is 33 µg/Kg (wet weight); guidelines for the four organic compounds are not provided here because they are not produced by mines. The Canadian Environmental Quality Guidelines also include water quality guidelines for the protection of aquatic life; these guidelines are described in detail in Chapter 9.

DFO Ecological Flow Requirements

The Framework for Assessing Ecological Flow Requirements to Support Fisheries in Canada (DFO 2013) provides guidance on the management of flows required to maintain the ecological functions that sustain fisheries in streams and rivers potentially affected by flow withdrawals. The guidance promotes the maintenance of natural flow regimes to sustain riverine ecosystems, with the understanding that the probability of degrading riverine ecosystems increases with increasing alteration of the natural flow regime. To manage this risk in Canadian rivers and streams, the Framework for Assessing Ecological Flow Requirements to Support Fisheries in Canada (DFO 2013) recommends that assessment of alterations to the natural flow regime should be considered in a cumulative sense, not just on a project-by-project basis, and that:

- Cumulative flow alterations less than 10% in amplitude of the actual “instantaneous” flow in the river relative to a “natural flow regime” have a low probability of detectable effects to ecosystems that support commercial, recreational, or Aboriginal fisheries. Such projects can be assessed with “desk-top” methods.
- Cumulative flow alterations that result in instantaneous flows less than 30% of the mean annual discharge (MAD) have a heightened risk of impacts to fisheries.
- For cumulative flow alterations greater than 10% of instantaneous discharge or that results in flows less than 30% of MAD, a more rigorous level of assessment is recommended to evaluate potential impacts on ecosystem functions which support fisheries.
- If the "natural flow regime” must be calculated with hydrologic modelling, it is recommended that data with the finest available time scale be used.
- Floor value or “cut-off limit” should be part of the overall prescription to conserve and protect fisheries and should not simply be considered during low-flow events.

- Given the inherent uncertainty in many ecological flow setting methods, the use of adaptive management based on long-term and follow-up monitoring with multiple control locations is recommended.

10.1.1.2 Provincial

The Environment Act

Alterations to stream channels that affect fish mobility and/or fish habitat and works resulting in modification to lake or river levels for a water surface area greater than 2 km^2 are considered Class 2 developments under section 3(9) of the Classes of Development Regulations pursuant to *The Environment Act* of Manitoba (Chapter 1). Consequently, any proposed alteration to streams in Manitoba is subject to provincial assessment and licensing requirements.

The Fisheries Act

The Manitoba provincial government administers commercial fishing in Manitoba under regulations made under *The Fisheries Act*. These regulations identify restricted species and areas, licence types, and allowable gear types. The Project is in the Northeast Region of Manitoba's Department of Conservation and Climate (MCC).

The Water Rights Act

The Water Rights Act, administered by MCC, regulates the use or diversion of water in Manitoba. Section 9 requires consideration of flows required to protect and maintain aquatic ecosystems during water licensing and allows the Minister to suspend or restrict water rights under a license if the available flow is insufficient to protect aquatic ecosystems, based on scientific information. Section 14.1 allows the Minister to undertake investigations into groundwater and instream flows to determine whether insufficient flows are negatively affecting aquatic ecosystems.

The Water Protection Act

The Water Protection Act, administered by MCC, provides for the protection of freshwater biota and human and wildlife consumers of fish. The Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOG) lists water quality and tissue residue guidelines, which are set out in the *Water Quality Standards, Objectives, and Guidelines Regulation*. The MWQSOG lists tissue residue guidelines for human consumers of fish for arsenic (3,500 µg/Kg), fluoride (150,000 µg/Kg), lead (500 µg/Kg), and mercury (500 µg/Kg). The MWQSOG has the same guidelines for the protection of wildlife consumers of fish for methylmercury and the four organic compounds as the Canadian Environmental Quality Guidelines. The MWQSOG also include water quality guidelines for the protection of aquatic life; these guidelines are described in detail in Chapter 9, Table 9-2.

The Mine and Minerals Act

Under the *Mines and Minerals Act,* water that is removed from the workings under a mine lease must be disposed of safely and securely. Regulation 67/99 of the Act stipulates requirements for restoration of watercourses during mine closure.

The Water Resources Conservation Act

The Water Resources Conservation Act requires that the removal of water from Manitoba's water basins is not done in quantities that could, individually or collectively, have significant adverse effects on the ecological integrity of Manitoba's water resources or their associated ecosystems.

Manitoba Lake Sturgeon Management Strategy--2012

The Manitoba Lake Sturgeon Management Strategy—2012 (CWSFB 2012) is the only fisheries management strategy relevant to the Project. Its goals include ensuring that existing populations are protected from depletion and, in areas with suitable habitat, restoring lake sturgeon (*Acipenser fulvescens*) populations to levels where they can be considered stable and self-sustaining.

Lake sturgeon in the upper Churchill River represent Lake Sturgeon Management Unit 2, which extends from the Saskatchewan border to the Missi Falls Control Structure at the outlet of South Indian Lake; the Project is located within the Management Unit. Population density in the upper Churchill River is currently low and recovery potential appears to be limited by lack of adult brood stock (CWSFB 2012). Stocking may be an effective, and possibly the only, recovery tool available, if a genetically suitable population can be identified to provide spawn (CWSFB 2012).

10.1.2 The Influence of Engagement on the Assessment

Engagement has been ongoing prior to and throughout the EIS process, and will continue with local Indigenous communities, stakeholders, the public, and government agencies through the life of the Project. More detail on the Engagement process can be found in Chapter 3.

Engagement feedback related to fish and fish habitat has been addressed through direct responses, updates to baseline information, and in the EIS, as appropriate. Key feedback that influenced the fish and fish habitat effects assessment is provided below.

10.1.2.1 Indigenous and Public Engagement

As part of the information sharing throughout the engagement process, Project-related information was provided by Indigenous communities in the form of traditional land and resource use (TLRU) studies and other forms of information sharing.

A Project-specific TLRU study was completed collaboratively with Marcel Colomb First Nation with a final report provided to the community on January 11, 2018 (Stantec 2018). The TLRU study included interviews with participants selected by Marcel Colomb First Nation regarding traditional land use in the Project area, including availability of traditional resources, access to traditional resources or areas, occupancy, cultural sites and areas, and experience of TLRU.

A Project-specific TLRU study was completed in collaboration with Peter Ballantyne Cree Nation but has not yet been released by community leadership for use in the environmental assessment. The TLRU study included interviews with community members in Kinoosao, Saskatchewan.

A TLRU study (Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project) was completed by an independent consultant for the Manitoba Metis Federation (SVS 2020), the results of which were received in February 2020. The study documents harvesting and land use by the Manitoba Métis Community within a 100 km radius of the Project.

During the March 26, 2015 Winnipeg community meeting and in their TLRU study (Stantec 2018; Chapter 17), Marcel Colomb First Nation indicated their concern that the Project could result a decrease in fish and/or other aquatic species, and could potentially affect fish populations traditionally harvested by its members due to an increase in non-members using land and resources.

During engagement with the Barren Lands First Nation, Manitoba Metis Federation, Mathias Colomb Cree Nation, Nisichawayasihk Cree Nation, O-Pipon-Na-Piwin Cree Nation, and Peter Ballantyne Cree Nation, potential Project effects on fish and aquatic resources were identified as a key concern and are outlined in Chapter 3. In addition, the Mathias Colomb Cree Nation, Nisichawayasihk Cree Nation, O-Pipon-Na-Piwin Cree Nation, Barren Lands First Nation, Northlands Denesuline First Nation, and Sayisi Dene First Nation raised concerns about potential effects of the Project on water quality and subsequent effects on fish and fish habitat (Chapter 3). These concerns included effects of the Project on water quality (e.g., runoff or seepage from tailings) as well as the potential for a transient work force to leave garbage on lands and in waterways (Manitoba Metis Federation 2020). Potential effects of the Project on water quality and fish and aquatic resources is included in this assessment.

The Mathias Colomb Cree Nation (2017) expressed concern that increased fish harvesting could occur due to people moving into the Lynn Lake area for employment at the mine. This change could affect traditional fishing activities. The Manitoba Metis Federation (SVS 2020) also raised the issue of fish harvesting by workers. The community of Granville Lake (Mathias Colomb Cree Nation) stated that their community "is based on a strong fishing and trapping background and anything related to water and fish up to the Kewateen river [Keewatin River] was seen as a huge importance" (Chapter 3). The Final EIS guidelines require an assessment of potential increases in angling pressure due to the presence of the workforce. Worker conduct, including behaviour off the Project site, is discussed in Chapters 14 and 15.

Fishing and potential effects to fish were the most common concern identified by respondents at the May 1, 2017 public open house and the second most widely reported activity by respondents at the February 4, 2020 open house in Lynn Lake (Chapter 3). The primary concerns about potential effects of the Project on fish and fish habitat from engagement with Indigenous communities and the public were changes in water quality and change in fish abundance. These comments were considered when defining boundaries and significance thresholds of potential effects for Chapter 9 and this chapter.

10.1.2.2 Regulatory Engagement

Engagement with regulatory agencies included an on-site meeting in October 2017, submission of a Project Description to the CEA Agency (now the Impact Assessment Agency of Canada), DFO, ECCC, and the Province of Manitoba in 2017, and in-person meetings or conference calls with DFO on June 24, 2019 and January 23, 2020 and with ECCC on October 3 and October 23, 2019. Regulators raised many of the same concerns as Indigenous communities and the public, as well as additional concerns about potential effects to fish and fish habitat, including:

- Loss of fish habitat due to placement of Project components in and around fish habitat, particularly MRSAs and the TMF.
- Changes in flow that may alter fish habitat.
- Fish and fish habitat baseline information breadth.

Conceptual Project designs were revised following discussions with DFO and ECCC in September 2016 (Chapter 3, Section 3.1.2) to avoid spatial overlap between the TMF, MRSAs, topsoil stockpiles, or ore stockpiles and watercourses and waterbodies frequented by fish. Section 10.4.1 addresses permanent alteration and destruction of fish-bearing watercourses and waterbodies due to construction, operation, and decommissioning/closure of the Project. Potential effects of changes in streamflow on fish and fish habitat is also assessed in Section 10.4.1.

ECCC requested information on interactions between mine infrastructure and the waterbodies closest to mine infrastructure, including potential water quality changes (ECCC 2017). The Final EIS guidelines (Appendix 4A) include assessment of potential effects to fish and fish habitat due to changes to water quality caused by the Project. Effects of the Project on water quality are discussed in Chapter 9. The effects of potential changes in water quality on fish and aquatic biota are discussed in Section 10.4.2.

DFO requested identification, mapping, and quantification of the different types of fish habitat present and the fish assemblages using this habitat near both sites (DFO 2017). DFO also requested that stream habitat mapping include assessments during high and low flow conditions (discussed during June 24, 2019 and January 23, 2020 meetings). Existing conditions for fish and fish habitat are presented in Section 10.2.

Alamos submitted a paragraph 35(2)(b) *Fisheries Act* authorization application to DFO on August 26, 2019, prior to the coming-into-force of amendments of the Fisheries Act on August 28, 2019. DFO provided Alamos with a letter identifying outstanding information requirements in the application on October 23, 2019. Subsequently, Alamos submitted a series of technical memoranda to provide the outstanding information requirements within 180 days of receiving this letter. Upon review of these memoranda, DFO determined that Alamos' application remained incomplete and that Alamos' application for a Section 35(2)(b) Fisheries Act authorization was refused. Consequently, Alamos will submit a new *Fisheries Act* authorization application under the amended *Fisheries Act*.

10.1.2.3 Influence of Traditional Knowledge and Land-Use

As part of the engagement process, Indigenous communities provided Project-related information in the form of traditional knowledge (TK) and TLRU studies. These are reported in Chapter 17, Appendix 17B. TK and TLRU have been incorporated in the Existing Conditions for Fish and Fish habitat in Section 10.2.

Fish have long been a year-round staple food source for Marcel Colomb First Nation. Fish species of importance to the Marcel Colomb First Nation (Stantec 2018) include: lake trout (*Salvelinus namaycush*), goldeye (*Hiodon tergisus*), sucker (*Catastomus sp.*), trout (unidentified species), sturgeon (lake sturgeon), northern pike (*Esox lucius*, also called jackfish), lake whitefish (*Coregonus clupeaformis*, also called tullibee), and walleye (*Sander vitreus*, also called pickerel). Fishing grounds of importance to the Marcel Colomb First Nation (Stantec 2018), currently or historically, include but are not limited to:

- Cockeram Lake: northern pike, lake whitefish, and walleye.
- Hughes River, Hughes Lake and Chepil Lake: lake sturgeon.
- Hughes Lake: walleye.
- Swede, Simpson, and Ellystan lakes: lake whitefish.
- Muskeg Lake: lake sturgeon and lake whitefish.
- Eden Lake: walleye, northern pike, and lake whitefish.
- Barrington Lake: lake trout.
- Cartwright and Anson lakes: walleye, northern pike, suckers.
- Wetikoeekan (Sasquatch) Lake: lake whitefish, walleye, northern pike, and lake trout.

Marcel Colomb First Nation (Stantec 2018) reported that there have been, or currently are, commercial fisheries at Gallagher, Goldsand, Wells, Barrington, Swede, Simpson, Ellystan, and Dunsheath lakes. The commercial and food fishery at Dunsheath Lake is for walleye, northern pike, and lake whitefish, which are sold to the Co-op in Leaf Rapids and the Freshwater Fish Marketing Corporation in Winnipeg.

The Manitoba Metis Federation indicated that fishing was the harvesting activity most frequently identified by participants in the Project area (SVS 2020). Fish species of importance to the Manitoba Metis Federation include (SVS 2020): walleye, northern pike, yellow perch (*Perca flavescens*), lake whitefish, lake sturgeon, suckers, sauger (*Sander canadensis*), and rainbow trout (*Oncorhynchus mykiss*). Fishing grounds of importance to the Manitoba Metis Federation include but are not limited to:

- Cockeram, Sickle, and Granville lakes: walleye, northern pike, yellow perch, and lake sturgeon.
- Keewatin River: walleye, northern pike, lake whitefish.
- Hughes Lake: walleye, northern pike, yellow perch.

- Swede Lake: walleye, lake whitefish.
- Simpson Lake: walleye.

TK and TLRU data were generally supported by the fish distribution baseline study for the Project (Volume 4, Appendix J). However, the TK and TLRU data were the only source of information on the distribution of lake sturgeon, which were not targeted as part of the baseline study, and on fish community composition in lakes outside of the Gordon and MacLellan site Local Assessment Areas (LAAs; Section 10.1.4.1), such as Hughes Lake at the Gordon site and Sickle Lake downstream of the MacLellan site. The TK and TLRU data influenced the selection of focal fish species on this assessment: northern pike, lake whitefish, and walleye were the most widespread species that were frequently targeted by interviewees.

10.1.2.4 Influence of Local or Regional Management Objectives

Manitoba Fisheries Branch's mandate is to "ensure sustainable use of the fisheries resource" (MSD 2019). Goals under this mandate include ensuring "No Net Loss" of fish habitat quality or quantity and ensuring that an adequate supply of fish exists for Indigenous peoples to fish for food (MSD 2017). These over-arching objectives have been considered during this assessment and in the development of options for the offsetting plan required to counterbalance the unavoidable loss of fish habitat due to construction, operation, and closure of the Project.

10.1.3 Potential Effects, Pathways and Measurable Parameters

Two potential effects to fish and fish habitat may occur due to construction, operation, and decommissioning/closure of the Project: 1) change in fish habitat, including the potential permanent alteration or destruction of fish habitat; and 2) change in fish health, growth, and survival (Table 10-1).

Change in fish habitat was included as a potential effect because harmful alteration, disruption or destruction of fish habitat may occur, which is prohibited by section 35 of the *Fisheries Act*. Changes in fish habitat may occur due to physical destruction of habitat under various mine infrastructure components, loss of riparian vegetation, and alteration of lake levels or stream flows. Changes to fish habitat have the potential to affect the ability of fish to conduct one or more life stages, or alter the annual recruitment or production of fish, potentially resulting in a HADD of fish habitat.

Fish health, growth, or survival was included as a potential effect because carrying out a work, undertaking or activity other than fishing that results in the death of fish is prohibited by section 34.3(1) of the *Fisheries Act*. Changes in fish health, growth, and survival may occur due to changes in water quality or sediment quality due to release of mine effluent or contact water, mobilized sediment, impacts from blasting, and increased fishing pressure, or through changes to the composition, abundance, and distribution of periphyton, plankton, and benthic invertebrate communities.

This assessment focuses on Project activities or components that have the potential to adversely affect fish and fish habitat. Specifically, the assessment focuses on four fish species or groups of species that provide, or support recreation or Indigenous fisheries, and because their life histories and habitat requirements cover the range of life histories and habitat requirements for other fish species in the Gordon and MacLellan site

LAAs. Focusing the assessment on these species allows identification of potential interactions between the Project and the factors important to fish production in the LAAs. Focusing on these four species also enables identification of avoidance and mitigation measures that would reduce potential effects to most, if not all, fish species and their habitats. These focal species are:

- Northern pike: a large-bodied, piscivorous (fish-eating) species that is widespread and the top predatory fish species in the LAAs. Northern pike spawn in the spring in still or slow-moving water with aquatic vegetation or submerged terrestrial vegetation.
- Lake whitefish: a large-bodied, insectivorous species found in larger lakes in the LAAs and that is known to be an important fish species to Indigenous people (Section 10.2.2). Lake whitefish spawn in the fall in lakes or rivers with rocky (i.e., gravels, cobbles, or boulders) substrates.
- Walleye: a large-bodied, piscivorous species found in larger lakes in the LAAs and that is known to be an important fish species to Indigenous people (Section 10.2.2). Walleye spawn in the spring along lake shorelines and in rivers and streams with rocky substrates.
- Forage species: a guild of primarily small-bodied fish species that are prey for large-bodied, piscivorous fish such as walleye and northern pike. Brook stickleback (*Culaea inconstans*) are the most abundant and widespread forage fish species in the LAAs. However, this guild also includes spottail shiner (*Notropis hudsonius*), lake chub (*Couesius plumbeus*), white sucker (*Catastomus commersoni*), and slimy sculpin (*Cottus cognatus*), commonly found fish species in lakes and streams in the LAAs that are prey for northern pike and walleye. The Final EIS guidelines (Appendix 4A) require that predicted effects on lower trophic levels (such as forage fish) be assessed.

Table 10-1 Potential Effects, Effects Pathways and Measurable Parameters for Fish and Fish Habitat

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in fish habitat	• Change in physical habitat due to mine infrastructure • Altered lake levels and streamflow (timing, duration, volume) for surface water due to construction of water management facilities and open pits	• Habitat area (ha or m^2) • Monthly lake level (m) • Monthly streamflows (m^3/s) • Lake volume (m^3) • Lake littoral area (ha or m^2)
Change in fish health, growth, or survival	• Lethal effects due to dewatering, infilling, blasting, change in angling pressure, or entrainment in water intakes • Change in water quality parameters that influence habitat suitability: dissolved oxygen, temperature, total suspended solids	• Concentrations of dissolved oxygen (mg/L), TSS (mg/L), and temperature (°C) • Numbers of fish mortalities (by species and age class) • Fish community composition (species presence/absence) • Relative abundance of fish (CPUE)

Table 10-1 Potential Effects, Effects Pathways and Measurable Parameters for Fish and Fish Habitat

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
	• Chronic or acute toxicity effects due to changes in water and sediment quality from mine effluent releases	• Fish survival (mean age and age frequency distribution) • Fish condition (Length-weight relationship; condition factor) • Fish growth (length-at-age relationships) • Hepatosomatic index (HSI) • Fish tissue metal concentration (mg/kg)

10.1.4 Boundaries

10.1.4.1 Spatial Boundaries

Three spatial scales were used to assess potential effects of the Project on fish and fish habitat: a Project Development Area (PDA); a Local Assessment Area (LAA); and a Regional Assessment Area (RAA). These spatial boundaries are the same as for the Surface Water VC (Chapter 9).

Project Development Area

At the Gordon site, the PDA includes the two existing open pits, the diversion channel between Gordon and Farley lakes, and portions of Gordon and Farley lakes within a 30 m buffer around the site (Chapter 2, Map 2-1).

At the MacLellan site, the PDA includes East Pond and its outlet stream within 30 m of the site, the Keewatin River at the access road bridge crossing, the Dot Lake outlet at the existing access road, and the Keewatin River at the water intake and effluent discharge location (Chapter 2, Map 2-2).

Local Assessment Area

The LAAs for the Fish and Fish Habitat VC at the Gordon site includes the PDA and the waterbodies and watercourses near or downstream of the PDA where potential Project-related effects on fish and fish habitat may occur (Table 10-2). Measurable effects to fish and fish habitat are not expected to occur beyond Ellystan Lake at the Gordon site. Therefore, the LAA at the Gordon site is limited to the lakes and streams within the Ellystan Lake watershed (Map 10-1). These lakes and streams are:

- Gordon Lake
- Farley Lake
- Unnamed ponds draining to Farley Lake
- Pump Lake
- Simpson Lake
- Swede Lake

- Marie Lake
- Marnie Lake
- Ellystan Lake

Table 10-2 Rationale for Inclusion of Gordon Site LAA Waterbodies

Waterbody	Rationale
Gordon Lake and its inlets	• Adjacent to and upstream of the open pit • Downstream from overburden stockpile • Downstream from MRSA • Freshwater source for mine operation
Diversion channel and its tributary lake	• Channel will be realigned to allow expansion of the open pit
Wendy Pit	• Within the PDA, will be dewatered prior to expansion of the open pit
East Pit	• Within the PDA, will be dewatered prior to expansion of the open pit
Farley Lake	• Adjacent to and downstream of the open pit • Downstream from MRSA • Downstream from ore stockpiles • Will receive water from water treatment plant • Will receive pit water during dewatering • Will receive mine outflow post-closure
Marie Lake and its outlet to Farley Lake	• No potential direct effects but part of the Farley Lake watershed
Marnie Lake and its outlet to Farley Lake	• No potential direct effects but part of the Farley Lake watershed
Farley Creek[1]	• Fish-bearing stream draining Farley Lake to Swede Lake • Will receive pit water during dewatering, via Farley Lake • Potential changes in water quality and quantity due to mine construction and operation
Pump Lake and its outlet to Simpson Lake	• Lake located closest to MRSA • Access road crosses culverted outlet to Simpson Lake
Simpson Lake	• Downstream of Pump Lake
Swede Lake and its outlet to Ellystan Lake	• Downstream of Farley Lake
Ellystan Lake	• Downstream of Swede Lake
Susan Lake	• Headwater lake in second watershed near MRSA

Note: [1] Farley Creek is a local name given to the stream draining Farley Lake to Swede Lake; it is not a stream name in the Manitoba gazette

The LAA also includes Susan Lake, a headwater lake in the Hughes Lake watershed that may be affected by changes in groundwater quantity and quality due to construction and operation of the open pit and MRSA at the Gordon site.

The LAA at the MacLellan site includes the PDA and the waterbodies and watercourses near or downstream of the PDA where potential effects to fish and fish habitat may occur (Table 10-3). Measurable effects to fish and fish habitat are not expected to occur beyond Cockeram Lake at the MacLellan site. Therefore, the LAA at the MacLellan site includes the following components within the Cockeram Lake watershed (Map 10-2):

- Lobster Lake and its outlet and inlet tributaries
- Minton Lake sub-watershed of the Cockeram River
- Cockeram River from Lobster Lake to Cockeram Lake
- Payne Lake and its outlet to the Keewatin River
- Dot Lake and its outlet to the Keewatin River
- Unnamed tributaries to the Keewatin River that drain the PDA
- Keewatin River from the Payne Lake outlet to Cockeram Lake
- Cockeram Lake

Table 10-3 Rationale for Inclusion of MacLellan Site LAA Waterbodies

Waterbody	Rationale
Payne Lake and its inlet and outlet to Keewatin River	• Headwater lake in watershed downstream of TMF
East Pond and its outlet to Keewatin River	• Potential groundwater interaction with the open pit
Dot Lake and its outlet to Keewatin River	• Existing access road crosses outlet and will be altered during construction • Potential groundwater interaction with the open pit
Unnamed tributaries to Keewatin River east bank between Payne Lake outlet and PR 391	• One unnamed tributary will be downstream of the TMF and MRSA • One unnamed tributary will be downstream of the mine buildings
Keewatin River	• The water intake will be in the Keewatin River • The mine effluent pipe outlet will be in the Keewatin River • Closest waterbody to the open pit
Minton Lake and its inlets and outlet	• Downstream of the TMF and MRSA
Unnamed Lake downstream of Minton Lake	• Downstream of the TMF and MRSA
Lobster Lake	• No potential direct effects but part of the Cockeram River watershed
Cockeram River	• Downstream of the TMF and MRSA
Cockeram Lake	• Downstream of the TMF and MRSA • Downstream of the water treatment pipe outlet in the Keewatin River

Regional Assessment Area

The RAA includes the drainage area that encompasses the PDA, both LAAs, and the streams and lakes that drain the LAAs to a common downstream location at Granville Lake. It also includes upstream lakes and streams in the Keewatin River watershed to provide regional context for the lakes and streams within the LAAs. The RAA includes the Lynn River watershed, a tributary watershed of the Keewatin River, because of the potential cumulative effects of the former East Tailings Management Area (ETMA) on water quality in the Keewatin River, Cockeram Lake, and lakes and streams downstream to Granville Lake (Map 10-3). The RAA extends downstream to Granville Lake, the first lake downstream within which run-off from both sites meet. The RAA extends north to the upstream limits of the Keewatin and Hughes River watersheds to include other past, present, and reasonably foreseeable Projects that could interact cumulatively with effects of the Project and to provide regional context for Project-specific effects to fish and fish habitat.

10.1.4.2 Temporal Boundaries

The temporal boundaries for the Project consist of the following phases:

- Construction – two years (scheduled to be carried out concurrently from Year -2 to Year -1 at both sites).
- Operation – 13 years (scheduled to be carried out from Year 1 to Year 6 at the Gordon site and from Year 1 to Year 13 at the MacLellan site).
- Decommissioning/closure – five to six years of active closure (scheduled to begin in Year 6 at the Gordon site and in Year 14 at the MacLellan site). Active closure will be followed by post-closure, which is the time-period during which active reclamation measures are complete, but monitoring is still required. The expected duration for post-closure is approximately 10 years. Pit filling is expected to take 11 years at the Gordon site and 21 years at the MacLellan site under average conditions (Chapter 9, Section 9.4.1). Permanent closure will occur when the site is stable, and monitoring is no longer required. For fish and fish habitat, this condition would occur when surface water flows and water chemistry parameters have stabilized and follow seasonal patterns expected based on climate conditions. The duration and conditions for post-closure monitoring and permanent closure will be detailed in subsequent submissions of the Closure Plan to regulatory agencies as Project design and execution progresses.

Sensitive time periods for the four focal fish species that overlap temporally with these Project phases are:

- Spring spawning period for northern pike and walleye (late April to mid-June).
- Late spring to early summer for forage species (late-June to early August).
- Fall spawning period for lake whitefish (early October to mid-December).
- Late overwintering period when dissolved oxygen concentrations in lakes and streams are at their lowest (late March to early April, prior to break-up).

10.1.5 Residual Effects Characterization

Potential residual effects to fish and fish habitat due to changes in fish habitat or changes in fish health, growth or survival are characterized in terms of direction, magnitude, geographic extent, timing, frequency, duration, reversibility, and ecological and socio-economic context (Table 10-4). Quantitative measures were identified, where possible. Otherwise, qualitative measures were defined.

Table 10-4 Definition of Terms used to Characterize Residual Effects on Fish and Fish Habitat

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Positive –** a residual effect that moves measurable parameters in a direction beneficial to fish and fish habitat relative to baseline **Adverse –** a residual effect that moves measurable parameters in a direction detrimental to fish and fish habitat relative to baseline
Magnitude	The amount of change in measurable parameters for fish and fish habitat relative to existing conditions	**Change in Fish Habitat** **Negligible –** no measurable change in habitat area (m^2 or ha), monthly flows (m^3/sec) or lake surface elevation (m) in a waterbody or watercourse. **Low –** a measurable change in habitat area, monthly flows or lake surface elevation in a waterbody or watercourse but that is within the range of natural variability **Moderate –** a measurable change in habitat area, monthly flows (<10%) or lake surface elevation in a waterbody or watercourse that is greater than the range of natural variability, but that does not affect the ability of fish to use this habitat to carry out one or more of their life processes **High –** a measurable change in habitat area, monthly flows (>10%) or lake surface elevation in a waterbody or watercourse that is greater than the range of natural variability and large enough so that fish can no longer rely on this habitat to carry out one or more of their life processes
		Change in Fish Health, Growth, and Survival **Negligible –** no measurable change in the abundance, structure, or health metrics of focal fish populations **Low –** a measurable change in the abundance, structure, or health metrics of focal fish populations, but that is within the range of natural variability **Moderate –** a measurable change in the abundance, structure, or health metrics of focal fish populations that is greater than the range of natural variability but not large enough to affect the productivity of focal fish populations **High –** a measurable change in abundance, structure, or health metrics of focal fish populations that is greater than the range of natural variability and large enough to affect the productivity of focal fish populations

Table 10-4 Definition of Terms used to Characterize Residual Effects on Fish and Fish Habitat

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Geographic Extent	The geographic area in which a residual effect occurs	**PDA –** residual effects are restricted to the PDA **LAA –** residual effects extend into the LAA **RAA –** residual effects extend into the RAA
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	**Not Applicable –** seasonal aspects are unlikely to affect fish and fish habitat **Applicable –** seasonal aspects may affect fish and fish habitat
Frequency	Identifies how often the residual effect occurs during the Project or in a specific phase	**Single event** **Multiple irregular event –** occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Duration	The period of time required until the measurable parameter(s) for the residual effect on fish and fish habitat returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	**Short-term –** residual effect restricted to less than two years or less than one generation of focal fish species **Medium-term –** residual effect extends through operation and decommissioning/closure or is greater than one but less than two generations of focal fish species **Long-term –** residual effect extends beyond the life of the Project and is greater than two generations of focal fish species
Reversibility	Pertains to whether fish and fish habitat can return to its existing condition after the Project activity ceases	**Reversible –** the residual effect is likely to be reversed after active reclamation **Irreversible –** the residual effect is unlikely to be reversed after active reclamation
Ecological and Socio-economic Context	Existing condition and trends in the area where residual effects occur	**Change in Fish Habitat** **Undisturbed –** area is relatively undisturbed or not adversely affected by human activity **Disturbed –** area has been substantially disturbed by previous human development or human development is still present
		Change in Fish Health, Growth, or Survival **Resilient –** VC is able to assimilate the additional change **Not Resilient –** VC is not able to assimilate the additional change because of having little tolerance to imposed stresses due to fragility or near a threshold

10.1.6 Significance Definition

Thresholds have been established to define significant adverse residual environmental effects on fish and fish habitat. These thresholds have been defined by considering the residual effects characterization criteria presented in Table 10-4, the federal and provincial regulations, policies, and guidelines identified in Section 10.1.1, the uniqueness and importance to fish of the potentially affected habitat, the sensitivity of the potentially affected fish species to changes in habitat quality, and the likelihood that the potential effect will cease within a time period relevant to sustainability of the affected fish populations. A significant adverse environmental effect is:

- A permanent alteration or destruction of fish habitat that is likely to cause a measurable reduction in the productivity of focal fish populations in the LAA; or
- A change in fish health, growth, or survival that is likely to cause a measurable reduction in the abundance, community composition, or population structure of focal fish populations in the LAA.

10.2 EXISTING CONDITIONS FOR FISH AND FISH HABITAT

Existing conditions for fish and fish habitat for the Project are presented in detail in the Fish, Fish Habitat, and Fish Tissue Baseline Technical Data Report (TDR) and associated Validation Report (Volume 4, Appendix J). Existing conditions for sediment and benthic macroinvertebrate (BMI) are presented in detail in the Sediment Quality and Lower Trophic Community Baseline TDR and associated Validation Report (Volume 4, Appendix K). The existing conditions and the methods used to characterize baseline conditions are summarized below.

10.2.1 Methods

10.2.1.1 Information Sources

Information sources on existing conditions for fish and fish habitat consisted of the following:

- A two-year baseline program (2015 to 2016) focused on fish and fish habitat in lakes and streams in the LAAs (Volume 4, Appendix J).
- Follow-up field work targeting identified data gaps in the fish and fish habitat information in 2018 and 2019 (Volume 4, Appendix J).
- A two-year baseline program (2015 to 2016) focused on sediment quality and lower trophic communities in lakes and streams in the LAA (Volume 4, Appendix K).
- TLRU information shared by Indigenous community members (Chapter 17).

The waterbodies and watercourses sampled at the Gordon and MacLellan sites during these studies are shown in Map 10-1 and Map 10-2, respectively.

The 2015-2016 fish and fish habitat baseline program consisted of fish habitat mapping and characterization, fish sampling to identify fish distribution, relative abundance and health, and fish tissue analysis. Follow-up field work conducted in 2018 and 2019 was limited to collection of small-bodied fish in Farley Lake at the Gordon site and the Lynn River at the MacLellan site and for tissue metals analysis. The 2015-2016 lower trophic study included sampling of periphyton, phytoplankton, zooplankton, and BMI communities for taxonomic identification, density, and community structure. Sediment samples were collected in 2015-2016 for metal concentrations. No data gaps existed in these data and, therefore, no additional data collection was conducted in 2018 or 2019.

TLRU studies were conducted between 2015 and 2019 (Chapter 17). Fish species distribution, relative abundance trends, relative sizes (for example, locations of particularly large fish), and fisheries (species and location) were the primary types of information drawn from these studies relating to the Fish and Fish Habitat VC.

Historical reports were reviewed and information pertinent to fish habitat, fish health, lower trophic communities, and fish tissue metal concentrations at the Gordon site and MacLellan site were compiled and assessed for accuracy, thoroughness, and relevance to the Project. These reports included:

- Farley Lake Gold Project—Project Description and Environmental Impact Assessment (ILAM 1989).
- Farley Lake Nickel Mine Lynn Lake—Preliminary Assessment of Metal Levels in Fish from the Lynn River Area (Rescan 1989).
- Granduc Mining Corporation Keystone Gold Mine—Farley Lake Project Environmental Impact Assessment (Goodwin Mining Services and Agassiz North Associates 1994).
- Lynn Lake Site-Specific Human Health and Environmental Risk Assessment—Final Report. Section III—Environmental Risk Assessment (Dillon et al. 2003).
- MacLellan Mine Project: Draft 2012 Environmental Baseline Study (Tetra Tech 2013).

Information in these historical baseline reports was compared to the data collected during the 2015-2016 baseline program (Volume 4, Appendix J), The information collected during the baseline program was consistent with these historical reports so the EIS relied on the newer baseline information rather than the older reports. Copies of these older reports are provided as an appendix to the Technical Baseline Validation Report in Volume 4, Appendix J, for reference.

10.2.1.2 Fish Habitat

Lakes

Fish habitat in lakes was mapped and quantified using bathymetric survey data and field-verified remote sensing of littoral substrate and vegetation types. In 2015, bathymetry data were collected in six lakes and the Keewatin River using a Trimble R8 differential GPS and a Sonar Milspec™ Depth Sounder. Data were collected every 1 m to 1.5 m along zigzag transects, with a maximum transect spacing of 150 m. In 2016, bathymetry data were collected in 12 additional lakes using a Garman Map 526s depth finder. Bathymetric surveys of the existing Wendy and East pits at the Gordon site were completed in 2015 and 2016 (Golder 2015; Volume 4, Appendix J).

Littoral habitat was mapped in 2016 by recording aquatic vegetation, shoreline cover, and substrate data in the near-shore areas of each study lake by boat or helicopter. Field crews recorded habitat characteristics on field maps that were subsequently digitized into discreet polygons of homogeneous habitat. The digitized maps were then used to generate a correlation between habitat type and enhanced satellite imagery using Object Based Imagery Analysis. These correlations were used to classify habitat in unmapped locations. The maps were used to quantify and qualify the habitat in each lake for rearing, foraging, and spawning by different fish species present in the LAAs.

Water quality vertical profile data were collected in all seasons in 2015, 2016, and 2017. The water quality parameters measured for the profiles were temperature, dissolved oxygen, pH, conductivity, and depth (Volume 4, Appendix I).

Streams

Confirming the number and alignment of watercourses in the LAA was a critical step for the Project due to the low relief of the area. The National Topographic System (NTS) 1:50,000 dataset was used as the starting point for identifying streams. This dataset was augmented with light detection and ranging (LiDAR) data to identify other potential stream channels. Potential watercourses within the PDA were ground-truthed in the field by identifying the location and extent of scoured channels during September 2016 and September 2019 during relatively low flow conditions (detailed in Volume 4, Appendix J). Ground-truthing during high flow conditions was conducted in June 2020 and information is being reviewed and will be reported in August 2020 (supplemental filing).

Habitat data in each stream identified in the LAAs was collected in the spring and summer of 2015 and 2016. Streams that could be directly affected by the Project were surveyed along their entire length or until the channel was no longer visible. Streams that were expected to be unaffected by the Project or downstream of Project footprint or water diversion effects were surveyed along a representative reach, measuring 10 times the wetted width or 30 m, whichever was longer. The following habitat data were collected in each stream:

- Channel dimensions (i.e., wetted width, bankfull width, slope, mean and maximum depth).
- Bank height, slope, stability, and materials.
- Water velocity.
- Habitat type (i.e., run, riffle, pool).
- Stream bed substrates (i.e., fines, sand, gravel, cobble, boulder).
- Riparian vegetation.
- Available instream and overhead cover.
- Dimensions of natural, anthropogenic, or potential barriers to fish passage (i.e., type, height, seasonality).

Temperature loggers were deployed from the summer of 2015 to the fall of 2016 in Gordon Lake and Farley Creek at the Gordon site and in the Keewatin River at the MacLellan site. Temperature loggers were also deployed from spring to fall in 2016 in Farley Creek at the Gordon site and in the Cockeram River, Keewatin River, and in the outlet channels of Dot Lake, Payne Lake, and an unnamed lake downstream of Minton Lake at the MacLellan site. Temperature loggers recorded water temperature in 15-minute to 1-hour intervals for the duration of deployment.

Habitat characteristics, locations, and types of barriers to fish passage, and water temperature data were used to rate habitat quality for spawning, rearing, migration, and overwintering for different fish species present in the LAAs based on their unique life history and habitat requirements. This was done for sport fish (walleye or northern pike), coarse fish (white sucker), and forage fish (brook stickleback) species.

Seasonal variations in lake levels and stream flows result in some streams and wetlands becoming intermittent or ephemeral. These waterbodies were included as potential fish habitat if there were accessible to fish for at least part of the year. While in the field during low flow periods, the field crews used indicators such as aquatic or hydrophilic vegetation, signs of sediment scour or deposition, and debris accumulations to identify locations that would be wetted during higher flows. Small watercourses, particularly those with no headwater lakes or wetlands, may also be unable to support fish due to freezing in the winter.

10.2.1.3 Fish Community Composition, Distribution, and Relative Abundance

Multiple gear types were used to capture different fish species in different habitats in spring, summer, and fall of 2015 and 2016 (Volume 4, Appendix J). Additional fishing was done in 2018 and 2019 to target small-bodied species in the Lynn River and Farley Lake (Volume 4, Appendix J). In lakes, gill nets, seine nets, fyke nets, backpack electrofishing, angling, and minnow traps were used. In streams, backpack electrofishing and minnow traps were the primary gears used. This diversity of gear types was used because of the diversity of habitat types present in the LAAs (e.g., large rivers, small ephemeral streams, bogs, and lakes) and because of the presence of large-bodied (e.g., northern pike) and small-bodied fish species (e.g., brook stickleback) in these different habitat types. Sampling in different seasons was done to document differences in seasonal habitat use by different fish species.

A spawning survey was conducted in spring 2016. This survey consisted of setting fyke nets, generally in pairs (one net facing upstream and one net facing downstream), at 12 sampling locations in eight waterbodies.

- Gordon Lake, near the south inlet.
- Diversion channel, near Gordon Lake.
- Farley Creek, downstream of Farley Lake and upstream of Swede Lake.
- Keewatin River, upstream of the Lynn River confluence and near the Dot Lake outlet confluence.
- Dot Lake outlet.
- Payne Lake outlet.

- Cockeram River, upstream of Cockeram Lake and downstream of PR 391.
- Minton Lake outlet, near confluence with Cockeram River.

Nets were checked daily for the duration of the spring spawning runs. Each captured fish was identified to species, enumerated, measured for length and weight, examined externally for sex and maturity (i.e., immature, mature, ripe, or spent), fin-clipped (left pelvic fin), and then released on the opposite side of the fyke net in their direction of travel.

Relative abundance of each fish species captured in each lake or stream for each gear type used was determined using catch per unit effort (CPUE). CPUE was calculated separately for fyke nets, gill nets, minnow traps, beach seines, and electrofishing at each location by dividing the number of fish captured by the effort (i.e., time or area fished) used. This analysis was limited to the summer 2016 dataset, which included the largest number of sample locations and gear types (Volume 4, Appendix J).

10.2.1.4 Fish Health

Captured fish were identified to species, measured for length (mm), weighed (to the nearest 0.1 g when possible), and visually examined for the presence of external parasites or lesions. Live fish were released immediately after analysis to reduce mortality, unless they were sacrificed for tissue analysis. Mortalities were also examined internally for sex, maturity, and evidence of parasites or lesions. Livers were removed and weighed. Ageing structures were collected from large-bodied fish mortalities:

- Northern pike cleithra.
- White sucker pectoral fins.
- Walleye dorsal spines.
- Yellow perch dorsal spines.
- Lake whitefish otoliths and scales.

Fish health metrics were analyzed using data from the fish collected in summer 2016, the largest dataset from one time period (Volume 4, Appendix J). Fulton’s condition factor, length-weight relationships, van Bertanlanffy growth curves, diet composition, and hepatosomatic indices (that is, liver to body weight ratio) were calculated. Fish diet data were collected by examining the stomach contents of a subsample of captured fish. Each food item was identified to species, genus, or family if possible, and counted. Unidentifiable items were categorized as digested matter and stomachs with no food items were identified as empty. Frequencies of dietary items were used to assess the diets of different large-bodied fish species.

Linear models were developed for the length-weight relationships and growth curves to check the assumptions of normality and homoscedasticity (equality of residual variances between groups), and to identify the influence of outliers. Statistical analyses were completed using the statistical program R. The model formula ($y = \beta_0 + \beta_i x_i$), adjusted R^2, and p-value were reported for each linear model. Alpha values of $\alpha = 0.05$ were used for significance discussions for statistical tests.

10.2.1.5 Fish Tissue Analysis

Tissue samples were collected for metals analysis from large-bodied fish (northern pike, walleye, and lake whitefish) and small-bodied fish (brook stickleback, spottail shiners, and slimy sculpin). At the Gordon site, fish tissue samples were collected from seven lakes in 2015 and four lakes in 2016 (Table 10-5). At the MacLellan site, fish tissue samples were collected from five lakes in 2015 and six lakes in 2016 (Table 10-5). Small-bodied fish were generally too small to be analyzed individually, so they were combined in whole-body composite samples that targeted eight samples per species per lake. Muscle, liver, and carcass tissues were analyzed individually for large-bodied fish, between 10 to 15 samples per species per lake. Tissue samples analyzed for percent moisture, lipid content, and metal concentrations at ALS Environmental in Winnipeg, Manitoba.

Table 10-5 Fish Tissue Sampling Locations by Year

Site	Lake	2015	2016
Gordon Site	White Owl Lake	✓	
Gordon Site	Swede Lake	✓	✓
Gordon Site	Farley Lake	✓	✓
Gordon Site	East Pit	✓	-
Gordon Site	Wendy Pit	✓	-
Gordon Site	Gordon Lake	✓	✓
Gordon Site	Susan Lake	✓	✓
MacLellan Site	Cockeram Lake	✓	✓
MacLellan Site	Eldon Lake	✓	✓
MacLellan Site	Dot Lake	✓	✓
MacLellan Site	Payne Lake	-	✓
MacLellan Site	Burge Lake	✓	-
MacLellan Site	Goldsand Lake	✓	-
MacLellan Site	Minton Lake	-	✓
MacLellan Site	Lobster Lake	-	✓

Northern pike were targeted for tissue sampling because they are a top predatory fish species, an important sport fish, and are widespread in the LAAs. Walleye were targeted for tissue sampling because they are a top predatory species, an important sport fish, and are found in large lakes (i.e., Swede Lake and Cockeram Lake) downstream of the proposed sites. Lake whitefish were targeted for tissue sampling because they are a sport fish and because they are a traditional food source for local Indigenous communities. Brook stickleback and slimy sculpin were targeted for tissue sampling because they have smaller territories than the larger bodied fish and do not undertake large migrations during the spawning period. As a result, their metals concentrations are more indicative of metals levels at their capture location. Spottail shiners were collected in lakes where brook stickleback or slimy sculpin could not be effectively captured.

Moisture and lipid content and metal concentrations from each species, in each lake, were summarized (mean, standard error of the mean, minimum, and maximum values) and compared to Manitoba tissue guidelines for protection of humans from arsenic, lead, and mercury (MWQSOG, MWS 2011) and to the Canadian Environmental Quality tissue guideline for the protection of wildlife that consume fish for methylmercury (33 µg/Kg ww). No selenium tissue guideline was available for Manitoba or Canada, so the British Columbia (BC) tissue selenium guidelines (BC MOE 2017) for egg/ovary (11 µg/g dw), whole-body (4 µg/g dw), and muscle tissue (4 µg/g dw) were used to compared with baseline tissue concentrations in fish from the LAAs.

10.2.1.6 Sediment Quality

Depositional habitats (i.e., areas where silt, clay, and fine organic sediments accumulate) were sampled in 2015 and 2016 (Volume 4, Appendix K). In 2015, sediment was collected at the same depositional sites that were sampled for BMI. At the Gordon site, these were sites in Gordon, Farley, Swede, Susan, and White Owl lakes. At the MacLellan site, these were sites in Goldsand and Cockeram lakes and one site in the Keewatin River near its mouth at Cockeram Lake. At each site, five composite samples, each consisting of three grabs, were collected using a Petit Ponar® grab sampler.

In 2016, sediment was collected from Gordon, Farley, Swede, Susan, Marie, Marnie, and Simpson lakes, and in the Marnie Lake outlet and Farley Creek at the Gordon site. Sediment was collected from Payne, Dot, Eldon, Lobster, Cockeram, and Minton lakes, from the Keewatin, Lynn, and Cockeram rivers, and from the inlet to Minton Lake at the MacLellan site. Three composite samples were collected at each site using a Petit Ponar® grab sampler. Sediment samples collected in 2015 and 2016 were sent to ALS Laboratories in Winnipeg for analysis of metals, particle size distribution and total organic carbon.

10.2.1.7 Lower Trophic Communities

Lower trophic communities are indicators of ecosystem health and form the basis of the aquatic food web. The following lower trophic communities were sampled during the 2015–2016 baseline studies (Volume 4, Appendix K):

- Periphyton (photosynthetic bacteria and algae growing on hard surfaces).
- Phytoplankton (free-floating photosynthetic bacteria and algae).
- Zooplankton (free-swimming invertebrates that feed on phytoplankton).
- BMI (invertebrates living on or in substrates).

Periphyton were sampled in lakes (2015) and streams (2016) to provide an indication of primary productivity and algal biomass on hard substrates. In 2015, artificial substrate samplers were used to examine periphyton colonization and growth in four lakes at the Gordon site (Gordon, Farley, Susan, and Swede lakes) and in two lakes at the MacLellan site (Eldon and Cockeram lakes). Artificial substrate samplers were set for five weeks extending from early summer to early fall. Samples were analyzed for chlorophyll *a* (Chl-a) concentrations and ash-free dry weight. In 2016, periphyton was collected from rocky substrates in erosional habitats in streams and rivers. Periphyton samples were collected from Farley Creek (AQF40) at the Gordon site and from the Dot Lake outlet (AQM5), Lynn River (AQM28), outlet of the unnamed lake downstream of Minton Lake (AQM33), and two sites in the Keewatin River upstream (AQM8) and downstream (AQM29) of the Lynn River confluence at the MacLellan site. Samples were sent to ALS Laboratories in Winnipeg for taxonomic identification and analysis of Chl-a and phaeophytin.

Phytoplankton communities were sampled from fives lakes at the Gordon site (Gordon, Farley, Swede, Susan, and White Owl lakes) and three lakes at the MacLellan site (Eldon, Goldsand and Cockeram lakes) in summer and fall of 2015; Goldsand Lake at the MacLellan site was only sampled in fall. Three replicate samples were collected using a tubular sampler, with each replicate consisting of three composited samples from different depths. In 2016, phytoplankton samples were collected from six lakes at the Gordon site (Gordon, Farley, Susan, Marnie, Swede, and Simpson) and five lakes at the MacLellan site (Payne, Dot, Lobster, Minton, and Cockeram). Unlike the 2015 samples, phytoplankton samples collected at each site in 2016 were comprised of three composited grab samples collected at one depth. This was done because vertical water temperature profiles indicated that the lakes were not thermally stratified. Samples were preserved and sent to the laboratory for taxonomic identification and abundance analysis.

Zooplankton samples were collected from the same lakes as phytoplankton in 2015 (summer and fall) and 2016 (summer). In both years, zooplankton samples were collected using a 63-µm mesh Wisconsin sampler hauled vertically from the maximum Secchi depth to the surface, taking care not to disturb bottom sediments. Three composite samples were collected at three different locations in each lake or basin. Each composite sample was composed of three separate vertical hauls. Preserved samples were sent to the laboratory for taxonomic identification and abundance analysis.

BMI were collected from deposition and erosional habitats during the fall of 2015 and 2016. In 2015, BMI samples were collected from depositional habitats in five lakes at the Gordon site and one lake at the MacLellan site and from depositional and erosional habitats in the Keewatin River (Table 10-6). In 2016, BMI were collected from depositional habitats in six lakes at the Gordon site and five lakes and three streams at the MacLellan site and in erosional habitats in one stream at the Gordon site and four streams at the MacLellan site (Table 10-6).

Table 10-6 Benthic Macroinvertebrate Sampling Locations, by Year

Site	Location	2015	2016
Gordon Site	Gordon Lake	Depositional	Depositional
Gordon Site	Farley Lake	Depositional	Depositional
Gordon Site	Marie Lake	-	Depositional
Gordon Site	Marnie Lake	-	Depositional
Gordon Site	Farley Creek	-	Depositional Erosional
Gordon Site	Swede Lake	Depositional	Depositional
Gordon Site	Simpson Lake	-	Depositional
Gordon Site	White Owl Lake	Depositional	-

Site	Location	2015	2016
Gordon Site	Susan Lake	Depositional	Depositional
MacLellan Site	Goldsand Lake	Depositional	-
MacLellan Site	Keewatin River	Depositional Erosional	Depositional Erosional
MacLellan Site	Payne Lake	-	Depositional
MacLellan Site	Dot Lake	-	Depositional
MacLellan Site	Dot Lake outlet	-	Erosional
MacLellan Site	Lynn River	-	Depositional Erosional
MacLellan Site	Cockeram Lake	Depositional	Depositional
MacLellan Site	Lobster Lake	-	Depositional
MacLellan Site	Inlet to Minton Lake	-	Depositional
MacLellan Site	Minton Lake	-	Depositional
MacLellan Site	Outlet of Unnamed Lake Downstream of Minton Lake	-	Erosional
MacLellan Site	Cockeram River	-	Depositional

In depositional habitats, three replicate samples were collected at each site using a Petit Ponar® grab sampler (each replicate was a composite of three grabs). Sampled material was sieved through a 500-µm mesh sample bucket and remaining invertebrates were preserved and sent to the laboratory for taxonomic identification and abundance analysis. In erosional habitats, three to five replicate samples (each a composite of three 'grabs') were collected from riffle habitats with gravel/cobble substrates and water depths less than 30 cm with a Surber sampler (2015) or a Hess sampler (2016) with a 500-µm mesh net. Each subsequent sample at a site was collected upstream of the previous sampling location to reduce disturbance of the BMI community. Samples were preserved and sent to the laboratory for the same analyses as the erosional samples.

The following abundance and community structure metrics were calculated for the periphyton, phytoplankton, and BMI communities sampled in 2015 and 2016 from the lakes and streams at the Gordon and MacLellan sites (Volume 4, Appendix K):

- Periphyton: chlorophyll *a*, density (cells/cm^2), taxonomic richness, Simpson's Diversity Index and Simpson's Evenness, and non-metric multidimensional scaling to examine differences between communities.
- Phytoplankton: biovolume and density, taxonomic richness, Simpson's Diversity Index and Simpson's Evenness, and chlorophyll *a* and phaeophytin samples collected with the phytoplankton samples.
- Zooplankton: biovolume, density, taxonomic richness, Simpson's Diversity Index and Simpson's Evenness.

- BMI: density, taxonomic richness (lowest practical level or family level), Ephemeroptera, Plecoptera, and Trichoptera (EPT) richness, Simpson's Diversity Index and Simpson's Evenness, taxon proportions, Hilsenhoff Biotic Index, and percent abundance of functional feeding groups.

10.2.2 Overview

The following overview of existing fish and fish habitat existing conditions is primarily based on Volume 4, Appendices J and K, unless otherwise stated.

The Project is in the Churchill River Upland Ecoregion of the Boreal Shield Ecozone, within the Reindeer Lake Eco-district in northwestern Manitoba (Smith et al. 1998). Outcrops of Precambrian bedrock interspersed with glacial and fluvio-glacial deposits dominate the region, overlain by a thin layer of mineral soils. The topography is generally flat. These conditions result in abundant lake and wetland habitats connected by low-gradient stream and river habitats with few but distinct higher-gradient riffle or cascade habitats.

Lakes range in size from a few hectares to thousands of hectares. Both large and small lakes are often shallow (less than 4 m deep) and do not stratify thermally during the summer. Muskeg bogs and wetlands are frequent in headwater areas, low-lying depressions, and behind the beaver dams that proliferate in the region. Black spruce (*Picea mariana*) and tamarack (*Larix laricina*) are the dominant tree species in low-lying areas while white spruce (*Picea glauca*) and jack pine (*Pinus banksiana*) are the dominant tree species in drier areas. Peat moss (*Sphagnum* sp.), willows (*Salix* sp.), and alder (*Alnus* sp.) are the most abundant vegetation in the riparian areas of the lakes, streams, and wetlands of the region.

Drainage at the Gordon and MacLellan sites is generally to the southeast via a system of irregular bedrock-controlled streams and rivers. The Gordon site is in the Hughes River watershed and the MacLellan site is in the Keewatin River watershed. Both rivers ultimately drain into Granville Lake, immediately upstream of South Indian Lake within the Churchill River watershed.

Stream flows within the region are typically highest in May and June when snow in the surrounding watersheds melts and enters the streams and rivers as runoff. A second, smaller, peak occurs in September and October due to the onset of fall rains. However, natural variability in rainfall patterns and beaver activity between years can result in peak flows occurring at different months during the open-water season. Lowest flows occur in winter. Many headwater streams freeze completely in the winter. The snowpack dictates the duration and magnitude of the spring freshet. The frequency and intensity of rain events dictate the fall flows.

Rock of the Precambrian Shield is low in cations such as calcium, potassium, and magnesium. This chemistry provides surface waters with limited acid-neutralizing capability and is the reason Shield lakes are highly sensitive to acid precipitation (Gunn and Pitblado 2004). This characterization is accurate for lakes and streams in the Project region where surface waters are typically low in total dissolved solids (less than 80 mg/L), soft (hardness less than 75 mg/L as $CaCO_3$, Weiner 2008), neutral to slightly acidic, and slightly colored by tannins released from the decay of organic vegetation, particularly the peat moss (*Sphagnum* sp.) that dominates the landscape.

The fish community in the region includes cold and cool water species typical of the Precambrian Shield region. Common large-bodied species include northern pike, walleye, lake whitefish, white sucker, yellow perch, and burbot (*Lota lota*). Common small-bodied fish species include emerald shiner (*Notropis atherinoides*), spottail shiner, brook stickleback, and slimy sculpin. Northern pike and walleye are the most angled fish in the area. Lake whitefish are also targeted.

10.2.2.1 Life History and Habitat Requirements of Focal Fish Species

Northern Pike

Northern pike spawn in shallow, vegetated habitats in early spring (Harvey 2009); in the Lynn Lake area northern pike migrated from May 11 to May 23 in 2016 (Volume 4, Appendix J). Females lay their adhesive eggs on vegetation, which suspends the eggs off the bottom substrates (Bradbury et al. 1999), where they incubate for 12 to 14 days before hatching (DFO and MNR 1996). The adults seek out shallow, still, fast-warming habitat with abundant vegetation (ideally flooded terrestrial vegetation), often migrating up tributaries in their search (Casselman and Lewis 1996). Annually fluctuating water levels, with highest levels during the spring spawning period and stable levels over the summer months are best for rearing young-of-year northern pike, whereas large fluctuations during the summer months or stable year-round water levels are less productive (Casselman and Lewis 1996). Juveniles rear in dense submergent or emergent vegetation, ideally adjacent to spawning habitat (Casselman and Lewis 1996). They are generalist predators, feeding mainly on fish but also on insects, amphibians, mammals, and birds (Harvey 2009). They are ambush predators preferring to feed in clear waters with vegetation (Bradbury et al. 1999). They typically grow up to 80 cm long (Scott and Crossman 1973). In northern Canada, northern pike live more than 10 and up to 24 years and mature at approximately six years of age (Inskip 1982).

Walleye

Walleye live in lakes, particularly large lakes with fine and organic substrates, although some populations reside in moving water year-round even when lacustrine habitat is available (Struthers et al. 2017). Walleye broadcast spawn in the spring in rivers and lakes, in relatively shallow water (less than 1.5 m deep in rivers, up to several meters in lakes), in still water or water moving at velocities up to 1.0 m/s. Spawning substrates are variable; the optimal substrate appears to be cobbles and gravels, but spawning has also been observed over sand, vegetation, and detritus. Geiling et al. (1996) found walleye eggs on riverine spawning areas enhanced with added gravels, and Lowie et al. (2001) found that walleye preferentially spawned over gravels when fines and boulders were also available. The eggs incubate for 12 to 18 days (DFO and MNR 1996). After the eggs hatch the fry move into deeper water, moving from streams to lakes, where they feed on zooplankton. Their diet shifts to benthic invertebrates and then to fish as they grow. Walleye typically grow up to 50 cm long (Scott and Crossman 1973) and live up to 20 years or more. Adult walleye prefer large lakes (more than 400 ha) with large littoral zones, using shallow areas (1 m to 15 m deep) over rocky substrates. Walleye densities are highest in turbid water where the light is less intense. (Summarized from Hartman 2009 except where noted).

Lake Whitefish

Lake whitefish inhabit lakes but can also live in rivers. They spawn in the fall, sometimes after ice formation has begun (September to December). Spawning occurs in shallow parts of lakes (less than 5 m deep) over gravels, cobbles, or boulders (Bradbury et al. 1999; DFO and MNR 1996). Eggs incubate for up to 25 weeks depending on water temperature (DFO and MNR 1996). Lake whitefish appear to spawn in areas with relatively steep slopes (20% to 50%), in waters >2 m deep, with cobble and boulder substrates and show a greater fidelity to habitat characteristics than to specific locations (Bégout Anras et al. 1999). Lake whitefish eat plankton as larvae, and benthic invertebrates and small fish as juveniles and adults (Scott and Crossman 1973). They grow up to 45 cm long and live up to 16 years (Mills and Beamish 1980).

Forage Fish

Brook stickleback are a widespread, small-bodied species that inhabit clearwater lakes and streams, from small shallow pools and ephemeral streams to large lakes and rivers. In larger waterbodies, they are generally captured in the shallow, vegetated littoral habitat. The adults build nests in vegetation, suspended above fine and organic substrates in shallow water (<0.4 m) in the spring to early summer, ideally when water temperatures are 15°C to 19°C. The males care for the offspring until they become free-swimming, then they rear in habitats with abundant cover (ideally >60%) from aquatic vegetation and soft substrates, into which they will burrow for cover. They feed on aquatic invertebrates, hunting visually. In the winter they move into deeper water and can tolerate prolonged dissolved oxygen levels <1 mg/L (Klinger et al. 1982). Adults use the same types of habitats and eat the same types of invertebrates as juveniles, but on a larger scale. Brook stickleback grow to approximately 5 cm (Scott and Crossman 1973), mature after one year (although small, gravid females have been observed in late summer, implying maturation at age 0+ [Stewart et al. 2007]) and live up to three years. Brook stickleback are sensitive to increases in turbidity and decreases in shallow, high-cover littoral habitat. Brook stickleback are also sensitive to nitrite (Lewis and Morris 1986). (Summarized from a review prepared by Stewart et al. 2007 except where noted).

Slimy sculpin can live in a variety of habitats, including deeper water in rivers and lakes. They predominantly reside in rockier areas compared to areas with fine substrates (Scott and Crossman 1973). Slimy sculpin spawn in the spring among cobbles or boulders, or under bedrock or wooden ledges (Bradbury et al. 1999). They eat primarily aquatic invertebrates (Stewart and Watkinson 2004). They grow to approximately 8 cm long. Slimy sculpin are relatively sedentary compared to other fish species in the Lynn Lake area; their home ranges rarely exceeding a few square meters.

White suckers inhabit large and small lakes and streams. White suckers migrate to spawn in spring to early summer; in the Lynn Lake area, white sucker migrated from May 13 to May 23 in 2016 (Volume 4, Appendix J). Spawning habitat is generally considered to be areas with gravel substrates, shallow (<0.3 m) water. Flowing water appears to be preferred, but lake populations have been observed spawning over sand or gravel in areas with wave action. Curry and Spacie (1984) recorded white sucker spawning over medium gravel in water 0.2 m to 0.25 m deep with velocities from 0.5 m/s to 0.6 m/s. While juvenile and adult white sucker can be found in a wide range of habitat types—Swift-Miller et al. (1999) recorded no statistically significant difference in white sucker density in glides, pools, and riffles in a Colorado stream—they do exhibit preferences: streams with gradients less than 1%; pools forming roughly 50% of the available habitat (Hubert and Rahel 1989); low velocities (<0.4 m/s); abundant cover, including deep pools; and large woody debris cover (Hubert and Rahel 1989). Their eggs incubate for 24 to 36 days (Hamel et al. 1997). Juveniles feed on zooplankton, shifting to a diet of benthic invertebrates with growth. Juveniles will also supplement their diet with detritus at times (Ahlgren 1990). The size of prey items increases with white sucker growth. White sucker can grow up to 20 cm to 50 cm, depending on whether they live in lakes or streams (Scott and Crossman 1973), and live up to 17 years, maturing at three to six years of age. (Summarized from Twomey et al. 1984 except where noted).

Lake chub and spottail shiner inhabit lakes and slow-moving stream habitats (Stewart and Watkinson 2004). Lake chub spawn in streams, over gravels and larger substrates, and are also known to spawn in lakes (Bradbury et al. 1999). Spottail shiner may use lake and stream habitats for spawning. These cyprinid species spawn in late spring (May or June). Lake chub and spottail shiner eat plankton and other pelagic aquatic invertebrates. Spottail shiner grow up to approximately 10 cm long, while lake chub can grow up to 20 cm long (Scott and Crossman 1973). These minnows are prey species for larger piscivorous species such as northern pike and walleye.

10.2.2.2 Fish Habitat

Habitat assessments were conducted in most lakes and streams within the LAA at the Gordon site and the LAA at the MacLellan site (see Map 10-1 and Map 10-2, respectively). However, only those lakes and streams adjacent to, or downstream of, the Project are described below. Detailed descriptions and representative photographs of the fish habitat in the other lakes and streams in the LAA are described in Volume 4, Appendix J. Maps showing the distribution of vegetation types (emergent species, floating species, submerged species, or no vegetation) and substrate size ranges (organics, fine [sand, gravel], coarse [cobbles, boulders]) in the littoral areas of the lakes are presented in Appendix A of Volume 4, Appendix J.

Gordon Site

Lakes at the Gordon site range in size from 4.8 ha (an unnamed lake north of the open pits and diversion channel) to 230.5 ha (Swede Lake). These lakes are generally shallow (average depths <5 m; Table 10-7), with littoral zones comprising between 39% (Marie Lake) to 55% (Gordon Lake) of the total lake area. Littoral zones are the shallow habitat that receives sunlight to the bottom during the growing season. Littoral zones were characterized based on Secchi depths (i.e., a measure of water clarity) measured in summer 2016, analysis of satellite data, and field observations. Emergent, floating, and submergent vegetation is present in most lakes and is typically the most abundant cover source for fish in the lakes. Most lakes within the LAA at the Gordon site provide spawning, rearing, and overwintering habitat for large-bodied and small-bodied fish species. Streams at the Gordon site are generally small (1.6 m to 5.2 m wide) with low gradients (<1%) and substrates dominated by fines and organic material (Table 10-8). Tributaries to Gordon Lake and Farley Lake with no headwater lakes or wetlands are known to freeze to the bottom in the winter and do not support fish.

Gordon Lake, upstream of the existing East and Wendy pits and at the headwaters of the Ellystan Lake watershed, has a surface area of approximately 19.0 ha, an average depth of 1.4 m, almost entirely organic bottom substrates, and abundant macrophyte growth in the littoral area. Due to its shallow depth, Gordon Lake does not thermally stratify in summer. Dissolved oxygen concentrations in winter are <1.0 mg/L in March (Table 10-7), concentrations that are too low to sustain large-bodied fish and small-bodied species other than brook stickleback (Harvey 2009; Klinger et al. 1982; Inskip 1982; Stewart et al. 2007; Twomey et al. 1984; Barton and Taylor 1994).

Farley Lake, downstream of the existing East and Wendy pits, has a surface area of 77.4 ha and an average depth of 1.3 m. However, it has a maximum depth of 10.8 m in its western basin and is <1 m deep in its eastern basin. The western basin stratifies in summer, but the northern and eastern basins do not. Bottom substrates in Farley Lake are more diverse than other lakes at the Gordon site and, depending on location, are comprised of organics, silt, sand, detritus, and boulders. Emergent macrophytes are the dominant cover type for fish, particularly in the shallow eastern basin, while boulders are the most abundant cover type along the shoreline. Water levels in Farley Lake are controlled by a beaver dam at its outlet; active construction of this dam has raised water levels in Farley Lake by approximately 1 m since 2015.

An existing diversion channel drains Gordon Lake to Farley Lake. This diversion channel is, on average, 8 m wide, 1.8 m deep, with a gradient of <1% (Table 10-8). Banks and bottom substrates are almost entirely comprised of angular riprap. Cover for fish is provided by deep water and overhanging riparian vegetation. In 2016, numerous beaver dams in the diversion channel impeded fish passage between Gordon and Farley lakes. Representative photos of the diversion channel are included in Volume 4, Appendix J (Appendix D).

Farley Creek drains Farley Lake to Swede Lake. It is approximately 4.0 km long and can be roughly divided into three separate reaches (from upstream to downstream): 1) an approximately 3,000 m long, low gradient (<1%), U-shaped channel within a wide (>70 m) wetland flood plain; 2) an approximately 100 m long, boulder cascade with a 7% average gradient and nearly 100% canopy cover from riparian trees; and 3) an approximately 900m long, low gradient (<1%), multi-braided channel within a wide (>50 m) wetland floodplain. Substrates in the upper reach are comprised of a deep layer of fines and organic detritus. Riparian vegetation within the wetland floodplain is comprised of willows and sedges. Beaver dams in this reach are numerous. Vertical drops up to 0.75 m in the boulder cascade reach likely inhibit upstream fish passage in most years as the fish species in the LAA are not known to be able to jump such heights. This cascade was the only permanent barrier to migration identified in the Gordon site LAA; beaver dams in Farley Creek and the diversion channel could impede fish passage but are not permanent barriers. However, the presence of fish upstream of this cascade indicates that fish can pass upstream in some years, most likely during the highest flows in the spring when vertical drops would be reduced, and riparian areas would be flooded. Like the upper reach, substrates in the lowest reach are comprised of fines and organic detritus and riparian vegetation is comprised of willows and sedges.

Swede Lake has a surface area of 230.5 ha, an average depth of 3.2 m, and a maximum depth of 9 m. Emergent macrophytes are the most abundant cover type for fish in the littoral zone, while boulders provide the most abundant (30% to 59% of total lake shoreline) cover type along the shoreline. Organic substrates and detritus are the most abundant substrate type in the offshore area of the lake. Swede Lake is separated from Simpson Lake, a lake upstream of Swede Lake but not downstream of the Gordon site, by the Gordon site access road and an approximately 1,800 mm diameter, fish-passable, culvert.

Table 10-7 Lakes in the Gordon site LAA

Lake[1]	Surface Area (ha)	Littoral Surface Area (ha)	Average depth (m)	Maximum Depth (m)	Littoral Substrates	Aquatic Vegetation	Dominant Littoral Cover Type	Dominant Bank Cover Type	Winter Dissolved Oxygen Range (mg/L)[2]
Gordon Lake	19.0	10.5	1.4	2.8	Organics, detritus	Submerged	Macrophytes	Macrophytes	0.05-0.7
Farley Lake[4]	77.4	39.0	0.9	10.8	Sand, silt, organics, detritus, boulder	Submerged	Macrophytes	Boulder	0-6.6
Swede Lake[3]	230.5	99.2	3.2	9.0	Organics, detritus	Emergent	Macrophytes	Boulder	1.4-10.4
East Pit	5.6	2.5	27.8	83.0	Bedrock, cobble, boulder	Emergent	Boulder	Cobble	0.03-10.8
Wendy Pit	5.3	2.4	17.0	68.0	Silt, cobble, gravel, boulder	Submerged	Macrophytes	Macrophytes	0-9.1
Susan Lake	11.9	5.5	3.1	5.5	Organics, detritus	Submerged	Macrophytes	Boulder	0.05-9.3

Notes:

[1] Further details including photographs are available in Volume 4, Appendix J (Section 4.1.2.1, Maps 8A-8I and 9A-9I in Appendix A, and Appendix C)

[2] Range of dissolved oxygen concentrations measured in lake profiles in March and April 2016, 2017

[3] Swede Lake was the downstream-most lake included in the baseline study (Volume 4, Appendix J); no fish habitat data were collected for Ellystan Lake.

[4] Farley Lake average depth adjusted from value presented in Volume 4, Appendix J to match correct value from Chapter 9.

Table 10-8 Watercourses in the Gordon site LAA

Watercourse Reach[1]	Reach Length (m)	Channel Width (m)	Channel Depth (m)	Average gradient	Dominant Substrate	Aquatic Vegetation	Riparian Vegetation	Cover Components
Farley Creek: Farley Lake to cascade	2,800	5.2	1.1	<1	Organics	Floating	Wetland and shrubs	Aquatic vegetation, overhanging shrubs
Farley Creek: cascade	100	3.4	0.3	7	Boulder	None	Trees	Boulders, overhanging trees, and shrubs
Farley Creek: cascade to Swede Lake	800	3	0.9	<1	Organics	Emergent	Wetland	Aquatic vegetation and overhanging grasses
Unnamed tributary to Farley Lake southwest	570	1.6	0.8	<1	Organics	Submerged	Shrubs and grasses	Overhanging trees and shrubs, aquatic vegetation
Diversion channel	1,300	8	1.8	<1	Organics	Submerged	Shrubs and grasses	Overhanging trees and shrubs, water depth/clarity
Unnamed tributary to Gordon Lake south	690	2.2	0.3	1	Organics	Emergent	Shrubs and mixed forest	Overhanging vegetation, woody debris

Notes: [1] Further details including photographs are available in Volume 4, Appendix J (Section 4.1.2.2.1 and Appendix D).

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East Pit and Wendy Pit, the two existing open pits at the Gordon site, are water-filled and isolated from Gordon Lake and Farley Lake by a berm and perimeter access road. East Pit is 83 m deep, with a total surface area of 5.6 ha. Wendy Pit is 68 m deep, with a total surface area of 5.3 ha. Both existing pits have bedrock sidewalls with a mixture of cobble and boulder substrates along the upper benches. Gravel and silt substrates are also present along the shoreline of Wendy Pit. Cover in the littoral zones of these pits is sparse (1% to 29% of the total littoral area) and limited to boulders in East Pit and cobbles in Wendy Pit. Emergent macrophytes are present along the margins of both pits but is sparse. Representative photos of the East Pit and Wendy Pit are included in Volume 4 Appendix J (Appendix D). Only the upper 10 m of East Pit and Wendy Pit are considered potential fish habitat. This is because, below 10 m, water in the existing pits is cold (~4°C) and oxygen depleted (<2 mg/L) year-round (Volume 4, Appendix I).

Susan Lake, to the southwest of the Gordon site and located in the adjacent Hughes Lake watershed, has a surface area of 11.9 ha, an average depth of 3.1 m, and a maximum depth of 5.5 m. Boulders provide nearly half of the abundant cover along the lake shoreline (30% to 59% of the total littoral area), while submergent macrophytes provide most of the abundant cover in the littoral zone. Substrates in the offshore area of Susan Lake are comprised of silt and organic detritus.

Overall, lakes and streams in the LAA at the Gordon site provide sufficient habitat for focal fish species to carry out their life processes. Spawning habitat for northern pike, yellow perch and brook stickleback is abundant in lakes and the slow-moving portions streams with aquatic vegetation, and include Farley, Swede, and Ellystan lakes. Within the LAA, spawning habitat for white sucker is found in streams with rock substrates (i.e., Farley Creek downstream of the rocky cascade) or within the rocky shoals of lakes (i.e., Farley and Swede lakes). Spawning habitat for walleye and lake whitefish exists along the rocky shorelines of Swede and Ellystan lakes. Slimy sculpin spawning, rearing, and foraging habitat is limited to the few rocky streams that exist in the Gordon site LAA. Overwintering habitat for northern pike, walleye, and lake whitefish is provided in the deeper portions of the lakes within the LAA while overwintering habitat for brook stickleback exists in all lakes and streams in the LAA including areas with very low dissolved oxygen concentrations in winter such as Gordon Lake and in the numerous beaver impoundments in Farley Creek.

The numerous beaver dams in Farley Creek and in the smaller tributaries of Gordon, Farley, and Swede lakes present impediments to fish passage during all but the spring freshet when water flows over and through these dams. The boulder cascade in Farley Creek likely poses a barrier to upstream fish migration in most years.

MacLellan Site

Lakes at the MacLellan site range in size from 3.7 ha (East Pond) to 2,105 ha (Cockeram Lake). These lakes are generally shallow (average depths <3 m) with relatively large littoral zones (21% to 35% of the total lake surface area). Except for East Pond, macrophytes are abundant in lakes within the LAA at the MacLellan site and during field studies were the dominant or co-dominant cover type in the littoral zone of most lakes. Most of the lakes within the LAA at the MacLellan site provide spawning, rearing, and overwintering habitat for large-bodied and small-bodied fish species. Small streams in the MacLellan site LAA, particularly those with no headwater lakes or ponds, are known to freeze to the bottom during the winter and do not support fish.

Except for the Keewatin and Cockeram rivers, streams at the MacLellan site are generally small (<5 m wide and <1 m deep) with low gradients (<1%), fine silt and organic substrates, and numerous beaver dams. These dams created upstream impoundments, often with wide (>50 m) wetland floodplains and a narrower (<5 m) active channel in the middle (Table 10-10). Higher gradient, erosional habitats (up to 3%) are only found in the frequent narrowings of the Keewatin River, in one bedrock confined channel area of the Cockeram River, and in the upper portion of the channel draining the unnamed lake downstream of Minton Lake to the Cockeram River.

Payne Lake, located immediately north of the proposed TMF, has a surface area of 59.8 ha, an average depth of 1.3 m, and a maximum depth of 3.7 m (Table 10-9). Macrophytes provide abundant cover along the shoreline and within the littoral zone. The banks themselves are steeply sloped. Fine organic substrates (including large pieces of detritus) are the dominant substrate type in the lake. Payne Lake is drained to the Keewatin River through a 2,400 m long, low gradient (<1%), braided, highly beaver-impacted channel. These beaver dams have created an approximately 100 m wide wetland floodplain, with an approximately 5 m wide, 1 m deep active channel in the middle. Substrates in this channel are exclusively fine silt and organics.

East Pond is located immediately east of the proposed open pit. It is the smallest (3.7 ha) and shallowest (1.1 m average depth and 1.6 m maximum depth) lake in the MacLellan site LAA. East Pond does not support macrophytes and its dominant littoral and bank cover types are woody and organic debris. Similar to Gordon Lake at the Gordon site and unique to the MacLellan site, East Pond is too shallow to thermally stratify in summer and has dissolved oxygen concentrations in late winter too low (<0.5 mg/L) to support any large-bodied fish species or any small-bodied fish species other than brook stickleback. East Pond is drained by a small (<1 m wide, <0.5 m deep), unnamed outlet channel. This channel joins with another small (<1.5 m, 0.5 m deep) headwater tributary draining the area near the proposed MRSA. Downstream of this confluence, the streamflows south to the Keewatin River and is highly impacted by beaver dams. As a result, the stream has an approximately 7 m wide active channel flowing through an approximately 31 m wide wetland floodplain, with exclusively organic substrates, abundant in-channel emergent macrophytes, and willows, sedges, and black spruce in the riparian area.

Dot Lake is on the west side of the Keewatin River, on the opposite side of the river from the proposed Project. It has a surface area of 98 ha, an average depth of 1.2 m, and a maximum depth of 2 m. Substrates in the littoral zone of Dot Lake include bedrock, sand, and organics. Dot Lake does not thermally stratify in summer. In winter, dissolved oxygen concentrations in Dot Lake range from 0.07 to 3.3 mg/L. The Dot Lake outlet is crossed by the MacLellan site access road, where a “perched” culvert currently blocks upstream fish passage and provides the hydraulic control for Dot Lake. The Dot Creek culvert is the only long-term barrier to fish passage identified in the MacLellan site LAA; beaver dams in the Payne Lake outlet and East Pond outlet impede migration but are not considered permanent. Downstream of the road, Dot Lake is drained to the Keewatin River through a 160 m long, 6.8 m wide, 0.4 m deep channel (Appendix D in Volume 4, Appendix J). Substrates in this stream are primarily fines, with gravel and cobbles in some locations. Cover for fish is provided by overhanging trees and shrubs.

The Keewatin River flows from north to south through the LAA at the MacLellan site and is the main tributary of Cockeram Lake downstream of the Project. Habitat in the river varies depending on the gradient and

Table 10-9 Lakes in the MacLellan Site LAA

Lake[1]	Surface Area (ha)	Littoral Surface Area (ha)	Average depth (m)	Maximum Depth (m)	Littoral Substrates	Aquatic Vegetation	Dominant Littoral Cover Type	Dominant Bank Cover Type	Winter Dissolved Oxygen Range (mg/L)[2]
Payne Lake	59.8	27.5	1.3	3.7	Organics, detritus	Submerged	Organic debris, macrophytes	Macrophytes	3.4-3.4
East Pond	3.7	1.0	1.1	1.6	Organics	None	Woody Debris	Organic Debris	0.1-0.3
Dot Lake	98.0	17.3	1.2	2.0	Bedrock, sand, organics	Emergent	Macrophytes	Macrophytes	0.07-3.3
Minton Lake	166.6	50.4	1.5	2.2	Sand, organics	Submerged	Macrophytes	Macrophytes	0.2-6.3
Unnamed Lake Downstream of Minton Lake	64.8	13.4	2.0	3.7	Sand, cobble, boulder	Submerged and floating	Boulder, woody debris	Macrophytes	0.4-3.5
Cockeram Lake	2,105.1	745.1	3.0	4.0	Sand, silt, clay, cobble, gravel, boulder	Emergent	Macrophytes	Macrophytes	2.8-13.8

Notes:
[1] Further details including photographs are available in Volume 4, Appendix J (Section 4.2.2.1, Maps 8J-8Q and 9J-9Q in Appendix A, and Appendix C)
[2] Range of dissolved oxygen concentrations measured in lake profiles in March and April 2016, 2017.

Table 10-10 Watercourses in the MacLellan site LAA

Watercourse Reach[1]	Study Length (m)	Channel Width (m)	Channel Depth (m)	Average Gradient (%)	Dominant Substrate	Aquatic Vegetation	Riparian Vegetation	Cover Components
Keewatin River	400	30 (at Hwy 391 crossing)	>1	2	Boulder	Emergent	Shrubs	Overhanging trees/shrubs, water depth/clarity
	400	152	0.75	1	Fines	Submergent	Shrubs	Overhanging trees/shrubs, aquatic vegetation, and boulders
Unnamed tributary to Keewatin River (KEE3-B1)	1700	6.6	0.6	<1	Organics	Emergent	Wetland and conifer	Aquatic vegetation and woody debris
Unnamed tributary to Keewatin River (KEE3-B2)	100	1.4	0.5	<1	Organics	Submerged	Wetland and conifer	Overhanging trees and shrubs, aquatic vegetation
East Pond outlet	300	0.85	0.4	<1	Organics	None	Conifer and grasses	Overhanging trees and shrubs, woody debris
Payne Lake outlet	40	5.1	1.0	<1	Organics	Emergent	Wetland and shrubs	Water depth and clarity, overhanging trees, and shrubs
Cockeram River	140 (run)	12 (run)	1.3 (run)	1	Organics (run	Submerged	Wetland, conifers	Aquatic vegetation, woody debris, overhanging grasses
	80 (riffle)	9.6 (riffle)	0.7 (riffle)	1	Boulder (riffle)	Submerged	Shrubs, grasses	Aquatic vegetation, woody debris, overhanging grasses
Outlet of unnamed lake downstream of Minton Lake	100	3.4	~0.5	1	Fines	Submerged and Free-Floating	Wetland, conifers, shrubs, grasses	Water depth/clarity, overhanging trees, and shrubs
Outlet of Minton Lake	400	3.7	<1	<1	Organics	Free-Floating	Wetland and conifer	Aquatic vegetation, overhanging grasses/forbes
Unnamed tributary to Minton Lake north	400	24.1	0.9	1	Organics	None	Wetland	Water depth/clarity, overhanging trees, and shrubs
Dot Lake outlet	150	6.75	0.4	1	Fines	Emergent	Shrubs and grasses	Overhanging trees and shrubs, water depth and clarity

Notes: Further details including photographs are available in Volume 4, Appendix J (Section 4.2.2.2.1 and Appendix D).

confinement of the channel and, is a repeating series of wide, shallow gradient (<2%) runs and narrow, steeper (up to 3%) rapids. The wide run habitats have sandy substrates in the middle of the channel and silty/sandy substrates with abundant emergent and submergent vegetation along the channel margins. Flow conditions in these run habitats is laminar. The vegetation beds along the margins of the channel provide abundant rearing habitat for juvenile fish. There are also occasional, deep (>10 m) areas within the run habitat, such as the first wide area upstream of PR 391. The narrower rapid habitats, such as those located at the existing bridge crossing on the MacLellan site access road, have boulder and bedrock substrates, turbulent flow, and no aquatic vegetation. These diverse habitat types provide spawning, rearing, and overwintering habitat for most large-bodied and small-bodied fish species in the LAA. The Keewatin River is currently crossed by two clear-span bridges within the LAA: the bridge on PR #391 just east of the Town of Lynn Lake and the bridge on the MacLellan Mine access road. Neither bridge currently inhibits upstream or downstream fish passage.

Minton Lake is located to the southeast of the proposed TMF. The lake has a surface area of 166.6 ha, a mean depth of 1.5 m, and a maximum depth of 2.2 m. Due to its shallow depth, Minton Lake does not thermally stratify in summer. In winter, dissolved oxygen concentrations range from 0.2 to 6.3 mg/L and are generally above those in East Pond (<0.3 mg/L) but below those in Cockeram Lake (range 2.8 to 13.8 mg/L). Bottom substrates are comprised largely of sand and fine organic material. Submergent macrophytes provide most of the cover for fish in the littoral zone of the lake. Minton Lake receives most of its inflow from a tributary draining a small unnamed lake directly north of Minton Lake and a large (~3.8 ha), beaver-impounded wetland area to the west of this unnamed lake. Downstream of the confluence of the wetland and unnamed lake outlet, habitat in the Minton Lake inlet channel is comprised of a series of beaver impoundments connected by numerous braided channels flowing within an approximately 24 m wide floodplain. Water depths in the beaver ponds are up to 1 m deep, while water depths in the channels are <0.5 m deep. Substrates behind the beaver dams and in the downstream channels are comprised almost exclusively by silt and fine organic material. A second, but considerably smaller inlet tributary drains into Minton Lake on its western side. This tributary drains an area south of the proposed MRSA but flows within a defined channel for only 320 m upstream of the lake. This tributary provides similar, but smaller, habitat for fish as the northern inlet. Minton Lake is drained to the east through a series of channels flowing through a wide (>100 m) sedge wetland. Vegetation in this wetland is dense although fish passage from the downstream lake is likely impeded but not restricted. Habitat in the inlet and outlet of Minton Lake likely provide spawning and rearing habitat for small-bodied species and those large-bodied species that spawn on aquatic vegetation (e.g., northern pike).

Although smaller (64.8 ha), an unnamed lake downstream of Minton Lake provides deeper and more diverse habitat than Minton Lake. This lake has an average depth of 2.0 m, a maximum depth of 3.7 m and littoral substrates that include sand, cobbles, and boulders. Submerged and floating aquatic vegetation are present around the lake margin in roughly equal amounts and provide cover for fish. Habitat in the outlet channel of this unnamed lake can be roughly divided into two reaches: a braided, higher gradient (1% to 2%) gravel/cobble riffle; and lower gradient (<1%), beaver-impounded, silt-bottomed run. The more upstream riffle habitat flows through a relatively open forest of aspen and birch with nearly 100% canopy cover. The more downstream run flows through a more open area of willow and black spruce riparian vegetation.

The Cockeram River flows from Lobster Lake to Cockeram Lake. Within the LAA, it is divided into two reaches: the reach that flows from the outlet of the unnamed lake downstream of Minton Lake to the confluence with the unnamed tributary that drains Arbour Lake, and the reach that flows from this confluence to Cockeram Lake. Habitat in the reach of the Cockeram River downstream from the outlet of the unnamed lake below Minton Lake has substrates that are predominantly fines and cover for fish is provided by water depth/clarity and trees and shrubs. In the lower reach, habitat consists primarily runs with organic substrates. Aquatic vegetation, deep water and large woody debris provided cover for fish. An approximately 200 m section of riffle with boulder and cobble substrates is present approximately 750 m upstream of the PR 391 bridge. Habitat in the outlet of the unnamed lake downstream of Minton Lake is a rocky riffle for approximately 200 m immediately downstream of the lake. Lower gradient run habitat with fine substrates and aquatic vegetation and woody debris for cover comprises the remainder of the habitat in this stream to its confluence with the Cockeram River. Instream and overhanging vegetation are abundant along the length of the stream.

Cockeram Lake is the largest lake (2,105 ha) in the LAA at the MacLellan site, and is the downstream receiving waterbody for inflows of the Keewatin and Cockeram rivers. The lake has an average depth of 3 m and a maximum depth of 4 m. Cockeram Lake does not thermally stratify in summer due to its relatively shallow depth and open exposure to prevailing winds. Habitat in Cockeram Lake is the most diverse of any lake in the LAA at the MacLellan site. Littoral substrates include sand, silt, clay, gravel, cobble, and boulders depending on shoreline aspect and exposure to prevailing winds. Emergent macrophytes are the dominant vegetation type in the lake, particularly along exposed shorelines. Floating and submerged vegetation is present in protected bays. During field studies macrophytes were the most abundant cover type in the littoral zone of the lake.

Overall, lakes and stream in the LAA at the MacLellan site provide habitat for all focal fish to carry out their life processes. Spawning habitat for northern pike, yellow perch and brook stickleback is abundant in lakes and the slow-moving portions streams with aquatic vegetation such as Minton Lake. Spawning habitat for white sucker is found in the flowing waters of the Cockeram River. Cockeram Lake provides spawning, rearing, and overwintering for all focal fish species owing to it large size and diversity of habitat types. The Keewatin River provides spawning, rearing, and foraging habitat for all focal fish owing to its alternating narrow, rocky rapid habitats and wider, deeper, and slower flowing run habitats with sand substrates and abundant aquatic vegetation along the margins. The Keewatin River also provides overwintering habitat for forage fish and for juvenile pike, sucker, and walleye although most adults of these species likely migrate to the lakes to overwinter.

10.2.2.3 Fish Community Composition, Distribution, and Relative Abundance

Gordon Site

Based on field studies, northern pike, brook stickleback, and white sucker were the most widely distributed fish species in lakes at the Gordon site (Map 10-4). Swede Lake had the most diverse species assemblage, with eight species present: northern pike, white sucker, yellow perch, walleye, spottail shiner, and lake whitefish, brook stickleback and slimy sculpin (Table 10-11).

In addition to the species listed above, the Marcel Colomb First Nation report fishing for lake sturgeon, goldeye, and lake trout in the Hughes River watershed (Stantec 2018). The Manitoba Metis Federation report fishing for lake sturgeon in Granville Lake (SVS 2020). Lake sturgeon inhabit large rivers and migrate to fast flowing water to spawn at the base of rapids or falls (COSEWIC 2017); based on aerial photographs, these habitats are abundant in the Hughes River outside of the LAA. Lakes and streams in the LAA at the Gordon site are unlikely to provide spawning or rearing habitat for lake trout because of their small size and relatively shallow depth, or for goldeye because of their preference for more turbid waters (Scott and Crossman, 1973) than those that exist in the LAA.

Gordon Lake supports only a self-sustaining population of brook stickleback. This is likely because they are the only fish species in the LAA that can survive the anoxic conditions that occur in Gordon Lake each winter. This is supported by the fact that no large-bodied fish were captured in gill nets set in Gordon Lake in summer 2016. White suckers were captured in Gordon Lake during spring 2016, however, it is highly unlikely that Gordon Lake supports a white sucker population due to the anoxic conditions that occur in the lake each winter. Instead, these fish were more likely upstream migrants from Farley Lake. Goodwin (2004) also captured white sucker in Gordon Lake, but concluded that they were too small to be of spawning age and that the importance of Gordon Lake to white suckers was unclear. Gordon Lake provides suitable habitat for all life stages of brook stickleback (Map 10-5).

Three large-bodied fish species were captured in Farley Lake: northern pike, white sucker, and yellow perch. No small bodied fish were captured in Farley Lake in four years of sampling (2015, 2016, 2018, and 2019; Appendix A.2) despite the use of gill nets, minnow traps, fyke nets, and backpack electrofishing. The reason for the apparent absence of small-bodied fish species in Farley Lake, including brook stickleback, is unknown but is more likely due to sampling ineffectiveness in the flooded riparian vegetation along the shoreline and in shallow, muddy eastern basin than to a true absence from the lake. Brook stickleback were found in the stomachs of northern pike captured in Farley Lake and are known to exist upstream in Gordon Lake, suggesting that they are present in Farley Lake. Farley Lake provides suitable habitat for all life stages of these three species (Map 10-6a, Map 10-6b, and Map 10-6c). Gill netting CPUE in Farley Lake was greatest for northern pike (6.9 fish/100 m^2 net per day) and lowest for yellow perch (0.2 fish/100 m^2 net per day) (Table 10-12).

Only brook stickleback were captured in the diversion channel between Gordon and Farley lakes in the summer of 2016. The channel was too deep to electrofish, so gill nets and minnow traps were used. No large-bodied fish were captured in the gillnets and only brook stickleback were captured in the minnow traps. However, one northern pike was observed. Use of the diversion channel by large-bodied fish is likely limited by the lack of habitat diversity and aquatic vegetation and the abundance of angular riprap and beaver dams.

Wendy and East pits support self-sustaining populations of white sucker and brook stickleback. The highest CPUE for white suckers captured in gillnets in the LAA at the Gordon site was in Wendy Pit (36.6 fish/100

m^2/day) (Table 10-12). The presence of both species in these isolated pits indicates that they can fulfill all their respective life-history requirements in the limited habitat provided in the upper 10 m of these pits (Map 10-7a, Map 10-7b, and Map 10-8).

Eight different fish species were captured in Swede Lake in 2016. Walleye were the most abundant species captured in gillnets (24.8 fish/100 m^2/day) and spottail shiner were the least abundant (0.2 fish/100 m^2/day) (Table 10-12). Brook stickleback and slimy sculpin were the only new species captured by electrofishing along the lake shoreline. Slimy sculpin were the most abundant species captured electrofishing (8.4 fish/100 s) while brook stickleback (0.6 fish/100 s) were the least abundant of the species captured by electrofishing (Table 10-12). Swede Lake provides suitable habitat for the three large-bodied focal species (northern pike, walleye, and lake whitefish) as well as two focal forage fish species (Map 10-9a, Map 10-9b, and Map 10-9c).

Based on TK, Swede Lake, along with Simpson and Ellystan lakes, were good places to fish for “jumbo” lake whitefish, however, they became less abundant after opening of the Farley Lake Mine (Stantec 2018). Swede and Simpson lakes have supported a commercial fishery in the past (ILAM 1989) but have not been commercially fished since prior to 2010 (Casper, pers. comm. 2019).

Burbot, northern pike, and white sucker were captured in fyke nets set in Farley Creek between Farley and Swede lakes in spring of 2016. Most of these fish were captured in nets set near Swede Lake and they represent movements of spawning fish into Farley Creek from the lake. Only slimy sculpin were captured in the boulder cascade section of Farley Creek during backpack electrofishing in summer and only two fish were captured (0.2 fish/100 s). Although no fish were captured electrofishing in Farley Creek upstream of the boulder cascade, it is likely that this reach supports brook stickleback and that the absence of fish from fishing effort was due to sampling inefficiencies in the deep, tannin-stained, soft-bottomed central channel.

Only northern pike and brook stickleback were captured in Susan Lake. However, the density of both species was higher in Susan Lake (46.7 northern pike/100 m^2/day of gillnetting and 6.2 brook stickleback/100 s of electrofishing) than in any other lake in the LAA at the Gordon site (Table 10-12). Susan Lake provides suitable habitat for all life stages of these two species (Map 10-10a and Map 10-10b).

Table 10-11 Fish Species Distribution in Lakes and Streams at the Gordon Site

Waterbody	Fish Species								
	Northern Pike	Brook stickleback	White Sucker	Yellow Perch	Walleye	Spottail Shiner	Lake Whitefish	Slimy Sculpin	Burbot
Swede Lake	✓	✓	✓	✓	✓	✓	✓	✓	
Farley Creek	✓		✓					✓	✓
Farley Lake	✓		✓	✓					
East Pit		✓	✓						
Wendy Pit		✓	✓						
Diversion Channel	✓	✓							
Gordon Lake		✓	✓						
Susan Lake	✓	✓							

Table 10-12 Catch Per Unit Effort for Lakes in Summer at the Gordon Site

Waterbody	Fish Species	Gill Net (fish per 100 m^2 per day)	Minnow Trap (fish per trap day)	Electrofishing (fish/100s)
Swede Lake	SPSH	0.2	0	3.2
	WHSC	7.3	0	4.8
	NRPK	12.4	0	0
	LKWH	4.5	0	0
	YLPR	3.9	0.1	1
	WALL	24.8	0	1
	BRST	0	0	0.6
	SLSC	0	0	8.4
Farley Lake	WHSC	0.9	0	0
	NRPK	6.9	<0.1	0
	YLPR	0.2	0	0
Marie Lake	NRPK	14.2	0	0.2
Marnie Lake	WHSC	16.2	0	0
	NRPK	1.1	0	0
	BRST	0	0.5	3.9
East Pit	WHSC	22.4	0	-
	BRST	0	5.3	-
Wendy Pit	WHSC	36.6	1.5	-
	BRST	0	0.8	-
Unnamed Lake north of the diversion channel	BRST	0	19.8	0
Gordon Lake	BRST	0	0.5	2.5
Susan Lake	NRPK	46.7	0	0
	BRST	0	0.4	6.2

MacLellan Site

Northern pike and brook stickleback were the most widely distributed fish species in the lakes at the MacLellan site; northern pike were captured in 12 lakes and brook stickleback were captured in 10 lakes (Map 10-11). The Keewatin River supported the largest assemblage of fish species (14 species): northern pike, brook stickleback, white sucker, longnose sucker (*Catastomus catastomus*), yellow perch, lake chub, spottail shiner, longnose dace (*Rhinichthys cataractae*), lake whitefish, cisco (*Coregonus artedi*), burbot, slimy sculpin, logperch (*Percina caprodes*), and trout-perch (*Percopsis omiscomaycus*) (Table 10-13). Goldsand Lake (11 species) and Cockeram Lake (nine species) had the next-most diverse assemblages. In addition to the species listed above, three other fish species were captured in lakes and streams within the LAA at the MacLellan site during the 2015-2016 baseline program (Volume 4, Appendix J): ninespine stickleback (*Pungitius pungitius*), walleye, and emerald shiner.

Members of the Marcel Colomb First Nation fish for burbot in the Keewatin River (Chapter 3) and for northern pike, lake whitefish, and walleye in Cockeram Lake (Stantec 2018). Members of the Marcel Colomb First Nation reported that “trout are more abundant in the lakes to the west around McGavock Lake and become less abundant to the east around Lynn Lake”. McGavock Lake is located approximately 50 km to the south east of the MacLellan site and outside of the LAA (Stantec 2018). Members of the Manitoba Metis Federation (SVS 2020) report that they fish for lake sturgeon in the winter in Cockeram Lake, Sickle Lake (downstream of Cockeram Lake) and Granville Lake, as well as for walleye, northern pike, yellow perch, lake whitefish, and lake trout in lakes throughout the RAA.

The highest electrofishing CPUE in the Keewatin River was for slimy sculpin (3.6 fish per 100 seconds) followed by lake chub (1.8 fish per 100 seconds) and longnose dace (1.3 fish per 100 seconds; Appendix 10A, Figure 10A-1). All other species were captured at rates of <0.3 fish per 100 seconds. Three fish species were captured in gillnets set in the Keewatin River: white sucker at a rate of 23.7 fish per 100 m^2 of net per day and northern pike and lake whitefish at rates ranging from 12.5 to 13.7 fish per 100 m^2 of net per day and 5.0 to 8.3 fish per 100 m^2 of net per day, respectively.

Brook stickleback are the only fish species present in East Pond. This is because, like Gordon Lake, East Pond is shallow (<2 m deep) and dissolved oxygen levels in winter are low enough (<0.5 mg/L) to preclude all other fish species from establishing self-sustaining populations. Brook stickleback in East Pond were captured minnow traps at a rate of 46.9 fish per trap day. There is little littoral vegetation in East Pond, but it is relatively isolated, so brook stickleback are expected to complete all of their life history stages within the lake (Map 10-12).

Brook stickleback are the only fish species present in Dot Lake. This is again likely due to the shallow depth (<2 m deep) and low winter dissolved oxygen concentrations (<3.5 mg/L) in Dot Lake but may also be due to the inability of fish to pass upstream through the “perched” culvert that current exists on the MacLellan Access Road at the Dot Lake outlet. Northern pike, white sucker, and longnose sucker were captured in the creek draining Dot Lake to the Keewatin River in spring and summer 2016. However, none of these species were captured in gillnets or minnow traps set in Dot Lake. Brook stickleback were captured in minnow traps set in Dot Lake at a rate of 4.4 fish per trap day. Dot Lake provides suitable habitat for all life stages of brook stickleback (Map 10-13).

Brook stickleback were captured in minnow traps at a rate of 11.6 fish per trap per day and were the only fish species captured in Payne Lake in 2016. Dissolved oxygen levels in Payne Lake are high enough in late winter (3.4 mg/L) to support other fish species, such as northern pike, but none were captured. Payne Lake provides suitable habitat for all life stages of brook stickleback (Map 10-14). The absence of northern pike and other large-bodied fish species in Payne Lake may be due to the combination of less than ideal overwintering habitat conditions in the lake and the proliferation of beaver dams in the channel draining Payne Lake to the Keewatin River; this channel is approximately 2.5 km long and has a beaver dam density of approximately one dam per 30 m. No fish were captured electrofishing in the Payne Lake outlet in the summer of 2016, but this is more likely due to the inefficiency of electrofishing and minnow trapping in the deep, tannin-stained channels. One northern pike was captured in the Payne Lake outlet, near its confluence with the Keewatin River, in spring 2016. This fish was most likely a Keewatin River resident that had moved a short (<10 m) distance into the Payne Lake outlet.

Northern pike and brook stickleback were the only two fish species captured in Minton Lake in 2016. These same two species and white sucker were also captured in the unnamed lake immediately downstream of Minton Lake. The gill netting CPUE for northern pike was greater in the unnamed lake downstream of Minton Lake (8.7 fish per 100 m^2 of net per day) than in Minton Lake (4.8 fish per 100 m^2 of net per day). Minton Lake provides suitable habitat for all brook stickleback and northern pike life stages (Map 10-15a and Map 10-15b).

Nine fish species were captured gill netting in Cockeram Lake in summer 2016: lake chub, emerald shiner, spottail shiner, white sucker, northern pike, lake whitefish, trout-perch, yellow perch, and walleye. Of these, emerald shiner had the highest CPUE (12.9 fish per 100 m^2 of net per day), followed by northern pike (6.3 fish per 100 m^2 of net per day) and walleye (5.4 fish per 100 m^2 of net per day). Ninespine stickleback and logperch were also captured in Cockeram Lake using a seine. Brook stickleback were not captured in Cockeram Lake in 2016 despite 17.2 trap days of minnow trapping effort. However, brook stickleback are present upstream in the Keewatin River and, therefore, are likely also present in Cockeram Lake. Habitat requirements of ninespine stickleback are similar to those of brook stickleback. Cockeram Lake provides suitable habitat for all life stages of the three large-bodied focal species (northern pike, walleye, and lake whitefish), as well as the focal forage fish species (Map 10-16a, Map 10-16b, Map 10-16c, and Map 10-16d).

Table 10-13 Fish Species Distribution in Lakes and Streams at the MacLellan Site

Waterbody	Northern Pike	Ninespine Stickleback	Brook Stickleback	White Sucker	Longnose Sucker	Yellow Perch	Walleye	Logperch	Spottail Shiner	Emerald Shiner	Lake Chub	Longnose Dace	Lake Whitefish	Cisco	Burbot	Slimy Sculpin	Trout-Perch
Cockeram Lake	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓				✓
Keewatin River (Cockeram Lake to Lynn River)	✓		✓	✓	✓	✓					✓	✓	✓		✓	✓	
Keewatin River (Lynn River to Burge Lake)	✓		✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓
Unnamed Tributary to Keewatin (outlet of East Pond)			✓														
East Pond			✓														
Dot Lake outlet	✓		✓	✓	✓												
Dot Lake			✓														
Payne Lake outlet	✓																
Payne Lake			✓														
Cockeram River (Cockeram Lake to Minton watershed)	✓			✓	✓	✓			✓		✓				✓	✓	
Outlet of Unnamed Lake Downstream of Minton Lake	✓			✓													
Unnamed Lake Downstream of Minton Lake	✓		✓	✓													
Minton Lake	✓		✓														
Inlet to Minton Lake			✓														

10.2.2.4 Spring Spawning Survey

Gordon Site

White sucker were the most abundant species (1,693 individuals) captured in Farley Creek upstream of Swede Lake in spring 2016. Their spawning activity peaked at temperatures between 9.4°C and 12.9°C between May 14 and May 23 (Volume 4, Appendix J). In addition, 20 individual northern pike were captured at this same location; the first spent northern pike was captured when the temperature reached 11.1°C. The cascade in Farley Creek, or the habitat immediately downstream of the cascade, may provide important spawning habitat for stream-spawning large-bodied fish in Swede Lake. Farley Creek had the highest spawning habitat value of the streams described in Volume 4, Appendix J.

Only two white suckers were captured in Farley Creek downstream of Farley Lake during the spring spawning survey in 2016. This may have been due to the presence of a large beaver dam at the outlet of Farley Lake that inhibited downstream movement of fish from the lake into the creek to spawn. No fish were captured moving upstream in Farley Creek to access habitat in Farley Lake.

Brook stickleback (approximately 2,400 individuals) were the only fish species captured at the outlet of Gordon Lake in spring 2016; no large-bodied fish species were captured moving upstream from Farley Lake to Gordon Lake through the diversion channel. These data suggest that there is no obligatory upstream migration of fish from Farley Lake to Gordon Lake to spawn.

MacLellan Site

Northern pike were the most abundant species captured at the MacLellan site in spring 2016. They were also the most widespread, captured at all seven sites. The most northern pike were captured in the two sites in the Cockeram River, upstream of Cockeram Lake and downstream of PR 391, followed by the outlet of the unnamed lake downstream of Minton Lake, the Keewatin River (two sites), Dot Lake outlet, and the outlet of Payne Lake. Spent northern pike were captured from May 14 to May 23, 2016.

10.2.2.5 Species at Risk

The western Hudson Bay populations of lake sturgeon are classified as “endangered” by COSEWIC but are not listed by the Manitoba Conservation Data Centre (MB CDC 2015) and are not on the SARA Schedule 1 Public Registry (Government of Canada 2019). Lake sturgeon are present in the Hughes River, and are reported to be present in Keewatin River. Preferred habitat within their designated unit (i.e., Churchill River Watershed) is characterized by large and deep lacustrine reaches separated by short, high-gradient riverine sections (COSEWIC 2017). Lake sturgeon spawn in late May to late June downstream of swift moving waters over a variety of coarse substrates. Eggs incubate for 5 to 10 days before hatching (DFO and MNR 1996). There are no other fish species at risk or invertebrate species at risk in the LAA or RAA.

10.2.2.6 Fish Health

Gordon Site

The average length, weight, and condition factor of fish captured in lakes in the LAA at the Gordon site in 2016 is provided in Appendix 10B, Table 10 B-1. The range of sizes of fish captured at the Gordon site was generally consistent with previous studies.

Length-weight relationships for the different species were similar between lakes, indicating similar condition. The exception was white sucker in Swede Lake, which generally showed higher condition (i.e., fish were heavier for a given length) than the other lakes. The higher condition of white suckers in Swede Lake may reflect greater food availability for white suckers than in other lakes in the LAA at the Gordon site. The van Bertanlanffy growth model for northern pike predicted a maximum length of 54.2 cm for the Gordon site lakes.

Overall, hepatosomatic index for northern pike at the Gordon site (Swede Lake, Farley, and Susan lakes) ranged from 0.7 to 2.3%. The northern pike in Susan Lake had the highest average hepatosomatic index (HSI) (1.4%) followed by Farley Lake (1.3%), and the northern pike in Swede Lake had the lowest HSI (1.1%). Average HSI for lake whitefish at the Gordon site (Swede Lake) was 1.2%.

Northern pike diet for fish sampled in the Gordon site consisted of brook stickleback, northern pike, yellow perch, spottail shiner, slimy sculpin and white sucker as well as benthic invertebrates including scuds (Order Amphipoda), water boatman (Family Corixidae), dragonflies (Suborder Anisoptera), leeches (Subclass Hirudinea), clams/snails (Phylum Mollusca), mayflies (Order Ephemeroptera) and worms (Subclass Oligochaeta). The type of fish prey eaten were indicative of the fish species present in the waterbody the pike were captured.

Lake whitefish diet included scuds, water boatman and snails/clams, white sucker diet included dragonfly larvae, leeches, and midges (Family Chironomidae) and yellow perch diet included dragonfly larvae.

MacLellan Site

The range of sizes of fish captured at the MacLellan site was consistent with previous studies. Average fork lengths (± standard error) measured during the 2016 summer program are provided in Appendix 10B, Table 10 B-2 and Table 10 B-3.

The length-weight relationships for the different species were similar between lakes and rivers in the LAA at the MacLellan site. The von Bertanlanffy growth model for northern pike at the MacLellan site predicted a maximum length of 87.4 cm. This is larger than the predicted maximum length of northern pike at the Gordon site. This difference likely reflects the larger size, greater habitat diversity, and better connectivity of the lakes and rivers at the MacLellan site compared to the Gordon site.

Overall, hepatosomatic index for northern pike in the MacLellan site LAA (Cockeram Lake, Keewatin River, Minton Lake, Lobster Lake) ranged from 0.4 to 2.7%. The northern pike in Lobster Lake had the highest average hepatosomatic index (HSI) (1.4%) followed by Minton Lake (1.3%), Keewatin River (0.9 to 1.1%), and Cockeram Lake (0.7%) with the lowest HSI. Average HSI for lake whitefish within the MacLellan site LAA (Cockeram Lake) was 1.2%.

The diet of northern pike sampled in the MacLellan site LAA consisted of brook stickleback, yellow perch, and white sucker as well as benthic invertebrates including scuds, water boatman, dragonflies, dobsonflies (Family Corydalidae) and mayflies and a water shrew. They type of fish prey observed were based on the fish species available within each waterbody or watercourse. Lake whitefish diet included beetles (Order Coleoptera) and other unidentified invertebrates.

10.2.2.7 Fish Tissue Analysis

Gordon Site

Laboratory analyses of liver, muscle, and carcass samples from northern pike captured in Farley, Swede, and Susan lakes showed that:

- Arsenic concentrations (maximum value 0.074 mg/kg w/w) were well below the MWQSOG tissue concentration (3.5 mg/kg w/w) for all tissue types.
- Lead concentrations were below the laboratory detection limit (0.04 mg/kg w/w) and well below the MSQSOG (0.5 mg/kg w/w). The exception was one northern pike carcass sample from Susan Lake that had a lead concentration (5.35 mg/kg w/w) above the MWQSOG tissue concentration (0.5 mg/kg w/w). This carcass sample was an outlier and may have been contaminated during processing.
- Mercury concentrations in all northern pike samples were below the MWQSOG tissue concentration (0.5 mg/kg w/w) except for 10% of samples from Swede Lake (four muscle samples, one carcass sample, and one liver sample), which were above the MWQSOG tissue concentration (Appendix 10A, Figure 10A-2).
- Selenium concentrations for all northern pike muscle and carcass samples were below or near the laboratory detection limit (0.1 mg/kg w/w) and well below the BC muscle tissue guideline (4.0 mg/kg w/w). However, 18 of the 45 liver samples (40%) across all three lakes exceeded the BC tissue guideline.

Laboratory analyses of liver, muscle, and carcass tissue samples from lake whitefish captured in Swede Lake showed that:

- Arsenic concentrations (maximum value 0.108 mg/kg w/w) were well below the MWQSOG tissue concentration (3.5 mg/kg w/w).
- Lead concentrations were below the laboratory detection limit (0.04 mg/kg w/w) and well below the MSQSOG (0.5 mg/kg w/w).
- Selenium concentrations in muscle and carcass samples (<0.4 mg/kg w/w) were an order of magnitude lower than the BC tissue guideline (4.0 mg/kg w/w). However, selenium concentrations in eight of the 15 liver samples (53%) exceeded the BC tissue guideline.

Laboratory analyses of whole-body brook stickleback and spottail shiners (two small-bodied forage fish species) from Gordon Lake, East Pit, Wendy Pit, and Susan Lake showed that:

- Arsenic concentrations (<0.5 mg/kg w/w) were above the detection limit but well below the MWQSOG (3.5 mg/kg w/w).
- Lead concentrations were below the laboratory detection limit (0.04 mg/kg w/w) and well below the MSQSOG (0.5 mg/kg w/w).
- Mercury concentrations (<0.05 mg/kg w/w) were well below the MWQSOG (0.5 mg/kg w/w).
- Selenium concentrations were below the BC tissue guideline (4.0 mg/kg w/w).

Although measured levels of metals in fish tissue were generally low, the Marcel Colomb First Nation have reported that fish abundances have been reduced since before the Farley Mine was operated, particularly at Swede Lake (Stantec 2018), where there was a commercial fishery targeting “jumbo” lake whitefish.

MacLellan Site

Laboratory analyses of liver, muscle, and carcass samples from northern pike from Cockeram Lake and Minton Lake showed that:

- Arsenic concentrations (maximum values <0.06 mg/kg w/w) were well below the MWQSOG tissue concentration (3.5 mg/kg w/w).
- Lead concentrations were below laboratory detection limits (0.04 mg/kg w/w) and well below the MSQSOG (0.5 mg/kg w/w) for all samples.
- All tissue samples from Minton Lake and most (87%) tissue samples from Cockeram Lake were below the MWQSOG for mercury (0.5 mg/kg w/w). Two liver, two muscle, and two carcass samples from Cockeram Lake had mercury levels above the MWQSOG (0.5 mg/kg w/w) but lower than 1.0 mg/kg w/w (Appendix 10A, Figure 10A-3). Similar guideline exceedances were observed in Burge and Goldsand lakes upstream of the influence of past mining activities.
- Selenium concentrations in all muscle and carcass samples were well below the BC tissue guideline (4.0 mg/kg w/w). However, all liver samples from Cockeram Lake and 40% of the liver samples from Minton Lake had selenium concentrations that exceeded the BC tissue guideline.

Laboratory analyses of liver, muscle, and carcass tissue samples from lake whitefish from Cockeram Lake showed that:

- Arsenic concentrations (<0.05 mg/kg w/w) were well below the MWQSOG (3.5 mg/kg w/w).
- Lead concentrations were below laboratory detection limits (0.04 mg/kg w/w) and well below the MSQSOG (0.5 mg/kg w/w).

- Selenium concentrations in muscle and carcass samples were <0.4 mg/kg w/w and an order of magnitude lower than the BC tissue guideline (4.0 mg/kg w/w). However, 92% of liver samples exceeded the BC tissue guideline, which applies to muscle samples only.

Laboratory analyses of whole-body brook stickleback and spottail shiner samples from Minton Lake, Dot Lake, and Payne Lake showed that:

- Arsenic concentrations (<0.07 mg/km w/w) were well below the MWQSOG (3.5 mg/kg w/w).
- Lead concentrations in all spottail shiner samples from all lakes, all brook stickleback samples from Dot and Payne lakes, and 75% of all brook stickleback samples from Minton Lake were an order of magnitude below the MSQSOG tissue guideline (0.5 mg/kg w/w). Only one of the four composite samples from Minton Lake (0.509 mg/kg w/w) had a lead concentration above the MWQSOG (0.5 mg/kg w/w).
- Mercury concentrations in both species were an order of magnitude lower than the MWQSOG (0.5 mg/kg w/w).
- Selenium concentrations in both species were below the BC tissue guidelines (4.0 mg/kg w/w).

10.2.2.8 Sediment Quality

Gordon Site

Sediments at all sample sites in the LAA at the Gordon site were comprised largely of silt and clay (Appendix 10A, Figure 10A-4). The exceptions were in Simpson and Swede lakes where fine and coarse sand comprised a larger proportion of the sediment than at the other sites. The relatively high proportion of silt and clay in Farley Creek is indicative of the depositional habitat present in the creek upstream and downstream of the boulder cascade.

Sediments collected from lakes and streams in the LAA at the Gordon site generally had metal concentrations below the Canadian Interim Sediment Quality Guidelines for the Protection of Aquatic Life (CCME 2020) and the Manitoba Interim Sediment Quality Guidelines for the Protection of Aquatic Life (MWS 2011). The exceptions were:

- Arsenic concentrations in Marie Lake (7.7 mg/kg) and Farley Lake (7.0 to 8.2 mg/kg) above the CCME ISQG and Manitoba ISQG of 5.9 mg/kg.
- Cadmium concentrations in Marie Lake (0.86 mg/kg) above the CCME ISQG and Manitoba ISQG of 0.6 mg/kg.
- Chromium concentrations in Susan Lake (48.8 mg/kg), Farley Lake (70.0 mg/kg), and Farley Creek (41.0 mg/kg) above the CCME ISQG and Manitoba ISQG of 37.3 mg/kg.
- Zinc concentrations in Marie Lake (186.2 mg/kg) above the CCME ISQG and Manitoba ISQG of 123.0 mg/kg.

Average metal concentrations at all sites in the LAA at the Gordon site were below the CCME and Manitoba Probable Effects Levels (PEL) with the exception of two individual replicates at two different sites: 1) one of three replicates in Marie Lake had a zinc concentration (321 mg/kg) above the CCME and Manitoba PEL of 315 mg/kg; and 2) one of three replicates in Farley Lake had a chromium concentration (126 mg/kg) above the CCME and Manitoba PEL of 90 mg/kg. Marie Lake is upslope from the former Farley Lake mine and Susan Lake is in the adjacent watershed from the former Farley Lake mine and, therefore, elevated metal concentrations in these lakes are unlikely to be mine related.

MacLellan Site

Sediments at all sample sites in the LAA at the MacLellan site were comprised largely of silt and clay (Appendix 10A, Figure 10A-5). Fine and coarse sands were more abundant in the Keewatin River, the Cockeram River, and in Cockeram Lake than at all other sites.

Metal concentrations in sediments collected from lakes and streams in the LAA at the MacLellan site exceeded Canadian and Manitoba ISQGs more frequently than in the Gordon site LAA, both upstream and downstream of historical mining activities (i.e., the ETMA adjacent to the Lynn River and Eldon Lake). Sediment guideline exceedances included:

- Arsenic concentration in Minton Lake (6.09 mg/kg) exceeded the CCME/Manitoba ISQG of 5.9 mg/kg.
- Cadmium concentrations in Payne Lake (0.71 mg/kg) and Eldon Lake (1.2 mg/kg) exceeded the CCME/Manitoba ISQG of 0.6 mg/kg.
- Chromium concentrations in Eldon Lake (54.4 mg/kg), the Keewatin River downstream of the Lynn River (85.5 mg/kg), and in the north basin of Cockeram Lake exceeded the CCME/Manitoba ISQG of 37.3 mg/kg.
- Copper concentrations in Eldon Lake (185 mg/kg), the Keewatin River downstream of the Lynn River (109.8 mg/kg), and in the north (50.8 mg/kg) and east (55.3 mg/kg) basins of Cockeram Lake exceeded the CCME/Manitoba ISQG of 35.7 mg/kg.
- Zinc concentrations in the Keewatin River downstream of the Lynn River (210 mg/kg) and in all five sampling locations in Cockeram Lake (>125 mg/kg) exceeded the CCME/Manitoba ISQG of 123 mg/kg.

Chromium, copper, and zinc concentrations in downstream of the ETMA also exceeded the CCME/Manitoba PEL concentrations:

- Chromium concentrations in Eldon Lake (54.4 mg/kg), the Keewatin River downstream of the Lynn River (85.5 mg/kg), and in the north basin of Cockeram Lake (39.3 mg/kg) exceeded the CCME/Manitoba PEL concentration of 90.0 mg/kg.
- Copper concentration at one of five locations in Cockeram Lake (213.0 mg/kg) exceeded the CCME/Manitoba PEL concentration of 197 mg/kg.

- Zinc concentrations in Eldon Lake (513.3 mg/kg) and the Lynn River (343.0 mg/kg) exceeded the CCME/Manitoba PEL concentration of 315 mg/kg.

These data show that the ETMA has resulted in elevated chromium, copper, and zinc (and potentially cadmium) concentrations in the sediments of downstream lakes and streams.

10.2.2.9 Lower Trophic Communities

Gordon Site

The periphyton community in the boulder cascade habitat in Farley Creek, the only erosional habitat present in the LAA at the Gordon site, was dominated by cyanobacteria (*Calothrix/Rivularia* and *Homeothrix*) and diatom (*Tabellaria*) species in 2016. Periphyton density was relatively low (1,732 cells/cm^2).

Phytoplankton biovolumes, cell densities, and taxonomic richness were generally higher in the larger lakes than in the smaller lakes at the Gordon site. Chlorophyll *a* concentrations, cell densities, and biovolumes were generally higher in the fall than in the summer in the larger lakes. The dominant phytoplankton taxon in Farley Lake was *Cryptomonas sp.*, which was present in all sampled lakes. The cyanobacteria *Aphanothece* sp. and diatom *Melosira* sp. were the dominant phytoplankton taxa in Swede, Simpson, and Susan lakes. The green alga *Dictyosphaerium* sp. was the dominant phytoplankton taxon in Gordon Lake.

Zooplankton biovolume, density, and taxonomic richness were greater in fall than in summer. Rotifers and ciliates were the most abundant zooplankton in all lakes. The ciliate *Vorticella* sp. was dominant or subdominant in Farley, Susan, and Swede lakes, while the rotifer *Conochilus* sp. was dominant in Gordon and Simpson lakes.

BMI densities and taxonomic richness were lower in small, headwater lakes (e.g., Susan Lake) than in larger lakes (e.g., Swede Lake). Chironomids were the dominant taxonomic group in all lakes sampled at the Gordon site, followed by bivalves, gastropods, amphipods, and oligochaetes. BMI densities were higher in depositional habitats than in erosional habitats in the sampled streams, but taxonomic richness was higher in erosional habitats. Depositional sites in streams, like lakes, were dominated by chironomids, bivalves, and amphipods. The dominant taxa at the erosional site in Farley Creek were EPT taxa (i.e., Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies)), taxa that require higher dissolved oxygen concentrations and harder substrates than chironomids, bivalves, and oligochaetes and that are generally indicators of good water quality.

MacLellan Site

The periphyton communities from erosional sites in the LAA at the MacLellan site ranged in density from 8,490 cells/cm^2 in the outlet of the unnamed lake downstream of Minton Lake to 1,521,000 cells/cm^2 at sites in the Lynn River. The low periphyton density in the outlet of the unnamed lake downstream of Minton Lake was likely due to the near 100% canopy cover at this site. The dominant periphyton taxa at most sites were cyanobacteria (*Calothrix/Rivularia* and *Homeothrix*) and diatom (*Tabellaria*) species.

The periphyton communities in the outlet of the unnamed lake downstream of Minton Lake and the Lynn River had relatively low variability among replicates and the community composition was statistically distinct. The community composition at Minton Lake and the Lynn River was also statistically distinct from the other sampling locations in the LAA at the MacLellan site. Conversely, the periphyton communities in the Keewatin River, upstream and downstream of the Lynn River confluence, and in the Dot Lake outlet had higher variability among replicates within a site and had periphyton communities that overlapped in taxonomic composition.

Phytoplankton biovolumes and cell densities were lower in the larger lakes than in the smaller lakes in the LAA at the MacLellan site. Phytoplankton communities in Dot, Lobster, and Payne lakes were dominated by the cyanobacteria taxon *Aphanothece* sp. Conversely, the phytoplankton communities in Cockeram Lake were dominated by diatoms (*Asterionella* or *Tabellaria*), the cryptoflagellate *Cryptomonas*, or the blue-green alga *Aphanocapsa* sp, which was also the dominant taxon in Minton Lake. In general, phytoplankton cell density, taxa richness, diversity and evenness followed similar seasonal trends by lake (i.e., if the richness was high in summer, it was high in fall).

Zooplankton biovolume, density, and taxonomic richness were greater in fall than in summer. Rotifers and ciliates were the most abundant zooplankton in all lakes. The ciliate *Vorticella* was dominant in Payne, Dot, and Minton lakes, while *Conochilus*, *Vorticella*, and *Kellicottia* were the dominant taxa in Cockeram Lake.

BMI densities and taxonomic richness were higher in the smaller lakes (Minton, Dot, and Payne lakes) than in the larger lake (Cockeram Lake) in the LAA at the MacLellan site. Chironomids were the dominant taxon in all locations except for one site in Cockeram Lake near the mouth of the Cockeram River where ceratopogonids were the dominant taxon. The BMI community at this site was more balanced in terms of the relative abundance of taxonomic groups compared to other sites in the lake or elsewhere and was comprised of any almost even composition of chironomids, gastropods, EPT taxa and ceratopogonids.

BMI densities were higher in depositional habitats than in erosional habitats in the streams in the LAA at the MacLellan site. However, taxonomic richness was higher in erosional habitats. Like the lakes, depositional sites in streams, were dominated by chironomids, bivalves, and amphipods. The dominant taxa at the erosional sites were EPT taxa.

10.3 PROJECT INTERACTIONS WITH FISH AND FISH HABITAT

Project activities for each phase are described in detail in Chapter 2, Section 2.3 and 2.4. Project related emissions and discharges are described in Chapter 2, Section 2.8. Potential interactions between Project activities and the environment were considered for the construction, operation, and decommissioning/closure phases of the Project. Identification of Project activities and their potential interactions was based on engagement with interested parties, the professional judgment of technical specialists involved in the assessment, and a review of existing conditions. The selection of interactions was also informed by the potential effects and effects pathways for each VC as described in Section 10.1.3.

Project activities and components that have the potential to interact with Fish and Fish Habitat at the Gordon and MacLellan sites are identified by a check mark in Table 10-14. These interactions are those that may result in a HADD of fish habitat, as well as those interactions that may adversely affect the health, growth, or survival of fish. Justification for those Project activities and components not expected to result in a change in fish habitat and/or a change in fish health, growth, or survival is provided following the table.

Emissions, discharges, and wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many and varied Project activities. Rather than acknowledging this by placing a check mark against each of these activities, "Emissions, Discharges and Wastes" have been consolidated as an integrated activity for efficiency with relevant detail described in the text. This category includes the emissions, discharges, and wastes generated by all project activities under each Project phase.

Table 10-14 Project-Environment Interactions with Fish and Fish Habitat

Project Activities and Components	Environmental Effects			
	Change in Fish Habitat		Change in Fish Health, Growth, or Survival	
	Gordon site	MacLellan site	Gordon site	MacLellan site
Construction				
Site Preparation at Both Sites (removal of existing buildings; removal of contaminated materials; vegetation clearing and earthworks; development of temporary construction camp at the MacLellan site)	–	–	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	–	–	–	–
Mine Components at Both Sites (construction of ore pads; ore, overburden and mine rock storage areas; mill feed storage area and crushing plant, ore milling and processing plant, and TMF at the MacLellan site; water management facilities [e.g., sumps, ponds and ditches])	✓	✓	–	–
Utilities, Infrastructure, and Other Facilities at Both Sites (construction of: buildings and yards; access roads [i.e., upgrades at the Gordon and MacLellan site] and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at the MacLellan site; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities)	✓	✓	✓	✓
Water Development and Control at Both Sites (dewatering of existing pits at the Gordon site; interceptor wells at the Gordon site; realignment of existing diversion channel at the Gordon site; and underground workings at the MacLellan site)	✓	–	✓	–
Emissions, Discharges, and Wastes[1]	–	–	✓	✓

Table 10-14 Project-Environment Interactions with Fish and Fish Habitat

Project Activities and Components	Environmental Effects			
	Change in Fish Habitat		Change in Fish Health, Growth, or Survival	
	Gordon site	MacLellan site	Gordon site	MacLellan site
Employment and Expenditure[2]	–	–	✓	✓
Operation				
Open Pit Mining at Both Sites (drilling; blasting; removal, loading and on-site hauling of mined material [i.e., ore, overburden, and mine rock])	✓	✓	✓	✓
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA, including truck transportation of ore from the Gordon site to the MacLellan site)	–	–	–	–
Storage/Stockpiling of Ore, Overburden, and Mine Rock at both sites	–	–	–	–
Ore Milling and Processing at the MacLellan site (ore crushing and conveyance; ore milling)	–	–	–	–
Water Management at Both Sites (mine water collection and storage; process water supply for the MacLellan site including water intake on Keewatin River at the MacLellan site; pumping fresh/fire water from Farley Lake at Gordon site; operation of interceptor wells at the Gordon site)	✓	✓	✓	✓
Tailings Management at the MacLellan site	–	–	–	–
Utilities, Infrastructure, and Other Facilities at Both Sites (presence and operation of: buildings and yards; access roads and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at MacLellan; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities; explosives storage, maintenance of access roads and bridges)	–	–	–	–
Emissions, Discharges, and Wastes[1]	–	–	✓	✓
Employment and Expenditure[2]	–	–	✓	✓
Decommissioning/Closure				
Decommissioning at Both Sites	–	–	–	–
Reclamation at Both Sites	✓	✓	–	–

Table 10-14 Project-Environment Interactions with Fish and Fish Habitat

Project Activities and Components	Environmental Effects			
	Change in Fish Habitat		Change in Fish Health, Growth, or Survival	
	Gordon site	MacLellan site	Gordon site	MacLellan site
Post-Closure at Both Sites (long-term monitoring)	–	–	✓	✓
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	–	–	–	–
Emissions, Discharges, and Wastes[1]	–	–	✓	✓
Employment and Expenditure[2]	–	–	✓	✓

NOTES:
✓ = Potential interaction
– = No interaction
[1] Emissions, Discharges, and Wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many Project activities. Rather than acknowledging this by placing a check mark against each of these activities, "Emissions, Discharges and Wastes" have been introduced as an additional component under each Project phase.
[2] Project employment and expenditures are generated by most Project activities and components and are the main drivers of many socio-economic effects. Rather than acknowledging this by placing a check mark against each of these activities, "Employment and Expenditures" have been introduced as an additional component under each Project phase.

Avoidance measures (spatial and/or temporal) prevent potential interactions between Project components or activities and fish and fish habitat by physically relocating the Project components or activities, or by scheduling Project activities to avoid critical periods in a fish's life history (e.g., spawning period). No residual effect was assumed to occur if an avoidance measure was available for a Project component or activity.

The Surface Water VC (Chapter 9) included interactions between the Project and potential changes in surface water quantity (Section 9.3) that were not included in Table 10-14. This is because all Project activities and components that could influence surface water quantity, and therefore the water balance model, were identified in Chapter 9 (Table 9-10), while only those Project activities and components that could directly affect fish and fish habitat through potential changes to surface water quantity were included in Table 10-14.

Project activities and components that are not expected to result in a change in fish habitat are:

- Site preparation activities at both sites during construction will occur on land, away from lakes and streams.

- Project-related transportation within the LAA at both sites during construction, operation, and decommissioning/closure phases; these activities will occur on land, away from lakes and streams.
- Water development and control at the MacLellan site because the water that will be removed from the underground workings will be pumped to the TMF, and not released to the environment.
- Employment and expenditure at both sites; these activities are not expected to interact with fish habitat.
- Storage/stockpiling of ore, overburden, and mine rock at both sites during operation will occur on land, away from lakes and streams.
- Ore milling and processing at the MacLellan site during operation because this will occur inside of the processing facility away from lakes and streams.
- Tailings management at the MacLellan site as tailings management will not interact with fish or fish habitat because the TMF has been designed and sited specifically to avoid lakes and streams to avoid requiring amendment of Schedule 2 of the MDMER.
- Utilities, infrastructure, and other facilities at both sites during operation because these activities will occur on land, away from lakes and streams.
- Decommissioning at both sites because these activities will be land-based and occur away from lakes and streams.
- Post-closure activities at both sites because long-term monitoring activities would not include alterations to fish habitat.

The Project could interact with fish health, growth, or survival through alterations to water quality or direct mortality to fish. Unmitigated, several Project activities and components would produce various discharges to lakes and streams at both sites. Rather than identifying these activities and components as interactions individually in Table 10-14, the potential interactions are grouped together into an “emissions, discharges, and wastes” activity in each mine phase. The Project activities and components that have the potential to interact with the fish health, growth, or survival and that have been grouped into “emissions, discharges and wastes” are:

- Site preparation at both sites could generate sediment during construction that may reach waterbodies.
- Mine components at both sites could generate sediment during construction that may reach waterbodies.
- Storage/stockpiling of ore, overburden, and mine rock at both sites during operation could generate sediment that may reach waterbodies.
- Ore milling and processing at the MacLellan site during operation could release sediment that may reach waterbodies.
- Reclamation at both sites could generate sediment that may reach waterbodies.

The Project activities and components that are not identified as interactions with fish health, growth, or survival in Table 10-14 are:

- Project-related transportation within the LAA during construction, operation, and decommissioning/ closure phases, because these activities will occur on land, away from lakes and streams.
- Water development and control at the MacLellan site, because water removed from the underground workings will be pumped to the TMF, not released to the environment.
- Tailings management at the MacLellan site because the TMF has been designed to be non-discharging during operation.
- Utilities, infrastructure, and other facilities at both sites during operation will occur on land, away from lakes and streams, and are not expected to release sediment during operation.
- Decommissioning at both sites because this activity only involves the removal of buildings from the land, which are not located near any lakes or streams.

The “employment and expenditure” activity has the potential to affect the health, growth, or survival of fish because of the increased number of potential recreational anglers who may be brought into work at the LLGP and live in the camp. For this reason, this activity has been checked for all Project phases.

10.4 ASSESSMENT OF RESIDUAL ENVIRONMENTAL EFFECTS ON FISH AND FISH HABITAT

10.4.1 Change in Fish Habitat

10.4.1.1 Analytical Assessment Techniques

Potential effects of the Project on fish and fish habitat were assessed quantitatively when model results were available, or qualitatively when model results were not available. Quantitative assessments included:

- GIS analysis of the Project footprint overlain on habitat maps of fish-bearing and non-fish-bearing watercourses and waterbodies to delineate potential habitat losses under the mine infrastructure.
- Comparison of water balance model predictions to baseline stream discharges and the federal Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada (DFO 2013). These comparisons were conducted for three modeled climate scenarios to depict the range of likely flow changes: average; 1:25 year dry; and 1:25 year wet.
- Comparison of water balance model predictions to baseline water levels in lakes and percent changes in maximum lake depths.

Qualitative assessments were conducted using a weight-of-evidence approach. This entailed the use of professional judgement based on an understanding of the Project and potential effect, the habitat use and life history of potentially affected fish species in the LAA and RAA, and the likely effectiveness of mitigation measures, supported by scientific literature, grey literature, industry best management practices, and regulatory guidelines, as available.

10.4.1.2 Project Pathways

Gordon Site

Changes in fish habitat may result from loss or alteration of habitat underneath mine infrastructure or from alteration of lake levels in lakes or streamflows the Gordon site LAA (Table 10-15).

Table 10-15 Project Pathways for Change in Fish Habitat at the Gordon Site

Project Activity or Component	Project Phase(s)	Project Pathways
Mine Components: Water Management	Construction	• Change in surface flows as construction of water management facilities (sumps, ponds, and ditches) alter natural drainage patterns and catchments areas.
Utilities and Infrastructure	Construction	• Change in habitat at road crossings requiring upgrading along the Gordon Mine access road.
Water Development and Control	Construction	• Alteration of water levels in Farley Lake and streamflows in Farley Creek during pit dewatering. • Loss of habitat in the existing diversion channel between Gordon and Farley lakes to allow expansion and mining in the open pit. • Change in habitat in Farley Lake due to construction of the freshwater intake and collection pond and groundwater interceptor well effluent pipes. • Change in habitat in Gordon Lake due to construction of the groundwater interceptor well effluent pipe. • Change in physical habitat at effluent diffuser in Farley Lake.
Open Pit Mining	Operation	• Change in surface flows in Gordon Lake and Farley Lake due to changes in the groundwater table as the open pit is developed.
Water Management	Operation	• Change in water levels in Farley Lake due to water withdrawals for fire and dust suppression, safety showers, and truck washes. • Change in water levels in Farley Lake and flows in Farley Creek due to release of contact water from the collection pond.

Table 10-15 Project Pathways for Change in Fish Habitat at the Gordon Site

Project Activity or Component	Project Phase(s)	Project Pathways
		• Change in water levels in Gordon Lake and Farley Lake and flows in Farley Creek due to operation of groundwater interceptor wells.
Reclamation	Decommissioning/Closure	• Change in water levels in Gordon Lake and Farley Lake and flows in Farley Creek due to diversion of contact water to the open pit and progressive reduction in groundwater interceptor well pumping to fill the open pit with water.

Potential changes in water levels in Gordon and Farley lakes could occur due to: depression of the groundwater table; loss of surface water from the lakes due to development of the open pit during construction and operation; and diversion of contact water to fill the open pit during decommissioning/closure. These changes have the potential to affect fish and fish habitat in Gordon and Farley lakes by:

- Reducing the quantity of littoral habitat used by fish for spawning, rearing, and foraging.
- Reducing the quantity of overwintering habitat under the ice.
- Reducing the quality of overwintering habitat due to reductions in dissolved oxygen concentrations.

Brook stickleback are the only fish species in Gordon Lake. Brook stickleback, northern pike, yellow perch, and white sucker inhabit Farley Lake. Summaries of their life histories and habitat preferences are discussed in Section 10.2.2.1.

Preferred, tolerated, and lethal dissolved oxygen concentrations for northern pike, brook stickleback, yellow perch, and white sucker are provided in Table 10-16. Brook sticklebacks can tolerate the lowest dissolved oxygen concentrations of these four fish species. Yellow perch and white suckers are the least tolerant of low dissolved oxygen concentrations (Table 10-16). Northern pike are nearly as tolerant of low dissolved oxygen concentrations as brook sticklebacks, which helps explain their preference for shallow, warm, weedy habitats in summer.

Table 10-16 Dissolved Oxygen Tolerances of Gordon Lake and Farley Lake Fish Species

Species	Dissolved Oxygen Concentration (mg/L)		
	Preference / Non-limiting*	Tolerance Range*, ^	Lethal Levels*
Brook stickleback	>2[H]	0.25[G] (laboratory) 0.3[G] (field)	No literature found
Northern pike	>3[I]	<0.5[J] (field) 0.25-0.5[F] (laboratory)	0.2[E] (field)
Yellow perch	>5.0[D]	0.5[E] (field) 0.5[F] (laboratory)	0.3[E] (field) 0.2 – 1.5[D]
White sucker	>2.4[A], >4[C]		<1.2[B]

Sources: [A] Twomey et al. 1984; [B] Siefert and Spoor (1974) as reported in Twomey et al. 1984; [C] Sellers et al. 1998; [D] Krieger et al. 1983; [E] Cooper and Washburn 1949; [F] Petrosky and Magnusson 1973; [G] Klinger et al. 1982; [H] Jones 1952; [I] Casselman and Lewis 1996; [J] Harvey 2009

* Each study recorded responses to dissolved oxygen differently. For this table, preferred and non-limiting values were based on habitat selection data or dissolved oxygen concentrations identified as non-limiting; tolerance values were based on concentrations at which fish exhibited oxygen-seeking behaviours but few or no fish died; lethal levels were based on concentrations at which fish mortalities occurred.

^ lowest dissolved oxygen concentrations that fish can survive and not show signs of stress

MacLellan Site

Changes in fish habitat will result from change in physical habitat due to mine infrastructure or from alteration of surface flows (lake levels and stream discharges) in waterbodies in the MacLellan site LAA (Table 10-17).

Table 10-17 Project Pathways for Change in Fish Habitat at the MacLellan Site

Project Activity	Project Phase(s)	Project Pathways
Mine Components: Water Management	Construction	• Change in surface flows as construction of water management facilities (sumps, ponds, and ditches) alter natural drainage patterns and catchments areas.
Utilities and Infrastructure	Construction	• Change in habitat at road crossings requiring upgrading along the MacLellan Mine access road. • Change in habitat at watercourse crossings along the new transmission line to the MacLellan site. • Change in habitat at the new intake structure to be constructed in the Keewatin River • Change in flows in Keewatin River due to operation of the water intake.

Table 10-17 Project Pathways for Change in Fish Habitat at the MacLellan Site

Project Activity	Project Phase(s)	Project Pathways
Open Pit Mining	Operation	• Change in water levels in East Pond and its outlet to the Keewatin River due to changes in the groundwater table as the open pit is developed.
Water Management	Operation	• Alteration of surface flows in Minton Lake due to expansion of water management ditches and sumps that alter its catchment area. • Change in flows in Keewatin River due to operation of the water intake.
Reclamation	Decommissioning/ Closure	• Change in water levels in East Pond as contact water and groundwater fill the open pit. • Change in flows in the Keewatin River tributary draining East Pond and in the Keewatin River once the open pit is filled and discharging to the environment.

Potential changes in water levels in Minton Lake, East Pond, the East Pond outlet (KEE3-B1), and the Keewatin River could occur due to: changes in the groundwater table; upstream catchment area run-off; and water withdrawals and effluent discharges during construction, operation, and decommissioning/ closure. These changes have the potential to affect fish and fish habitat by altering the depths and littoral areas in lakes and the width, depth, and water velocity of streams and rivers. These habitats, particularly the Keewatin River, are important spawning, rearing, foraging, and overwintering habitat for fish. Life histories of the fish species in Minton Lake, East Pond and its outlet, and in the Keewatin River are presented in Section 10.2.2.1. Potential changes in water levels in lakes could also affect overwintering habitat quality for fish. Preferred, tolerated, and lethal dissolved oxygen concentrations for fish species in the MacLellan LAA are provided in Table 10-16.

10.4.1.3 Mitigation Measures

Most of the mitigation measures to reduce Project-related effects on fish habitat are related to avoidance measures and to the mitigation measures proposed to reduce Project-related effects on surface water quantity (Chapter 9, Sections 9.4.1.3 and 9.4.2.3). They include mitigation measures common to both sites and mitigation measures specific to the MacLellan or Gordon sites. Mitigation measures specific to eliminating or reducing Project-related effects on fish habitat are also identified.

The implementation of the mitigation measures and other commitments described in this section will be the responsibility of Alamos and or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

The mitigation measures proposed are effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection. For example, Manitoba Infrastructure's guidelines (DFO and MNR 1996) for new road crossings will be used when constructing, maintaining, or upgrading stream crossings on mine access roads.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Mitigation Measures Used at Both Sites

The primary mitigation measure to avoid or reduce the Project-related changes in fish habitat was to locate Project components away from fish habitat wherever possible. Alamos' approach to reducing changes in fish habitat was to first avoid effects to habitat, then to reduce the affected area as much as practicable, then to offset for any unavoidable losses of fish habitat. The Project footprint went through an evaluation of alternatives, described in Chapter 2, during which Project components were moved to avoid fish habitat. This process included changing the shape, size, and location of the TMF and MRSA at the MacLellan site to avoid fish-bearing tributaries of Minton Lake. Additional mitigation measures relating to availability of habitat area, common to both sites are:

- Sizing new culverts to convey the 1:100-year flood and using open-bottom structures where practical to maintain fish habitat values and fish passage.
- New road crossings will be sized and installed following Manitoba Infrastructure guidelines (DFO and MNR 1996).
- Designing open pit outlets so they are impassable to fish, to discourage fish from colonizing open pits in post-closure.
- Counterbalancing unavoidable habitat losses by implementing offsets from the suite of options described in the Fish Habitat Offsetting Plan (Chapter 23).

Avoiding and reducing Project-related changes to fish habitat is a first step toward avoiding and reducing Project-related changes to surface flows that could affect fish habitat. Additional mitigation measures to avoid or reduce potential effects to groundwater quantity (Chapter 8) and surface water quantity (Chapter 9) at both sites are:

- Limiting the construction footprint to the extent possible to reduce potential reductions in groundwater recharge, to limit the number of watercourses overprinted by the PDA, and to limit the number of extent of changes to catchment area runoff due to encroachment of the PDA into various watersheds.
- Constructing upstream perimeter ditches to divert non-contact water around Project components, reporting to the original receiving environments.

- Using standard construction methods such as seepage cutoff collars, where trenches extend below the water table, to mitigate preferential flow paths.
- Collecting groundwater seepage from underground/open pit dewatering.
- Pumping excess water to collection ponds as needed.
- Maintaining existing drainage patterns to the extent possible with the use of culverts.
- Refilling open pits with contact water at closure to return groundwater levels to near baseline conditions.

Project-specific environmental management and monitoring plans will also be implemented for both sites (Chapter 23).

Mitigation Measures Specific to the Gordon Site

Mitigation measures to avoid or reduce Project-related changes in fish habitat, including those potentially due to changes in groundwater and surface water flows, at the Gordon site are:

- Constructing a new diversion channel to convey surface run-off from Gordon Lake to Farley Lake.
- Trucking potable water to the Gordon site from the MacLellan site to limit the freshwater withdrawal requirements at the Gordon site to those needed for fire suppression, safety showers, and truck washes.
- Constructing and operating groundwater interceptor wells on either side of the open pit (Chapter 8, Section 8.4.2.2. and 8.4.3.2) to capture and return groundwater and surface water to Gordon and Farley lakes that would otherwise flow into the open pit.
- Directing contact water from the collection ditches around the MRSA, overburden stockpile, and mine infrastructure to the open pit during decommissioning/closure to reduce the filling period.
- Continuing to operate the groundwater interceptor wells during closure while the open pit fills with water and progressively reducing their pumping rates until the water level in the open pit reaches the elevation of the surrounding groundwater table.

The groundwater interceptor wells are required to control inflow to the open pit due to a high permeability zone in the shallow bedrock near Wendy Pit, East Pit, Gordon Lake, and Farley Lake (Chapter 8). Unmitigated, the inflow to the open pit could reduce water levels in Gordon Lake and Farley Lake. Inflows into the open pit would also become contact water. The groundwater interceptor wells are a necessary Project component but are also a mitigation measure to reduce potential changes in Gordon and Farley lakes.

Mitigation Measures Specific to the MacLellan Site

Mitigation measures to avoid or reduce the Project-related changes in fish habitat, including those potentially due to changes in groundwater and surface flows, at the MacLellan site are:

- Restricting water withdrawal rates from the Keewatin River to <10% of instantaneous discharge at all times.
- Collecting and conveying non-contact water to the collection pond for discharge to the Keewatin River during operation.
- Designing the TMF with two cells to allow progressive development during operation to reduce water management requirements.
- Recycling water between the processing facility and the TMF to reduce freshwater requirements from the Keewatin River during operation.
- Directing water from the TMF and MRSA to the open pit during decommissioning/closure to reduce the filling period.

Fish and Fish Habitat Specific Mitigation Measures

Additional mitigation measures to reduce potential effects of the Project to fish habitat, including standard mitigation measures identified in DFO's Measures to Protect Fish and Fish Habitat (DFO 2019), are:

- Limiting disturbance areas around waterbodies to maintain existing riparian vegetation and promote recovery of riparian vegetation by marking buffer zones around sensitive habitats and work areas; using existing access routes; reducing soil compaction by using weight-distributing materials under machinery.
- Maintaining fish passage by avoiding obstructing watercourses or otherwise interfering with fish movement.

10.4.1.4 Project Residual Effects

Gordon Site

Alteration or Destruction of Fish Habitat

Alteration or destruction of fish habitat at the Gordon site will occur due to dewatering of the existing East and Wendy pits and isolation, dewatering, and excavation of the existing diversion channel between Gordon and Farley lakes. Alteration of fish habitat may also occur due to:

- Placement of the water intake pipe and collection pond effluent pipe in Farley Lake.
- Placement of pipes and diffusers for the groundwater interceptor well discharges in Gordon and Farley lakes.
- Upgrading watercourse crossings at the Pump Lake outlet and between Swede and Simpson lakes on the Gordon site access road (Table 10-15); upgrades to the existing bridge over the Hughes River will not require any instream component or activities.

Descriptions of each of these potential alterations or destruction of fish habitat, and the likely effectiveness of mitigation measures are provided below.

East Pit and Wendy Pit Dewatering

East and Wendy pits will be dewatered in the first year of mining to enable mining of the new open pit. Both pits are inhabited by white suckers and brook stickleback (Map 10-7a, Map 10-7b, and Map 10-8). However, neither pit supports any fish species that are part of a recreational or Indigenous fishery and, because neither pit is hydraulically connected to Gordon Lake or Farley Lake, fish in the pits do not support any other fish populations, including populations of focal fish species in adjacent or downstream lakes and streams. Because the pits are man-made and are isolated from other waterbodies, Alamos does not consider the loss of habitat in East and Wendy pits to be a HADD of fish habitat. However, should DFO disagree, Alamos has a suite of offsets available that could be used to counterbalance the loss of fish habitat in East and Wendy pits. Regardless, the loss of fish habitat in East Pit and Wendy Pit will be a long term, irreversible event. However, the effect on fish will be limited to the pits themselves.

Diversion Channel Isolation and Dewatering

The existing diversion channel between Gordon and Farley lakes will be isolated and dewatered during the first year of construction to allow development of the new, larger open pit at the Gordon site. Prior to this occurring, a new diversion channel will be constructed north of the existing diversion channel. When ready, this new channel will convey runoff from Gordon Lake to Farley Lake immediately after the inlet to the existing diversion channel is blocked, to maintain flows and the fish migration pathway.

Northern pike and brook stickleback are known to use habitat in the diversion channel and white suckers and yellow perch from Farley Lake may also use the channel, albeit only rarely. Habitat in the diversion channel is poor quality for northern pike spawning due to the paucity of aquatic vegetation, and poor quality for white sucker and yellow perch spawning owing to the paucity of gravels, low water velocities, and limited exposure to wave action. Habitat in the diversion channel is likely limited to rearing habitat for juvenile pike, white sucker, and yellow perch. Brook stickleback likely use the channel year-round.

The unavoidable loss of habitat in the existing diversion channel will be partially offset by construction of the new diversion channel (which will be approximately the same length and width) and fully offset by construction of habitat enhancement features to increase the suitability of the channel for the fish species present in Gordon and Farley lakes.

A comparison of the habitat quantity and habitat quality between the existing diversion channel and the new diversion channel at the Gordon site is provided in Table 10-18. At bank-full discharge, the new diversion channel will provide approximately 1,280 m^2 more habitat than the existing diversion channel. Comparison of habitat quantity during low flows is complicated by the beaver dams that currently exist in the diversion channel. These dams have back flooded the existing channel and increased the average wetted width during low flow conditions.

Habitat quality in the new diversion channel will be higher for fish than in the existing diversion channel. This is because the existing diversion channel was designed exclusively for conveyance of run-off from

Gordon Lake to Farley Lake around the existing open pits. While accomplishing this same primary objective, the new diversion channel will also include habitat features designed to increase its use by fish from Gordon Lake and Farley Lake. These features include a low-flow channel to provide fish passage in summer, aquatic vegetation planting beds on seasonally inundated channel margin benches, pools to provide refugia for fish in summer and winter, cobbles and boulders to provide cover for fish, and planted riparian vegetation to provide cover, shade, bank stability, and leaf litter and invertebrate inputs to the channel. Together, the greater size and higher quality of the new diversion channel is expected to counterbalance the loss of habitat in the existing diversion channel due to construction and operation of the Project. Therefore, no adverse residual effect is anticipated.

Alamos will include the habitat enhanced diversion channel in its application for a paragraph 35(2)(b) *Fisheries Act* Authorization as offsetting for the loss of habitat in existing diversion channel. Alamos will work with local Indigenous communities, MCC, and DFO to finalize the offset plan so that unavoidable losses of fish habitat are fully counterbalanced in the LAAs.

Table 10-18 Summary of Habitat Quantity and Quality in the Existing and Proposed Diversion Channels

Waterbody	Habitat Quantity		Habitat Quality
	High Flow	Low flow	
Existing diversion channel	8,800 m^2 (8 m wide x 1,100 m long)	6,600 m^2 (6 m wide[1] x 1,100 m long)	Constructed V-shaped diversion channel with riprap banks and bottom; low gradient (<1%) with numerous beaver dams.
New diversion channel	10,080 m^2 (8.4 m wide[2] x 1,200 m long)	2,160 m^2 (1.8 m wide[3] x 1,200 m long)	Constructed channel with low flow channel for fish passage, pools for fish refugia during low flows, cobbles/boulders on channel bottom for cover, excavated beds to promote aquatic vegetation growth for cover, and riparian plantings to provide shade, bank stability, and allochthonous inputs

Notes:
[1] average wetted width during summers of 2015 and 2016 when four beaver dams were present in the channel
[2] with 0.35 m freeboard between top-of-bank and the 100-year water levels
[3] width of low flow channel; assumes no beaver dams in channel

Intake and Effluent Pipes

Freshwater will be pumped from Farley Lake only via two submersible pumps (one duty, one standby) and conveyed to the site in a 50 mm high-density polyethylene (HDPE) pipeline (Map 10-17). The intake will be in the western basin of Farley Lake and will be screened with the smallest appropriate screen pod to prevent fish from being impinged or entrained on the screen based on DFO's Interim Code of Practice (DFO 2020a). Based on the 3 L/s maximum water withdrawal rate during operation, the screen would need to have an minimum total screen area of 0.03 m^2 to reduce approach velocities across the screen face to <0.098 m/s, the maximum approach velocity to preclude impingement or entrainment of juvenile white sucker and yellow perch in Farley Lake. However, the screen pod installed in Farley Lake would have a screen area of 0.24

m^2, the smallest screen pod currently made in Canada. The intake would be suspended from an A-frame to keep it off the bottom and anchored with a lock block.

Contact water from the collection pond will discharge into the west basin of Farley Lake (Map 10-17. The effluent pipe will consist of a minimum 300 mm diameter HDPE pipe with a slotted HDPE pipe connected perpendicularly at its end with a flange and bolt connection to act as a diffuser. The effluent pipe and diffuser will be placed on the bottom of Farley Lake and held in place with lock blocks. The end of the pipe and diffuser will be pointed upwards with an elbow to avoid scouring the bottom and disturbing sediments.

Water from the groundwater interceptor wells will be pumped to collection ponds on either side on the open pit. Water from these ponds will be discharged through 300 mm diameter HDPE pipes placed on the bottom of Gordon and Farley lakes and held in place with lock blocks (Map 10-17). Pipes will extend to the deepest part of Gordon and Farley lakes, away from weed beds or other habitat features that would attract fish. Each pipe will have a similar diffuser installed at the end as the contact water collection pond effluent pipe. The effluent pipe in Farley Lake will be pointed up to prevent bottom scour.

Once installed, the anticipated in-water footprint areas of each of these intake and effluent pipes in Gordon and Farley lakes are <1 m^2 each. All pipes would be removed from the lakes at the conclusion of mining at the Gordon Site and, therefore, would be in the water for approximately seven years. In total, approximately 64 m^2 of riparian habitat near Gordon Lake and 363 m^2 of riparian habitat near Farley Lake would be disturbed during installation of the pipes. These areas are expected to re-grow naturally within one or two years. A HADD of fish habitat is not expected to occur in Gordon or Farley lakes because of these intake and effluent pipes because of their small in-water footprints, their placement away from habitats that would attract fish, and the relatively small spatial and short temporal alteration of riparian habitat at the installation locations.

Access Road Crossing Upgrades

Upgrades to the road crossings on the Gordon site access road may require new crossing structures at the Pump Lake outlet and between Swede Lake and Simpson Lake. The current Pump Lake outlet crossing is a culvert. If a new culvert is required, it will be sized to accommodate a 1 in 100-year peak flow and be installed to allow fish passage at all flows. Swede Lake and Simpson Lake are hydraulically connected by a single 1,800 mm diameter corrugated steel culvert. If a new culvert is required, it will be sized to accommodate a 1 in 100-year peak flow. Any new road crossings will be sized and installed following Manitoba Infrastructure guidelines (DFO and MNR 1996).

Preliminary investigations indicate that the existing clear-span bridge over the Hughes River is structurally sound and requires only minor repairs (e.g., replacement of longitudinal and transverse timber deck stringers and running planks, replacement of one 3-m long steel superstructure panel) for it to support all mine related traffic. No alteration to the bridge abutments or abutment armouring is required. Therefore, no adverse effects to fish or fish habitat will occur.

Change in Lake Levels and Stream Flows

Potential changes in lake levels and streamflows may occur at the Gordon site due to construction and operation of water management facilities (i.e., sumps, ponds, ditches, and water intake), dewatering of the existing East and Wendy pits during construction, dewatering of groundwater interceptor wells during construction, operation, and decommissioning/closure, and filling the open pit with water during decommissioning/closure (Table 10-15). These potential effects on water levels in Gordon and Farley lakes and flows in Farley Creek were modelled collectively in a water balance model prepared for the Gordon site (Volume 5, Appendix D) and included results of a groundwater model; results of the model are summarized in Volume 5, Appendix F. Potential effects of changes to groundwater quantity and surface water quantity predicted by the model are described in Chapters 8 and 9, respectively. Potential effects to fish and fish habitat due to changes in lake levels and streamflows predicted by the model are assessed below. For the purposes of this assessment, the decommissioning/closure phase was divided into two time periods:

- Active Closure: the years between the end of mining and the end of active decommissioning and reclamation which includes the period required to fill the open pit with water to the level that the groundwater table reaches baseline.
- Post-closure: the years after active decommissioning and reclamation is complete, during which the open pit finishes filling and begins discharging to the receiving environment.

During construction, the activities and components that, collectively, will affect water levels and streamflows in the Gordon LAA are: 1) construction of contact water collection ditches and sumps around the overburden stockpile, the ore stockpile, and the MRSA; 2) dewatering of East and Wendy pits; and 3) reduction of groundwater inflows to Gordon and Farley lakes due to lowering of the groundwater table while the existing pits are dewatered.

The collection ditches and sumps will reduce the upstream catchment areas of a small Gordon Lake tributary by approximately 30% and a small Farley Lake tributary by approximately 27%. Water diverted from both tributaries will be directed to a collection pond and then into Farley Lake with the net effect a reducing inflow to Gordon Lake and increasing inflow to Farley Lake. These ditches and sumps will affect inflows to both lakes until decommissioned in the closure phase.

Water in East and Wendy pits will be pumped to Farley Lake over a period of approximately 20 months; East Pit will be dewatered at a rate of 0.046 m^3/s and Wendy Pit will be dewatered at a rate of 0.020 m^3/s (Volume 5, Appendix D). The surface water model assumed that dewatering would begin at the beginning of January in the first year of construction. As these existing pits are dewatered, the groundwater table elevation is predicted to decrease approximately 1.0 m or less within 800 m of the historical open pits at the end of construction (Chapter 8, Map 8-17). This drawdown extends predominantly north and south of East and Wendy pits due to the constraints of Gordon and Farley lakes. However, groundwater discharge to Gordon and Farley lakes is predicted to decrease during construction as the existing pits are dewatered (Table 10-19).

Groundwater interceptor wells will be installed during the first year of construction on either side of the new open pit. The purpose of these wells is to capture groundwater and surface water to prevent drawdown of

Gordon and Farley lakes during dewatering. Water from the wells will be pumped to collection ponds on either side of the open pit and discharged to Gordon Lake and Farley Lake by pipelines and diffusers on the lake beds.

Table 10-19 Estimated Groundwater Discharge to Gordon and Farley Lakes During Baseline Conditions and Project Phases

Waterbody	Groundwater Discharge (m^3/s)			
	Baseline	End of Construction	End of Operation	Post Closure (i.e., full open pit)
Gordon Lake	0.0006	-0.005	-0.010	0.0004
Farley Lake	0.002	-0.007	-0.014	0.003

Notes:
Positive values represent flow from groundwater to surface water
Negative values represent flow from surface water to groundwater
The reduction in groundwater discharge will be offset by returning the pumped water from the groundwater interceptor wells to Gordon and Farley lakes.

During operation, water levels and streamflows in the Gordon LAA will be affected by continued operation of collection ditches and sumps, water withdrawal from Farley Lake (260 m^3/day) for dust and fire suppression, safety showers, and truck wash and by lowering of the groundwater table by development of the new open pit. Dewatering of the open pit during operation is predicted to lower the groundwater table by up to 1 m within approximately 1,200 m of the open pit and up to 10 m within 600 m of the open pit (Chapter 8, Map 8-18). The induced infiltration of surface water (predominantly from Gordon and Farley lakes) to the shallow overburden and bedrock is predicted to limit the extent of groundwater drawdown during open pit development. Due to development of the open pit, Gordon and Farley lakes are predicted to shift from groundwater receiving features (i.e., groundwater flows into the lakes) under baseline conditions to groundwater recharging features (i.e., surface water in the lakes flows to groundwater) at the end of operation (Table 10-19). Groundwater interceptor wells will continue to pump during operation to prevent the drawdown of Gordon and Farley lakes and to reduce drawdown of the groundwater table due to development of the open pit.

At the conclusion of mining, all contact water will be directed to the open pit and pumping rates in the groundwater interceptor wells will be gradually decreased to allow the open pit to fill with water. The time it takes for the open pit to fill was modelled as part of the water balance model (Volume 5, Appendix D) and was predicted to take between 9 and 12 years to fill depending on climate and run-off conditions (11 years under average climate conditions). Groundwater interceptor wells will stop pumping once the water level in the open pit reaches the elevation where it is in hydraulic equilibrium with the groundwater table. At this time, the groundwater table is predicted to return to near baseline conditions, except for a small area between the formed pit lake and Farley Lake where groundwater levels are predicted to be about 0.5 m lower than baseline (Chapter 8, Map 8-19). The lakes are expected to return to groundwater receiving features when the open pit is full (i.e., fully formed pit lake; Table 10-19).

Gordon Lake

Predicted changes in surface water elevations in Gordon Lake for the average climate scenario due to the combined effects of changes in groundwater and surface water inflows during construction, operation, and decommissioning/closure (active closure and post-closure) phases are shown in Table 10-20. In Gordon Lake, surface water elevations are predicted to:

- Increase in winter (i.e., November to April) between 2 cm and 8 cm during construction and operation. These increases would result in increases in the maximum depth of Gordon Lake between 0.7% and 2.7% in winter during these Project phases.
- Remain within 1 cm of baseline levels in winter during closure, resulting in changes in the maximum depth of Gordon Lake between 0.1% and -0.3%.
- Remain within 3 cm of baseline levels during the open-water season (i.e., late April to October/November) during construction, operation, and decommissioning/closure. These changes would result in changes in the maximum depth of Gordon Lake by <1% in spring (May and June), <1% in summer (July and August), and <1% in fall (September and October).
- Decrease by <4 cm in all months in post-closure. These decreases would result in decreases in the maximum depth of Gordon Lake of <1% in winter (i.e., November to April) and <2% during the open-water season (i.e., late April to October/November) in post-closure.

Similar percent changes in water level elevations in Gordon Lake are predicted to occur in 1:25 dry year and 1:25 wet year climate scenarios (Appendix 10A, Figure 10A-6).

Predicted increases in water levels in Gordon Lake in winter assume that groundwater continues to flow toward the open pit between November and April. It is more likely however, that groundwater inflows to the open pit will be substantially reduced in winter due to freezing of all water, including groundwater, on or behind the open pit walls. This situation would require lower pumping rates in the groundwater interceptor wells in winter and, therefore, smaller changes in water levels in Gordon Lake.

Predicted changes in water levels in Gordon Lake during construction, operation, and decommissioning/closure phases are not expected to cause a substantive change in the littoral habitat area for fish in Gordon Lake (Map 10-5). The amount of aquatic vegetation in the littoral area of Gordon Lake, which currently supports brook stickleback spawning, rearing, and foraging, will likely remain unchanged because of the limited extent of predicted water level changes. Furthermore, the predicted water level changes do not account for beaver activity, which is likely to continue in the new outlet of Gordon Lake (the new diversion channel). Beaver activity can alter lake levels by larger amounts than the predicted Project effects. For this reason, predicted water level changes are not expected to result in any measurable change in reproductive success, rearing habitat availability, or productivity for the Gordon Lake brook stickleback population.

Predicted decreases in water levels in Gordon Lake during post-closure are not expected to have any measurable effect on the brook stickleback population in the lake because the predicted decreases are too small (i.e., maximum decrease of <4 cm during the spring freshet) to negatively affect brook stickleback spawning, rearing, or foraging. The lake level will effectively return to baseline water levels.

Table 10-20 Predicted Change in Surface Water Level Elevation and Percent Change in Maximum Depth Compared to Modelled Baseline Conditions in Gordon Lake, by Mine Phase, for the Average Climate Scenario

Month	Change by Project Phase							
	Construction		Operation		Active Closure		Post-Closure	
	Water level Change (cm)	% Change in Maximum Depth	Water level Change (cm)	% Change in Maximum Depth	Water Level Change (cm)	% Change in Maximum Depth	Water Level Change (cm)	% Change in Maximum Depth
January	3.6	1.3	5.2	1.8	0.4	0.1	-0.5	-0.2
February	5.5	2.0	6.2	2.2	0.2	0.1	-0.4	-0.2
March	6.8	2.4	7.0	2.5	0.1	0.0	-0.4	-0.1
April	7.5	2.7	7.6	2.7	0.0	0.0	-0.5	-0.2
May	2.0	0.7	2.0	0.6	-3.1	-1.0	-3.9	-1.3
June	-0.1	0.0	-0.1	0.0	-2.4	-0.8	-3.7	-1.2
July	-0.3	-0.1	-0.3	-0.1	-2.4	-0.8	-3.4	-1.1
August	-0.3	-0.1	-0.4	-0.1	-2.3	-0.7	-3.1	-1.0
September	0.0	0.0	0.0	0.0	-2.2	-0.7	-3.0	-1.0
October	0.6	0.2	0.6	0.2	-1.8	-0.6	-2.4	-0.8
November	2.1	0.7	2.0	0.7	-1.0	-0.3	-1.4	-0.5
December	3.9	1.4	3.8	1.3	-0.4	-0.1	-0.7	-0.2

Notes: Positive changes indicate increases in depth, negative changes indicate decreases (cm).
Percent changes were calculated by dividing the predicted change by the baseline depth for each month.
Source: Volume 5, Appendix D

Predicted decreases in water levels in Gordon Lake in winter during post-closure are unlikely to alter dissolved oxygen concentrations in Gordon Lake such that they have any measurable effect on the ability of brook stickleback to successfully overwinter. This is because water levels are predicted to decrease by <1 cm in early winter (i.e., November to January) and no lower during late winter (i.e., February to April) when dissolved oxygen concentrations in Gordon Lake are at their lowest. Dissolved oxygen concentrations in Gordon Lake typically decrease below 1 mg/L in later winter under existing conditions and brook stickleback are able to persist in the lake despite these near anoxic conditions. Brook stickleback have physiological (Black et al. 1954) as well as morphological and behavioural (Klinger et al. 1982) adaptations that allow them to survive low dissolved oxygen conditions such as those that currently occur in Gordon Lake and that will continue to occur in Gordon Lake post-closure. These adaptions include lowering of their metabolic rate, increasing the rate of gill ventilation, and utilizing elevated dissolved oxygen microzones under the ice surface (Klinger et al. 1982).

Farley Lake

Predicted change in surface water elevations in Farley Lake for the average climate scenario due to the combined effects of changes in groundwater and surface water inflows during construction, operation, decommissioning/closure (active closure and post-closure) phases are shown in Table 10-21. In Farley Lake, surface water elevations are predicted to:

- Increase in winter (i.e., November to April) between 7 cm and 26 cm during construction, and between 2 cm and 25 cm during operation resulting in <3% increases in the maximum depth of Farley Lake during these phases.
- Remain within 1.5 cm of baseline conditions in winter during closure, resulting in changes <0.1% or less in the maximum depth of Farley Lake.
- Increase during the open-water season (i.e., late April to October/November) between 2 cm and 18 cm during construction and operation, resulting in <2% increases in the maximum depth of Farley Lake during these Project phases.
- Decrease during the open-water season between 1 cm and 2 cm during closure, resulting in <0.2% decreases in the maximum depth of Farley Lake during decommissioning/closure.
- Increase by up to 3 cm in winter (i.e., November to April), increase by 3 cm in early spring (late April-May), decrease by <1 cm from June through September, and increase by <1 cm in October during post-closure, resulting in <1% change in the maximum depth of Farley Lake during any month during post-closure.

Predicted increases in water levels in Farley Lake in winter assume that groundwater continues to flow toward the open pit between November and April. It is more likely however, that groundwater inflows to the open pit will be substantially reduced in winter due to freezing of all water, including groundwater, on or behind the open pit walls. This situation would require lower pumping rates in the groundwater interceptor wells in winter and, therefore, smaller changes in water levels in Farley Lake.

Similar percent changes in water level elevations in Farley Lake are predicted to occur in 1:25 dry year and 1.25 wet year climate scenarios (Appendix 10A, Figure 10A-7).

Table 10-21 Predicted Change in Surface Water Level Elevation and Percent Change in Maximum Water Depth Compared to Modelled Baseline Conditions in Farley Lake, by Mine Phase, for the Average Climate Scenario

Month	Change by Project Phase							
	Construction		Operation		Active Closure		Post-Closure	
	Water Level Change (cm)	% Change in Maximum Depth	Water Level Change (cm)	% Change in Maximum Depth	Water Level Change (cm)	% Change in Maximum Depth	Water Level Change (cm)	% Change in Maximum Depth
January	14.4	1.3	18.7	1.6	1.3	0.1	1.6	0.1
February	20.8	1.8	25.1	2.2	0.8	0.1	2.1	0.2
March	24.0	2.1	24.3	2.1	0.5	0.0	2.6	0.2
April	25.6	2.3	22.7	2.0	0.2	0.0	3.1	0.3
May	17.9	1.5	15.4	1.3	-2.0	-0.2	2.9	0.3
June	10.3	0.9	5.7	0.5	-1.9	-0.2	-0.4	0.0
July	10.3	0.9	3.8	0.3	-1.9	-0.2	-0.7	-0.1
August	9.9	0.8	2.8	0.2	-1.9	-0.2	-0.7	-0.1
September	9.6	0.8	2.7	0.2	-1.8	-0.2	-0.3	0.0
October	7.3	0.6	2.3	0.2	-1.7	-0.1	0.2	0.0
November	7.8	0.7	2.4	0.2	-1.1	-0.1	0.7	0.1
December	10.5	0.9	4.5	0.4	-0.5	0.0	1.2	0.1

Notes: Positive changes indicate increases in depth, negative changes indicate decreases (cm)
Percent changes were calculated by dividing the predicted change by the baseline depth for each month
Source: Volume 5, Appendix D

Predicted increases in water levels in Farley Lake during construction and operation phases are expected to cause an increase in the littoral zone of Farley Lake. Most of this increase would occur in the shallower and weedier east basin where the topography of the shoreline is less steep than in the north and west basins (Map 10-6a, Map 10-6b, Map 10-6c). Although this additional littoral area cannot be quantified due to precision limitations of the bathymetry and LiDAR data collected for Farley Lake, any increase in the availability of flooded vegetation may increase the amount of spawning habitat for northern pike, which are known to have high spawning success in flooded riparian areas (Casselman and Lewis 1996). These increases may also increase spawning habitat for yellow perch. However, unlike northern pike, yellow perch are not obligate vegetation spawners (Krieger et al. 1983) so any increase can be expected to be smaller. Potential increases in water levels in Farley Lake are unlikely to benefit white suckers because they spawn on bare substrates (Twomey et al. 1984), habitat that would not be expected to increase due to water level increases in Farley Lake during construction and operation phases.

Predicted decreases in water levels in Farley Lake in summer during decommissioning/closure (active closure and post-closure) are expected to be too small to have any measurable effect on northern pike, yellow perch, or white sucker populations in the lake. However, there may be a transition period at the beginning of post-closure, as water levels return to near baseline, when aquatic vegetation in the east basin of Farley Lake adjusts to the lower water levels. Northern pike are the species most likely to be affected by such a change because of their reliance on aquatic vegetation for spawning, rearing, and foraging. However, this transition period is expected to be short (i.e., one or two years) because aquatic vegetation, such as the pondweed (*Potamogeton* sp.) that grows in the east basin of Farley Lake, grow quickly and reproduce primarily through the rhizomes. Northern pike in northern Canada are long lived (more than 10 and up to 24 years) and mature at approximately six years of age (Inskip 1982). For these reasons, no measurable change in northern pike spawning success, recruitment, or population size is expected to occur during this period.

Farley Creek

Predicted flow changes in Farley Creek, for the average climate scenario, due to the combined effects of the activities and components that are predicted to alter groundwater and surface water inflows during construction, operation, and decommissioning/closure phases are shown in Table 10-22. In Farley Creek, discharges are predicted to:

- Increase in winter (i.e., November to April) between 0.035 m^3/s and 0.068 m^3/s during construction, and between 0.009 m^3/s and 0.074 m^3/s during operation. These changes result in flow increases up to 375% in late winter (April) during construction and up to 313% in late winter during operation.
- Increase in spring (i.e., late April/May to June) between 0.070 m^3/s and 0.109 m^3/s during construction, and between 0.037 m^3/s and 0.089 m^3/s during operation. These changes result in flow increases between 25% and 75% in spring during these phases.
- Increase in summer and fall (i.e., July to October) between 0.043 m^3/s and 0.070 m^3/s during construction, and between 0.013 m^3/s and 0.024 m^3/s during operation. These changes result in flow increases between 34% and 46% during construction and between 10% and 16% during operation.
- Increase by <0.005 m^3/s during late winter (i.e., January to April) and decrease by <0.013 m^3/s during spring, summer, fall, and early winter (i.e., May to December) during active closure. These changes result in flow changes <10% in every month of the year, except January (11% increase).
- Increase up to 0.005 m^3/s in winter (i.e., November to April), increase up to 0.012 m^3/s in spring (i.e., May and June) and decrease by up to 0.004 m^3/s during summer and fall (i.e., July to October) during post-closure. The changes result in flow changes <10% during spring, summer, fall, and early winter (i.e., May to December) and changes between 11% and 27% in late winter (i.e., January to April).

The predicted changes in flow in Farley Creek under the 1:25 dry year and 1:25 wet year climate scenarios follow the same pattern (Appendix 10A, Figure 10A-8).

Table 10-22 Predicted Change in Discharge in Farley Creek Compared to Modelled Baseline Conditions, by Mine Phase, for the Average Climate Scenario

Month	Baseline Discharge (m^3/s)	Change by Project Phase											
		Construction (Years -2 to -1)			Operation (Years 1 to 6)			Active Closure (Years 6 to 11)			Post-Closure (from Year 12)		
		Predicted discharge (m^3/s)	Predicted Change (m^3/s)	Predicted Change (%)	Predicted Discharge (m^3/s)	Predicted Change (m^3/s)	Predicted Change (%)	Predicted Discharge (m^3/s)	Predicted Change (m^3/s)	Predicted Change (%)	Predicted Discharge (m^3/s)	Predicted Change (m^3/s)	Predicted Change (%)
January	0.029	0.070	0.041	**141**	0.084	0.055	**191**	0.032	0.003	**11**	0.032	0.003	**11**
February	0.023	0.079	0.056	**248**	0.096	0.074	**325**	0.024	0.002	7	0.026	0.004	**17**
March	0.019	0.083	0.064	**329**	0.084	0.065	**335**	0.020	0.001	5	0.024	0.004	**23**
April	0.018	0.086	0.068	**375**	0.075	0.057	**313**	0.019	0.000	2	0.023	0.005	**27**
May	0.148	0.257	0.109	**74**	0.236	0.089	**60**	0.135	-0.012	-8	0.159	0.012	8
June	0.153	0.222	0.070	**46**	0.189	0.037	**24**	0.141	-0.011	-7	0.150	-0.002	-2
July	0.154	0.224	0.070	**46**	0.178	0.024	**16**	0.143	-0.011	-7	0.149	-0.004	-3
August	0.157	0.225	0.068	**43**	0.175	0.018	**11**	0.146	-0.011	-7	0.152	-0.004	-3
September	0.143	0.205	0.062	**43**	0.159	0.016	**11**	0.133	-0.010	-7	0.141	-0.002	-1
October	0.124	0.167	0.043	**34**	0.137	0.013	10	0.116	-0.008	-7	0.125	0.001	1
November	0.042	0.113	0.035	**44**	0.087	0.009	**12**	0.074	-0.004	-5	0.080	0.002	3
December	0.091	0.077	0.035	**82**	0.055	0.012	**29**	0.041	-0.001	-3	0.045	0.003	7
Annual	0.091	0.151	0.060	**66**	0.130	0.039	**43**	0.085	-0.005	-6	0.092	0.002	2

Notes:

Positive changes indicate increases in discharge, negative changes indicate decreases (m^3/s)

Bolded numbers are those that exceed the 10% change in amplitude of baseline flow and, therefore, have a higher probability of detectable impacts to ecosystems that support commercial, recreational, or Aboriginal fisheries (DFO 2013)

None of the predicted flow reductions during closure, post-closure phases will result in flows <30% of mean annual discharge (MAD) that weren't already <30% of MAD for baseline conditions, the second of the two criteria in that heightens the risk of impacts to commercial, recreational, or Aboriginal fisheries (DFO 2013)

Source: Volume 5, Appendix D

Predicted increases in flow in Farley Creek in winter during construction, operation, and decommissioning/closure phases assumes that groundwater and surface water continue to flow toward the open pit between November and April, and that the groundwater interceptor wells pump all winter to prevent drawdown of the lakes. This assumption is conservative and likely overestimates the amount of flow change that will occur in the winter; it is more likely that all water, including groundwater, on or behind the open pit walls, will freeze in winter or flow at much reduced rates than those modeled. This situation would require substantially lower pumping rates in the groundwater interceptor wells in winter, and therefore, smaller changes in flow in Farley Creek in winter than currently predicted by the model.

Despite this likely over-estimation, the actual volume of water predicted to be added to Farley Creek in winter during these phases is relatively small. For example, during operation, when winter flows in Farley Creek are predicted to increase most, the maximum volume of water predicted to be added to Farley Creek is 0.074 m^3/s or 74 L/s in February. While this increased water represents a large percentage increase (i.e., 325%) in flow, flows in Farley Creek at this time of year are naturally at their lowest (i.e., 0.023 m^3/s or 23 L/s in an average year). Therefore, the volume of water in Farley Creek, while much higher than would naturally occur in winter, is not higher than flows that would naturally occur in Farley Creek in summer (i.e., 0.157 m^3/s or 157 L/s; Appendix 10A, Figure 10A-8). Therefore, the predicted increases in flow in Farley Creek in winter is not expected to result in substantial changes in channel morphology, geometry, or substrates, particularly given the proliferation of beaver dams in Farley Creek. It is uncertain how such predicted increases in winter flows would affect the ice regime in Farley Creek given the uncertainty of where this water would flow (i.e., under the ice or over the ice) and how the presence of beaver dams would affect this flow.

During construction and operation, flows in Farley Creek are conservatively predicted to increase up to 75% in spring (Table 10-22). These higher spring flows have the potential to alter channel morphology and geometry of Farley Creek by over-topping or blowing-out beaver dams, increasing bottom and bank scour, and detaching peat hummocks and aquatic vegetation. However, such effects are expected to be moderated by the creek's morphological and physical attributes. For most of its length, Farley Creek is a low gradient (<1%) stream flowing within a wide (>75 m), heavily vegetated, wetted floodplain, with an abundance of beaver dams. While there is a narrow (<5 m) central channel, most of the creek's wetted width is comprised of peat hummocks with attached willows and sedges. Therefore, much of the additional water flowing down Farley Creek in spring would be expected to spread out over this wide wetland floodplain, which would dissipate much of its energy.

The predicted increase in spring flows coincides with the spawning period for white sucker and northern pike, the two large-bodied fish species known to spawn in the lower 1 km of Farley Creek between the impassable cascade and Swede Lake. Northern pike prefer to spawn on flooded riparian vegetation and other aquatic vegetation (Casselman and Lewis 1996), while white sucker prefer to spawn over gravels in flowing water. The higher spring flows in Farley Creek may result in some displacement of aquatic vegetation but these changes are not expected to have a measurable effect on spawning success for northern pike in Farley Creek because of the abundance of aquatic vegetation in Farley Creek, the likely dissipation of most of the hydrodynamic energy of across the wide floodplain and ability of northern pike to spawn in flooded riparian areas (Casselman and Lewis 1996).

Potential effects to white sucker spawning in Farley Creek may be more acute than for northern pike because of the greater possibility of scouring of the gravels and cobbles below the cascade that white suckers are most likely to sue for spawning. While white suckers prefer to spawn in shallow (<0.3 m), flowing water (0.5 m/s to 0.6 m/s) over gravel substrates (Curry and Spacie 1984), they will spawn over a relatively wide range of substrates, from sand to boulders, in streams or along lake shorelines (Twomey et al. 1984). This behavior was observed at the Gordon site where white suckers must be able to spawn over the cobble and boulders on the bedrock upper benches of Wendy and East pits. As a result, while the predicted flow increases in spring may temporarily alter white sucker spawning habitat in Farley Creek, measurable changes to the white sucker population in Swede Lake are not expected as other spawning habitats in the lake and in other tributaries will remain available and unchanged.

The higher spring flows in Farley Creek are expected to last seven years (i.e., construction through operation). This duration is roughly equal to the typical life span for northern pike (Casselman and Lewis 1996) and white suckers (Begley et al. 2018), although considerably shorter than their maximum life spans of 30 years (Casselman and Lewis 1996) and 15 years (Langhorne et al. 2001; Begley et al. 2018), respectively. Northern pike typically mature at 3 to 5 years of age (Casselman and Lewis 1996) and white suckers typically mature at 5 to 6 years of age (Langhorne et al. 2001) in northern latitudes, and typically spawn every year once reaching maturity. Therefore, although successful spawning by northern pike and white sucker may be reduced in Farley Creek during construction and operation, this effect is not expected to persist into decommissioning/closure (i.e., when spring flows in Farley Creek are expected to return to near baseline) and therefore, is unlikely to preclude any one fish from spawning in Farley Creek during its lifetime.

Predicted flow changes in Farley Creek during decommissioning/closure (active closure) are driven by continued changes in groundwater discharge to Gordon Lake and Farley Lake as the open pit fills with water and the groundwater interceptor wells continue to pump, albeit at lower flow rates, and by changes to surface runoff caused by altering the ground surface permeability. However, the increased winter flows and decreased open water flows during active closure are <10% of baseline in all months of the year except January (11% increase). Further, none of the predicted flow decreases in Farley Creek during active closure would result in flows <30% of MAD in any month that was not already below 30% of MAD under baseline conditions (i.e., February and March). Because predicted flow changes in Farley Creek during active closure do not exceed these two flow criteria described in the Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada (DFO 2013), there is a low probability of the predicted flow changes during closure resulting in detectable impacts to fish in Farley Creek.

The predicted flow changes during post-closure (i.e., once the pit lake has formed and is discharging to Farley Lake) are driven by changes in groundwater discharge to Gordon Lake, Farley Lake, and the open pit and by changes to surface runoff caused by altering the ground surface permeability. However, the predicted changes during the open-water months are small enough to be within the precision of the water balance model (Volume 5, Appendix D). The predicted flow increases in winter are likely overestimated because of the conservative assumptions about winter discharges in the model.

The magnitude of the predicted flow changes during each mine phase decreases with increasing distance downstream from Farley Lake. This is due to the attenuating effect of increasing natural run-off from the increasing watershed area moving downstream and from the storage effects of Swede and Ellystan lakes. No adverse effects to fish living in Swede or Ellystan lakes or using the stream channels between these lakes or between Ellystan Lake and the Hughes River are expected for this reason. No measurable change in flow in the Hughes River is expected to occur during any mine phase because the change in flow downstream of Ellystan Lake is likely to be small and the volume of the Hughes River in is much larger than the volume of water flowing into the Hughes River from Ellystan Lake. For this reason, no adverse effects to any fish in the Hughes River are expected to occur, including lake sturgeon, the only aquatic species at risk in the LAA.

While current model predictions are conservative, Alamos understands that the predicted flow changes in Farley Creek during construction and operation are well above those considered likely to have a low probability of causing detectable effects to aquatic ecosystems (i.e., <10% change in instantaneous flow; DFO 2013). Therefore, Alamos commits to explore options to mitigate potential effects to fish and fish habitat in Farley Creek during construction and operation phases. Mitigation options that will be investigated include:

- Extending the dewatering of East and Wendy pits during construction from 20 months to up to 24 months.
- Diverting a portion of the water pumped out of East and Wendy pits during construction to other locations that do not flow directly to Farley Creek such as Pump Lake, a small headwater lake of Simpson Lake located near the Gordon site, Swede Lake downstream of Farley Lake or the Hughes River.
- Diverting a portion of the water pumped out of the groundwater interceptor wells during construction and operation to these same other locations.
- Adjusting groundwater interceptor well pumping rates during decommissioning/closure to reduce excess flows in Farley Creek.

For the reasons described above, Alamos believes that HADD to fish habitat can be avoided in Farley Creek during all Project phases. The most likely effects of the increased flows during construction and operation are a temporary reduction in the number of beaver dams, alteration of wetland vegetation in the floodplain used by northern pike and brook stickleback for spawning and rearing, and scouring and redistribution of gravels used by white suckers for spawning. While uncertain, increased flooding in the spring may be beneficial to northern pike, which are known to successful spawn on flooded riparian vegetation. Northern pike spawning success has been shown to be positively correlated to high water levels during spawning with stable water levels after the egg incubation period (Casselman and Lewis 1996).

MacLellan Site

Alteration or Destruction of Fish Habitat

Permanent alteration or destruction of fish habitat at the MacLellan site may occur due to construction of the water intake and effluent pipe in the Keewatin River, upgrades to road crossings over the Keewatin River, and construction of the transmission line from Lynn Lake to the MacLellan site (Table 10-17). Descriptions of each of these potential alterations or destruction of fish habitat, and the likely effectiveness of mitigation measures, are provided below.

Water Intake and Effluent Pipe in the Keewatin River

Freshwater will be withdrawn from the Keewatin River for make-up water for ore processing during the first year of mine operation and for fire and dust suppression, safety showers, truck washes, and potable water for the camp during construction, operation, and decommissioning/closure. The freshwater intake will be installed in the Keewatin River upstream of the existing MacLellan site access road bridge crossing (Map 10-18). The intake will be a cylindrical screen pod fitted at the end of a 250 mm suction pipe connected to a pumphouse located on the east bank of the river. The screen pod will be located approximately 8 m from the riverbank and placed on an A-frame to suspend it off the river bottom. The suction pipe will be held in place by a series of lock blocks placed on the riverbed. The pipe will be buried in the east bank with heat tracing.

Contact water at the MacLellan site will be collected in a collection pond, then pumped through a buried pipeline to a stilling basin that will be constructed on the east bank of the Keewatin River, upstream of the site access road crossing and downstream of the freshwater intake. This stilling basin will be comprised of an energy dissipation pool and an apron built with Class 450 riprap. Effluent in the energy dissipation pool will flow to the river by gravity over the riprap apron built between the dissipation pool and the river The purpose of the stilling basin will be to reduce water velocities of the effluent before being discharged passively to the river.

It is expected that the physical instream footprint of the freshwater intake pipe will be 2.5 m^2; there will be no instream footprint for the effluent stilling basin as this basin will not extend into the river. This footprint is not expected to cause HADD to fish habitat in the Keewatin River nor impede upstream or downstream movements of fish or boat traffic at any time of year. The intake pipe will be removed at the end of mining.

Construction of the intake pipe and stilling basin will disturb approximately 14 m^2 and 28 m^2 of riparian habitat, respectively. Riparian habitat at the intake would be expected to naturally re-grow within one or two years. Riparian habitat at the effluent stilling basin location would be altered for the duration of the construction and operation phases at the MacLellan site (i.e., 15 years). However, these temporary losses of riparian habitat are likely too low in magnitude, too short in duration, and too small in geographic extent to cause any measurable effect on fish or fish habitat.

Access Road Crossing Upgrades

A single lane, clear-span, pre-cast concrete bridge currently provides access over the Keewatin River to the MacLellan site (Appendix 10C, Photo 10 C-1). The bridge is 6 m wide, has a span of 13.8 m, and is supported on timber cap sills and precast concrete abutments (Ausenco 2019). This bridge will be left in place and will have weight-restrictions placed on it to limit traffic to lighter duty trucks and traffic. New guardrails, hazard markers, and weigh-restriction warning signs will be installed (Ausenco 2019).

A new single lane, clear-span bridge will be built immediately downstream of the existing bridge to provide access to the MacLellan site by haul trucks and heavier traffic. Although detailed designs of this bridge have not been completed, it is expected that this bridge will consist of a prefabricated steel superstructure supported by precast concrete foundations and bin wall abutments (Ausenco 2019). Bridge abutments would be installed above the high-water mark on both sides of the river and no alteration of the river channel underneath the bridge would be required. No adverse effects to fish or fish habitat in the Keewatin River will occur as a result.

Transmission Line Crossings

While the alignment of the transmission line between Lynn Lake and the MacLellan site has not been finalized, the current right-of-way follows existing cut lines or the existing access road. There are two streams along this right-of-way: the outlet of Dot Lake and the Keewatin River. Both transmission line crossings would be aerial, causing no permanent alteration to fish habitat. Mitigation measures to reduce potential effects to fish habitat in the outlet of Dot Lake and the Keewatin River would include prohibiting installation of poles in either watercourse or their riparian areas, erosion and sediment control measures, and potentially constructing the line in winter. Riparian habitat along the transmission line alignment will not need to be altered for maintenance because the alignment will follow existing disturbed corridors. For these reasons, no adverse effects to fish and fish habitat will occur.

Change in Lake Level and Stream Flows

Potential changes in lake levels and streamflows may occur at the MacLellan site due to:

- Construction and operation of water management facilities (i.e., sumps, ponds, ditches, water intake, and effluent pipe).
- Expansion of sumps, ponds, and ditches surrounding the expanding TMF and MRSA during operation.
- Construction of groundwater seepage collection ditches between the TMF and MRSA and Minton Lake during operation.
- Changes in groundwater flows due to interactions between the groundwater table and mine components such as the TMF, MRSA, and open pit during operation.
- Filling the open pit with water during decommissioning/closure (Table 10-15).

These potential effects on water levels in lakes and streams near the TMF and MRSA were modelled collectively in a water-balance model prepared for the MacLellan site (Volume 5, Appendix E). They include groundwater modeling and results are summarized in Volume 5, Appendix G. Potential effects of changes to groundwater quantity and surface water quantity predicted by these models are described in Chapters 8 and 9, respectively. Potential effects to fish and fish habitat due to changes in lake levels and streamflows predicted by these models are assessed below. For the purposes of this assessment, the decommissioning/ closure phase was divided into two time periods:

- Active Closure: the years between the end of mining and the end of active decommissioning and reclamation which includes the period required to fill the open pit with water to the level that the groundwater table reaches baseline.
- Post-closure: the years after active decommissioning and reclamation is complete, during which the open pit finishes filling and begins discharging to the receiving environment.

Contact water collection ditches and sumps will be constructed around the TMF, MRSA, overburden stockpiles, and other mine infrastructure. These collection ditches and sumps will reduce the catchment areas of Minton Lake and East Pond due to encroachment mine infrastructure into their watersheds. Water diverted from these watersheds will be directed to a collection pond. From the collection pond, the water will either be used as process water in the processing facility or discharged to the Keewatin River. During construction, water in the existing underground works at the MacLellan site will pumped to the TMF and, therefore, will not affect water quantity or water quality in any lake or stream at the MacLellan site.

The elevation of the groundwater table is expected to decrease during construction as the open pit is developed. At the end of the construction phase, groundwater levels are predicted to be lowered by approximately 1 m or more within 200 m of the starter pit. In the area of East Pond, the water table is predicted to be lowered by approximately 5 m.

At the end of construction, groundwater discharge to the Keewatin River is predicted to increase by 67% (Table 10-23). This result is due to the modelling assumption that the full extent of the effect of groundwater mounding and increased hydraulic gradient between the TMF and the river occurs when there is limited development of the open pit. For this reason, this is likely to be an overestimation. However, a decrease in groundwater flow to the Keewatin River during construction is not expected.

Table 10-23 Estimated Groundwater Discharge to the Keewatin River During Baseline Conditions and Project Phases

Waterbody	Groundwater Discharge to Surface Water (m^3/s)			
	Baseline	End of Construction	End of Operation	Post-Closure (i.e., full pit)
Keewatin River	0.009	0.015	0.008	0.009

During operation, dewatering of the open pit is predicted to lower the water table by 1 m or more within approximately 800 m of the open pit, increasing to more than 10 m within 600 m of the open pit. Induced infiltration of surface water to the shallow overburden and bedrock limits the extent of groundwater drawdown during this phase (Chapter 8, Map 8-21). The drawdown extends predominantly south of the open pit due to the constraints of the Keewatin River and mounding of the water table in the vicinity of the TMF (Chapter 8, Map 8-20). During operation, groundwater discharge to the Keewatin River is predicted to return to near baseline conditions as the open pit reaches its maximum depth. Groundwater that seeps into the open pit during operation will be pumped to the TMF and recycled between the processing plant and the TMF.

At the conclusion of mining, dewatering of the open pit will cease and water in the TMF pond and all other sources of contact water will be diverted to the open pit to begin its filling. Water levels in the open pit will rise until the water level reaches the same elevation as the local groundwater table. Based on predicted groundwater inflow rates and the volume of surface water runoff directed to the open pit during decommissioning/closure, the open pit is predicted to take approximately 21 years to fill based on an average climate and runoff scenario (Volume 5, Appendix E). Once full, the open pit will discharge through a constructed outlet to the east into the natural channel that currently drains East Pond to the Keewatin River. At this time, the groundwater table is predicted to return to near baseline conditions during post-closure, except for a small area between the MRSA and the open pit where groundwater levels are predicted to be about 1 m lower than baseline (Chapter 8, Map 8-22). This lowering of the groundwater table is due to the removal of a topographic high associated with open pit development.

Once the open pit is full, groundwater seepage collection ditches between the TMF and MRSA and Minton Lake will continue to operate until water quality in the ditches meets water quality guidelines for the protection of freshwater aquatic life. Once attained, these ditches will be decommissioned. With and without the seepage collection ditches, groundwater discharges to the Keewatin River are predicted to return to near baseline conditions (i.e., within 0.001 m^3/s of baseline conditions) once the open pit is full. Because the timing of the ditch decommissioning is uncertain, groundwater discharge to the Keewatin River with the ditches active was carried forward into the surface water model and shown in Table 10-24.

Water will be withdrawn from the Keewatin River through the intake installed upstream of the site access road bridge to supply make-up water for ore processing during the first year of operation and for fire and dust suppression, safety showers, truck washes and potable water in the camp for all Project phases. The maximum water requirement during first year of operation is expected to be 0.087 m^3/s (0.009 m^3/s on average), while water withdrawals for the rest of operation is expected to be 0.011 m^3/s.

During operation, contact water from the plant site, overburden stockpile, and approximately 55% of the MRSA will be collected in diversion ditches and conveyed to a collection pond. Water in the collection pond will then be pumped to the processing plant or TMF. Excess water in the collection pond will be discharged to the Keewatin River via an effluent pipe and diffuser installed upstream of the site access road bridge but downstream of the freshwater intake. The effluent discharge rate during operation will vary with precipitation, but is expected to range from 0.005 m^3/s to 0.064 m^3/s.

Minton Lake

Predicted changes in water levels in Minton Lake for the average climate scenario due to the combined effects of predicted changes in groundwater and surface water inflows during the construction, operation, and decommissioning/closure phases are shown in Table 10-24. In Minton Lake, water levels are predicted to:

- Decrease by less than 4 cm in winter (November to April) during construction, operation, and decommissioning/closure, resulting in <2% change in maximum water depth.
- Decrease by less than 6 cm during the open-water season (May to October) during construction, operation, and decommissioning/closure, resulting in <3% change in maximum water depth.

Similar percent changes in water level elevations in Minton Lake are predicted to occur in 1:25 dry year and 1:25 wet year climate scenarios (Appendix 10A, Figure 10A-9).

Table 10-24 Predicted Change in Surface Water Level Elevation and Percent Change in Maximum Depth Compared to Modelled Baseline Conditions in Minton Lake, by Mine Phase, for the Average Climate Scenario

Month	Change by Project Phase							
	Construction		Operation		Active Closure		Post-Closure	
	Water Level Change (cm)	% Change in Maximum Depth	Water Level Change (cm)	% Change in Maximum Depth	Water Level Change (cm)	% Change in Maximum Depth	Water Level Change (cm)	% Change in Maximum Depth
January	-0.4	-0.2	-0.9	-0.4	-1.3	-0.6	-1.3	-0.7
February	0.0	0.0	-0.4	-0.2	-0.9	-0.4	-0.9	-0.5
March	0.2	0.1	0.0	0.0	-0.5	-0.3	-0.5	-0.3
April	0.4	0.2	0.2	0.1	-0.3	-0.2	-0.3	-0.2
May	-3.4	-1.6	-3.5	-1.7	-4.0	-1.9	-4.0	-1.9
June	-4.5	-2.1	-4.5	-2.1	-4.9	-2.3	-4.9	-2.3
July	-3.2	-1.6	-3.2	-1.6	-3.6	-1.8	-3.6	-1.8
August	-4.2	-2.0	-4.2	-2.0	-4.6	-2.2	-4.6	-2.2
September	-5.2	-2.4	-5.2	-2.4	-5.6	-2.6	-5.6	-2.6
October	-4.8	-2.2	-4.8	-2.2	-5.1	-2.4	-5.1	-2.4
November	-3.1	-1.5	-3.1	-1.5	-3.5	-1.6	-3.5	-1.6
December	-1.9	-0.9	-1.9	-0.9	-2.3	-1.1	-2.3	-1.1

Notes: Positive changes indicate increases in discharge, negative changes indicate decreases (m^3/s)
Percent changes were calculated by dividing the predicted change by the baseline discharge for each month
Source: Volume 5, Appendix E

The predicted changes in Minton Lake water levels during construction, operation, and decommissioning/closure are not expected to cause a substantive change in the littoral habitat area for fish in Minton Lake (Map 10-15a and Map 10-15b). This is because the amount of aquatic vegetation in the littoral area of Minton Lake that currently supports northern pike and brook stickleback spawning, rearing and foraging will likely remain unchanged from baseline and because water levels in Minton Lake are highly dependent on the height and permanence of beaver dams in the braided wetland that constitutes the Minton Lake outlet. Beaver activity in the Minton Lake outlet is expected to remain unchanged during any of these Project phases.

The predicted water depth reductions in the winter are unlikely to reduce the quantity or quality of overwintering habitat in Minton Lake for northern pike and brook stickleback. This is because the majority (i.e., ~65%) of Minton Lake is >1.8 m deep and the maximum predicted water level reduction in winter is only 4 cm. As a result, the change in overwintering habitat availability is likely to be limited and any resulting change in dissolved oxygen concentrations, if any, are unlikely to affect northern pike or brook stickleback, the two fish species with the lowest dissolved oxygen concentration tolerances in the MacLellan LAA (Table 10-16).

East Pond and Outlet

The combined effect of lowering the groundwater table by up to 10 m and reducing its catchment area by approximately 64% are expected to completely dewater East Pond during construction and operation. Water from local runoff and precipitation may maintain a small wetted area in East Pond, but this wetted area is not expected to be deep enough to support fish. Loss of outflow from East Pond will also result in the near dewatering of its outlet, an unnamed Keewatin River tributary (KEE3-B1).

Drawdown of the water table will continue to dewater East Pond during active closure while the open pit fills with water. Only after the open pit has filled (post-closure), and the groundwater table elevation has returned to near baseline levels, will water begin to accumulate in East Pond. Therefore, it is expected that habitat in East Pond and in the East Pond outlet (KEE3-B1) will not be functional fish habitat for at least 36 years. East Pond only supports a brook stickleback population due to its shallow depth and anoxic conditions in winter (Map 10-12). Brook stickleback were the only fish to be captured in the East Pond outlet during baseline surveys in 2015 and 2016 (Volume 4, Appendix J). However, it is possible that other fish species, in the Keewatin River, such as northern pike, also use this stream for rearing and foraging and potentially spawning. The relatively shallow depth of this tributary likely limits its use to juveniles of large-bodied fish species. There is no overwintering habitat for any large-bodied fish species (e.g., northern pike, white sucker) in this tributary as it freezes to the bottom in most, if not all, locations in winter.

The loss of East Pond, a natural waterbody that supports fish, would constitute a HADD of fish habitat. Offsets that counterbalance the loss of East Pond and its outlet will be included in Alamos' application for a paragraph 35(2)(b) *Fisheries Act* Authorization application such that no adverse effects to fish populations in the MacLellan LAA would occur.

Keewatin River

Flows in the Keewatin River downstream of the MacLellan site are predicted to remain within 2% of baseline flows in all months during all Project phases and, in most months in all phases, predicted flow changes are <1% different than baseline (Table 10-25). These low magnitude flow changes are primarily associated with changes in runoff within the site compared to baseline conditions due to changes soil permeabilities (i.e., changes in runoff coefficients) with in the PDA. Small flow decreases during closure are also influenced by diversion of site runoff to the open pit rather than to the Keewatin River. During post-closure, increased flows in the Keewatin River are associated with the mine runoff that is discharged to the Keewatin River after the open pit is full, including the formed pit lake overflow. Nevertheless, the change in groundwater flow and surface water runoff within the PDA during all months and all Project phases is small in comparison to the flow volume of the Keewatin River.

Predicted flow changes in Keewatin River during the construction, operation and decommissioning/closure phases are not expected to have any measurable effect on the quantity or quality of fish habitat in the Keewatin River downstream of the MacLellan site. This is because the flow changes are predicted to be no greater than 2% higher, and mostly <1% different, in all months during all Project phases. Such low magnitude changes in flow are unlikely to have any measurable effect on channel widths, depths, or water velocities in the Keewatin River and, therefore, are unlikely to have any measurable effect on spawning, rearing, foraging, or overwintering habitat for any fish species, including lake sturgeon, the only fish species at risk that may be present in the Keewatin River. This contention is supported by DFO's Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada (DFO 2013), which states that "cumulative flow alterations <10% in amplitude of the actual flow in the river relative to the natural flow regime have a low probability of detectable effects to ecosystems that support commercial, recreational, or Aboriginal fisheries".

10.4.2 Change in Fish Health, Growth, or Survival

10.4.2.1 Analytical Assessment Techniques

Methods to assess potential effects of predicted water quality changes on fish health, growth, and survival considered direct (i.e., direct effects to fish) and indirect (i.e., adverse effects to primary and secondary producers that form the basis for the aquatic food-web upon which fish depend for food) effects pathways. Potential Project activities that could directly or indirectly impact fish health, growth or survival at both sites include:

- Increased TSS concentrations.
- Increase metal, metalloid, or nutrient concentrations from groundwater seepage and/or mine effluent discharges.
- Changes in water temperature from dewatering of existing pits and/or groundwater interceptor wells.
- Sound over-pressures from blasting.
- Impingement or entrainment in water intakes.
- Increased fishing pressure from the workforce.

Parameters of potential concern (POPCs) identified in the Surface Water Quality Effects Assessment (Chapter 9, Section 9.5.2.1,) were assessed for their potential effects on fish health, growth, and survival. This was because POPCs were, by definition, the only water quality parameters predicted to exceed provincial and/or federal water quality guidelines for the protection of freshwater aquatic life, specifically because of the Project (i.e., baseline concentration did not exceed guidelines), and be at least 20% higher

Table 10-25 Predicted Change in Keewatin River Discharge Downstream of MacLellan Site During Construction, Operation, and Decommissioning/Closure

Month	Baseline Discharge (m^3/s)	Project Phase											
		Construction			Operation			Active Closure			Post-Closure		
		Predicted Discharge (m^3/s)	Predicted Change (m^3/s)	Predicted Change (%)	Predicted Discharge (m^3/s)	Predicted Change (m^3/s)	Predicted Change (%)	Predicted Discharge (m^3/s)	Predicted Change (m^3/s)	Predicted Change (%)	Predicted Discharge (m^3/s)	Predicted Change (m^3/s)	Predicted Change (%)
January	7.050	7.052	0.003	0	7.056	0.006	0	7.051	0.001	0	7.069	0.019	0
February	6.402	6.418	0.016	0	6.454	0.052	1	6.410	0.008	0	6.433	0.031	0
March	5.830	5.861	0.031	1	5.927	0.097	2	5.843	0.013	0	5.869	0.039	1
April	5.374	5.398	0.024	0	5.397	0.023	0	5.373	-0.001	0	5.402	0.028	1
May	7.684	7.636	-0.048	-1	7.639	-0.045	-1	7.587	-0.097	-1	7.714	0.030	0
June	12.052	12.051	-0.002	0	12.111	0.059	0	12.041	-0.039	0	12.077	0.025	0
July	13.334	13.320	-0.013	0	13.384	0.050	0	13.278	-0.056	0	13.360	0.027	0
August	9.970	9.965	-0.006	0	10.019	0.049	0	9.926	-0.044	0	9.991	0.021	0
September	7.263	7.257	-0.006	0	7.294	0.031	0	7.225	-0.038	-1	7.298	0.035	0
October	6.237	6.226	-0.012	0	6.235	-0.003	0	6.206	-0.031	0	6.262	0.025	0
November	6.935	6.935	0.000	0	6.935	0.000	0	6.926	-0.010	0	6.952	0.017	0
December	7.532	7.532	0.001	0	7.529	-0.002	0	7.527	-0.005	0	7.541	0.010	0
Annual	7.972	7.971	-0.001	0	7.998	-0.002	0	7.947	-0.025	0	7.997	0.025	0

Notes: Positive changes indicate increases in discharge, negative changes indicate decreases (m^3/s)
Bolded numbers are those that exceed the 10% change in amplitude of baseline flow and, therefore, have a higher probability of detectable impacts to ecosystems that support commercial, recreational, or Aboriginal fisheries (DFO 2013)
None of the predicted flow reductions during closure, post-closure phases will result in flows <30% of mean annual discharge (MAD) that weren't already <30% of MAD for baseline conditions, the second of the two criteria in that heightens the risk of impacts to commercial, recreational, or Aboriginal fisheries (DFO 2013)
Source: Volume 5, Appendix E

than baseline concentrations. Potential project effects on fish and aquatic biota due to potential changes in nutrients concentrations (i.e., phosphorus or nitrogen) were also assessed.

Predicted POPCs do not necessarily mean that adverse effects will occur in fish or aquatic biota. This is because guidelines are typically developed to protect the most sensitive species at a provincial or federal level (which may not be present at the site), and often incorporate uncertainty factors and include conditions that may not be relevant at a local or regional level. In addition, some guidelines do not incorporate the most recent science about the toxicity of a parameter to fish or aquatic biota. Therefore, POPCs are used to flag parameters that require evaluation to determine whether adverse effects to fish and aquatic biota are likely to occur at the concentrations predicted by the water quality models. Methods to assess potential effects of POPCs on fish health, growth, and survival were applied in the following order:

- Assessed whether there are guidelines from other jurisdictions that incorporated newer science or considered relevant toxicity modifying factors that are more recent than the Manitoba and/or Canadian guidelines.
- Searched the scientific literature for new studies completed since the guideline was developed that may update the relevant guideline.
- Assessed the appropriateness of the guideline to the aquatic biota and fish species present in the LAAs.
- Evaluated co-occurrence of parameters that may influence the toxicity of the POPCs (e.g., water hardness, temperature, pH) based on the scientific literature and the site-specific concentrations of these factors at the site.
- For POPCs known to bioaccumulate (e.g., mercury and selenium), used available scientific literature on bioaccumulation in aquatic biota and fish species, or appropriate analogs, present in the LAAs.
- Assessed the potential acute and/or chronic toxicological effects of the POPCs exceeding guidelines, focusing on effects to survival, reproduction, development, or growth that could have population-level effects.

Qualitative assessments were conducted using a weight-of-evidence approach for other potential Project interactions with fish health, growth, or survival. This entailed the use of professional judgement based on an understanding of the potential effect, the habitat use and life history of potentially affected fish species in the LAA and RAA, and the likely effectiveness of mitigation measures, supported by scientific literature, grey literature, industry best management practices, and regulatory guidelines, as available.

10.4.2.2 Project Pathways

Project activities or components that have the potential to affect the health, growth, or survival of fish were identified in Table 10-14 in Section 10.3. These activities and components are:

- Utilities, Infrastructure, and Other Facilities during the construction at the Gordon and MacLellan sites, specifically the installation of water intakes in Farley Lake at the Gordon site and in the Keewatin River at the MacLellan site and installation of new culverts on the access roads at both sites. Construction activities could affect fish or eggs within the construction footprint.

- Water Development and Control during construction at the Gordon site, specifically dewatering the existing pits and destruction of the existing diversion channel, which will discharge pit water to Farley Lake (potentially effecting water temperature and quality) and could cause direct mortality of fish living in the existing pits during dewatering.
- Emissions, discharges, and wastes during the construction, operation, and decommissioning/closure phases is a Project pathway common to both sites. However, the source of these emission, discharges and wastes are specific to each site and are described in the sections below.
- Employment and expenditures during the construction, operation, and decommissioning/closure phases, specifically the increased number of potential recreational anglers who may be brought to work at the LLGP and live in the camp.
- Open Pit Mining at Both Sites, specifically detonation of explosives in the open pit which may cause the death of fish or fish eggs due to sound over-pressures in nearby fish-bearing lakes and streams.
- Water Management at Both Sites, specifically impingement of fish on screens or entrainment of fish in the pumps in Farley Lake and the Keewatin River.
- Post-Closure at Both Sites, specifically the fish sampling for Environmental Effects Monitoring, which can require sacrifice of large numbers of fish and organisms from lower trophic levels.

Changes in water quality associated with “emissions, discharges, and wastes” to the aquatic environment have the potential to affect fish health, growth, or survival by causing lethal (i.e., acute) or sub-lethal (i.e., chronic) toxicological effects to individual fish. These emissions, discharges, and wastes could include both water and sediment. Population-level effects may occur if the concentrations of POPCs are high enough to cause acute or chronic effects to enough individual fish to affect the annual recruitment of fish into the population. These effects could be either direct (i.e., causing mortality or impaired reproduction or growth in fish) or indirect (i.e., causing mortality or impaired reproduction or growth of periphyton, plankton, or benthic macroinvertebrates that are eaten by fish, resulting in changes in the abundance or types of prey available to fish).

Gordon Site

Potential discharges to the aquatic receiving environment during the construction, operation, and decommissioning/closure phases at the Gordon site are:

- The release of sediment during site preparation, construction of ore pads, overburden stockpile and MRSA areas, access roads, the diversion channel, and water management facilities during the construction phase.
- The release of sediment during stockpiling of ore, overburden, and mine rock and maintenance of access roads during operation.

- The release of sediment during reclamation of the overburden stockpiles, ore stockpiles, and MRSA.
- Release of POPCs during dewatering of Wendy and East pits during construction.
- Release of POPCs during discharge of groundwater pumped from the groundwater interceptor wells installed between the open pit and Gordon Lake and Farley Lake during construction, operation, and closure.
- Discharge of contact water, including blast residues and accumulated groundwater in the open pit and run-off from the MRSA, ore stockpile, and overburden stockpile, during construction and operation.
- Release of POPCs during overflow from the open pit to Farley Lake at post-closure.

Except for groundwater from the groundwater interceptor wells between the open pit and Gordon Lake, these discharges would be directed to the western basin of Farley Lake. Based on mean travel time, modelled groundwater seepage from the MRSA is not predicted to reach Gordon Lake, Farley Lake, or Susan Lake within 800 years after the open pit is flooded (Chapter 8) and, therefore, is not assessed.

MacLellan Site

Potential discharges to the aquatic receiving environment during the construction, operation, and decommissioning/closure phases at the MacLellan site are:

- Release of sediment during site preparation, construction of ore pads, overburden stockpile and MRSA areas, access roads, the TMF, and water management facilities during the construction phase.
- Release of sediment during stockpiling of ore, overburden, and mine rock and maintenance of access roads during operation.
- Release of sediment during reclamation of the overburden stockpiles, ore stockpiles, MRSAs, and TMF.
- Release of sediment and POPCs during dewatering of the existing underground mine workings during construction.
- Discharge of contact water, including blast residues and accumulated groundwater in the open pit and run-off from the MRSA, ore stockpile, overburden stockpile and mine infrastructure, during construction and operation.
- Discharge of effluent from the wastewater treatment plant during construction, operation, and decommissioning/closure.
- Release of POPCs due to seepage from the TMF during operation and decommissioning/closure.
- Release of POPCs during overflow from the open pit to the Keewatin River tributary (KEE3-B1), and ultimately the Keewatin River, when the flooded open pit overflows during post-closure.

Except for TMF seepage, which is predicted to flow toward Minton Lake, all these discharges would be directed to the Keewatin River. Overflow from the open pit at closure will be directed to Keewatin River via a small Keewatin River tributary (KEE3-B1) that currently drains East Pond.

10.4.2.3 Mitigation Measures

The implementation of the mitigation measures and other commitments described in this section will be the responsibility of Alamos and or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

The mitigation measures proposed are effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection. Certain mitigation measures are widely-applied industry standards, including the use of collection ditches for contact and non-contact water, infrastructure design and maintenance measures (such as maintaining grading and designing inlet and outlet channels), equipment maintenance, sewage treatment, and screening water intakes. These measures are expected to effectively mitigate potential changes to fish health, growth, and survival.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Most of the mitigation measures to reduce Project-related effects on fish health, growth, or survival are the same as those proposed to reduce Project-related effects on surface water quality (Chapter 9, Section 9.5.2.3) and surface water quantity (Chapter 9, Section 9.5.1.3). They include mitigation measures common to both sites and mitigation measures specific to the MacLellan and Gordon sites. Mitigation measures in each of these categories are described below. Mitigation measures specific to eliminating or reducing Project-related effects on fish health, growth, or survival are also identified.

Common Mitigation Measures

Mitigation measures to reduce potential effects of changes in surface water quality on fish health, growth, or survival at both sites are:

- Grading perimeter and access roads to divert runoff away from the open pits and fish-bearing waterbodies.
- Maintaining access roads by periodically regrading and ditching to improve water flow and reduce erosion.

- Using dust suppression measures (Chapter 6, Section 6.4.1.3) for exposed ground areas within the PDA during dry periods as necessary to reduce dust deposition to surface waters.
- Constructing non-contact water ditches upslope of overburden stockpiles, MRSAs, ore stockpiles, mine infrastructure and the TMF to reduce contact water volumes.
- Constructing contact water collection ditches around the MRSAs, overburden stockpiles, and ore stockpiles to convey the 1:25-year storm event to collection ponds.
- Constructing contact water collection ponds to contain (without discharge) run-off from a 1:100-year storm event with active storage that considers maximum ice thickness in winter.
- Designing collection pond inlets and outlets to reduce water velocities, scour (erosion of sediment) and pond stratification potential (chemical or thermal).
- Maintaining culverts in access road crossings to remove accumulated material and debris to reduce erosion, flooding, and sediment mobilization.
- Implementing sediment and erosion control measures during construction to limit the release of TSS and turbidity in lakes and streams.
- Implementing Project-specific environmental management and monitoring programs including:
  - Surface Water Monitoring and Management Plan (Chapter 23, Section 23.5.5).
  - Groundwater Monitoring Plan (Chapter 23, Section 23.5.4).
  - Explosives Management Plan (Chapter 23, Section 23.5.10).
  - Erosion and Sediment Control Plan (Chapter 23, Section 23.5.13).
  - Wildlife Monitoring and Management Plan (Chapter 23, Section 23.5.14).
  - Emergency Response and Spill Prevention and Contingency Plans (Chapter 23, Section 23.5.1), which will include the measures listed in Measures to Protect Fish and Fish Habitat (DFO 2019).
- Implementing progressive rehabilitation (placement of a vegetated soil cover) of the overburden and MRSAs to reduce infiltration rates.
- Filling the open pits at closure with contact water to reduce the duration of pit wall exposure and to return groundwater levels to baseline conditions.

Gordon Site

Mitigation measures to reduce potential effects of changes in surface water quality on fish health, growth, or survival that are specific to the Gordon site are:

- Constructing a new diversion channel prior to the decommissioning of the existing diversion channel between Gordon and Farley lakes to maintain water levels.
- Aerating Wendy and East pits to encourage precipitation of elements that form oxides (e.g., iron oxide), to break down of thermal and chemical stratification, and to increase dissolved oxygen concentrations prior to dewatering.
- Installing and operating groundwater interceptor wells between the open pit and Gordon Lake and Farley Lake to maintain water levels in Gordon and Farley lakes.
- Aerating groundwater from the interceptor wells in collection ponds to encourage iron precipitation and increase dissolved oxygen concentrations prior to discharge to Gordon Lake and Farley Lake.
- Transporting domestic waste to the sewage treatment plant at the MacLellan site.

MacLellan Site

Mitigation measures to reduce potential effects of changes in surface water quality on fish health, growth, or survival that are specific to the MacLellan site are:

- Constructing contact water collection ditches around the TMF to convey the 1:25-year storm event to the collection pond.
- Pumping water from the existing underground works to the TMF for storage and eventual use in the processing facility.
- Designing the TMF with two cells to allow progressive development during operation to reduce water management requirements.
- Operating the TMF as a non-discharging facility during operation through reclaiming TMF water for use in the ore processing mill.
- Recycling water between the TMF and the mill to the extent possible during operation to reduce freshwater make-up requirements.
- Using a closed circuit for cyanide use and cyanide destruction in the processing plant (via Air/SO_2 oxidation and precipitation of metals) to reduce cyanide concentrations in tailings slurry prior to release of the slurry for storage in the TMF (Chapter 2, Section 2.3.2.1).
- Constructing groundwater cut-off ditches to reduce the volume of groundwater seepage from the TMF entering Minton Lake post-closure.
- Treating domestic waste in an average 0.0007 m3/s (i.e., 60,000 L/day) sewage treatment plant so that it meets the Wastewater Systems Effluent Regulations under the *Fisheries Act* and the MWQSOG (2002) prior to discharge to the Keewatin River via a pipeline and diffuser.
- Implementing passive treatment options (e.g., controlled pit stratification, fertilizer amendment, flow segregation) in the open pit should monitoring show that pit water quality is not suitable for release to

the environment during the approximately 21 years anticipated to fill the open pit with water at the conclusion of operation.

Fish and Fish Habitat-Specific Mitigation Measures

Additional mitigation measures to reduce potential effects of the Project to the health, growth, or survival of fish and aquatic biota are:

- Requiring heavy machinery working near water to be kept in good working condition, to be re-fueled no closure than 50 m from any waterbody or watercourse, and to be filled with biodegradable hydraulic fluids.
- Identifying and flagging riparian zones within which heavy machinery is prohibited from entering.
- Limiting in-water works to outside of the northern Manitoba Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat (DFO 2020b) as practical.
- Isolating in-water work areas and conducting fish rescues prior to dewatering, including East Pond at the MacLellan site, Wendy and East pits at the Gordon site, the existing diversion channel at the Gordon site, and other locations where instream construction will be required.
- Implementing runoff, erosion, and sediment control measures to reduce the amount of water available to become sediment laden, the amount of sediment that is mobilized through erosion, and the amount of sediment that is conveyed to waterbodies. Additional details are available in Erosion and Sediment Control Plan (Chapter 23, Section 23.5.13). The final plan will include the measures listed in the Measures to Protect Fish and Fish Habitat (DFO 2019).
- Monitoring the effectiveness of construction management plan mitigation measures during construction activities near water, including total suspended solids and/or turbidity and comparing measured valued to MWQSOG (2002) and CCME (2002b) guidelines.
- Using a heat exchanger, when required, to heat or cool water from Wendy and East pits prior to discharge to Farley Lake during construction and water from the groundwater interceptor wells prior to discharge to Gordon and Farley lakes to maintain the temperature regime in both lakes so as not to negatively affect primary and secondary production rates and alter important behavioral cues for fish (i.e., spawning and overwintering cues).
- Installing screens on the water intakes that are sized using DFO's Interim Code of Practice: End of Pipe Fish Protection Screens for Small Water Intakes in Freshwater (DFO 2020a). The screens will be sized based on the weakest swimming fish species in the Keewatin River (burbot, an anguilliform swimming species) and Farley Lake (white sucker and yellow perch, two subcarangiform swimming fish species).
- Restricting water withdrawal rates to <10% of the instantaneous discharge of the Keewatin River at all times.

- Limiting the size, timing, and setback distances of blasting charges to avoid percussive injuries to fish or damage to incubating eggs. Blasting protocols tailored to the Gordon and MacLellan sites and their fish species assemblages will be developed during Project permitting, using guidance outlined in the Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Wright and Hopky 1998).
- Establishing and enforcing a worker code-of-conduct for employees brought into work at the LLGP that would limit potential over-fishing of lakes, stream, and rivers in the Project area (e.g., restricting fishing in lakes of streams of a specific size, those used by local Indigenous groups for subsistence or traditional purposes, or determined to contain already depressed populations by Manitoba Conservation and Climate).

10.4.2.4 Residual Effects

Residual Effects Common to Gordon and MacLellan Sites

Potential Effects due to Sedimentation During Construction

Increased TSS concentrations caused by sediment deposition into watercourses can affect fish and fish habitat by impeding visual predators, suffocating eggs deposited on substrates, obscuring and reducing the quality of spawning habitats, and injuring fish (e.g., gill abrasion). Sediment can be mobilized into waterbodies during unmitigated construction activities near water.

Best management practices for runoff, erosion, and sediment control will be used during mine construction activities conducted near water at the Gordon and MacLellan sites. These practices include diversion of contact water to collection ponds to settle out suspended sediment before release to the environment. These best management practices are well established and can be tailored for local site conditions. Therefore, these measures are expected to effectively reduce potential erosion and transport of sediment into lakes and streams at all construction areas. With best management practices and environmental monitoring, and given the frequency (e.g., multiple irregular) and duration (e.g., short-term), exposure of fish to TSS concentrations that exceed MWQSOG and Canadian water quality guidelines for the protection of freshwater aquatic life is expected to be negligible; no adverse residual effects are anticipated.

Potential Effects due to Blasting

Explosives used in mining cause shock waves in aquatic ecosystems of rapidly increasing, then rapidly decreasing pressure, before pressure returns to pre-blast levels (Wright and Hopky 1998). This shock wave can kill or injure fish and kill or damage fish eggs. The impact of blasting on fish depends on the size and location of the blast, the timing of the blast in relation to the fish life history, the density of surfaces bounding the water (i.e., bedrock stream beds reflect the shock wave while organic stream beds would absorb some of the impact), the detonation method, and the species, size, and life history stage of the fish (Wright and Hopky 1998). Blasting protocols will be developed that will be specifically tailored to the geology and fish at the Gordon and Farley sites using the approaches described in Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Wright and Hopky 1998) as a starting point. This approach is expected to result in few, if any, fish mortalities in Farley and Gordon lakes at the Gordon site and in the Keewatin River at the MacLellan site; residual effects on the abundance of fish in any of these waterbodies are anticipated to be negligible. The risk of fish mortality due to blasting will end with the cessation of blasting at the end of operation.

Potential Effects due to Water Intakes

Fish, particularly juveniles and species that are weak swimmers, can become entrained (drawn into) or impinged (trapped against) water intakes if the water velocity is too high. The water velocity is affected by the rate of withdrawal and the area of the withdrawal. Fish screens are a standard method for preventing entrainment and impingement (DFO 2020a). Screens for the Keewatin River and Farley Lake water intakes will be designed based on the expected maximum water withdrawal rates and the species of fish in the Keewatin River and Farley Lake.

The preliminary design for the Farley Lake intake screen included the following considerations:

- Cylindrical screen pod to be placed in Farley Lake.
- Freshwater requirement of 0.003 m^3/s during operation (Ausenco 2019).
- DFO's Interim Code of Practice: End of pipe fish protection screens for small water intakes in freshwater (DFO 2020a).
- Protection from impingement or entrainment of juvenile yellow perch and white suckers, two subcarangiform (i.e., trout-like) swimming fish species.

Based on these preliminary design criteria, the Gordon site will require an intake with a 0.20 m x 0.20 m x 0.20 m screen pod (Screen Services 2020). This screen will have a total open area of 0.10 m^2 to reduce approach velocities to less than 0.035 m/s across the screen face, the maximum approach velocity that precludes impingement and entrainment of juvenile yellow perch and white suckers on the screens or in the pumps (DFO 2020a). Openings in the screen will be no more than 2.54 mm in size.

The preliminary design for the Keewatin River intake screen includes the following considerations:

- The make-up freshwater requirement of 0.090 m^3/s during the first year of operation (Ausenco 2019).
- The freshwater requirement of 0.012 m^3/s after the first year of operation (Ausenco 2019).
- DFO's Interim Code of Practice: End of pipe fish protection screens for small water intakes in freshwater (DFO 2020a).
- Protection from impingement or entrainment of juvenile burbot, the poorest swimming juvenile fish in the Keewatin River; burbot are an anguilliform (i.e., eel-like) swimming fish species.

Based on these preliminary design criteria, the MacLellan site will require an intake with a 0.53 m x 0.53 m x 0.91 m screen pod (Screen Services 2020). This screen will have a total screen area of 2.50 m^2 to reduce approach velocities to less than 0.035 m/s across the screen face, the maximum approach velocity that precludes impingement and entrainment of juvenile burbot on the screens or into the pumps. (DFO 2020a). Openings in the screen will be no more than 2.54 mm in size.

Lower freshwater requirements after the first year of mining (0.012 m^3/s) may result in fouling of the screen pod designed for the larger freshwater requirements during the first year of mining. Therefore, the original screen pod may be replaced with a 0.25 m x 0.25 m x 0.25 m screen pod (Screen Services 2020). Such a screen would have a total screen area of 0.38 m^2 with openings no more than 2.54 mm in size to be compliant with the Interim Code of Practice (DFO 2020a).

With these screens, fish mortalities due to entrainment or impingement at the water intakes in Farley Lake and the Keewatin River are expected to be negligible, resulting in no measurable change in the abundance, structure, or health metrics of any fish population in either waterbody. The risk of fish mortality in the intakes will be low but continuous (resulting in a multiple irregular event frequency), lasting for a medium-term duration, ending with the cessation of water withdrawals at the end of operation.

Potential Effects due to Recreational Angling

The Mathias Colomb Cree Nation (2017) and the Manitoba Metis Federation (2020) both expressed concern about the potential effect of fishing pressure by mine employees, particularly non-residents of Lynn Lake or northern Manitoba brought in to work at the LLGP. To reduce the potential risk to fish populations in the Lynn Lake area, Alamos will develop and implement a worker code-of-conduct that will apply to all employees who fly in or drive to work shifts at the Project. This code-of-conduct will cover many aspects of worker behaviour, and may include, but not be limited to:

- Restricting fishing in lakes or streams of a specific size, those used by local Indigenous groups for subsistence or traditional purposes or determined to contain already depressed populations by Manitoba Conservation and Climate.
- Prohibiting employees from using freezer space in the camp to store angled fish.
- Implementing a catch-and-release only policy for all out-of-town workers while on site.

This code-of-conduct, and any amendments to it, when combined with Manitoba recreational fishing quotas and size restrictions is expected to effectively reduce potential fishing pressure by mine employees on fish populations in area lakes and streams to the point where no measurable change (e.g., negligible magnitude residual effect) in fish population sizes or age structure would be expected to occur.

Gordon Site

Surface water quality was predicted at various nodes in lakes and streams at the Gordon (Table 10-26) as described in Chapter 9. Two POPCs were predicted at the following assessment nodes at the Gordon site for the Expected Case (i.e., average climate conditions/average groundwater quality/average geochemistry source terms/average baseline surface water quality):

- Fluoride, with a long-term CEQG of 0.12 mg/L, is predicted to reach:
  - Maximum predicted concentrations of 0.14 mg/L in Gordon Lake (AQF2) during construction, operation, and decommissioning/closure phases.

- Maximum predicted concentrations of 0.19 mg/L in West Farley Lake (AQF34) during construction, operation, and decommissioning/closure phases.
- Maximum predicted concentrations of 0.19 mg/L in East Farley Lake (AQF9) during construction, operation, and decommissioning/closure phases.
- Maximum predicted concentrations of 0.13 mg/L in Swede Lake (AQF15) during operation and decommissioning/closure phases.

- Phosphorus, with a long-term MWQSOG of 0.025 mg/L, is predicted to reach a maximum concentration of 0.027 mg/L in West Farley Lake (AQF34).

Each of these POPCs is assessed below for its potential to cause lethal or sub-lethal effects to fish and aquatic biota in these lakes.

Table 10-26 Gordon Site Assessment Nodes

Assessment Node Name	Corresponding Water Quality Site	Assessment Node Description
Susan Lake	AQF11	Downstream of the PDA and upstream of Hughes Lake
Gordon Lake	AQF2	Adjacent to PDA; will receive discharges from groundwater interceptor wells
West Farley Lake	AQF34	Adjacent to PDA; planned to receive discharge from collection pond and open pit
East Farley Lake	AQF9	Eastern basin of Farley Lake; linked to West Farley Lake via a narrow channel
Swede Lake	AQF15	Downstream of East Farley Lake
Ellystan Lake	AQF20	Downstream of Swede Lake; farthest node downstream of the PDA

Potential Effects due to Fluoride

Maximum predicted fluoride concentrations in Gordon Lake, Farley Lake (east and west basins), and Swede Lake range from 0.13 mg/L to 0.19 mg/L, which are 1.1 to 1.6 times higher than the long-term CEQG of 0.12 mg/L. The frequency of guideline exceedances in these lakes ranges from <1% of the time in the east basin of Farley Lake during the construction phase to 40% of the time in the west basin of Farley Lake during post-closure.

The CEQG for fluoride (0.12 mg/L) is an interim guideline that applies a safety factor of 100 to results of a study using caddisflies, where adverse effects (mortality after 144 hours of exposure) were reported at fluoride concentrations of 11.5 mg/L (CCME 2002a). The safety factor was used because this study was based on acute lethality, rather than sublethal effects (e.g., effects on growth or reproduction) after chronic exposure. While the CEQG for fluoride is not dependent on other water chemistry parameters, CCME (2002) notes that the toxicity of fluoride is affected by water hardness (i.e., decreasing toxicity with increasing hardness), which is consistent with the hardness-dependent fluoride guidelines derived by other jurisdictions such as BC (BC MOE 1990).

Most studies have found that adverse effects of fluoride to fish and other aquatic biota, including secondary producers such as benthic invertebrates, begin to occur at concentrations greater than 1 mg/L (BC MOE 1990, CCME 2002a, Camargo 2003). The most sensitive species and sublethal endpoint was noted by Damkaer and Dey (1989), who found that the upstream migration behavior of some Pacific salmon (*Onchorhynchus* sp.) species was affected at concentrations of 0.5 mg/L fluoride. However, this study was conducted in soft water and the results may have been confounded by the presence of elevated aluminum concentrations (Camargo 2003). Overall, while there are limited data on fluoride toxicity to aquatic organisms following long-term exposures, studies summarized by BC MOE (1990), CCME (2002), and Camargo (2003) suggest that adverse effects are unlikely to occur at concentrations below 0.5 mg/L in soft water, with the toxicity threshold for adverse effects likely to be higher in harder waters.

No studies of fluoride toxicity were identified that were based on species known to be present in waterbodies within the LAAs. Salmonid species, such as rainbow trout and Pacific salmon, are often the most sensitive species to inorganic POPCs such as fluoride. Therefore, for the purposes of evaluating the potential for adverse effects to the health, growth, or survival of fish and aquatic biota in lakes at the Gordon site, a long-term toxicity benchmark of 0.5 mg/L fluoride was used, based on the Damkaer and Dey (1989) study. While the endpoint in this study (disruption of upstream migration behavior of Pacific salmon) is not relevant for fish species Gordon, Farley, or Swede lakes, this benchmark is expected to be protective of the fish in these lakes because most adverse effects have only been reported at concentrations higher than 1 mg/L of fluoride.

The maximum predicted fluoride concentrations at the Gordon site are more than 2.5 times lower than the proposed toxicity benchmark of 0.5 mg/L for fish and aquatic biota. Therefore, adverse residual effects on fish health, growth, or survival would not be expected at the fluoride concentrations predicted by the surface water quality model for the Farley, Gordon, or Swede lakes at the Gordon site.

Potential Effects due to Phosphorus

Phosphorus was identified as a POPC at the Gordon site because the maximum predicted value was predicted to be 0.027 mg/L in the west basin of Farley Lake during the construction phase, a concentration 1.1 times higher than the long term MWQSOG (0.025 mg/L) and 1.2 times higher than the maximum baseline concentration. Phosphorus concentrations were predicted to be higher than baseline concentrations and the MWQSOG for only three of the 24 months of the construction phase (13%) (e.g., short-term duration) when dewatering of the existing pit lakes and pumping from groundwater interceptor wells into the west basin of Farley Lake would occur.

The MWQSOG for total phosphorus was set to protect freshwater aquatic biota, including fish and secondary producers such as benthic invertebrates, from potential effects of eutrophication, a shift in trophic status in lakes due to increased primary productivity (i.e., production of photosynthetic freshwater organisms such as periphyton and phytoplankton) caused by additions of nitrogen, phosphorus, or dissolved organic carbon. A moderate increase in trophic status can be beneficial in nutrient-poor systems. However, decomposition of phytoplankton and periphyton associated with large increases in nutrient supply can lead to decreased oxygen levels, particularly during winter, which can affect the survival of fish (CCME 2004).

Average (0.021 mg/L) and maximum (0.023 mg/L) baseline and predicted maximum phosphorus concentrations (0.027 mg/L) in the west basin of Farley Lake fall into the meso-eutrophic (0.020 to 0.035 mg/L) range defined for lakes in the Canadian Guidance Framework for the Management of Freshwater Ecosystems (CCME 2004). Baseline (0.15 mg/L N) and predicted (0.364 mg/L N) total inorganic nitrogen concentrations fall into the oligotrophic range (<0.70 mg/L N) defined for streams and river by Alexander and Smith (2006).

Eutrophication can result from the addition of nitrogen as well as phosphorus. Therefore, predicted changes in nitrogen species (i.e., ammonia, nitrite, and nitrate) were examined, given that leaching of blast residues from the open pit and mine rock storage area is a potential source of nitrogen during operation and again when the formed pit lake overflows to Farley Lake during post-closure. The potential for nutrient changes to result in a shift in trophic status was evaluated by comparing average total inorganic nitrogen and total phosphorus concentrations and their ratios for each Project phase (Table 10-27). The N:P ratio is commonly used to identify the most likely limiting nutrient for plant growth (algae), with values around 7 indicating a balance between nitrogen and phosphorus (i.e., no clear limiting nutrient), values well below 7 indicating likely nitrogen limitation, and values well above 7 indicating likely phosphorus limitation (Schindler 2008; Jarvie et al., 1999). Table 10-27 indicates a N:P ratio ranging between 7 and 9 for all phases of the Project, except operation when the predicted N:P ratio of 19 suggests a phosphorus limitation. The predicted N:P ratios suggest:

- During construction, the low magnitude increase in phosphorus concentrations in West Farley Lake will not result in a notable change in a limiting nutrient; the change is too small to result in a shift in trophic status.
- During operation and decommissioning/closure phases, no trophic change related to phosphorus is predicted because there are no phosphorus sources during operation to elevate phosphorus concentrations higher than the MWQSOG.
- During operation, the approximately two-fold increase in nitrogen concentrations and N:P ratio of 19 may result in a shift to phosphorus as a limiting nutrient; however, no shift in trophic status of West Farley Lake is predicted because there are no phosphorus sources during operation to elevate phosphorus concentrations higher than the MWQSOG.

The short-term (three month) increase in total phosphorus concentrations during construction would not be expected to result in eutrophication of West Farley Lake, given the low magnitude exceedance of the MWQSOG and baseline conditions. Similarly, the approximately two-fold increase in inorganic nitrogen concentrations during operation would not be expected to result in eutrophication of West Farley Lake, given that it would not be accompanied by any increase in phosphorus concentrations.

Table 10-27 Baseline and Predicted (Expected Case) Nutrient Concentrations in the West Basin of Farley Lake

Project Phase	Total Phosphorus (mg/L P)	Ammonia (mg/L N)	Nitrite (mg/L N)	Nitrate (mg/L N)	Total Inorganic Nitrogen (mg/L N)	N:P Ratio
Baseline	0.0214[a]	0.0313	0.0231	0.0931	0.151	7
Construction	0.0213[a]	0.0771	0.0212	0.0918	0.190	9
Operation	0.0194[a]	0.0861	0.0199	0.258	0.364	19
Active Closure	0.0172[a]	0.0590	0.0140	0.0686	0.142	8
Post-closure	0.0237	0.0505	0.0314	0.115	0.197	8

Note: [a] average baseline and predicted total phosphorus concentrations lower than the MWQSOG of 0.025 mg/L
Data source: Volume 5, Appendix E

Potential Effects due to Temperature Changes

Without mitigation, water temperatures in Farley Lake and Farley Creek would likely be altered due to pit dewatering during construction and groundwater interceptor well discharge during operation. This is because the volume of cold (i.e., <4°C) water below 10 m depth in Wendy and East pits is relatively large in comparison to the volume of water in Farley Lake and because the volume and temperature (6°C) of groundwater that would be pumped from the groundwater interceptor wells would be relatively constant. By comparison, water temperatures in Farley Lake vary with the seasons, from a low of near 0°C in late winter to a high of near 20°C in July. Therefore, depending on the time of year, pit dewatering and discharging of groundwater from the groundwater interceptor wells could substantially alter water temperatures in the lake.

Any change in water temperature in Farley Lake has the potential to alter the growth and survival of fish and primary (i.e., phytoplankton) and secondary (i.e., zooplankton and benthic invertebrates) producers upon which fish depend for food. This is because water temperature is one of the primary abiotic factors affecting physiological and biological processes in fish, plankton, and benthic invertebrates in lakes. Water temperature also affects various chemical processes in lakes, such as the rate of organic matter decomposition, exchange of metals and ions at the water and sediment interface, and oxidation-reduction potential. Changes in water temperature could also negatively affect important behavioral cues for spawning or overwintering for fish.

A simple mass-balance model was created to predict potential water temperature changes in Farley Lake during the construction and operation phases without mitigation; details of this model and its assumptions and limitations are presented in Appendix 10D. Without mitigation, monthly water temperatures in Farley Lake are predicted to increase during fall and winter (October to April) and decrease during the spring (May and June) and summer (July to September) compared to baseline during construction and operation phases (Table 10-28). The overall effect of dewatering the open pits and operating the groundwater interceptor wells on water temperatures in Farley Lake would be a general flattening of the annual thermal regime in the lake; lower maximum temperatures in summer and higher minimum temperatures in winter (Appendix 10D).

Increases in fall and winter water temperatures in Farley Lake would be larger during operation (up to 6°C higher than baseline) than during construction (up to 5°C higher than baseline) because of the greater influence of the warmer groundwater interceptor well inflows without the influence of the cooler pit water (Table 10-28). Conversely, decreases in spring and summer water temperatures in Farley Lake would be larger during construction (up to 13°C lower than baseline) than during operation (up to 9°C lower than baseline) because of the greater cooling effect of combined pit water and groundwater interceptor inflows during construction compared to the cooling effect of just the groundwater interceptor well inflows during operation (Table 10-28).

Table 10-28 Predicted Monthly Water Temperatures in Farley Lake during Construction (Year -2 to -1) and Operation (Year 1 to 6) Without Mitigation

Month	Water temperature (°C)				
	Baseline (Measured)	Construction		Operation	
		Predicted	Predicted change	Predicted	Predicted change
January	0.3	2.1	+1.8	5.9	+5.6
February	-0.2	3.1	+3.3	5.0	+5.2
March	-0.1	3.7	+3.8	4.3	+4.4
April	0.1	4.1	+4.0	4.0	+3.9
May	7.7	4.7	-3.0	5.5	-2.2
June	16.3	5.7	-10.6	8.3	-8.0
July	19.8	6.9	-12.9	10.9	-8.9
August	17.3	7.1	-10.2	11.6	-5.7
September	11.0	6.5	-4.5	10.3	-0.7
October	2.4	5.5	+3.1	7.6	+5.2
November	0.9	5.2	+4.3	6.1	+5.2
December	0.6	5.2	+4.6	5.1	+4.5

Although the model used to predict water temperatures in Farley Lake during the construction and operation phases is conservative and simplistic (Appendix 10D), it does highlight the potential adverse effects to fish and other aquatic biota in Farley Lake in the absence of mitigation. For this reason, Alamos will mitigate potential effects to fish and aquatic biota by passing pit water and groundwater interceptor water through a heat exchanger prior to discharge when required. To do this, water temperatures in Farley Lake and Gordon Lake will be monitored, and the discharge water temperature heated or cooled until it is within an acceptable range (e.g., 1°C or 2°C) of background water temperatures in the lakes such that discharge of this water would not hinder the growth, survival, or behavioral cues of fish or other aquatic biota in the lakes. This mitigation measure will also reduce potential changes to the ice regimes in Gordon and Farley lakes, and Farley Creek.

With mitigation, the Project is expected to result in only small (e.g., <2°C) increases or decreases in water temperatures in Gordon Lake and Farley Lake during construction, operation, and closure phases (i.e., medium term duration), primarily during the coldest and warmest times of year (i.e., multiple regular event). The magnitude of the measurable change is expected to be limited to a level that is not biologically important. This change in water temperature will occur in all months when the groundwater interceptor wells are operating, and East and Wendy pits are being dewatered. This change in water temperature will be reversible within weeks or months as water temperatures re-equilibrate to climate-driven values.

MacLellan Site

Surface water quality was predicted at various nodes in lakes and streams at the MacLellan site (Table 10-28) as described in Chapter 9. The following POPCs were identified at the following assessment nodes at the MacLellan site for the Expected Case (i.e., average climate conditions/average groundwater quality/average geochemistry source terms/average baseline surface water quality) by the MacLellan water quality model:

- Total aluminum is predicted to reach a maximum concentration of 0.049 mg/L in the Keewatin River (AQM8) and a maximum concentration of 0.200 mg/L in the small Keewatin River tributary (KEE3-B1) draining East Pond (AQM18) in post-closure, which both exceed the pH-dependent long-term MWQSOG and CEQG range between 0.005 mg/L and 0.100 mg/L.

- Total arsenic is predicted to reach a maximum concentration of 0.023 mg/L in the small Keewatin River tributary (KEE3-B1) draining East Pond (AQM18) in post-closure, which exceeds the long-term CEQG of 0.005 mg/L but not the MWQSOG of 0.15 mg/L.

- Total cadmium is predicted to reach a maximum concentration of 0.000042 mg/L in Minton Lake (AQM16) and a maximum concentration of 0.00052 mg/L in the small Keewatin River tributary (KEE3-B1) draining East Pond (AQM18) in post-closure, which both exceed the hardness-dependent long-term CEQG range between 0.000040 mg/L and 0.00047 mg/L.

- Dissolved cadmium is predicted to reach a maximum concentration of 0.00052 mg/L in the small Keewatin River tributary (KEE3-B1) draining East Pond (AQM18) in post-closure, which exceeds the hardness-dependent long-term MWQSOG range between 0.000045 mg/L and 0.00061 mg/L.

- Total copper is predicted to reach a maximum concentration of 0.0059 mg/L in the small Keewatin River tributary (KEE3-B1) draining East Pond (AQM18) in post-closure, which exceeds the hardness-dependent long-term CEQG of 0.004 mg/L.

- Total fluoride is predicted to reach a maximum concentration of 0.21 mg/L in the small Keewatin River tributary (KEE3-B1) draining East Pond (AQM18) in post-closure, which exceeds the long-term CEQG of 0.12 mg/L.

Potential adverse effects on fish and aquatic biota health, growth, or survival from each of these POPCs is assessed in the following subsections. Importantly, most of the potential guideline exceedances identified above are in the small Keewatin River tributary (KEE3-B1) during the post-closure phase when the open pit has filled with water and is discharging to the environment. This is important because it is expected that although phosphorus and nitrogen were not identified as POPCs, the potential for changes in phosphorus and nitrogen concentrations to result in eutrophication of various lakes was assessed.

Table 10-29 MacLellan Site Assessment Nodes

Assessment Node Name	Corresponding Water Quality Site	Assessment Node Description
QM02	AQM4	Keewatin River upstream of PDA (no anticipated effects)
KEE3-PAY1	AQM31	Small tributary to Keewatin River; downstream of Payne Lake; north west of TMF
QM03	AQM7	Keewatin River; first node downstream of collection pond discharge
KEE3-B1	AQM18	Small tributary to Keewatin River; within PDA; south east of Open Pit
QM06	AQM8	Keewatin River; downstream of QM03, Kee3-B1, and PDA
QM05	AQM29	Keewatin River; downstream of QM06 and confluence with Lynn River
Minton Lake	AQM16	Within PDA; south east of Mine Rock Storage Area and TMF
QM10	AQM10	South Cockeram River; downstream of Minton Lake
QM08	AQM11	South Cockeram Lake; downstream of QM10

Potential Effects due to Total Aluminum

For total aluminum, the MWQSOG is based on the CEQG of 0.005 mg/L in waters with pH less than 6.5 or 0.1 mg/L in waters with a pH greater than 6.5 (CCME 2020). Total aluminum concentrations in the Keewatin River downstream of the MacLellan site (AQM8) are predicted to exceed the long-term MWQSOG and CEQG only 7% of the time during the post-closure phase and are only predicted to be higher than the MWQSOG and CEQG in January when the maximum total aluminum concentration is predicted to be 0.016 mg/L. This maximum concentration is approximately three-fold higher than the pH-dependent, long-term MWQSOG and CEQG in January (0.005 mg/L) when the average pH measured in baseline studies in January was 6.4.

The maximum predicted total aluminum concentration of 0.049 mg/L in the Keewatin River downstream of the MacLellan site (AQM8) during post-closure phase occurs during a month when the average baseline pH was higher than 6.5. Therefore, the CEQG is 0.1 mg/L during this period and the maximum post-closure concentration of total aluminum does not exceed this guideline.

For water with pH less than 6.5, the CEQG is based on a study with American toad (*Bufo americanus*) at pH 4.3. In this study, the no observed adverse effects level (NOAEL) was 0.005 mg/L (CCREM 1987). For water with pH of 6.5 or higher, the CEQG was based on an aluminum guideline developed by the United States Environmental Protection Agency (US EPA) in 1973 which recommended 0.1 mg/L as the limit.

While the CEQG for waters with a pH of less than 6.5 may be reasonable for waters with very low pH (e.g., <5.0), it may be unreasonably conservative at pH levels between 5 and 6.5 (Butcher 1988). In addition, the CEQG was derived in 1987 and does not account for more recent scientific studies or toxicity modifying factors (other than pH) that are known to influence the toxicity of aluminum to aquatic biota.

The United States Environmental Protection Agency (US EPA) updated the aquatic life ambient water quality criteria for aluminum in freshwaters in December 2018 (US EPA 2018). The updated US EPA (2018) guideline accounts for toxicity modifying factors including pH, dissolved organic carbon, and hardness, which are not considered in the CEQG. The 2018 US EPA guideline considers more recent scientific studies than the 1987 CEQG and is based on a range of species, including algae, aquatic invertebrates, fish, and amphibians. An excel-based calculator from the US EPA[1], where site-specific pH, hardness, and dissolved organic carbon are inputs, can used to provide the long-term total aluminum guideline on a site-by-site basis.

The BC long-term guideline is for dissolved aluminum (BC MOE 2019a), which is more relevant than the MWQSOP and CEQG because dissolved aluminum concentrations are more representative of the fraction of total aluminum that is bioavailable; therefore, the fraction most likely to cause adverse effects on fish and aquatic biota. The BC long-term guideline is also pH-dependent and has a similar “breakpoint” as the CEQG at pH 6.5. However, in water with pH lower than 6.5, BC MOE (2019a) provides a pH-dependent equation that better accounts for increasing aluminum toxicity with decreasing pH than the CEQG, particularly at pH levels close to 6.5. The long-term guideline provided by BC MOE (2019a) for water with a pH of less than 6.5 is:

$$Long - term\ dissolved\ aluminum\ guideline = e^{(1.6\ -\ [3.327\ \times pH] + [0.402\ \times\ pH^2])}$$

Applying the BC long-term dissolved aluminum guideline to the total aluminum concentrations predicted in the Keewatin River (AQM8) provides a conservative assessment of potential risk to aquatic biota, since dissolved aluminum concentrations are approximately 55 to 57% of total aluminum concentrations at the AQM8 assessment node in January.

When site-specific baseline data from the Keewatin River for dissolved organic carbon, hardness, and pH are input into the US EPA calculator, the long-term guideline for total aluminum is 0.31 mg/L. Similarly, when site-specific baseline pH values are input into the BC MOE long-term guideline equation, the long-term guideline for dissolved aluminum is 0.042 mg/L. The maximum predicted total aluminum concentration in the Keewatin River (0.049 mg/L) in post-closure is approximately six times lower than the US EPA (2018) total aluminum guideline and similar to the BC long-term guideline for dissolved aluminum (BC MOE 2019a). Therefore, adverse residual effects on the health, growth, and survival of fish and aquatic biota from exposure to total aluminum in post-closure are not expected in the Keewatin River downstream of the MacLellan site.

Total aluminum concentrations in the small Keewatin River tributary (KEE3-B1) draining East Pond (AQM18) are predicted to reach a maximum concentration of 0.2 mg/L in post-closure. This maximum predicted concentration is two times higher than the MWQSOG and CEQG of 0.1 mg/L in this tributary with a baseline pH >6.5. This guideline would be exceeded approximately 71% of the time and occur in most months in post-closure.

When site-specific baseline data for dissolved organic carbon, hardness, and pH from the small Keewatin River tributary (KEE3-B1) are input into the US EPA calculator, the long-term guideline for total aluminum

[1] Available at: https://www.epa.gov/sites/production/files/2018-12/aluminum-criteria-calculator-v20.xlsm

ranges from 0.93 mg/L to 1.1 mg/L. The maximum predicted concentrations of total aluminum in the KEE3-B1 tributary are approximately five times lower than the US EPA (2018) total aluminum long-term guideline. Therefore, adverse residual effects on the health, growth, or survival of fish and aquatic biota from exposure to total aluminum in post-closure are not expected in the small Keewatin River tributary (KEE3-B1) draining East Pond.

Potential Effects due to Total Arsenic

Total arsenic is predicted to reach a maximum concentration of 0.023 mg/L in the small Keewatin River tributary (KEE3-B1) draining East Pond (AQM18) in post-closure. This maximum predicted arsenic concentration is approximately 4.5 times higher than the long-term CEQG of 0.005 mg/L. Total arsenic concentrations are predicted to exceed the CEQG regularly (i.e.,74% of the time) during post-closure. However, total arsenic concentrations in this Keewatin River tributary were not predicted to exceed the long-term MWQSOG of 0.15 mg/L at any time, during any mine phase.

For total arsenic, the CEQG was derived by applying a safety factor of 10 (i.e., dividing by 10) to the toxicity threshold of 0.05 mg/L identified following a 14-day exposure to arsenic for the most sensitive species (*Scenedesmus obliquus*, an algal species; CCME 2001). Based on literature considered in the CEQG guideline derivation, fish and aquatic invertebrates were less sensitive to arsenic than aquatic plants or algae (CCME 2001). Adverse effects in fish and other non-algal aquatic biota were typically observed at arsenic concentrations between 0.3 mg/L and 1 mg/L (CCME 2001).

A search of the US EPA ECOTOX database (US EPA 2020) did not identify any additional, peer-reviewed and publicly accessible studies of arsenic toxicity to aquatic biota where the toxicity thresholds were lower than those reported in CCME 2001. The ECOTOX database yielded one study with a reported Lowest Observable Adverse Effect Level of 0.038 mg/L and 0.1 mg/L after 21 days of arsenic acid exposure to *Daphnia magna* (water flea). However, these results appear to be anomalous, as toxicity thresholds for *D. magna* in four other peer-reviewed published studies ranged from 1.3 to 10 mg/L following 21-day exposures to the same chemical. The study results with low toxicity thresholds cannot be reviewed or confirmed as the study is only available as an internal document for the Office of Pesticide Programs at the US EPA. Therefore, this study is considered unreliable, as it is not available for public review, was not peer-reviewed, and produced results inconsistent with other available studies.

Total arsenic concentrations are only predicted to be higher than 0.02 mg/L in two months during post-closure (April of Year-35and April of Year-36); otherwise concentrations are predicted to be below 0.013 mg/L. The maximum predicted arsenic concentration at the KEE3-B1 assessment node is 0.023 mg/L, which is an order of magnitude (10 times) lower than the lowest concentration where adverse effects to fish and non-algal aquatic biota would likely occur (approximately 0.3 mg/L) and approximately two times lower than the arsenic toxicity threshold (0.05 mg/L) of the most sensitive algal species (CCME 2001). For these reasons, adverse residual effects on the health, growth, or survival of fish and aquatic biota in this Keewatin River tributary from exposure to total arsenic are not expected to occur.

Potential Effects due to Total or Dissolved Cadmium

In Minton Lake, total cadmium concentrations are predicted to exceed the range of the hardness-dependent, long-term total cadmium CEQG of 0.000038 mg/L to 0.000061 mg/L approximately 10% of the time during the post-closure phase, with a maximum magnitude 1.1 times higher than the long-term total cadmium CEQG. Dissolved cadmium concentrations in Minton Lake are predicted to be below the long-term dissolved cadmium MWQSOG (0.000067 mg/L to 0.00011 mg/L) during all phases of the Project.

In the small Keewatin River tributary (KEE-B1), total and dissolved cadmium concentrations are predicted to be higher than the hardness-dependent, long-term total cadmium CEQG (0.0031 mg/L to 0.00047 mg/L) and long-term dissolved cadmium MWQSOG (0.000435 mg/L to 0.00061 mg/L), respectively, in only two months of the post-closure phase, April of Year-34 and April of Year-35. In these two months, the maximum magnitude of guideline exceedance is 1.6 times the total cadmium CEQG and 1.2 times the dissolved cadmium MWQSOG.

The long-term CEQG for total cadmium was developed in 2014 using a species-sensitivity distribution method that considered a range of Canadian fish, aquatic invertebrate, aquatic plant, and amphibian species (CCME 2014). The CEQG for total cadmium is hardness-dependent and screening for POPCs (including cadmium) was based on the average hardness measured each month during baseline studies, not the Project-related hardness predicted by the water quality model.

The toxicity of cadmium is inversely correlated with water hardness (i.e., toxicity to aquatic biota decreases as water hardness increases). Water hardness is predicted to increase between 2.2 and 3.3 times higher than existing conditions in Minton Lake and the KEE3-B1 tributary at times when exceedances of the hardness-dependent, long-term total cadmium CEQG are predicted to occur. When the predicted future water hardness is considered, adverse effects to fish and aquatic biota from total cadmium are not expected in Minton Lake and KEE3-B1 tributary because total cadmium concentrations would be below the hardness-dependent, long-term CEQG of 0.000068 to 0.0012 mg/L.

The hardness dependent long-term MWQSOG is based on dissolved cadmium concentrations. This guideline is more relevant from a biological perspective because it is the dissolved fraction that is bioavailable and, therefore, the fraction most likely to cause adverse effects to fish and aquatic biota, such plankton and benthic invertebrates. Dissolved cadmium concentrations were predicted concentrations to be higher than MWQSOG only in the KEE3-B1 tributary and not in Minton Lake.

The MWQSOG is based on a dissolved cadmium guideline developed by the US EPA in 2001. However, the US EPA updated their long-term dissolved cadmium guideline in March 2016, incorporating newer toxicity studies and six species not previously considered in the 2001 guideline (US EPA 2016). The updated guideline is also hardness-dependent and is based on the following formula (US EPA 2016):

$$Dissolved\ cadmium\ guideline = e^{(0.7977 \times \ln(hardness) - 3.909)} \times (1.101672 - [\ln(hardness) \times 0.041838])$$

The US EPA (2016) dissolved cadmium guideline is provided in μg/L, and is divided by 1,000 to calculate the guideline in mg/L.

The predicted dissolved cadmium concentrations in the KEE3-B1 tributary are higher than the MWQSOG based on the 2001 US EPA dissolved cadmium guideline (0.00044 mg/L) in only two months in the post-closure phase, April of Year-34 (0.00050 mg/L) and April of Year-35 (0.0052 mg/L). However, the predicted dissolved cadmium concentrations are below the 2016 US EPA guideline of 0.0013 mg/L (calculated using the same hardness of 228 mg/L used in POPC screening for April at the KEE3-B1 assessment node).

Based on the analysis above, adverse residual effects to the health, growth, or survival of fish and aquatic biota in Minton Lake and in the small Keewatin River tributary (KEE3-B1) are not expected to occur during the post-closure phase, even though cadmium was identified as a POPC, because:

- Total cadmium concentrations in Minton Lake are predicted to exceed the CEQG only 10% of the time during post-closure and only by 1.1 times the CEQG. Total cadmium concentrations in Minton Lake are not predicted to exceed the CEQG when the predicted increase in water hardness in Minton Lake caused by the Project in post-closure is used to calculate the CEQG.
- Total dissolved cadmium concentrations in Minton Lake predicted to be below the MWQSOG in each Project phase.
- Total cadmium concentrations in the Keewatin River tributary (KEE3-B1) are predicted to exceed the CEQG <1% of the time (two months only) during the post-closure phase and only by 1.6 times the CEQG in these rare occurrences. Total cadmium is not predicted to exceed the CEQG when the predicted increase in water hardness in KEE-B1 caused by the Project in post-closure is used to calculate the CEQG.
- Total dissolved cadmium concentrations in the Keewatin River tributary (KEE3-B1) are predicted to exceed the MWQSOG <1% of the time (two months only) during the post-closure phase and only by 1.2 times the MWQSOG in these rare occurrences. Dissolved cadmium is not predicted to exceed the updated US EPA dissolved cadmium guideline at any time during any phase.

The predicted total and dissolved cadmium guideline exceedances were predicted to occur during post-closure. This timing will allow Alamos to monitor water quality in the open pit as it fills with water and to amend water quality in the open pit, if necessary, prior to its discharge to KEE3-B1.

Potential Effects due to Total Copper

Total copper concentrations are predicted to exceed the hardness-dependent, long-term CEQG of 0.004 mg/L in the Keewatin River tributary (KEE-B1) only 5% of the time, and only during November or April in the post-closure phase, with a maximum magnitude of 1.5 times higher than the guideline. In contrast, dissolved copper concentrations are predicted to be below the hardness-dependent, long-term dissolved copper MWQSOG during all phases of the Project. Since dissolved copper is the more biologically available fraction, exceedance of the total copper CEQG, but not the dissolved copper MWQSOG, suggests that exceedance of the total CEQG is of lower concern.

For total copper, the CEQG is 0.004 mg/L at water hardness values higher than 180 mg/L (CCREM 1987). The CEQG incorporates a five-fold safety factor (i.e., the equation is multiplied by 0.2) because “the effect from hardness on the chronic toxicity of copper is inconclusive" (CCREM 1987). However, there has been additional research on copper toxicity to aquatic biota since the 1987 CEQG was developed. This research has established that copper toxicity to aquatic biota decreases with increasing water hardness (US EPA 2007 and BC MOE 2019b). This suggests that the five-fold safety factor used in the long-term total copper CEQG is overly conservative and out-of-date. If the uncertainty factor is removed from the CEQG (i.e., the CEQG is multiplied by 5) or if the uncertainty factor is reduced to 2 instead of 5, there are no exceedances of the total copper guideline in the Keewatin River tributary (KEE3-B1) in any mine phase.

Therefore, while total copper concentrations are predicted to exceed the long-term total copper CEQG during post-closure, the occurrences are regular (November or April during post-closure) and rare, the magnitude of exceedance is low, and the CEQG is likely over-conservative based on more recent research into the relationship between copper toxicity and water hardness. For these reasons, adverse residual effects on the health, growth, or survival of fish and aquatic biota, such as plankton and benthic invertebrates and their contributions to primary and secondary productivity, in the Keewatin River tributary (KEE3-B1) are not expected.

Potential Effects due to Fluoride

Total fluoride is predicted to reach a maximum concentration of 0.21 mg/L in the small Keewatin River tributary (KEE3-B1) draining East Pond (AQM18) in post-closure, which exceeds the long-term CEQG of 0.12 mg/L.

Total fluoride concentrations are predicted to exceed the long-term CEQG of 0.12 mg/L 25% of the time in the Keewatin River tributary (KEE3-B1) during the post-closure phase, with a maximum magnitude of 1.7 times higher than the long-term CEQG. As described for the Gordon site, a fluoride toxicity benchmark of 0.5 mg/L was used to determine if adverse effects to the health, growth, and survival of fish and aquatic biota may occur. The maximum predicted fluoride concentration in the Keewatin River tributary (KEE3-B1) is 0.21 mg/L, which is below this fluoride toxicity benchmark. Therefore, adverse residual effects to the health, growth, or survival of fish and aquatic biota in the Keewatin River tributary are not expected.

Potential Effects due to Phosphorus and Nitrogen

Although phosphorus and nitrogen were not identified as POPCs at the MacLellan site for Expected Case predictions, there is potential for a eutrophication effect related to discharge of treated domestic wastewater (phosphorus and nitrogen source) and/or discharge of treated mine water (nitrogen from blast residues) into the Keewatin River during one or more Project phases.

The water quality model for the MacLellan site accounted for contact water sources but did not incorporate discharges from the wastewater treatment plant, as design details had not been finalized. The plant will be designed to meet federal and provincial effluent quality criteria.

The potential for changes in water quality for the Keewatin River was evaluated qualitatively by calculating available dilution at the lowest flows of the year at hydrology monitoring site QM01 in the Keewatin River, upstream of the MacLellan site. The wastewater treatment plant will have a maximum discharge of 60,000 L/day (0.0007 m^3/s). Flows in the Keewatin River range from 3.29 m^3/s (March) to 13.24 m^3/s (June) in an average year (Volume 5, Appendix E). During the winter low flow period, the fully mixed effluent will account for 1.2% of river flow. During the summer growing season, flows in the Keewatin River range from 9.39 m^3/s in August to 8.75 m^3/s in September. In these months, when nutrients are available for periphyton growth, the fully mixed effluent will account for <0.5% of river flow. This proportion of effluent in the river, and associated potential nutrient loadings is negligible, and is not expected to result in any change in trophic status (i.e., primary productivity) of the river.

Baseline and predicted average concentrations of total phosphorus, ammonia, nitrite, and nitrate in the Keewatin River (AQM8) are listed in Table 10-29. The baseline and predicted phosphorus concentrations of approximately 0.02 mg/L fall into the mesotrophic (0.010 to 0.020 mg/L) range defined for lakes in the Canadian Guidance Framework for the Management of Freshwater Ecosystems (CCME 2004). The baseline (0.087 mg/L N) and predicted (0.114 mg/L N) total inorganic nitrogen concentrations fall into the oligotrophic range (<0.70 mg/L N) defined in Alexander and Smith (2006) for streams and rivers. Baseline and predicted concentrations are lower than the CEQG for nitrate (13 mg/L), and the MWQSOGs for nitrite (0.06 mg/L), ammonia (3.06 mg/L; conservatively based on chronic exposure for early life stages at a pH of 7.5 and water temperature of 20°C) and total phosphorus (0.025 mg/L).

Table 10-30 Baseline and Predicted (Expected Case) Nutrient Concentrations in the Keewatin River

Project Phase	Total Phosphorus (mg/L P)	Ammonia (mg/L N)	Nitrite (mg/L N)	Nitrate (mg/L N)	Total Inorganic Nitrogen (mg/L N)	N:P Ratio
Baseline	0.0194 [a]	0.0184	0.0127	0.0563	0.0874	4.5
Construction [b]	0.0193 [a]	0.0188	0.0127	0.0601	0.0916	4.7
Operation [b]	0.0191 [a]	0.0218	0.0131	0.0788	0.114	5.9
Active Closure [b]	0.0193 [a]	0.0177	0.0127	0.0555	0.0859	4.4
Post-closure [b]	0.0192 [a]	0.0232	0.0125	0.0559	0.0917	4.8

Notes:
[a] average baseline and predicted total phosphorus concentrations lower than the MWQSOG of 0.025 mg/L
[b] Includes the mine contact water sources but not treated sanitary wastewater
Data source: Volume 5, Appendix E

The potential for nutrient changes to result in a shift in trophic status in the Keewatin River was evaluated by comparing average total inorganic nitrogen and total phosphorus concentrations and their ratios for each Project phase (Table 10-21). This was done because blast residues from the MRSA are a potential source of nitrogen during operation and groundwater seepage from the TMF and MRSA is a potential source of nitrogen during post-closure. The N:P ratio ranges between 4.4 to 5.9 which suggests that nitrogen will be the limiting nutrient in the Keewatin River during all Project phases, just as it currently is at baseline. Therefore, the predicted changes in nitrogen concentrations in the Keewatin River during construction, operation, and post-closure phases are not predicted to result in eutrophication in the river because the increases are not predicted to be high enough to trigger a shift in trophic status based on the categories defined in the literature; N:P ratios below 7 indicating a nitrogen limitation (Schindler 2008; Jarvie et al. 1999).

10.4.3 Summary of Project Residual Environmental Effects on Fish and Fish Habitat

A summary of Project residual effects characterization is provided in Table 10-31. This summary is based on results of the potential effects analysis provided in Sections 10.4.1 and 10.4.2.

Table 10-31 Project Residual Effects on Fish and Fish Habitat

Residual Effect	Residual Effects Characterization								
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context
Gordon site									
Change in Fish Habitat	C, O, D	A	H	LAA	MT	A	C	R	D
Change in Fish Health, Growth, or Survival	C, O, D	A	N	LAA	LT	A	R	I	R
MacLellan site									
Change in Fish Habitat	C, O, D	A	L	LAA	ST	A	R	R	D
Change in Fish Health, Growth, or Survival	D	A	N	LAA	LT	A	R	I	R

KEY

See Table 10-5 for detailed definitions

Project Phase
C: Construction
O: Operation
D: Decommissioning/closure

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term;
MT: Medium-term
LT: Long-term

Timing:
N/A: Not Applicable
A: Applicable

Frequency:
S: Single event
IR: Multiple Irregular event
R: Multiple Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context (Fish Habitat):
D: Disturbed
U: Undisturbed

Ecological/Socio-Economic Context (Fish Health, Growth, or Survival):
R: Resilient
NR: Not Resilient

10.4.3.1 Change in Fish Habitat

At the Gordon site, the magnitude of potential residual effects to fish and fish habitat is characterized as high, due exclusively to the predicted increase in discharge of up to 375% in Farley Creek during construction and operation. However, this adverse residual effect is not expected to extend spatially beyond the LAA to the Hughes River and the high magnitude effect would not extend temporally beyond operation (i.e., medium-term). This residual effect would occur continuously throughout construction and operation, and closure, albeit to a much lower magnitude, and would have potential timing implications for fish species using Farley Creek for spawning, such as northern pike and white suckers. Importantly, this residual effect would be reversible because flows in Farley Creek would return to near baseline flows in post-closure.

The magnitude of potential residual effects to fish and fish habitat due to potential increases in water levels in Gordon and Farley lakes are characterized as low because the predicted changes are within the range of natural variability in these lakes which are continually affected by beaver activity. Loss of fish habitat in the existing diversion channel during construction is characterized as a high magnitude residual effect, but one that would be short-term and not result in an adverse effect on fish because it would be immediately offset by construction of the new diversion channel.

At the MacLellan site, the magnitude of potential residual effects to fish and fish habitat due to the predicted increases in discharge in the Keewatin River is characterized as low because the increases are well below the thresholds identified by DFO as likely to cause negative effects to aquatic ecosystems that support commercial, recreational, or Aboriginal fisheries (i.e., predicted flow changes are well below a 10% change in instantaneous discharge and will not lower flows below 30% of mean annual discharge in the Keewatin River at any time). These low magnitude changes in flow are not expected to alter the ability of fish to use the Keewatin River for spawning, rearing, foraging, migration or overwintering habitat even though the flow changes are expected to occur each winter (i.e., multiple regular frequency).

The predicted decreases in water levels in Minton Lake are characterized as low magnitude because they are within the range of natural variability in lake levels, which are driven by natural beaver activity at the lake outlet. The loss of East Pond due to predicted drawdown of the groundwater table is characterized as a high magnitude residual effect, but one that would be restricted to East Pond, without a measurable effect on fish in the Keewatin River. This effect would also be counterbalanced by implementation of offsets in the RAA as part of Alamos’ Fish Habitat Offsetting Plan.

The ecological context for the potential residual effects at both sites is characterized as disturbed because the historical Farley and MacLellan mines would have affected the fish habitat at both the Gordon and MacLellan sites. The historical Farley Mine created the diversion channel and Wendy and East pits. In addition to these physical habitats, the existing pits and reclaimed mine rock storage areas may have affected the groundwater table. The historical underground MacLellan Mine has altered the water permeability of the ground within its footprint, altered runoff patterns, and has likely affected the local groundwater table.

10.4.3.2 Change in Fish Health, Growth, or Survival

The magnitude of residual effects due to the predicted fluoride and phosphorus guideline exceedances at the Gordon site are characterized as negligible. This is because the predicted fluoride concentrations are only between 1.1 and 1.6 times the CEQG but 2.5 times lower than the proposed toxicity benchmark more considered more appropriate for assessing fluoride toxicity than the CEQG. The phosphorus guideline exceedance is characterized as a negligible magnitude effect because the maximum predicted phosphorus concentration in Farley Lake was only 1.1 times the provincial guideline and was predicted to occur when nitrogen, not phosphorus, is the factor limiting primary production in the lake.

The magnitude of residual effects due to total aluminum, arsenic, total and dissolved cadmium, total copper, and fluoride at the MacLellan site are also characterized as negligible. This is because the predicted concentrations of these parameters were only marginally higher than the federal or provincial guidelines, and were either below the guideline for dissolved fractions (i.e., the biologically available fraction), lower than a proposed toxicity benchmark for the most sensitive aquatic species, or were lower than a more recent guideline based research conducted since the provincial or federal guideline was developed.

The duration of residual effects (albeit negligible) to fish health, growth, or survival is characterized as long-term at both sites due to the potential for guideline exceedances and exceedances of baseline plus 20% to occur during the post-closure phase. The frequency of residual effects to fish health, growth, or survival is characterized as multiple regular event at both sites because many POPCs are predicted to be elevated during the same time of year during the same flow conditions. The timing of residual effects to fish health, growth, or survival is characterized as applicable because changes in water quality occur in most months of the year and through various stages of the Project and, therefore, may affect all life stages of fish including eggs, fry, juveniles, and adults at various times in the life histories (e.g., spawning, rearing, overwintering). Reversibility of residual effects at both sites is characterized as irreversible because many POPCs are predicted to occur in post-closure and are not predicted to return to baseline concentrations within the time frame predicted by the water quality models.

The ecological context for the potential residual effects at both sites is characterized as resilient because changes to water quality that could affect fish health, growth, or survival have occurred in the past at both sites due to historical mining activities and because fish populations are generally adaptable and resilient to changes in water quality that are below toxicity thresholds, as is the case for the LLGP.

10.5 ASSESSMENT OF CUMULATIVE ENVIRONMENTAL EFFECTS ON FISH AND FISH HABITAT

The Project residual effects described in Section 10.4, are likely to interact cumulatively with residual environmental effects from other physical activities (past, present, and reasonably foreseeable). The effects of past and current projects relative to conditions prior to historical mining activities contribute to baseline conditions upon which Project effects are assessed. Conditions prior to historical mining activities are generally considered to be similar to currently undisturbed areas of the RAA.

The resulting cumulative environmental effects (i.e., future case with the Project) are assessed. The future case without the Project is also assessed. This is followed by an analysis of the Project contribution to cumulative effects. Future Projects and activities that are reasonably foreseeable are defined as those that (a) have been publicly announced with a defined Project execution period and with sufficient Project details that allow for a meaningful assessment, (b) are currently undergoing an environmental assessment or (c) are in a permitting process.

The assessment of cumulative effects is initiated with a determination of whether two conditions exist:

- The Project has residual environmental effects on the VC; and
- The residual effects could act cumulatively with residual effects of other past, present, or reasonably foreseeable future physical activities.

If either is not met, the assessment of cumulative effects concludes with a statement that further assessment of cumulative effects is not warranted because the Project does not interact cumulatively with other Projects or activities.

10.5.1 Project Residual Effects Likely to Interact Cumulatively

Table 4C-1 in Chapter 4, Environmental Assessment Methods, presents the Project and physical activities inclusion list, which identifies other Projects and physical activities that might act cumulatively with the Project. Where residual environmental effects from the Project act cumulatively with residual effects from other Projects and physical activities (Table 10-32), a cumulative effects assessment is undertaken to determine their significance.

Table 10-32 Interactions with the Potential to Contribute to Cumulative Effects

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Environmental Effects	
	Change in Fish Habitat	Change in Fish Health, Growth, or Survival
Past and Present Physical Activities and Resource Use		
Mineral Development		
• “A” Mine	✓	✓
• EL Mine	✓	✓
• Fox Mine	–	–
• Farley Mine	✓	✓
• Ruttan Mine	–	–
• MacLellan Mine (Historical)	✓	✓
• Burnt Timber Mine	✓	✓
• Farley Lake Mine	✓	✓
• Keystone Gold Mine	✓	✓

Table 10-32 Interactions with the Potential to Contribute to Cumulative Effects

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Environmental Effects	
	Change in Fish Habitat	Change in Fish Health, Growth, or Survival
• East/West Tailings Management Areas	✓	✓
Mineral Exploration	✓	✓
Water and Waste Projects (sewage plants, waste disposal grounds)	✓	✓
Residential and Community Development (including cottage subdivisions)	✓	✓
Infrastructure Development (transmission line, airport, highways, roads, rail)	✓	✓
Other Resource Activities (hunting, fishing, berry picking)	–	–
Future Physical Activities		
Mineral Development	✓	✓
Mineral Exploration	✓	✓
Traditional Land Use	–	–
Resource Use Activities	–	–
Recreation	–	✓

NOTES:
✓ = Other Projects and physical activities whose residual effects are likely to interact cumulatively with Project residual environmental effects.
– = Interactions between the residual effects of other Projects and residual effects of the Project are not expected.
For a detailed description and mapped locations of Projects and Physical Activities, where applicable, see Chapter 4, Appendix 4-D (Table 4D-2), and Maps 4-1 and 4-2.

Projects and activities in Table 10-32 that do not have check marks do not have residual effects that are likely to interact spatially or temporally with potential residual effects of the Project, and are not discussed further.

Species at risk in the RAA (i.e., lake sturgeon) are not expected to be affected by the Project within the LAA or in the surrounding RAA and, therefore, are not considered in the cumulative effects assessment.

Past and present Projects and activities would have contributed to baseline conditions in the LAA in which the Project will be located. Therefore, the cumulative effects of these past and present Project and activities are reflected in the baseline fish habitat, fish tissue, and water quality baseline datasets for the Project and have been inherently considered in the assessment of Project-specific residual effects. Any influence of past and current Projects and activities on water quality was also captured in the surface water quality predictive modelling for the Project, which considered existing water quality conditions as a model input. Therefore, cumulative effects of past and present Projects and activities are included in the assessment of residual Project effects.

10.5.1.1 Change in Fish Habitat

The predicted changes to fish habitat as a result of the Project are not expected to extend beyond the LAA. At the Gordon site, Project residual effects on fish habitat are limited to the Gordon and Farley lakes and to Farley Creek downstream of the Gordon site. These locations are within the Gordon site LAA. At the MacLellan site, Project residual effects to fish habitat are limited to Minton Lake, East Pond and its outlet; potential flow alterations in the Keewatin River are predicted to be <2% downstream of the Lynn River confluence and negligible at the outlet of Cockeram Lake, the downstream-most waterbody in the MacLellan site LAA. There are no other projects or activities within the Gordon or MacLellan LAAs and, therefore, there is no potential spatial or temporal overlap of any residual effects from other projects with the residual effects of the Project. For these reasons, cumulative effects of the Project and other reasonably foreseeable future Projects and activities on fish habitat are not anticipated.

10.5.1.2 Change in Fish Health, Growth, or Survival

Past and Present Physical Activities and Resource Use

Predictions of Project-related changes in surface water quality implicitly capture potential cumulative effects associated with the past and present Projects and activities listed in Table 10-32, because the surface water quality models incorporated the results of an extensive multi-year baseline water quality monitoring program (Volume 5, Appendices D and E). Effects associated with existing and historical Projects are, therefore, reflected in the measured baseline water quality data for the waterbodies within the LAAs. The measurements include past contamination caused by the ETMA, the former Burnt Timber Mine, and the former MacLellan Mine in the MacLellan LAA and by the former Farley Mine in the Gordon LAA.

Future Physical Activities

At the Gordon site, Project residual effects on fish health, growth, and survival were limited to within the LAA. Residual effects due to fluoride were noted at Gordon, West Farley, East Farley, and Swede lakes, but did not extend further downstream to Ellystan Lake. For phosphorus, residual effects were only identified in West Farley Lake but not in lakes further downstream (e.g., East Farley or Swede lakes).

At the MacLellan site, Project residual effects on fish health, growth, and survival were limited to within the LAA. More specifically, Project residual effects were limited to KEE3-B1 (in a small tributary to the Keewatin River within the PDA), QM06 (Keewatin River, downstream of KEE3-B1), and Minton Lake (within the PDA) assessment nodes. Project residual effects on fish health, growth, or survival at the MacLellan site do not extend past the Lynn River confluence (e.g., QM05 assessment node, located downstream of the confluence of the Keewatin River and Lynn River).

Past and present resource activities (such as hunting, fish, and berry picking) and physical activities such as traditional land use, resource use activities, and recreation are not likely to have measurable residual effects on surface water quality and, thus, are not expected to interact cumulatively with Project residual effects on fish health, growth, or survival due to changes in water quality. Some Projects (e.g., Ruttan Mine and Fox Mine) are outside of the RAA and, therefore, residual effects to surface water quality from these

Projects are not anticipated to interact cumulatively with Project residual effects on fish health, growth, or survival due to changes in water quality.

There are a number of community sewage treatment plants or on-site sewage treatment systems (e.g., at cottage subdivisions) that could produce effluent containing nutrients and metals. These POPCs could affect surface water quality if effluent was discharged to surface water or transported to surface water via groundwater. While the sewage treatment facilities have the potential to release nutrients and metals to a localized area of the aquatic environment, the facilities are outside of the LAA and not close enough to have physical overlap with the areas where Project residual effects to fish health, growth or survival were identified.

Future mineral exploration or mining Project developments could contribute nutrients and metals to the local downstream aquatic environment. However, these Projects would be expected to also implement mitigation measures to protect water quality and fish health, growth, and survival, like those proposed for the Project. Any effects to water quality (and consequently to fish health, growth, and survival) from other Projects would likely be limited to a localized area downstream of the future exploration or mine. These areas are outside of the Project LAAs where Project residual effects were identified and would not overlap spatially, so no cumulative effects would be expected.

There is an annual fishing derby held on Burge Lake, located in the RAA upstream of the MacLellan site. Recreational angling by Project workers will be reduced through the worker code of conduct and camp rules. However, some workers may choose to move to Lynn Lake and Alamos would not be able to control what those workers do when they are not on shift. Some of these workers may be recreational anglers and may fish outside of the LAA, including participating in the Burge Lake fishing derby. While a potential cumulative effect from increased fishing pressure due to the presence of the LLGP workforce exists, any potential cumulative effect is expected to be negligible in magnitude because the number of workers that choose to move to Lynn Lake is expected to be small, the number of recreational anglers in the this group is expected to be even smaller, there is a large number of recreational angling opportunities in the RAA.

Based on the analysis above, cumulative effects of the Project and other reasonably foreseeable future projects and activities on fish health, growth, and survival are not anticipated.

10.5.2 Cumulative Effects Without the Project

Mineral exploration in the Lynn Lake region has occurred many times in many locations since the mid-20th century. Therefore, it is reasonable to assume that mineral exploration will occur again in the future whether the Project occurs or not. These mineral exploration activities would require provincial permitting or, if the Project proceeds to regulatory review, and environmental impact assessment. These processes would require the mine proponent to go through an assessment process to identify potential effects to fish habitat and to fish health, growth and survival and, to identify and implement appropriate mitigation or offset measures, such as has been done here for the LLGP.

Traditional land use, resource use activities (such as sport fishing), and recreational activities are expected to continue at baseline levels if the Project did not occur. These activities are not expected to affect fish habitat or fish health, growth, and survival in new ways if the Project did not occur.

10.6 EFFECTS TO FEDERAL LANDS

Federal lands within the LAA and RAA for Fish and Fish Habitat consist of Black Sturgeon Reserve, which falls within the RAA. The Black Sturgeon Reserve is located in the Hughes River watershed on the west side of Hughes Lakes, upstream of the confluence of the Hughes River and Farley Creek. The MacLellan site is in the Keewatin River watershed. No changes in fish habitat, either through alteration or destruction of fish habitat or through changes in lake levels or stream flows, are expected to occur in Hughes Lake. Residual effects to fish habitat at the Gordon site are limited to Gordon and Farley Lakes, and to Farley Creek. No changes in fish health, growth, and survival are expected to occur in Hughes Lake because residual effects on fish health, growth, and survival are expected to be limited to the LAA. These effects are anticipated to be similar to other receptors in the RAA as described in Sections 10.5

10.7 DETERMINATION OF SIGNIFICANCE

10.7.1 Significance of Project Residual Effects

With the mitigation and environmental protection measures described above, Project residual effects to fish habitat at the Gordon and MacLellan sites are predicted to be not significant. Potential changes in flow in Farley Creek at the Gordon site pose the greatest potential risk to focal fish populations due to changes in fish habitat at the Gordon site. However, this potential effect is not expected to cause a measurable reduction in the productivity of any focal fish population in the Gordon LAA. This is because Farley Creek is unlikely to be the only spawning location for the northern pike populations in Farley Lake and Swede Lake (i.e., there is abundant aquatic vegetation used by northern pike for spawning in both lakes), the stream morphology and geometry of Farley Creek is likely to attenuate some of the habitat altering energy of the increased flows, and the increased flows in Farley Creek would only occur for at most eight years, which is shorter than two generations of all focal fish species in the Gordon LAA. Importantly for this significance determination, Alamos understands the potential risks to fish habitat in Farley Creek due to the predicted flow increases and realizes that uncertainty remains about the importance of Farley Creek to the annual production of focal fish populations in the Gordon LAA. For this reason, Alamos will continue to explore the realistic options available to reduce the magnitude of potential effects on fish habitat in Farley Creek and its use by focal fish species in the Gordon LAA.

Potential changes to fish habitat at the MacLellan site are not of high enough magnitude, high enough frequency, or of long enough duration to result in a measurable reduction in the productivity of focal fish populations in the LAA. Where fish habitat losses will be permanent (i.e., East Pond), these losses will be counterbalanced by offsets in the RAA.

With the mitigation and environmental protection measures described above, residual Project effects to fish heath, growth, and survival at the Gordon and MacLellan sites are predicted to be not significant. This is because the mitigation measures included in the Project are expected to be effective at reducing changes in water quality and other sources of acute or chronic fish mortality such that no measurable reduction in the abundance, community composition, or population structure of focal fish populations in the LAA are expected to occur.

10.8 PREDICTION CONFIDENCE

10.8.1 Change in Fish Habitat

For change in fish habitat, the prediction confidence is moderate. This is because predicted effects to lake levels and streamflows at the Gordon and MacLellan sites were based on results of groundwater and surface water models that, like all models, required assumptions to represent complex physical processes mathematically, to address situations when data limitations existed, and where a full understanding of the temporal and spatial scale of the linkages between groundwater and surface water interactions were uncertain. Where assumptions were required, conservatism was used to predict the greatest potential changes in water level elevations and streamflow, during all months and phases of the Project, to reduce the uncertainty imposed by these assumptions. Uncertainties and conservatism in the groundwater and surface water models, are described in detail in Chapter 8 and Chapter 9, respectively, but are summarized below.

Potential effects to groundwater were based on steady-state groundwater flow models, which predicted the long-term average annual effects on groundwater flow and conservatively overestimated the drawdown effects on water levels. Prediction confidence in the groundwater models is high because the groundwater flow models were calibrated to within an acceptable range of error for groundwater levels and groundwater discharge to surface water features. At the Gordon site, groundwater recharge rates from the new MRSA and the historical MRSAs to the receiving environment were conservative because they did not account for the presence of seepage collection ditches and recharge applied within the MRSAs over the life of the mine. The effect of dewatering the open pit through pumping of the interceptor wells was conservative because the interceptor wells were assumed to pump year-round whereas, in the winter, the open pit walls will likely freeze. At the MacLellan site, groundwater recharge rates at the MRSA, TMF, and historical MRSA to the receiving environment were conservative because the prediction of groundwater recharge rates and seepage from the TMF was based on the final maximum elevation of the TMF dams and TMF reclaim pond at the end of operation, which imposed the highest vertical hydraulic gradient from the TMF reclaim pond, and groundwater recharge rates applied within the MRSA, TMF, and historical MRSA were assumed to be carried through to final receptors (e.g., Keewatin River, open pit).

Potential effects to surface water were based on snowmelt-runoff models, calibrated using field data from the Lynn Lake climate station and the hydrometric monitoring program conducted at the Gordon site and MacLellan site in 2015 and 2016. However, the duration and geographic distribution of this timeseries dataset were limited by extensive beaver activity. For example, a beaver dam at the outlet of Farley Lake was increased by approximately 1 m between 2015 and 2016, with a corresponding increase in Farley Lake water levels. Similarly, beaver dams in the diversion channel between Gordon Lake and Farley Lake, in the East Pond outlet channel and in the Minton Lake outlet also fluctuated in height throughout the sampling period. As a result, reliable outlet rating curves and stage-discharge relationships were possible only in a limited number of locations (e.g., the outlet of Ellystan Lake, Cockeram River). Therefore, runoff volumes, streamflows and water levels in the lakes and streams of interest were scaled from these stations using unit runoff relationships and watershed areas to regional Water of Survey of Canada stations. In total, these factors reduced the certainty of the surface water balance models and climate scenarios. However, the assumptions made related to scaling were conservative, as were assumptions regarding contact water runoff in proportion to non-contact water, runoff coefficients, and infiltration rates at both sites. These assumptions control the timing of run-off and are the likely explanation for the predicted increase in flows in the Keewatin River in March during operation and in March and April during post-closure. It is more likely that during these time periods, minimal runoff would be produced within the site as it would be locked up as ice or snow.

The effect of changes in lake levels and surface flows on fish habitat quantity and quality could not be quantitatively predicted. This was because of limitations in the hydrology datasets (as explained above) and characteristics of the habitat. For example, hydraulic models that are used to estimate change in water velocity and depth with discharge were not possible for Farley Creek because Farley Creek consists of a narrow central channel surrounded on both sides by a wide wetland floodplain with multiple beaver dams. Therefore, the effects of changes in surface flows on fish habitat were described qualitatively based on the fish and fish habitat baseline dataset, fish life histories and habitat requirements assembled from the literature, and professional judgement.

The predicted changes in fish habitat are addressed with both site-specific and industry-standard mitigation measures (Section 10.4.1.3), including fish habitat offsetting. Details of the Fish Habitat Offsetting Plan will be finalized through consultation with DFO, MCC, and local Indigenous groups. All offsets options under consideration to counterbalance harmfully altered, disrupted, or destroyed fish habitat at the Gordon and Maclellan sites are technically feasible, biologically relevant, and designed to provide long-term benefits to the production of fish. Offset options include, but are not limited to: habitat replacement, such as construction of a habitat-enhanced diversion channel to replace the existing diversion channel; habitat restoration, such as replacement of culverts impeding fish passage with bridges; and research to support management and recovery of endangered lake sturgeon populations in the upper Churchill River watershed. Offsets will be monitored after construction to determine their effectiveness.

10.8.2 Change in Fish Health, Growth and Survival

For change in fish health, growth, and survival, the prediction confidence is high. This is because the predicted effects are common to mining and, therefore, are generally well-understood. The potential effects on fish health, growth, or survival are mostly addressed with site-specific, industry-standard mitigation measures as result (Section 10.4.2.3).

The assessment for fish health, growth, and survival was based on predictive water quality modelling that incorporated existing conditions, water quantity estimates from the water balance model, potential sources and quantities of POPCs (e.g., geochemical sources terms from mine rock and tailings), and proposed mitigation and water management measures. While water quality modelling was completed using industry-standard methods and software, there is uncertainty due to underlying datasets (e.g., limited winter flow data, missing or incomplete chemistry data, scaling of geochemistry source terms, beaver dam effects) or other factors (e.g., influence of future climate change). Conservative assumptions were made in the models to help address this uncertainty.

The assessment of potential effects also considered the potential for predicted concentrations of POPCs to cause measurable adverse effects to fish and other aquatic biota based on evaluation of the guidelines (and the science on which they were based) and other available information from the scientific literature or toxicological databases. For many of the POPCs evaluated in this assessment, the effects of the parameter and the toxicity modifying factors are well understood and toxicity thresholds are available across a wide range of species. While there are uncertainties in determining toxicity thresholds for fish and aquatic biota, the approach used in this assessment is reasonably conservative and relied on either water quality guidelines from other regulatory agencies (e.g., US EPA, BC MOE) or the lowest observed effect threshold for the most sensitive species. Where possible and relevant, the influence of known toxicity modifying factors was also incorporated into the assessment.

There can also be uncertainty in determining toxicity thresholds for fish and aquatic biota. This is because data are not available for all species present in the LAA, scientific studies using surrogate species may not be representative of local species or local conditions (e.g., due to toxicity modifying factors), there can be differences both between species and within a species in response to POPC exposure, and exposures can be variable as fish are relatively mobile and can move within and between waterways. However, these issues are not unique to the Project and the approaches used here have been used in similar assessments for other projects across Canada.

The uncertainties that affect the confidence of the assessment for fish health, growth, and survival will be addressed through the development and implementation of water quality monitoring. This monitoring will be linked to an adaptive management plan so that results of monitoring can inform whether additional mitigation and management actions are required to avoid or reduce adverse effects to fish health, growth, or survival.

10.9 FOLLOW-UP AND MONITORING

10.9.1 Change in Fish Habitat

The following follow-up and monitoring plans are proposed that are relevant to change in fish habitat:

- Compliance and effectiveness monitoring of offsetting habitats (Chapter 23, Section 23.5.15). If the monitoring program indicates that the constructed or restored habitats are not functioning, remedial actions or additional offsets would be considered.
- Lake level monitoring described in the Surface Water Monitoring and Management Plan (Chapter 23, Section 23.5.5). Monitored lakes will include, but not be limited to, Gordon, Farley, and Minton lakes.
- Stream flow monitoring described in the Surface Water Monitoring and Management Plan (Chapter 23, Section 23.5.5). Monitored watercourses will include, but not be limited to, Farley Creek and the Keewatin River downstream of the MacLellan site.

If an unexpected deterioration of the environment is observed as part of follow-up and/or monitoring, intervention mechanisms will include the adaptive management process described in Chapter 23, Section 23.2. This may include an investigation of the cause of the deterioration and identification of existing and/or new mitigation measures to be implemented to address it.

Expected site conditions, criteria and monitoring to determine that site is stable and may enter permanent closure is proposed in the Conceptual Closure Plan (Chapter 23, Appendix 23 A), and the Vegetation and Wetlands VC (Chapter 11).

In addition to the above, a fish habitat monitoring plan will be developed through engagement with local Indigenous groups, DFO, and MCC. It is anticipated that this monitoring plan will include, but not necessarily be limited to, the following effects that may occur due to changes in lake levels and streamflows:

- Reduction in the quantity of littoral habitats (i.e., shallow, near-shore areas) in lakes used by fish for spawning, rearing, or foraging.
- Reduction in the quantity or quality (based on water depth and water velocity) of stream habitats used by fish for spawning, rearing, or foraging.
- Changes in the quantity or quality of overwintering habitat in lakes.
- Changes in water temperatures that could affect the growth or survival of fish.

It is expected that monitoring potential changes in fish and fish habitat will be based on a “before-after-impact-control” study design. This will entail comparison of physical habitat metrics important to fish (e.g., water depths) measured before mine construction (i.e., baseline condition) to these same metrics measured during construction, operation, and closure of the Project and to these same metrics measured in lakes and streams that will not be affected by the Project (i.e., reference sites). Reference sites where habitat, water level, and streamflows were measured during baseline studies conducted in 2015 and 2016 include White Owl Lake, Marie Lake, and Marnie Lake at the Gordon site and Lobster Lake, Burge Lake, and Goldsand Lake at the MacLellan site. The utility of these existing reference sites, and the need for any additional reference sites, will be assessed prior to mine construction.

Components of a conceptual fish habitat monitoring plan are described in the following sections.

10.9.1.1 Changes in Littoral Habitat

Changes in littoral habitat will be monitored using water level data from the pressure transducers installed in Gordon and Farley lakes at the Gordon site and in Payne and Minton lakes at the MacLellan site coupled with georeferenced, elevation-rectified, bathymetry maps developed for all four lakes during baseline surveys conducted in 2015 and 2016. Baseline littoral habitat quantity for each fish species present in each lake will be quantified using:

- Pre-mine average spring (i.e., spawning period) and summer (i.e., foraging period) water levels.
- The surface area delineated from the shoreline to the depth equal to the average summer Secchi disc depth (i.e., the depth of sunlight penetration into the water column).
- Habitat maps delineating homogenous littoral habitats in each lake based on substrate type and presence/absence of aquatic vegetation.

- Known habitat preferences of fish species for spawning, rearing, and foraging from the published literature.

Average baseline spring and summer littoral habitat quantities will be compared to spring and summer littoral habitat quantities calculated from water level data from the pressure transducers during each year of mine construction, operation, and decommissioning/closure.

10.9.1.2 Changes in Stream Habitat

Changes in the quantity and quality of stream habitat will be monitored by establishing transects in reaches used by fish for spawning, rearing, and foraging in Farley Creek (Gordon site) and in reaches of the outlet of the unnamed lake downstream of Minton Lake (MacLellan site) to develop one-dimensional (1-D) hydraulic models that predicted average water depth and average water velocity at different discharges.

Prior to mine construction, relationships between stream discharge and average water depth and average water velocity in each stream will be developed by collecting water depths and water velocities at each transect over the range of flows that occur during the spring freshet and summer low flow periods. From these relationships, estimates for average baseline weighted useable area (WUA) for northern pike and white sucker spawning and rearing will be calculated for different flows based on habitat suitability curves both species developed from the published literature; northern pike and white suckers are the two fish species known to use Farley Creek and the outlet of the unnamed lake downstream of Minton Lake for spawning in spring and for rearing in summer (Volume 4, Appendix J). Changes in WUA for northern pike and white sucker spawning and rearing in Farley Creek and the outlet of the unnamed lake downstream of Minton Lake during mine construction, operation, and closure will be estimated from the measured stream discharges in each stream and the stream discharge/WUA relationships.

Both Farley Creek and the outlet of the unnamed lake downstream of Minton Lake have numerous beaver dams that create useable habitat for small-bodied fish species and juveniles of large-bodied fish species. Prior to construction, the number of beaver dams present in each creek during summer will be counted during an aerial survey from a helicopter. These surveys will be repeated each year during construction, operation, and closure phases.

10.9.1.3 Change in Overwintering Habitat Quantity and Quality

Changes in the quantity and quality of overwintering habitat in Gordon Lake and Farley Lake at the Gordon site and in Payne Lake and Minton Lake at the MacLellan site will be monitored by comparing the maximum water depths and minimum dissolved oxygen concentrations under the ice during baseline conditions to those measured during the construction, operation, and decommissioning/closure phases. Water depths and dissolved oxygen concentrations will be measured at the deepest portion of each lake or lake basin and at randomly selected locations during late winter (e.g., March) prior to construction and during each year of the construction, operation, and decommissioning/closure phases.

10.9.1.4 Fish and Fish Habitat Thresholds and Adaptive Management

The Fish and Fish Habitat Monitoring Plan will likely include an adaptive management component. If an unexpected deterioration in fish habitat is observed as part of follow-up and/or monitoring, intervention mechanisms will include the adaptive management process described in Chapter 23, Section 23.2. This adaptive management component will be used to determine if, and what, mitigation actions need to be taken to reduce the magnitude, timing, or duration of changes in water levels in lake or flows in streams used by fish, and may include an investigation of the cause of the deterioration and identification of existing and/or new mitigation measures. This adaptive management component is expected to include:

- Percentage-based thresholds based on the observed change from baseline in littoral habitat area for fish species in lakes and weighted useable area for fish species in streams.
- Percentage based thresholds based on the observed change from baseline water depths under the ice in lakes in winter.
- Minimum dissolved oxygen thresholds based on tolerance and/or lethal thresholds for fish species developed from the published literature.
- A hierarchical plan to investigate the potential causes of threshold exceedance to determine if the threshold exceedance is related to measurement error, equipment malfunction, a single anomalous event, a regional phenomenon, or a Project-related effect due to changes in groundwater quantity or surface water quantity.
- A plan to report any Project-related threshold exceedances to the appropriate regulatory authorities.
- A hierarchical plan to implement remedial actions to existing mitigation measures or to implement additional or new mitigation measures to reduce or eliminate threshold exceedances.

10.9.2 Change in Fish Health, Growth and Survival

The following follow-up and monitoring plans are proposed that are relevant to change in fish health, growth, or survival:

- Environmental monitoring during construction and operation to follow-up on the Erosion and Sediment Control Plan (Chapter 23, Section 23.5.13).
- Surface water quality monitoring at both sites, described in the Surface Water Monitoring and Management Plan (Chapter 23, Section 23.5.5).
- Monitoring plans related to sources of POPCs that can affect water quality such as the Mine Rock Management Plan (Chapter 23, Section 23.5.3), Groundwater Monitoring Plan (Chapter 23, Section 23.5.4), Erosion and Sediment Control Plan (Chapter 23, Section 23.5.13).
- Environmental Effects Monitoring Plan (Chapter 23, Section 23.5.19), which is required under the MDMER when there is discharge or seepage of mine water to the aquatic environment and includes

monitoring for effluent and water quality, sediment quality, benthic invertebrate communities, and fish health (including tissue sampling) and population studies at reference sites and at site(s) downstream of the discharge point(s).

Each of these plans will be developed during engagement with local First Nations, DFO, ECCC, and MCC. It is anticipated that this monitoring plan will include comparison of water quality samples collected from near-field and far-field sites downstream of the Gordon and MacLellan sites, and reference sites upstream of, or in adjacent watersheds to, the Gordon and MacLellan sites, during all Project phases. The frequency, duration, analytical parameters, and detection limits for this monitoring plan will be established prior to construction of the Project.

10.9.2.1 Fish Health, Growth, and Survival Thresholds and Adaptive Management

The Fish and Fish Habitat Monitoring Plan will likely include an adaptive management component. If an unexpected deterioration in fish health, growth, or survival is observed as part of follow-up and/or monitoring, intervention mechanisms will include the adaptive management process described in Chapter 23, Section 23.2. This adaptive management component will be used to determine if, and what, mitigation actions need to be taken to reduce the magnitude, frequency, or duration of any water or sediment quality guideline exceedances measured in any lake or flows downstream of the Gordon and MacLellan sites, and may include an investigation of the cause of the deterioration and identification of existing and/or new mitigation measures. This adaptive management component is expected to include:

- Quantitative water quality thresholds for specific POPCs in select lakes and stream downstream of the Gordon and MacLellan sites.
- A hierarchical plan to investigate the potential causes of guidelines exceedances to determine if the exceedance is related to measurement error, equipment malfunction, a single anomalous event, a regional phenomenon, or a Project-related effect due to changes in groundwater quantity or surface water quantity.
- A plan to report any Project-related threshold exceedances to the appropriate regulatory authorities.
- A hierarchical plan to implement remedial actions to existing mitigation measures or to implement additional or new mitigation measures to reduce or eliminate threshold exceedances.

10.10 SUMMARY OF COMMITMENTS

10.10.1 Common Mitigation Measures

- Sizing new culverts to convey the 1:100-year flood and using open-bottom structures where practical to maintain fish habitat values and fish passage.
- New road crossings will be sized and installed following Manitoba Infrastructure guidelines (DFO and MNR 1996).

- Designing open pit outlets so they are impassable to fish, to discourage fish from colonizing open pits in post-closure.
- Offsetting unavoidable habitat losses using the approach described in the Fish Habitat Offsetting Plan section in Chapter 23. The list of project activities expected to cause HADD of fish habitat, and offsetting requirements to counterbalance HADD of fish habitat, will be finalized in consultation with DFO during the technical review of the Project.
- Limiting the construction footprint to the extent possible to reduce potential reductions in groundwater recharge, to limit the number of watercourses overprinted by the PDA, and to limit the number of extent of changes to catchment area runoff due to encroachment of the PDA into various watersheds.
- Constructing upstream perimeter ditches to divert non-contact water around Project components, reporting to the original receiving environments.
- Using groundwater seepage cutoff collars, where trenches extend below the water table, to mitigate preferential flow paths.
- Collecting groundwater seepage from underground/open pit dewatering.
- Pumping excess water to collection ponds as needed.
- Maintaining existing drainage patterns to the extent possible with the use of culverts.
- Refilling open pits with contact water at closure to return groundwater levels to near baseline conditions.
- Grading perimeter and access roads to divert runoff away from the open pits and fish-bearing waterbodies.
- Maintaining access roads by periodically regrading and ditching to improve water flow and reduce erosion.
- Using dust suppression measures for exposed ground areas within the PDA during dry periods as necessary to reduce dust deposition to surface waters.
- Constructing non-contact water ditches upslope of overburden stockpiles, MRSAs, ore stockpiles, mine infrastructure and the TMF to reduce contact water volumes.
- Constructing contact water collection ditches around the MRSAs, overburden stockpiles, and ore stockpiles to convey the 1:25-year storm event to collection ponds.
- Constructing contact water collection ponds to contain (without discharge) run-off from a 1:100-year storm event with active storage that considers maximum ice thickness in winter.
- Designing collection pond inlets and outlets to reduce water velocities, scour (erosion of sediment) and pond stratification potential (chemical or thermal).

- Maintaining culverts in access road crossings to remove accumulated material and debris to reduce erosion, flooding, and sediment mobilization.
- Implementing erosion and sediment control measures during construction to reduce increases in TSS concentrations in lakes and streams.
- reclaiming overburden and MRSAs to reduce infiltration rates.
- Filling the open pits at closure with contact water to reduce the duration of pit wall exposure and to return groundwater levels to baseline conditions.

10.10.2 Gordon Mitigation Measures

- Constructing a new diversion channel to convey surface run-off from Gordon Lake to Farley Lake.
- Trucking potable water to the Gordon site from the MacLellan site to limit the freshwater withdrawal requirements at the Gordon site to those needed for fire suppression, safety showers, and truck washes.
- Constructing and operating groundwater interceptor wells on either side of the open pit to capture and return groundwater and surface water to Gordon and Farley lakes that would otherwise flow into the open pit.
- Directing contact water from the collection ditches around the MRSA, overburden stockpile, and mine infrastructure to the open pit during closure to reduce the filling period.
- Continuing to operate the groundwater interceptor wells during closure while the open pit fills with water and progressively reducing their pumping rates until the water level in the open pit reaches the elevation of the surrounding groundwater table.
- Constructing a new diversion channel prior to the decommissioning of the existing diversion channel between Gordon and Farley lakes to maintain water levels.
- Aerating Wendy and East pits to encourage precipitation of elements that form oxides (e.g., iron oxide), to break down of thermal and chemical stratification, and to increase dissolved oxygen concentrations prior to dewatering.
- Installing and operating groundwater interceptor wells between the open pit and Gordon Lake and Farley Lake to maintain water levels in Gordon and Farley lakes.
- Aerating groundwater from the interceptor wells in collection ponds to encourage iron precipitation and increase dissolved oxygen concentrations prior to discharge to Gordon Lake and Farley Lake.
- Transporting domestic waste to the sewage treatment plant at the MacLellan site.

10.10.3 MacLellan Mitigation Measures

- Restricting water withdrawal rates from the Keewatin River to <10% of instantaneous discharge at all times.
- Collecting and conveying non-contact water to the collection pond for discharge to the Keewatin River during operation.
- Designing the TMF with two cells to allow progressive development and rehabilitation of the TMF during operation to reduce water management requirements.
- Recycling water between the processing facility and the TMF to reduce freshwater requirements from the Keewatin River during operation.
- Directing water from the TMF and MRSA to the open pit during closure to reduce the filling period.
- Constructing contact water collection ditches around the TMF to convey the 1:25-year storm event to the collection pond.
- Pumping water from the existing underground works to the TMF for storage and eventual use in the processing facility.
- Designing the TMF with two cells to allow progressive development during operation to reduce water management requirements.
- Operating the TMF as a non-discharging facility during operation by reclaiming TMF water for use in the ore processing mill.
- Recycling water between the TMF and the mill to the maximum extent possible during operation to reduce freshwater make-up requirements.
- Using a closed circuit for cyanide use and cyanide destruction in the processing plant (via Air/SO_2 oxidation and precipitation of metals) to reduce cyanide concentrations in tailings slurry prior to release of the slurry for storage in the TMF (Chapter 2, Section 2.3.2.1).
- Constructing groundwater cut-off ditches to reduce groundwater seepage from the TMF entering Minton Lake post-closure.
- Treating domestic waste in an average 60,000 L/day sewage treatment plant so that it meets the Wastewater Systems Effluent Regulations under the *Fisheries Act* prior to discharge to the Keewatin River via a pipeline and diffuser.
- Implementing passive treatment options (e.g., controlled pit stratification, fertilizer amendment, flow segregation) in the open pit should monitoring show that pit water quality is not suitable for release to the environment during the approximately 21 years anticipated to fill the open pit with water at the conclusion of operation.

10.10.4 Fish and Fish Habitat Specific Mitigation Measures

- Limit disturbance areas around waterbodies to maintain existing riparian vegetation and promote recovery of riparian vegetation by marking buffer zones around sensitive habitats and work areas; using existing access routes; reducing soil compaction by using weight-distributing materials under machinery.
- Maintain fish passage by avoiding obstructing watercourses or otherwise interfering with fish movement.
- Requiring all heavy machinery working near water to be kept in good working condition, to be re-fueled no closure than 50 m from any waterbody or watercourse, and to be filled with biodegradable hydraulic fluids.
- Identifying and flagging riparian zones within which heavy machinery is prohibited from entering.
- Limiting in-water works to outside of the northern Manitoba Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat (DFO 2020b) as practical.
- Isolating in-water work areas and conducting fish rescues prior to dewatering, including East Pond at the MacLellan site, Wendy and East pits at the Gordon site, the diversion channel at the Gordon site, and any other locations where instream construction will be required.
- Implementing runoff, erosion, and sediment control measures to reduce the amount of water available to become sediment laden, the amount of sediment that is mobilized through erosion, and the amount of sediment that is conveyed to waterbodies. Additional details are available in Erosion and Sediment Control Plan (Chapter 23, Section 23.5.13). The final plan will include the measures listed in the Measures to Protect Fish and Fish Habitat (DFO 2019).
- Monitoring the effectiveness of construction management plan mitigation measures during construction activities near water, including total suspended solids and/or turbidity and comparing measured valued to MWQSOG (2002) and CCME (2002b) guidelines.
- Using a heat exchanger to heat or cool water from Wendy and East pits prior to discharge to Farley Lake during construction and water from the groundwater interceptor wells prior to discharge to Gordon and Farley lakes to maintain the temperature regime in both lakes so as not to negatively affect primary and secondary production rates and alter important behavioral cues for fish (i.e., spawning and overwintering cues).
- Installing screens on the water intakes that are sized using DFO's Interim Code of Practice: End of Pipe Fish Protection Screens for Small Water Intakes in Freshwater (DFO 2020a). The screens will be sized based on the weakest swimming fish species in the Keewatin River (burbot, an anguilliform swimming species) and Farley Lake (white sucker and yellow perch, two subcarangiform swimming fish species).
- Restricting water withdrawal rates to <10% of the instantaneous discharge of the Keewatin River at all times.

- Limiting the size, timing, and setback distances of blasting charges to avoid percussive injuries to fish or damage to incubating eggs. Blasting protocols tailored to the Gordon and MacLellan sites and their fish species assemblages will be developed during Project permitting, using guidance outlined in the Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Wright and Hopky 1998).
- Establishing and enforcing a worker code-of-conduct for employees brought into work at the LLGP that would limit potential over-fishing of lakes, stream, and rivers in the Project area (e.g., restricting fishing in lakes of streams of a specific size, those used by local First Nations for subsistence or traditional purposes, or determined to contain already depressed populations by MCC).

10.10.5 Follow-up and Monitoring

- Compliance and effectiveness monitoring of offsetting habitats (Chapter 23, Section 23.5.15). If the monitoring program indicates that the constructed or restored habitats are not functioning, remedial actions or additional offsets would be considered.
- Lake level monitoring described in the Surface Water Monitoring and Management Plan (Chapter 23, Section 23.5.5). Monitored lakes will include, but not be limited to, Gordon, Farley, and Minton lakes.
- Stream flow monitoring described in the Surface Water Monitoring and Management Plan (Chapter 23, Section 23.5.5). Monitored watercourses will include, but not be limited to, Farley Creek and the Keewatin River downstream of the MacLellan site.
- Developing a fish and fish habitat monitoring plan with engagement with local First Nations, DFO, and MCC.
- Environmental monitoring during construction and operation to follow-up on the Erosion and Sediment Control Plan (Chapter 23, Section 23.5.13).
- Surface water quality monitoring at both sites, described in the Surface Water Monitoring and Management Plan (Chapter 23, Section 23.5.5).
- Developing monitoring plans related to sources of POPCs that can affect water quality such as the Mine Rock Management Plan (Chapter 23, Section 23.5.3), Groundwater Monitoring Plan (Chapter 23, Section 23.5.4), Erosion and Sediment Control Plan (Chapter 23, Section 23.5.13).
- Developing an Environmental Effects Monitoring Plan (Chapter 23, Section 23.5.19), which is required under the MDMER when there is discharge or seepage of mine water to the aquatic environment and includes monitoring for effluent and water quality, benthic invertebrate communities, and fish health and population studies at reference sites and at site(s) downstream of the discharge point(s).

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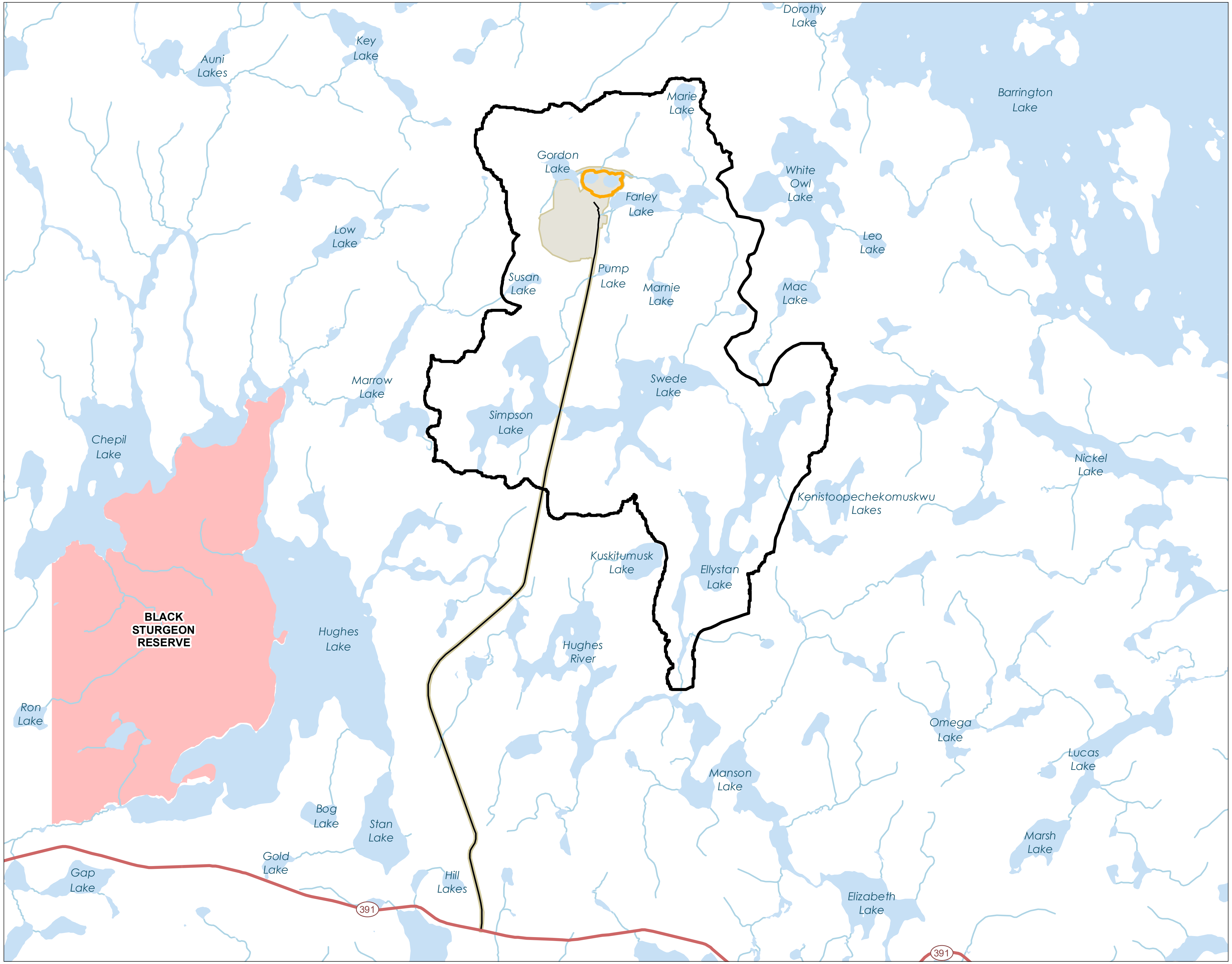

Project Infrastructure

- Proposed Open Pit
- Project Development Area

Study Area

- Fish and Fish Habitat Local Assessment Area (LAA)

Landbase

- Existing Access Road
- Highway
- Watercourse
- Waterbody
- First Nation Reserve

N

0 1 2 Kilometres

(At original document size of 11x17)
1:75,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-04-15
Technical Review by SNelson on 2020-04-15
Senior GIS Review by GKroupa on 2020-04-15

Client/Project
111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-1

Title
Fish and Fish Habitat
Local Assessment Area - Gordon Site

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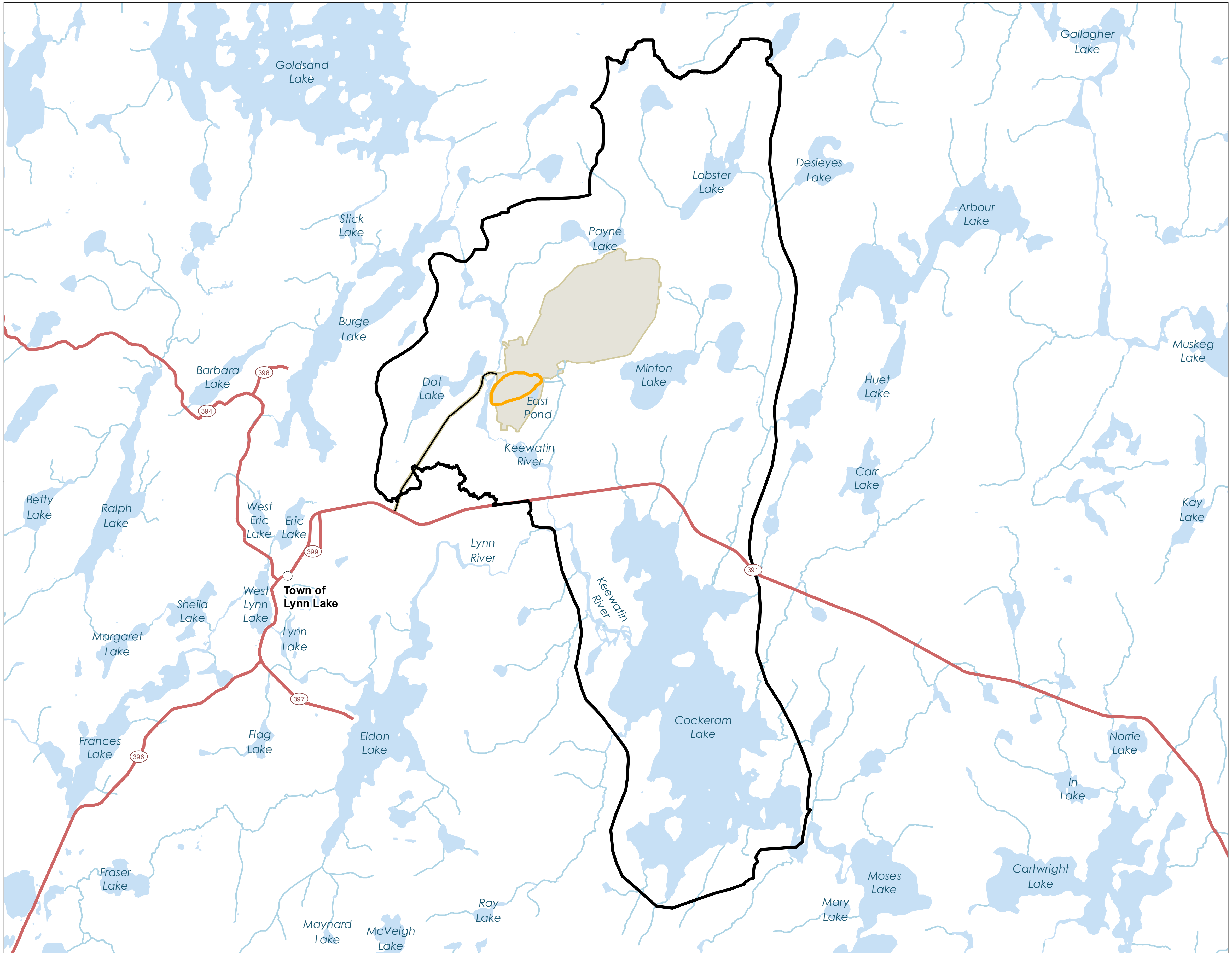


Stantec

Alamos Gold Inc.

Project Infrastructure

- Proposed Open Pit
- Project Development Area

Study Area

- Fish and Fish Habitat Local Assessment Area (LAA)

Landbase

- Existing Access Road
- Highway
- Watercourse
- Waterbody

N

0 1.5 3 Kilometres

(At original document size of 11x17)
1:100,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.

Project Location
Lynn Lake, Manitoba

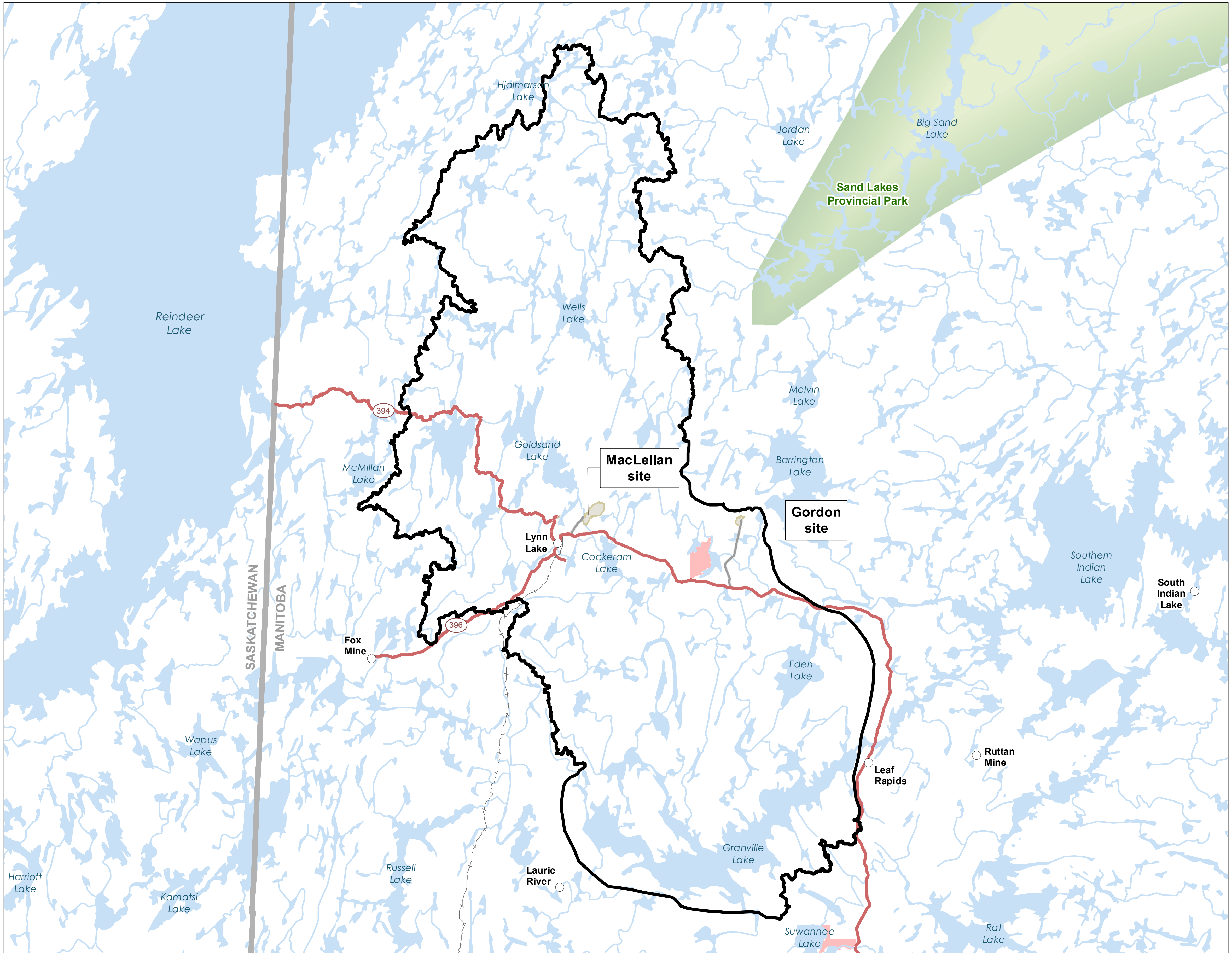
Prepared by ACampigotto on 2020-05-12
Technical Review by SNelson on 2020-05-12
Senior GIS Review by GKroupa on 2020-04-15

Client/Project
111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-2

Title
Fish and Fish Habitat
Local Assessment Area - MacLellan Site

G:\ GIS Project Folder\111473008 LLGP EA\figures\Ch10 Fish and Fish Habitat\Map10-2 FISH LAA MacLellan 20200415.mxd Revised: 2020-05-12 By: ACampigotto



Stantec

Alamos Gold Inc.

Project Infrastructure

Project Development Area

Study Area

Fish and Fish Habitat Regional Assessment Area (RAA)

Landbase

Community

Highway

Access Road

Rail

Watercourse

Waterbody

First Nation Reserve

Provincial Park

Provincial Border

N

0 10 20 Kilometres

(At original document size of 11x17)
1:800,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-04-15
Technical Review by SNelson on 2020-04-15
Senior GIS Review by GKroupa on 2020-04-15

Client/Project 111473008

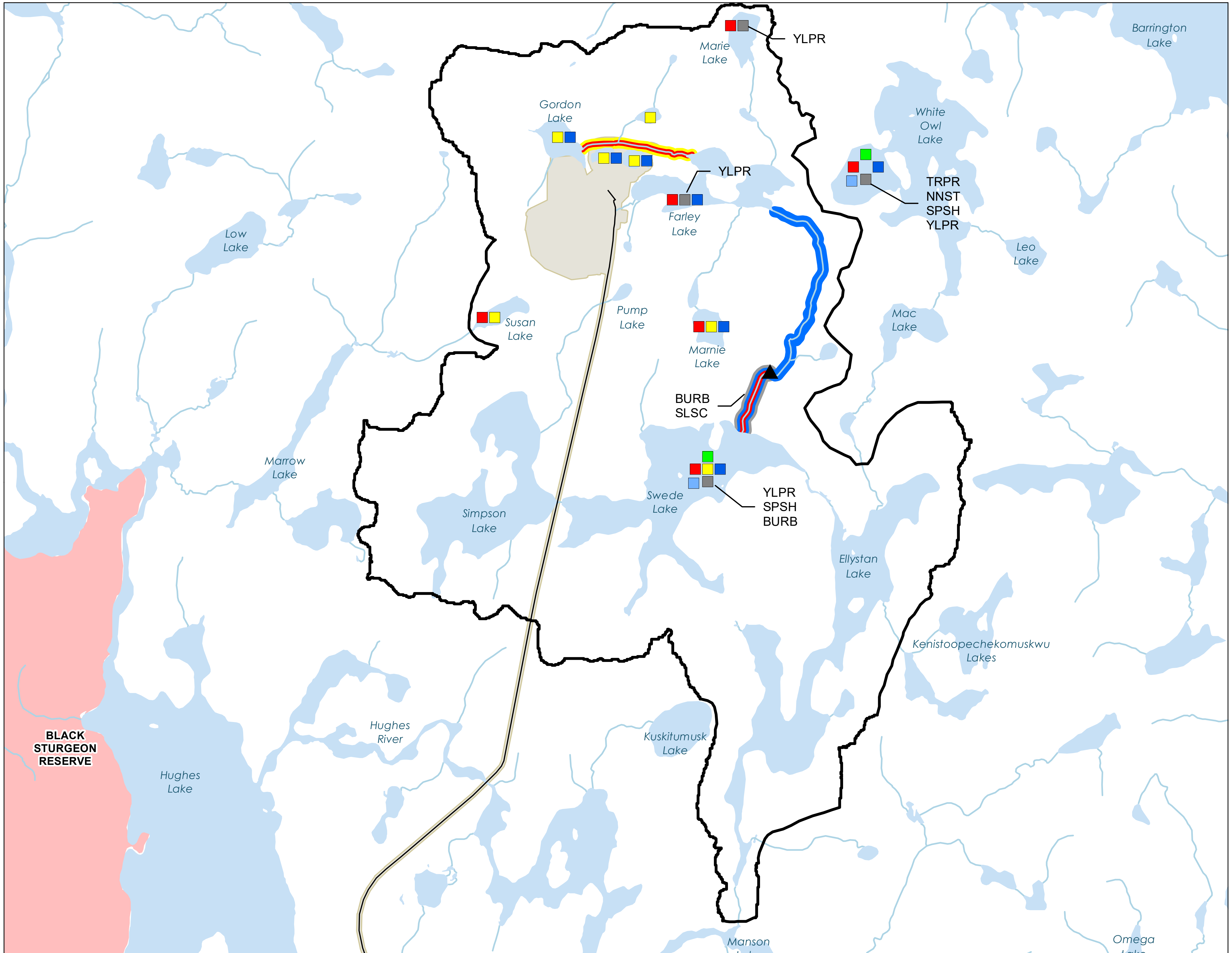
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.

10-3

Title

Fish and Fish Habitat - Regional Assessment Area



Stantec

Alamos Gold Inc.

Project Infrastructure

Project Development Area

Study Area

Fish and Fish Habitat Local Assessment Area (LAA)

Fish Distribution Results

Waterbody Results

- Northern Pike (NRPK)
- Brook Stickleback (BRST)
- White Sucker (WHSC)
- Walleye (WALL)
- Lake Whitefish (LKWH)
- Other
  - Yellow Perch (YLPR)
  - Spottail Shiner (SPSH)
  - Burbot (BURB)
  - Trout Perch (TRPR)
  - Nine-spine Stickleback (NNST)

Watercourse Results

- Northern Pike (NRPK)
- Brook Stickleback (BRST)
- White Sucker (WHSC)
- Other
  - Burbot (BURB)
  - Slimy Sculpin (SLSC)

Note: CISC historically reported in Swede Lake and LNSC in Farley Lake

Cascade Inhibiting Fish Passage

Landbase

Existing Access Road

Watercourse

Waterbody

First Nation Reserve

N

0 0.5 1 Kilometres

(At original document size of 11x17)
1:50,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.

Project Location
Lynn Lake, Manitoba

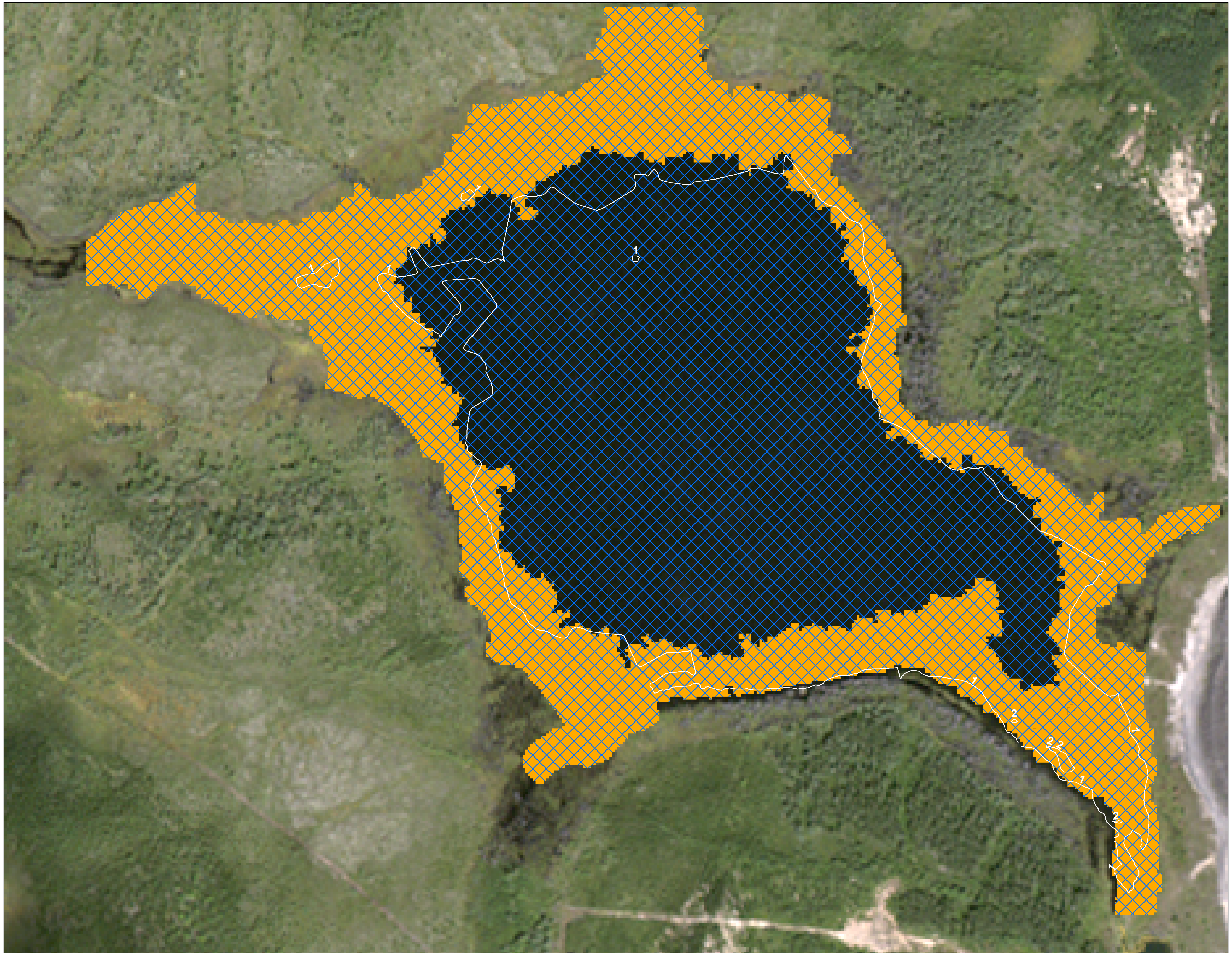
Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project
111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-4

Title
Fish Species Distribution at the Gordon Site



Brook Stickleback Habitat Areas

- Spawning / Rearing / Nursery / Feeding (10.5 hectares)
- Overwintering / Migration (19.0 hectares)

Survey Locations

- Water Depth Contours (m)

N

0 40 80 Metres
(At original document size of 11x17)
1:3,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

Project Location
Lynn Lake,
Manitoba

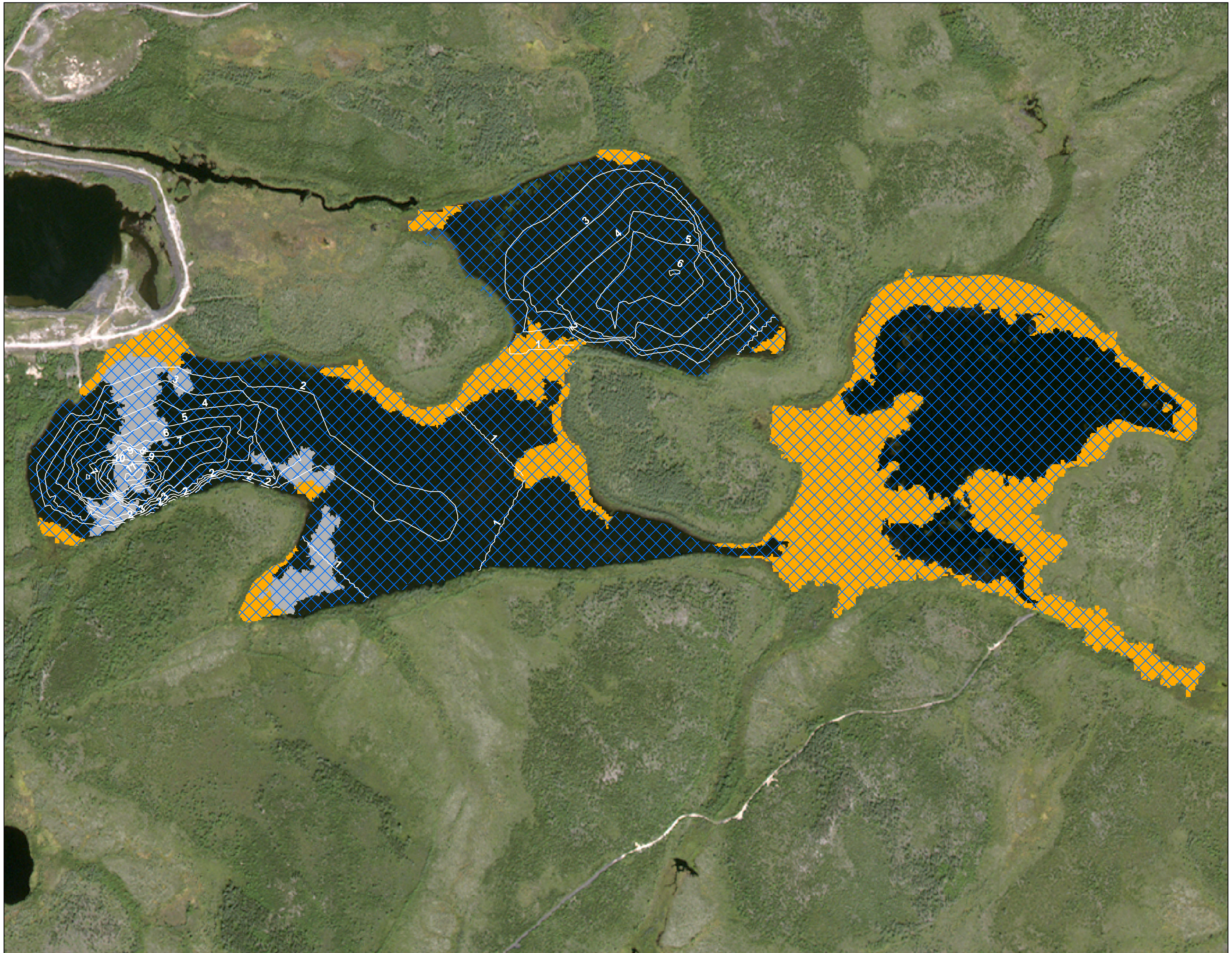
Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-5

Title
Gordon Lake
Brook Stickleback Habitat

G:_GIS_Project_Folder\111473008_LLGP_EA\figures\Ch10_Fish_and_Fish_Habitat\Map10-5_FISH_GordonLake_Fish_BrookStickleback_Habitat_20200716.mxd Revised: 2020-07-21 By: ACampigotto



Stantec

ALAMOS GOLD INC.

Northern Pike Habitat Areas

- Spawning / Rearing / Nursery (20.4 hectares)
- Not Available / Cloud (3.9 hectares)
- Feeding / Overwintering / Migration (77.4 hectares)

Survey Locations

- Water Depth Contours (m)

N

0 100 200 Metres
(At original document size of 11x17)
1:7,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

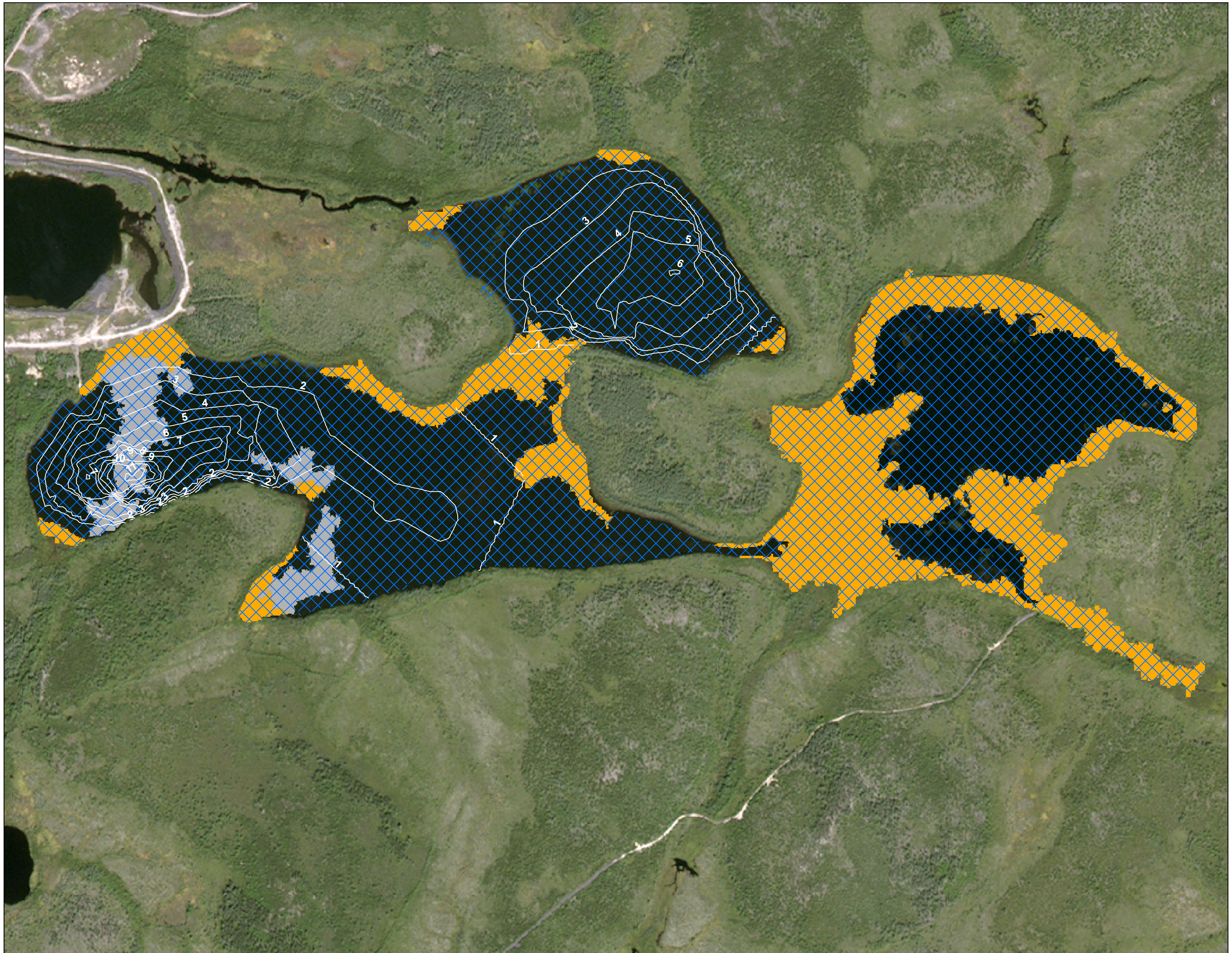
Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-6a

Title
Farley Lake
Northern Pike Habitat



Stantec

Alamos Gold Inc.

Brook Stickleback Habitat Areas

- Spawning / Rearing / Nursery / Feeding (20.4 hectares)
- Not Available / Cloud (3.9 hectares)
- Overwintering / Migration (77.4 hectares)

Survey Locations

- Water Depth Contours (m)

N

0 100 200 Metres
(At original document size of 11x17)
1:7,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008

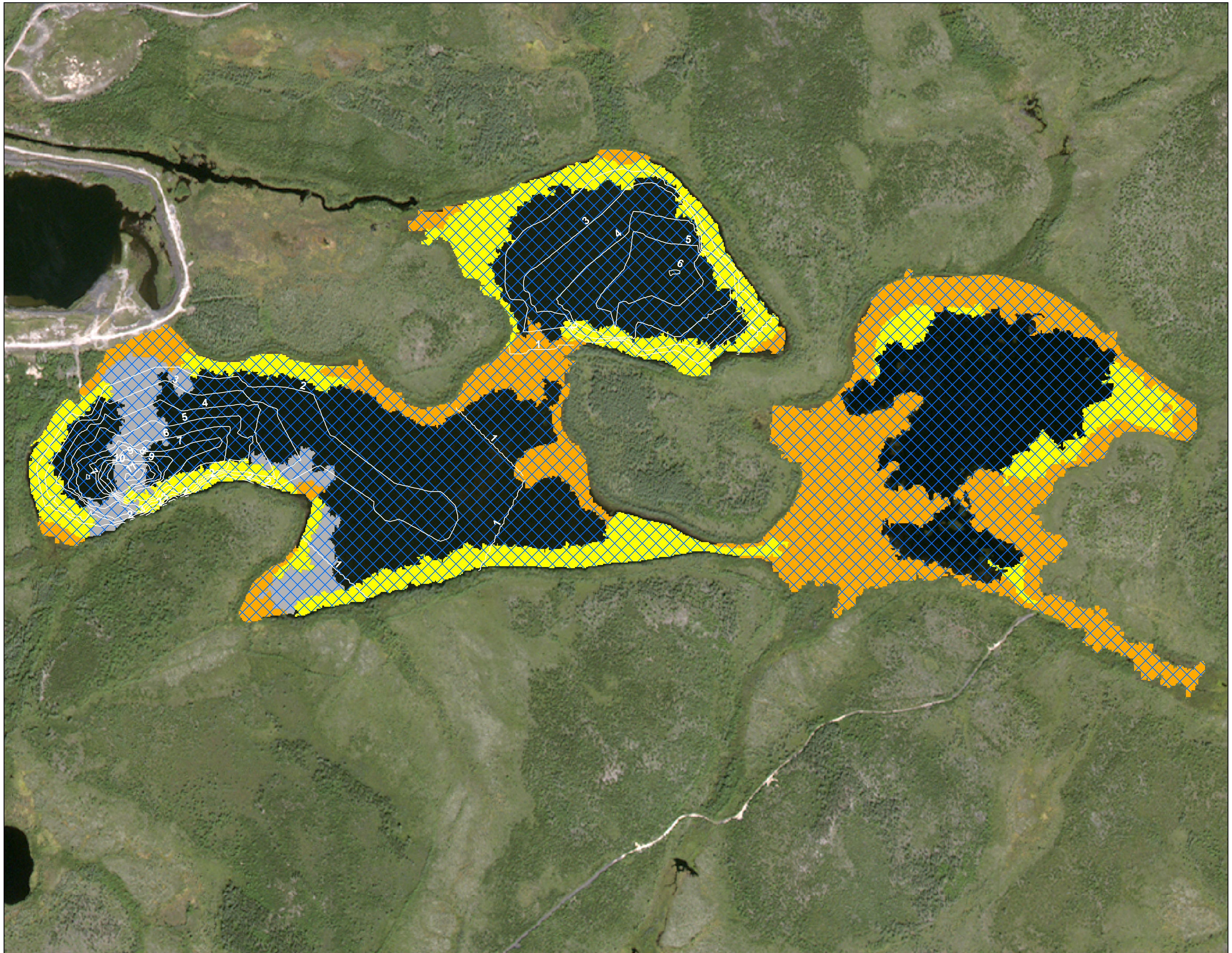
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.

10-6b

Title

Farley Lake
Brook Stickleback Habitat



Stantec

Alamos Gold Inc.

White Sucker Habitat Areas

- Spawning (14.7 hectares)
- Rearing / Nursery (20.4 hectares)
- Not Available / Cloud (3.9 hectares)
- Feeding / Overwintering / Migration (77.4 hectares)

Survey Locations

- Water Depth Contours (m)

N

0 100 200 Metres

(At original document size of 11x17)
1:7,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

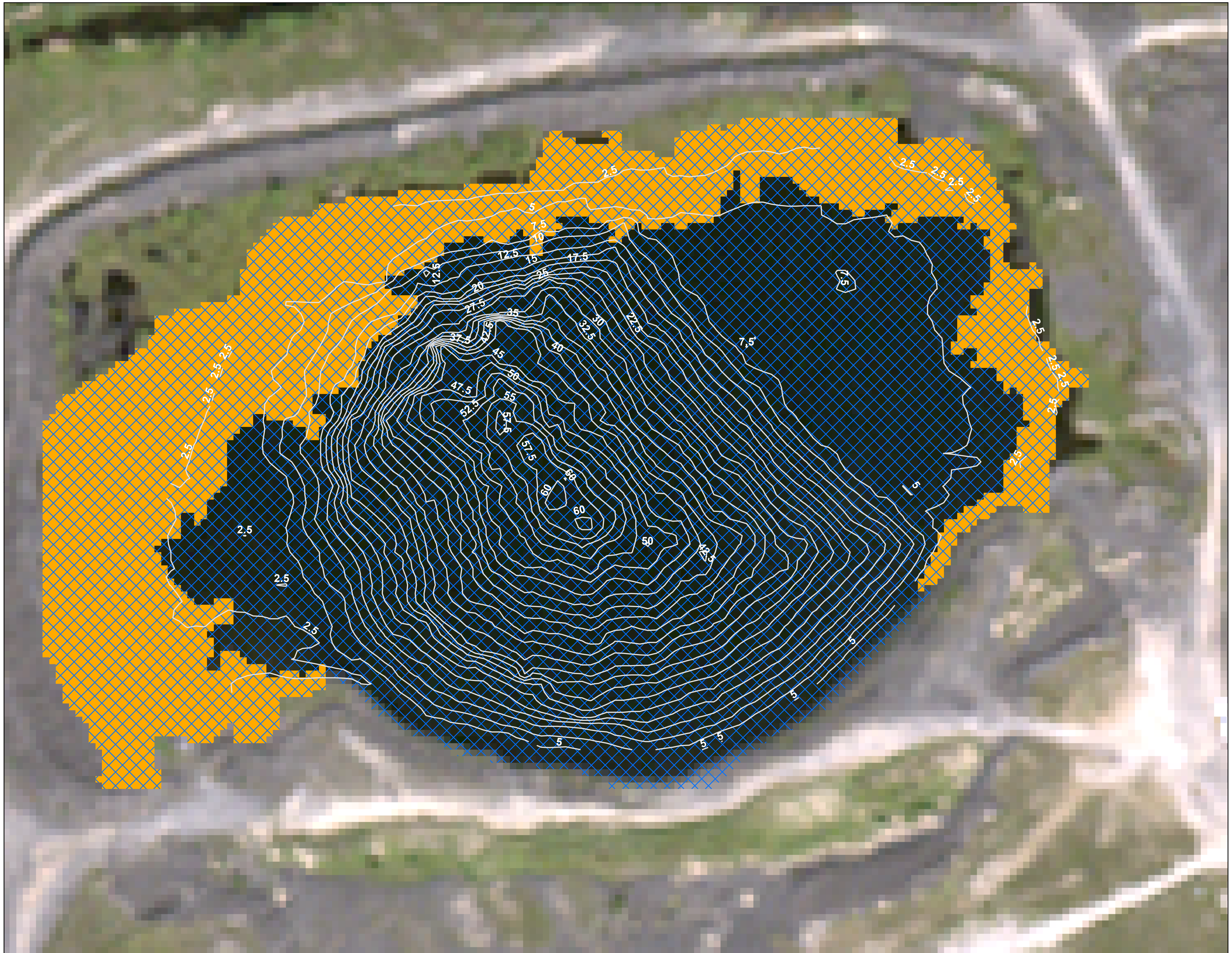
Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project
111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-6c

Title
Farley Lake
White Sucker Habitat



Stantec

Alamos Gold Inc.

Brook Stickleback Habitat Areas

Spawning / Rearing / Nursery / Feeding (1.5 hectares)

Overwintering / Migration (5.3 hectares)

Survey Locations

Water Depth Contours (m)

N

0 10 20 Metres

(At original document size of 11x17)
1:1,200

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

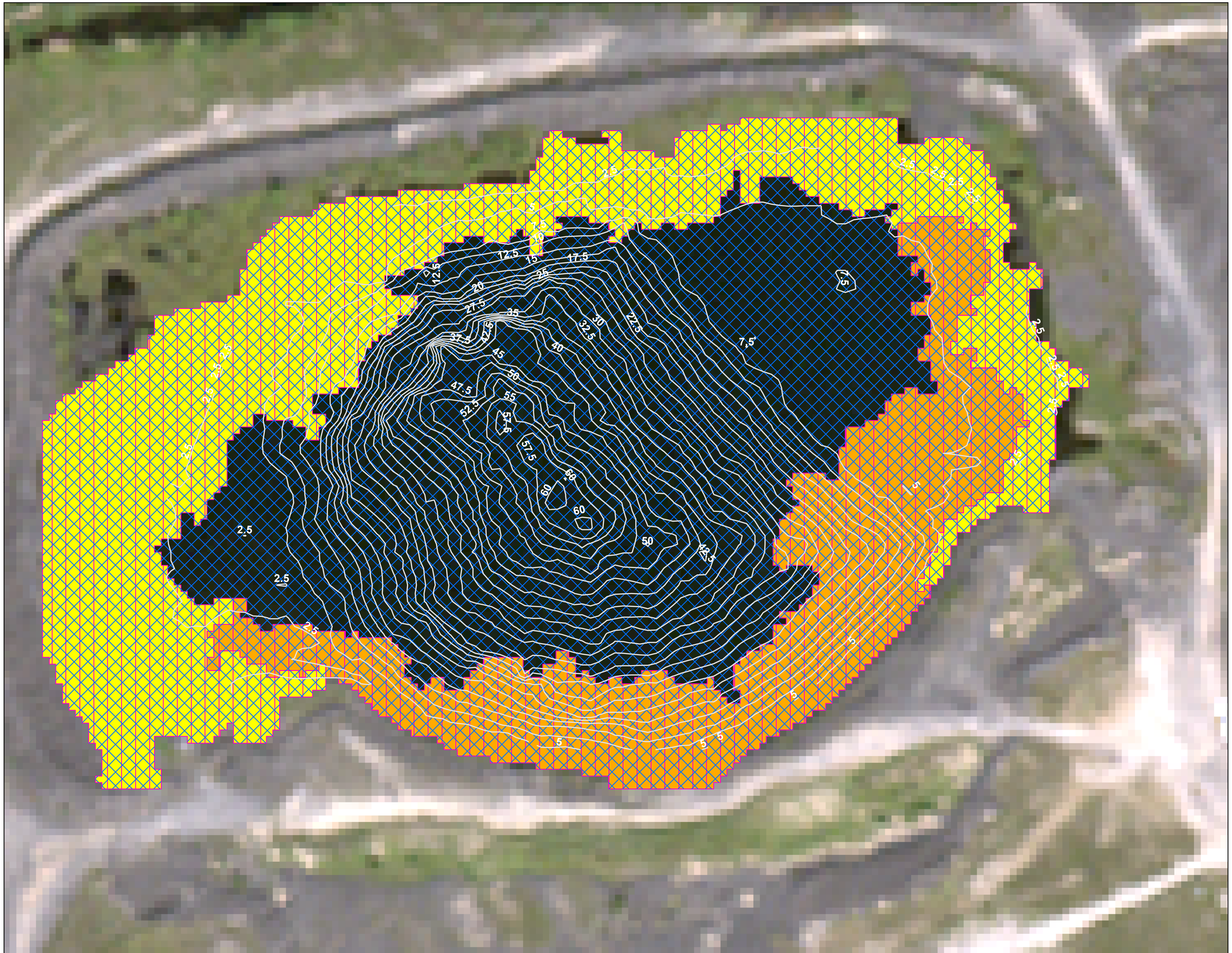
Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-7a

Title
Wendy Pit
Brook Stickleback Habitat



Stantec

Alamos Gold Inc.

White Sucker Habitat Areas

- Spawning (0.9 hectares)
- Rearing / Nursery (1.5 hectares)
- Feeding (2.4 hectares)
- Overwintering / Migration (5.3 hectares)

Survey Locations

- Water Depth Contours (m)

N

0 10 20 Metres
(At original document size of 11x17)
1:1,200

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

Project Location
Lynn Lake,
Manitoba

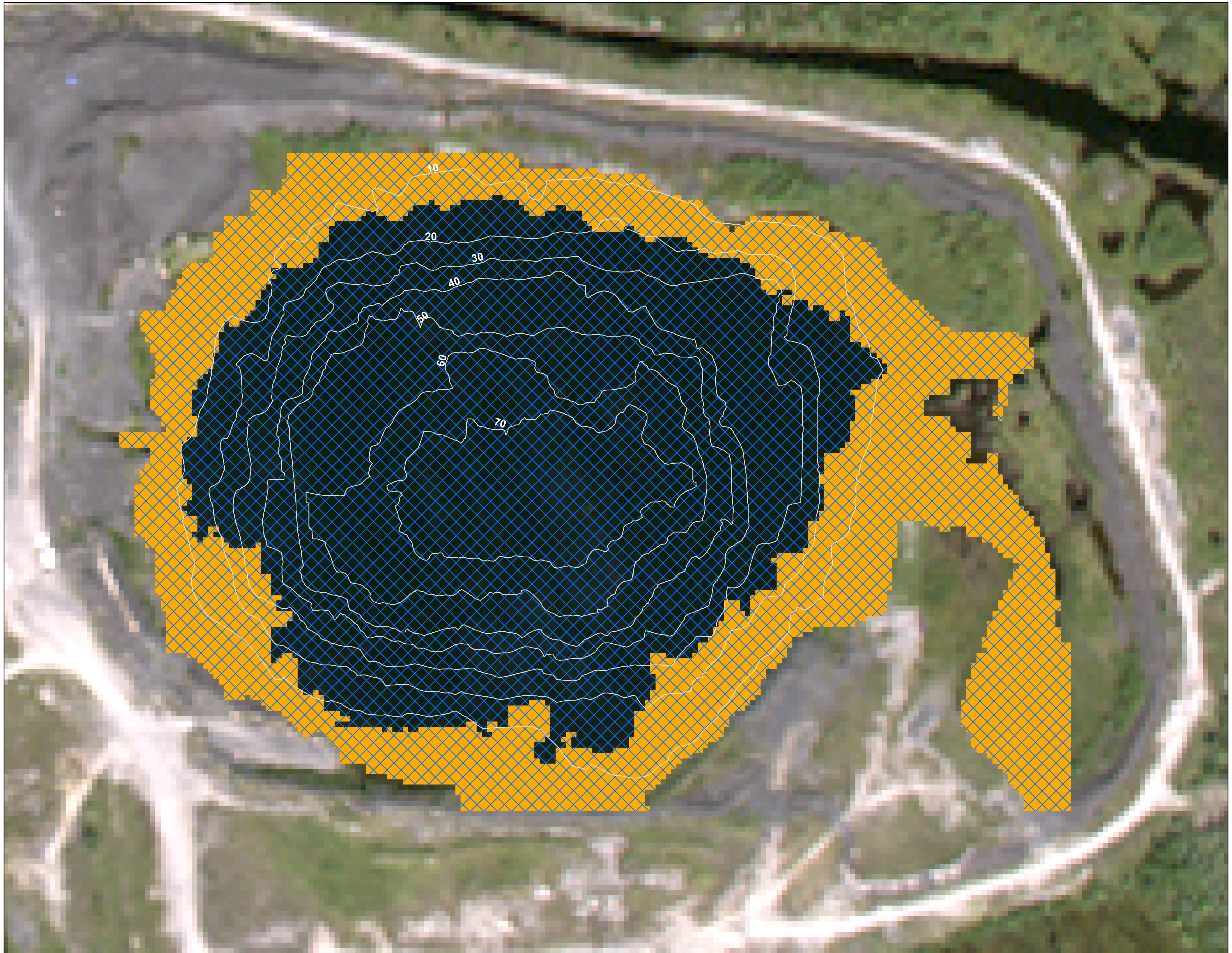
Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-7b

Title
Wendy Pit
White Sucker Habitat

G:_GIS_Project_Folder\111473008_LLGP_EA\figures\Ch10_Fish_and_Fish_Habitat\Map10-7b_FISH_WendyPit_WhiteSucker_Habitat_20200716.mxd Revised: 2020-07-21 By: ACampigotto



Stantec

Alamos Gold Inc.

Brook Stickleback and White Sucker Habitat Areas

- Spawning / Rearing / Nursery / Feeding (2.5 hectares)
- Overwintering / Migration (5.6 hectares)

Survey Locations

- Water Depth Contours (m)

N

0 20 40 Metres

(At original document size of 11x17)
1:1,500

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.

10-8

Title

East Pit
Brook Stickleback and White Sucker Habitat

Stantec

Alamos Gold Inc.

Northern Pike Habitat Areas

- Spawning / Rearing / Nursery (46.3 hectares)
- Not available / Cloud (49.5 hectares)
- Feeding / Overwintering / Migration (230.5 hectares)

Survey Locations

- Water Depth Contours (m)

N

0 200 400 Metres

(At original document size of 11x17)
1:12,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

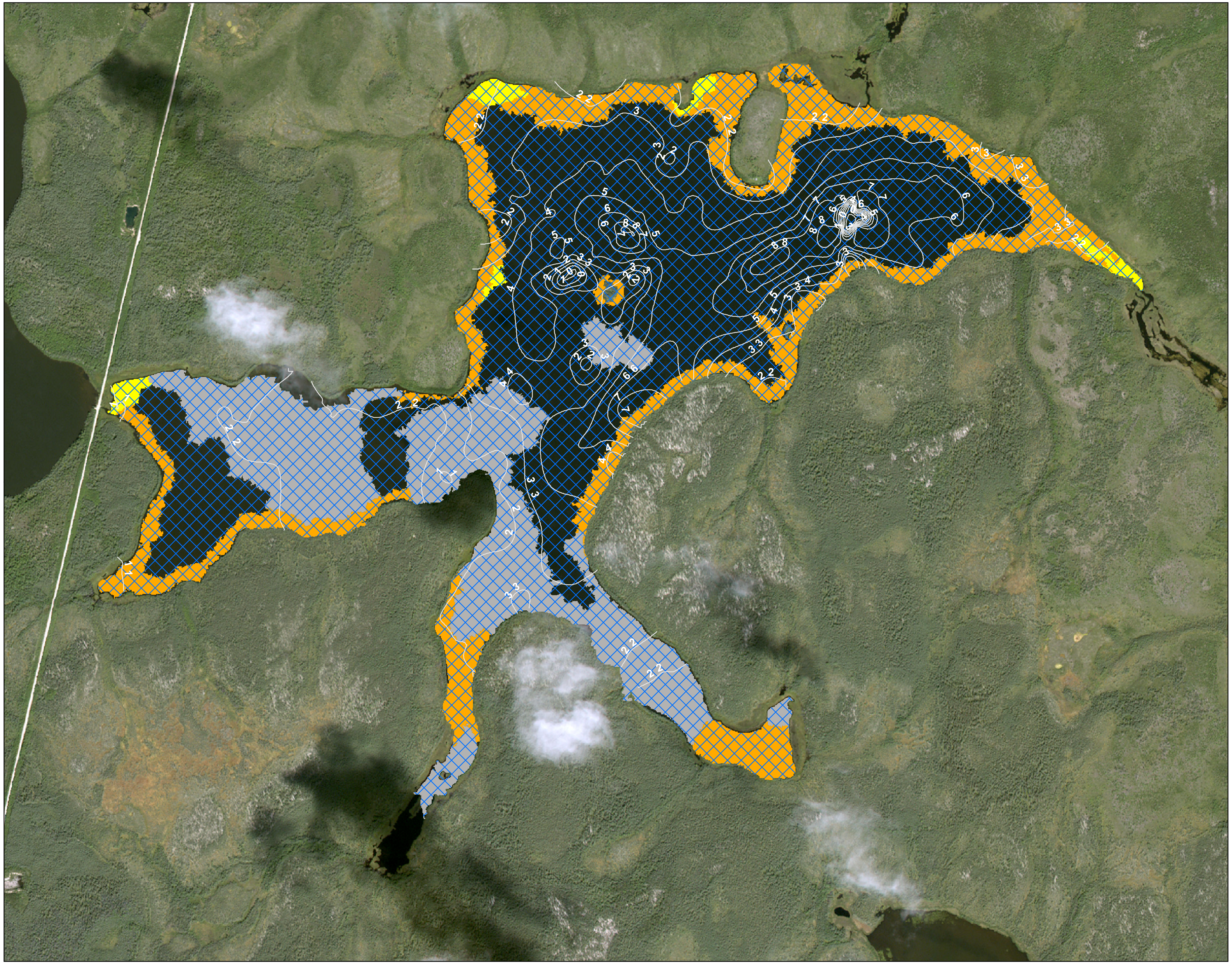
Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-9a

Title
Swede Lake
Northern Pike Habitat



Stantec

Alamos Gold Inc.

Walleye, Lake Whitefish, and White Sucker Habitat Areas

- Spawning (3.4 hectares)
- Rearing / Nursery (46.3 hectares)
- Not available / Cloud (49.5 hectares)
- Feeding / Overwintering / Migration (230.5 hectares)

Survey Locations

- Water Depth Contours (m)

N

0 200 400 Metres

(At original document size of 11x17)
1:12,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project
111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-9b

Title
Swede Lake
Walleye, Lake Whitefish, and White Sucker Habitat

Stantec

Alamos Gold Inc.

Brook Stickleback Habitat Areas

- Spawning / Rearing / Nursery / Feeding (46.3 hectares)
- Not available / Cloud (49.5 hectares)
- Overwintering / Migration (230.5 hectares)

Survey Locations

- Water Depth Contours (m)

N

0 200 400 Metres

(At original document size of 11x17)
1:12,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

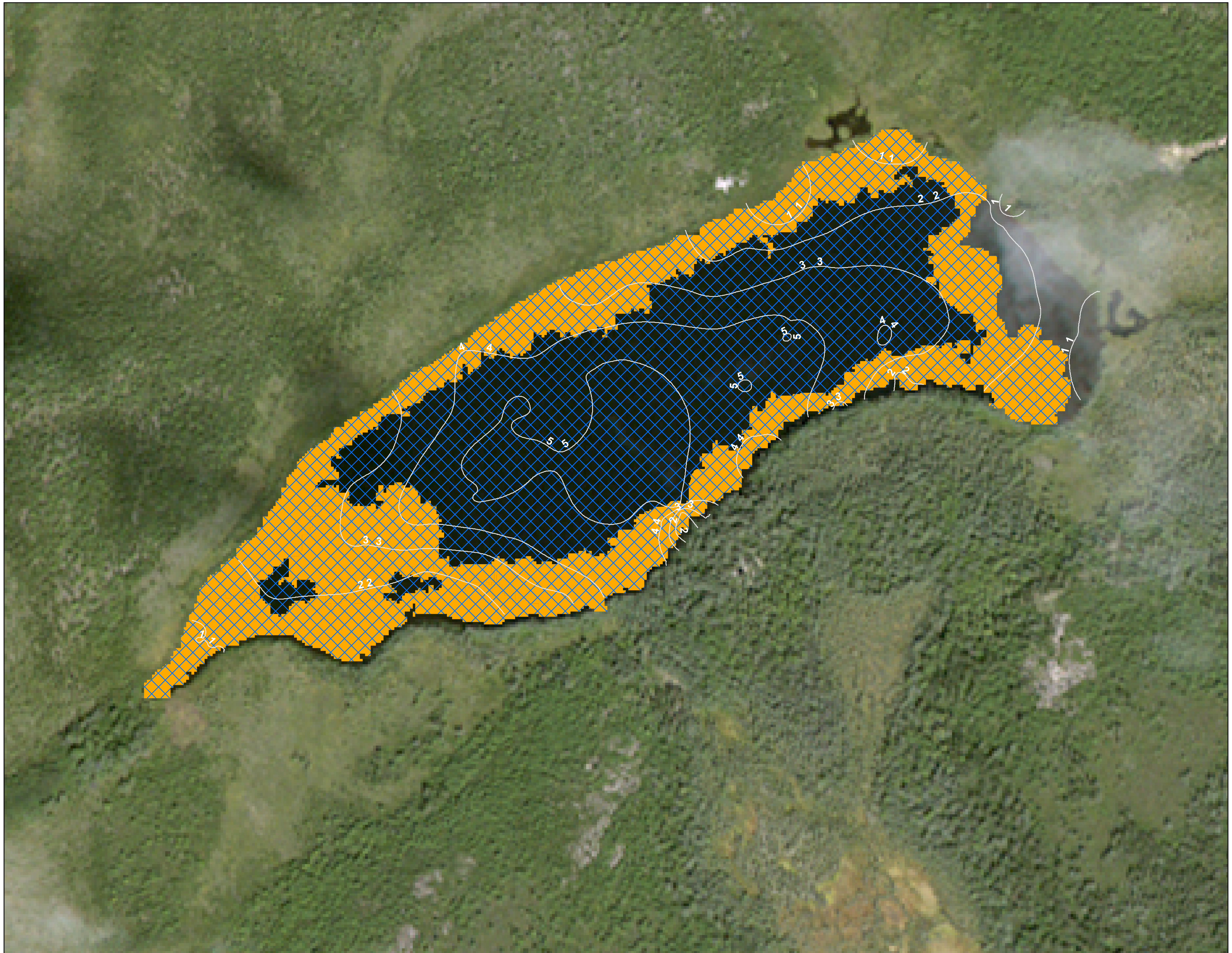
Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-9c

Title
Swede Lake
Brook Stickleback Habitat



Stantec

Alamos Gold Inc.

Northern Pike Habitat Areas

- Spawning / Rearing / Nursery (5.6 hectares)
- Feeding / Overwintering / Migration (11.9 hectares)

Survey Locations

- Water Depth Contours (m)

N

0 40 80 Metres

(At original document size of 11x17)
1:3,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008

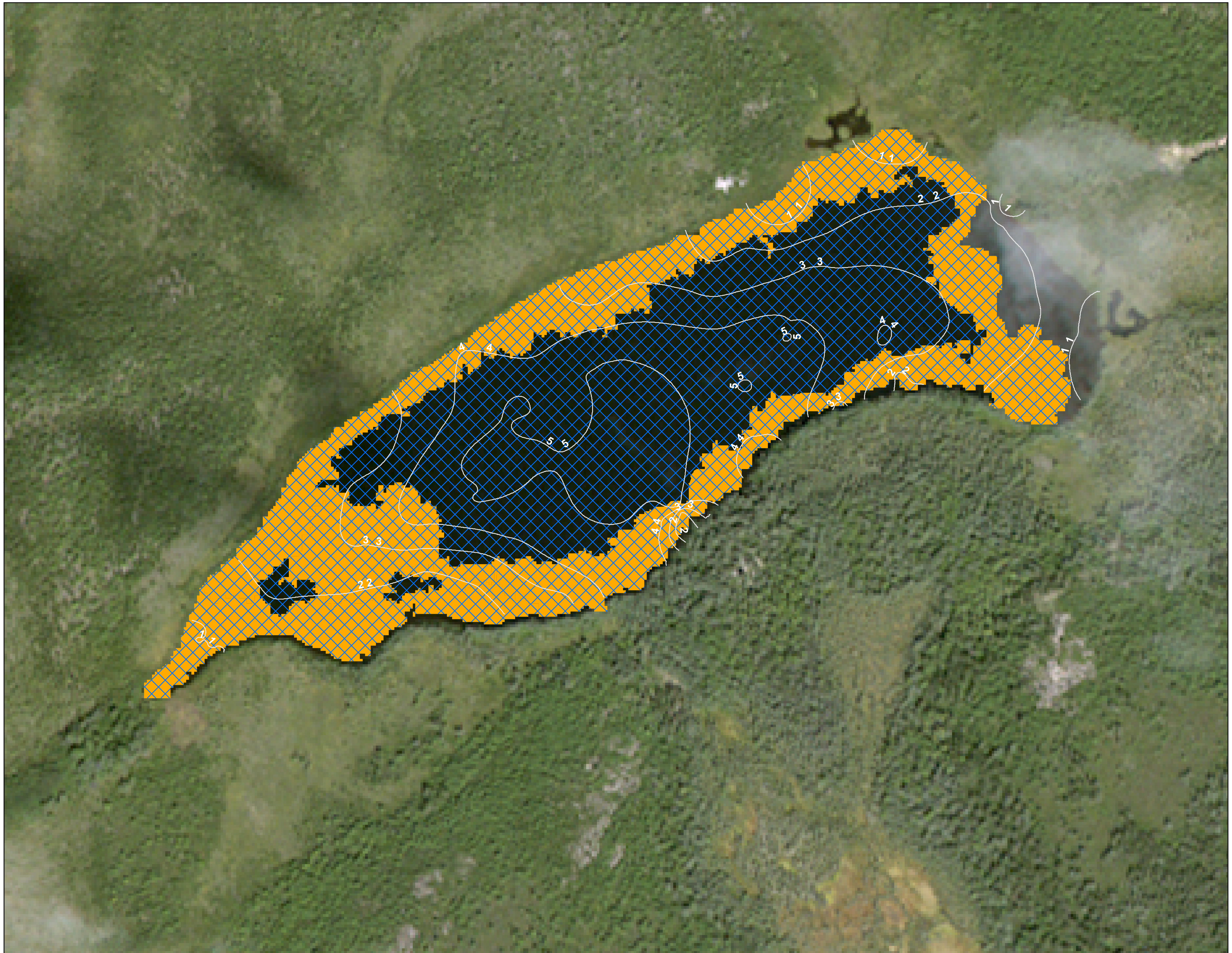
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.

10-10a

Title

Susan Lake
Northern Pike Habitat



Stantec

Alamos Gold Inc.

Brook Stickleback Habitat Areas

Spawning / Rearing / Nursery / Feeding (5.6 hectares)

Overwintering / Migration (11.9 hectares)

Survey Locations

Water Depth Contours (m)

N

0 40 80 Metres

(At original document size of 11x17)
1:3,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N

2. Base Data Sources: Government of Manitoba and Government of Canada.

3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008

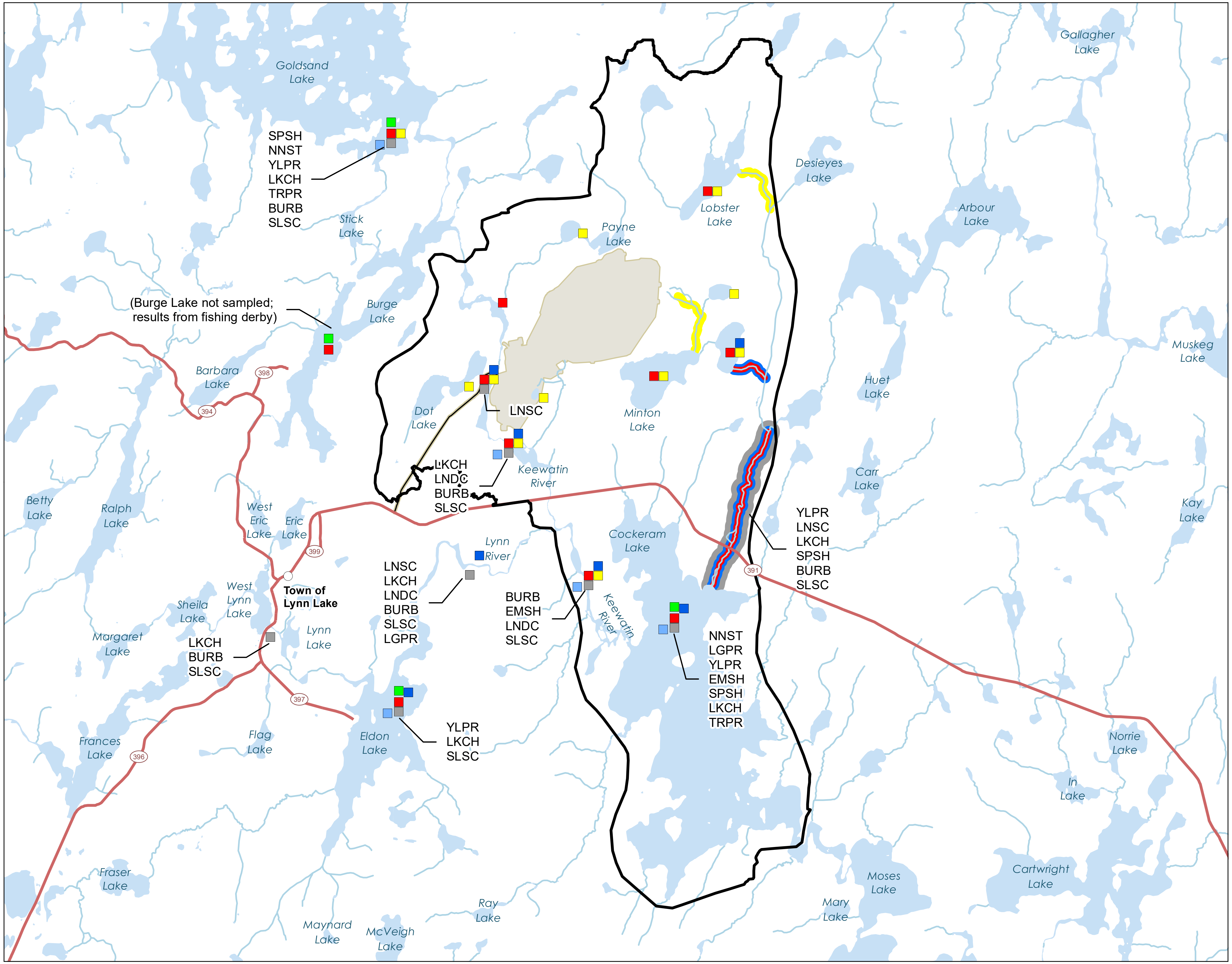
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.

10-10b

Title

Susan Lake
Brook Stickleback Habitat



Stantec

Alamos Gold Inc.

Project Infrastructure

Project Development Area

Study Area

Fish and Fish Habitat Local Assessment Area (LAA)

Fish Distribution Results

Waterbody Results

- Northern Pike (NRPK)
- Brook Stickleback (BRST)
- White Sucker (WHSC)
- Walleye (WALL)
- Lake Whitefish (LKWH)
- Other
  - Yellow Perch (YLPR)
  - Spottail Shiner (SPSH)
  - Log Perch (LGPR)
  - Longnose Sucker (LNSC)
  - Burbot (BURB)
  - Nine-spine Stickleback (NNST)
  - Trout Perch (TRPR)
  - Emerald Shiner (EMSH)
  - Lake Chub (LKCH)
  - Longnose Dace (LNDC)
  - Cisco (CISC)
  - Slimy Sculpin (SLSC)

Watercourse Results

- Northern Pike (NRPK)
- Brook Stickleback (BRST)
- White Sucker (WHSC)
- Yellow Perch (YLPR)
- Other
  - Spottail Shiner (SPSH)
  - Burbot (BURB)
  - Longnose Sucker (LNSC)
  - Lake Chub (LKCH)
  - Slimy Sculpin (SLSC)

Note: CISC historically reported in Swede Lake and LNSC in Farley Lake

Landbase

- Existing Access Road
- Highway
- Watercourse
- Waterbody

N

0 1.5 3 Kilometres

(At original document size of 11x17) 1:100,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-11

Title
Fish Species Distribution at the MacLellan Site

Stantec

Alamos Gold Inc.

Brook Stickleback Habitat Areas

Spawning / Rearing / Nursery / Feeding / Overwintering / Migration (3.7 hectares)

Survey Locations

Water Depth Contours (m)

N

0 20 40 Metres

(At original document size of 11x17) 1:2,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-12

Title
East Pond
Brook Stickleback Habitat

G:_GIS_Project_Folder\111473008_LLGP_EA\figures\Ch10_Fish_and_Fish_Habitat\Map10-12_FISH_EastPond_Fish_BrookStickleback_Habitat_20200716.mxd Revised: 2020-07-21 By: ACampigotto

Stantec

Alamos Gold Inc.

Brook Stickleback Habitat Areas

Spawning / Rearing / Nursery / Feeding (23.8 hectares)

Overwintering / Migration (98.0 hectares)

Survey Locations

Water Depth Contours (m)

N

0 100 200 Metres

(At original document size of 11x17)
1:8,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

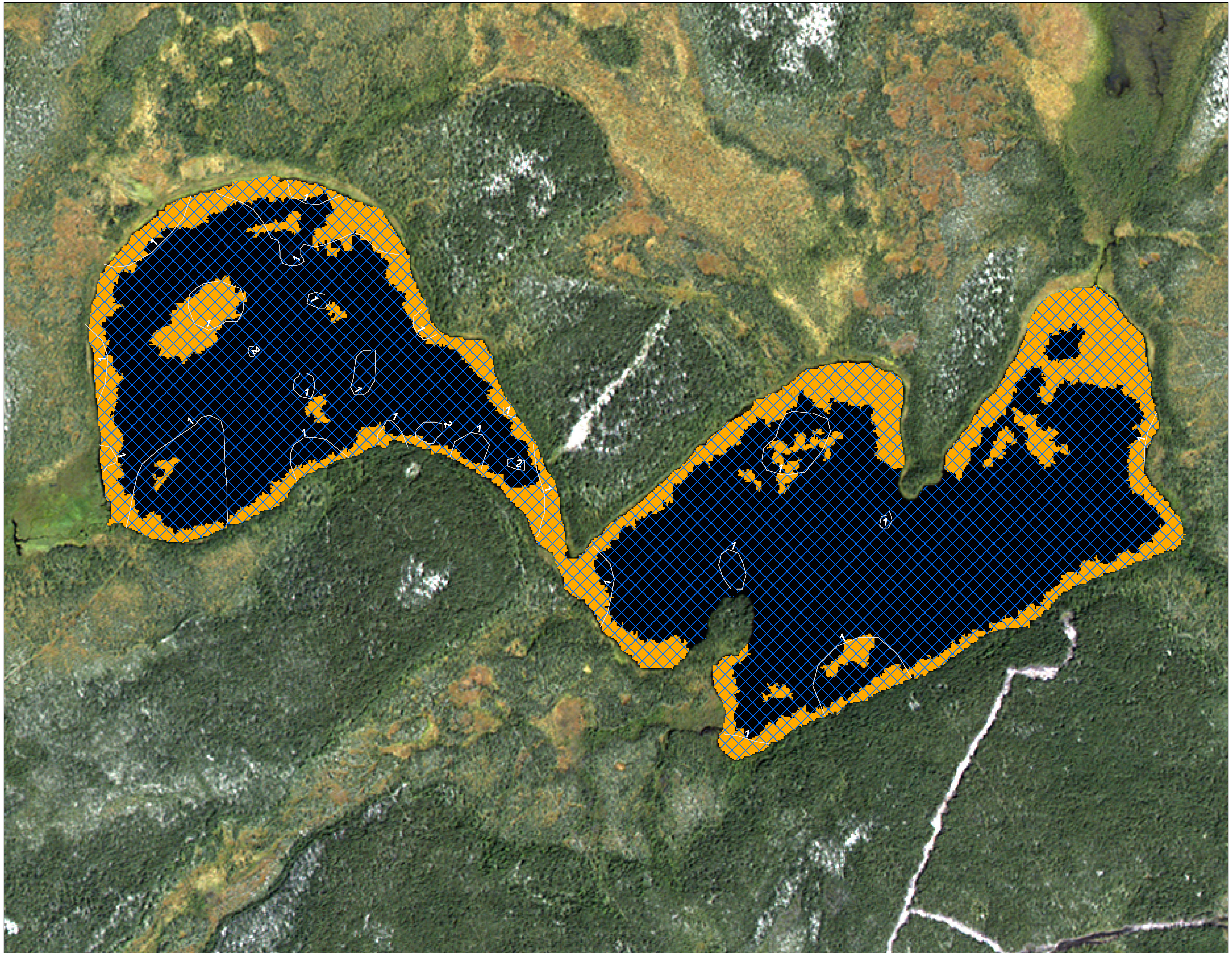
Map No.

10-13

Title

**Dot Lake
Brook Stickleback Habitat**

G:_GIS_Project_Folder\111473008_LLGP_EA\figures\Ch10_Fish_and_Fish_Habitat\Map10-13_FISH_DotLake_BrookStickleback_Habitat_20200721.mxd Revised: 2020-07-21 By: ACampigotto



Stantec

Alamos Gold Inc.

Brook Stickleback Habitat Areas

Spawning / Rearing / Nursery / Feeding (16.7 hectares)

Overwintering / Migration (59.8 hectares)

Survey Locations

Water Depth Contours (m)

N

0 50 100 Metres

(At original document size of 11x17)
1:6,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008

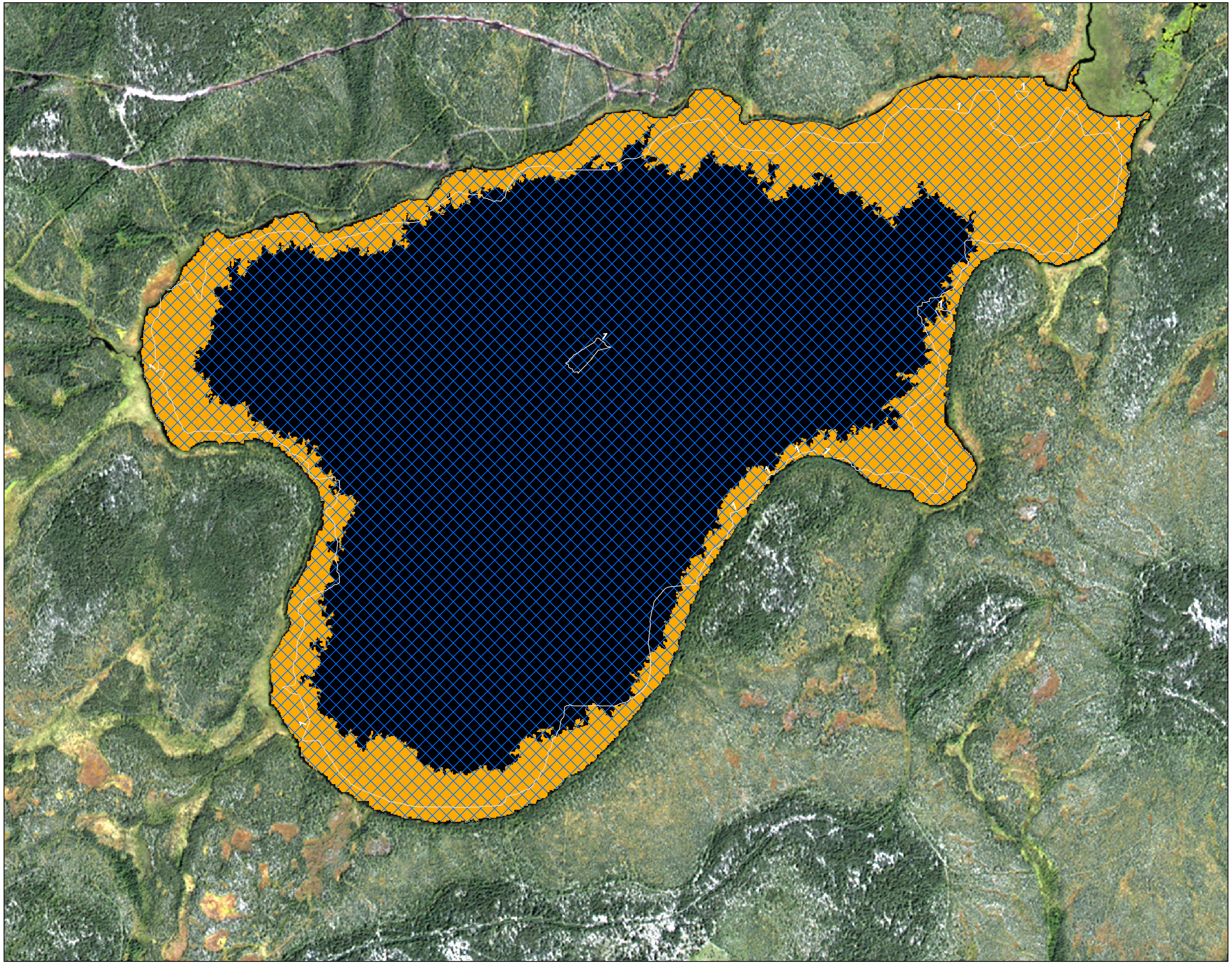
ALAMOS GOLD INC.
Lynn Lake Gold Project

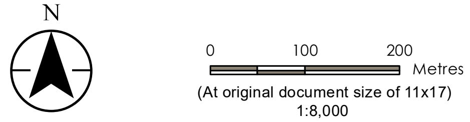
Map No.

10-14

Title

Payne Lake
Brook Stickleback Habitat





Stantec

Alamos Gold Inc.

Northern Pike Habitat Areas

Spawning / Rearing / Nursery (50.4 hectares)

Feeding / Overwintering / Migration (166.6 hectares)

Survey Locations

Water Depth Contours (m)

(At original document size of 11x17)
1:8,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

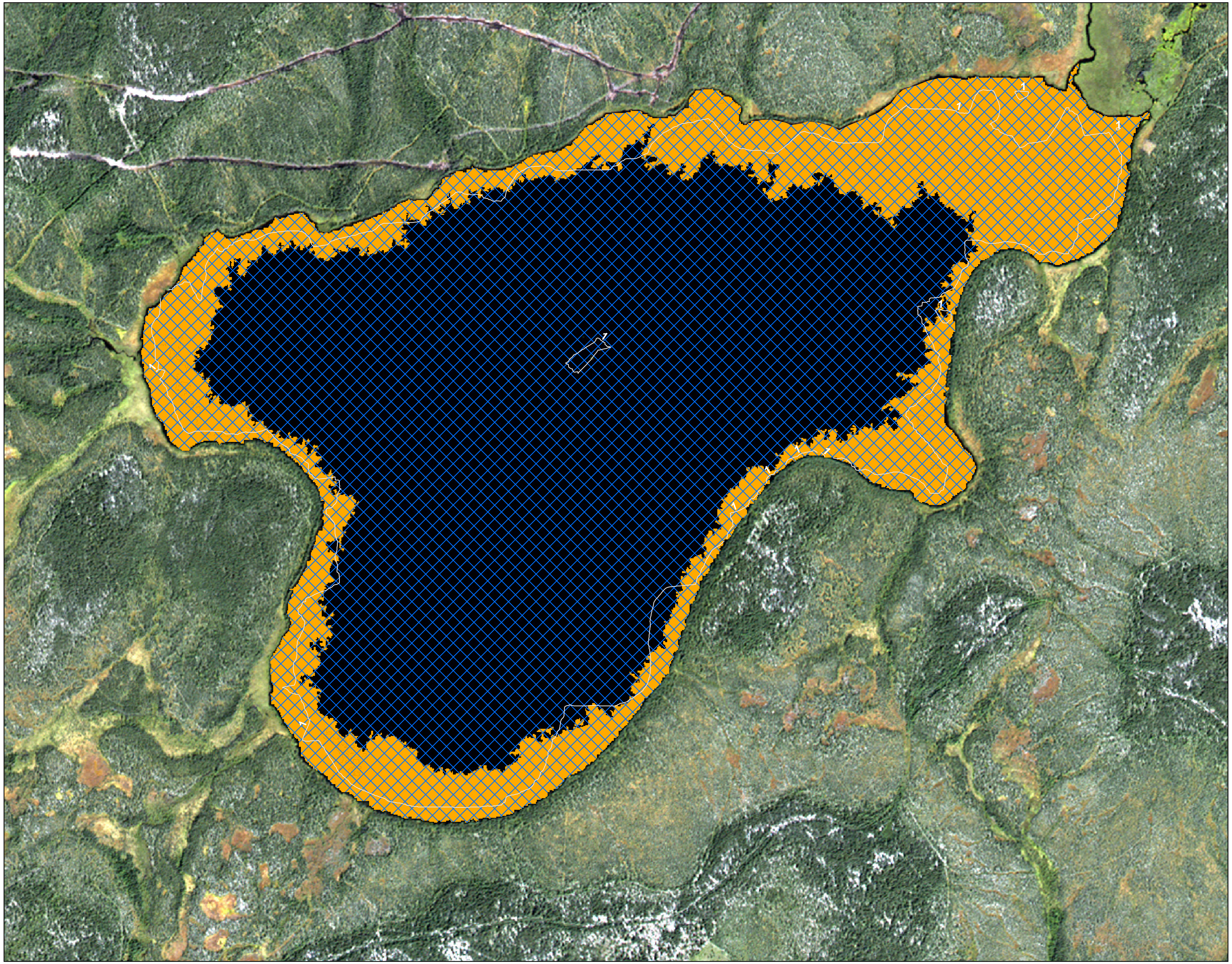
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
10-15a

Title
Minton Lake
Northern Pike Habitat

G:_GIS_Project_Folder\111473008_LLGP_EA\figures\Ch10_Fish_and_Fish_Habitat\Map10-15a_FISH_MintonLake_NorthernPike_Habitat_20200721.mxd Revised: 2020-07-21 By: ACampigotto



Stantec

ALAMOS GOLD INC.

Brook Stickleback Habitat Areas

Spawning / Rearing / Nursery / Feeding (50.4 hectares)

Overwintering / Migration (166.6 hectares)

Survey Locations

Water Depth Contours (m)

N

0 100 200 Metres

(At original document size of 11x17)
1:8,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

Project Location
Lynn Lake,
Manitoba

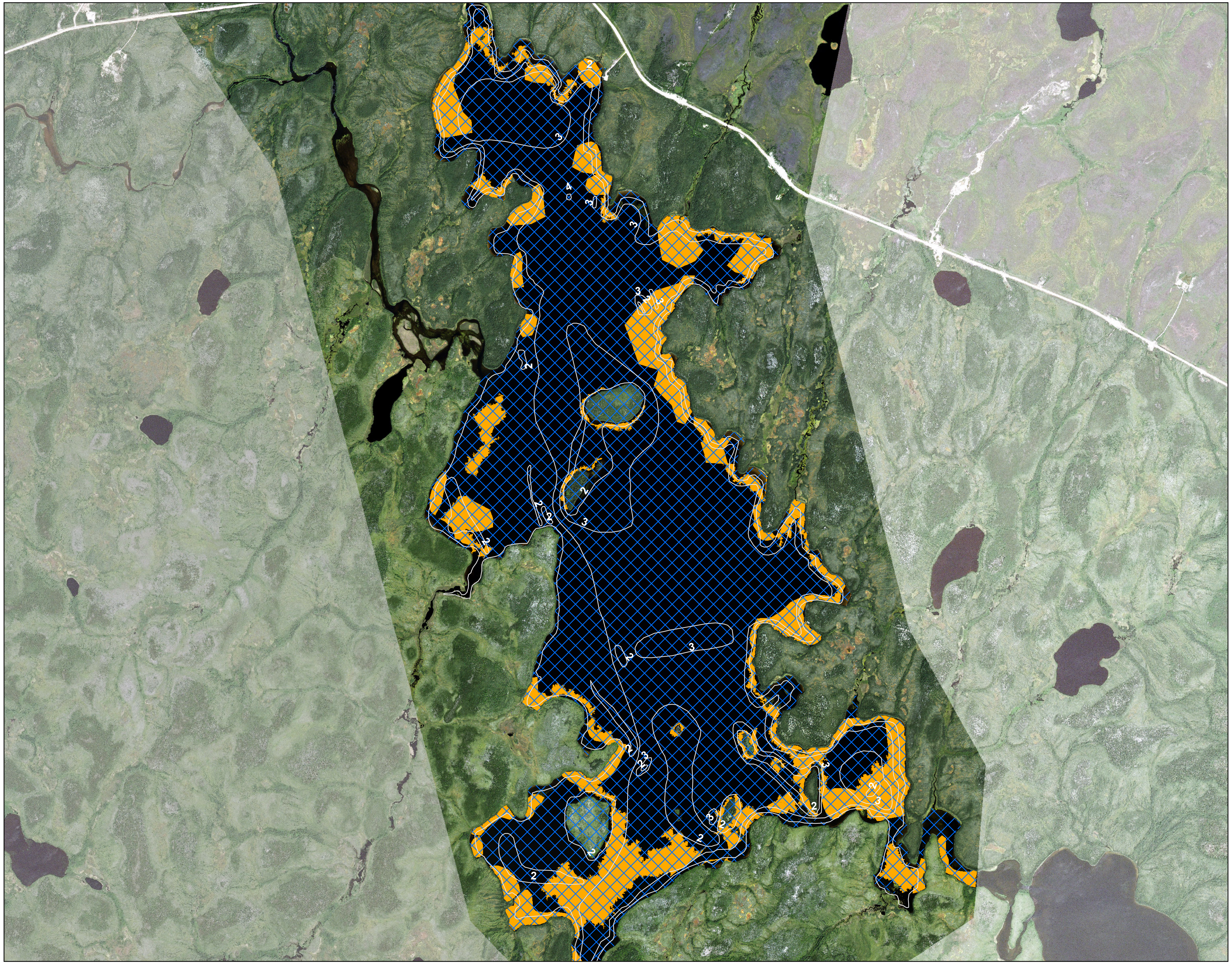
Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-16

Client/Project
111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-15b

Title
Minton Lake
Brook Stickleback Habitat

G:_GIS_Project_Folder\111473008_LLGP_EA\figures\Ch10_Fish_and_Fish_Habitat\Map10-15b_FISH_MintonLake_BrookStickleback_Habitat_20200721.mxd Revised: 2020-07-21 By: ACampigotto



Stantec

Alamos Gold Inc.

Northern Pike Habitat Areas

Spawning / Rearing / Nursery (458.2 hectares)

Feeding / Overwintering / Migration (2105.1 hectares)

Survey Locations

Water Depth Contours (m)

N

0 500 1,000 Metres

(At original document size of 11x17)
1:40,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008

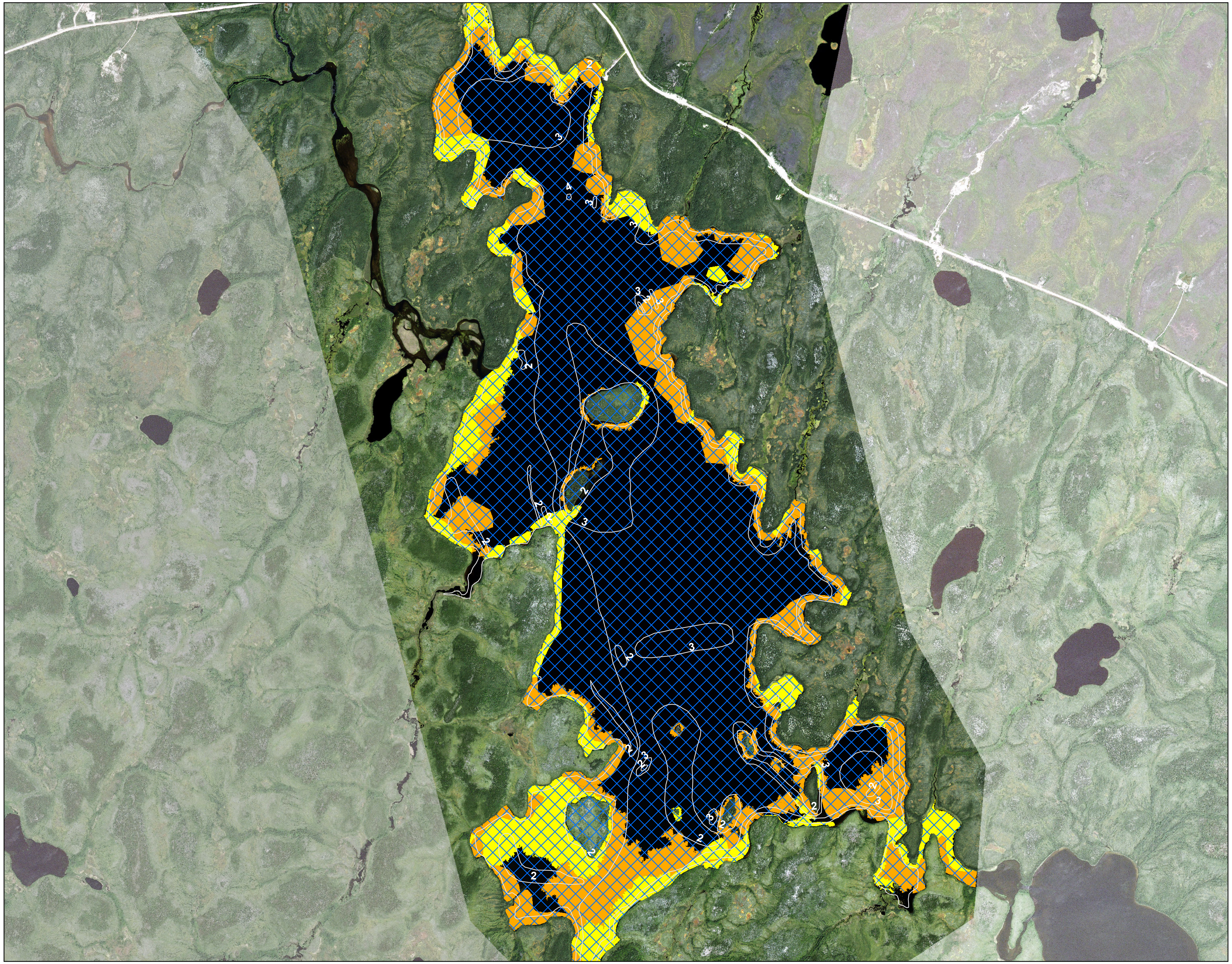
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.

10-16a

Title

Cockeram Lake Northern Pike Habitat



Stantec

Alamos Gold Inc.

Walleye and White Sucker Habitat Areas

- Spawning (286.8 hectares)
- Rearing / Nursery (458.2 hectares)
- Feeding / Overwintering / Migration (2105.1 hectares)

Survey Locations

- Water Depth Contours (m)

N

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(At original document size of 11x17)
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Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-16b

Title
Cockeram Lake
Walleye and White Sucker Habitat

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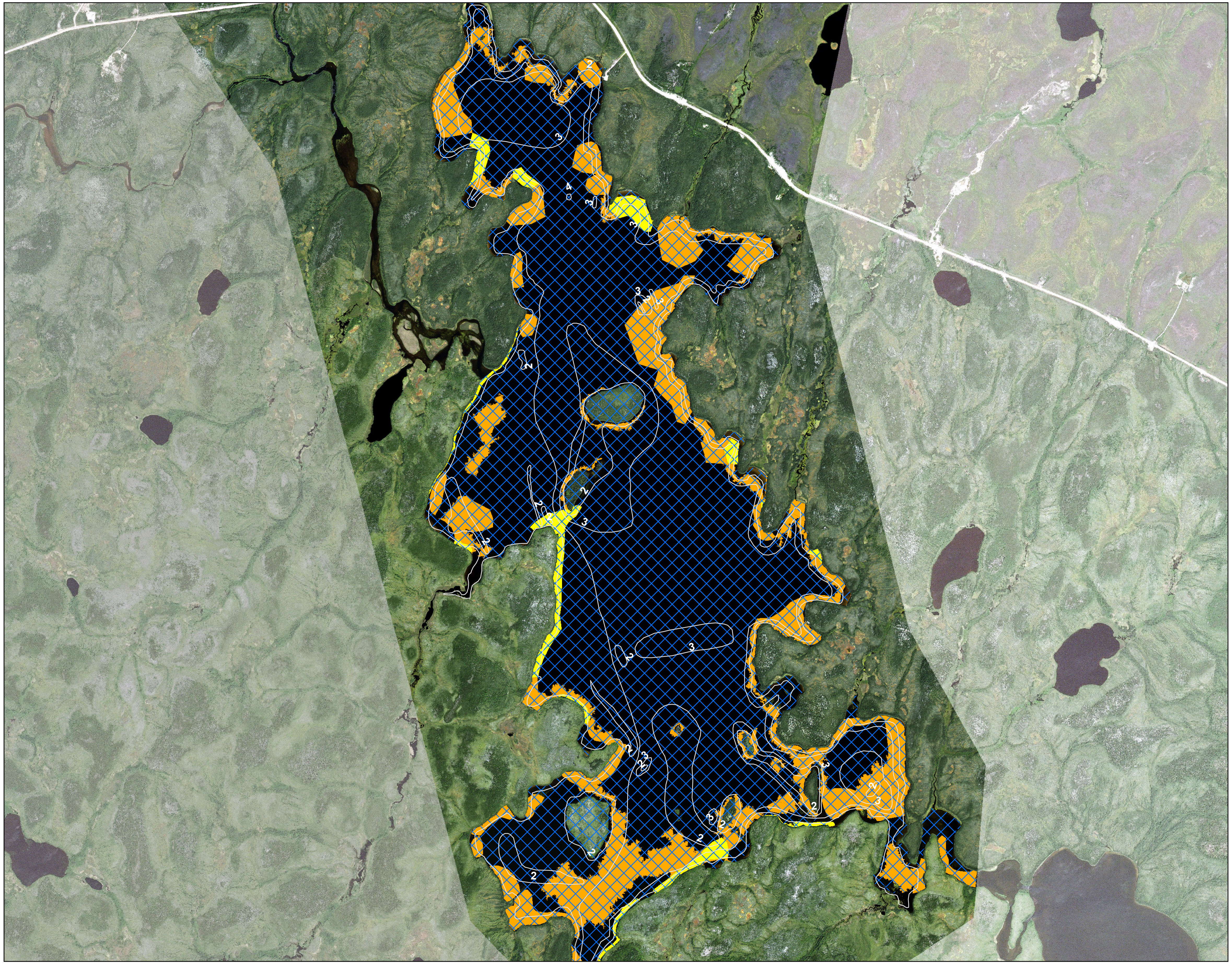


Stantec

ALAMOS GOLD INC.

Lake Whitefish Habitat Areas

- Spawning (58.1 hectares)
- Rearing / Nursery (458.2 hectares)
- Feeding / Overwintering / Migration (2105.1 hectares)

Survey Locations

- Water Depth Contours (m)

N

0 500 1,000 Metres

(At original document size of 11x17)
1:40,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

Project Location
Lynn Lake,
Manitoba

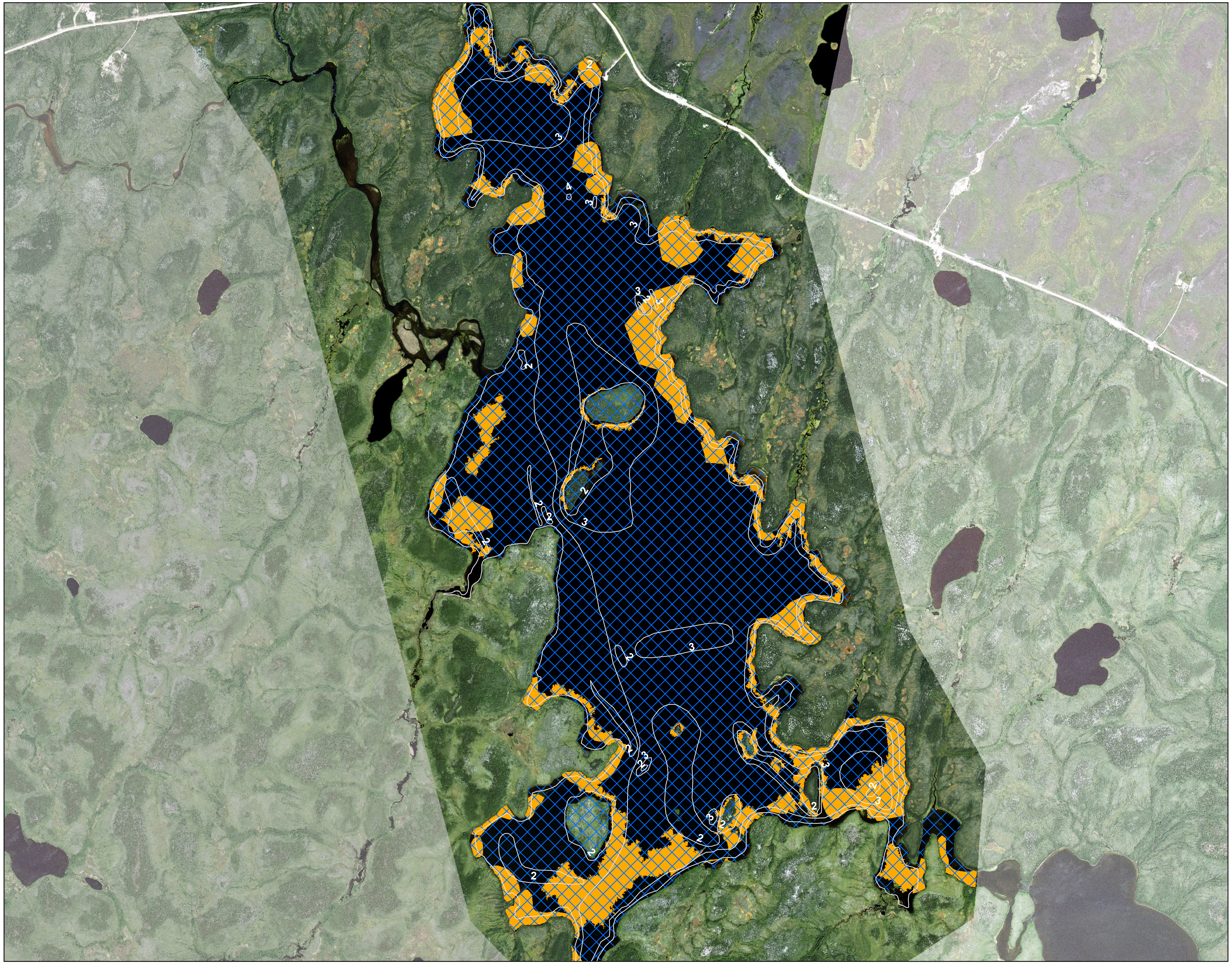
Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-16c

Title
Cockeram Lake
Lake Whitefish Habitat

G:_GIS_Project_Folder\111473008_LLGP_EA\figures\Ch10_Fish_and_Fish_Habitat\Map10-16b_FISH_CockeramLake_LakeWhitefish_Habitat_20200721.mxd Revised: 2020-07-21 By: ACampigotto



Stantec

Alamos Gold Inc.

Brook Stickleback Habitat Areas

Spawning / Rearing / Nursery / Feeding (458.2 hectares)

Overwintering / Migration (2105.1 hectares)

Survey Locations

Water Depth Contours (m)

N

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(At original document size of 11x17)
1:40,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Imagery: WorldView 2; August 11, 2016; Pseudo True Colour

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-07-21

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.

10-16d

Title

Cockeram Lake
Brook Stickleback Habitat

Stantec

Alamos Gold Inc.

Project Infrastructure

- Proposed Open Pit
- Potential Ore Stockpile
- Potential Mine Rock Storage Area
- Potential Overburden Stockpile
- Project Development Area
- Buildings
- Collection Pond

Site Access

- Proposed Site Access Road
- Drainage Road

Other Infrastructure

- Construction Temporary Facility
- Parking
- Diversion Channel
- Fresh Water Pipe
- Sewer
- Potable Water
- Drainage Ditch - Clean water
- Drainage Ditch - Potentially Contaminated
- Drainage Pipe
- Fire Water

Gordon Features

- Interceptor Wells
- Effluent Pipeline
- Freshwater Pipeline
- Diffuser

Landbase

- Existing Access Road
- Watercourse
- Waterbody

N

0 250 500 Metres

(At original document size of 11x17)
1:12,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Project Infrastructure features provided by QPit and Ausenco.

Project Location
Lynn Lake,
Manitoba

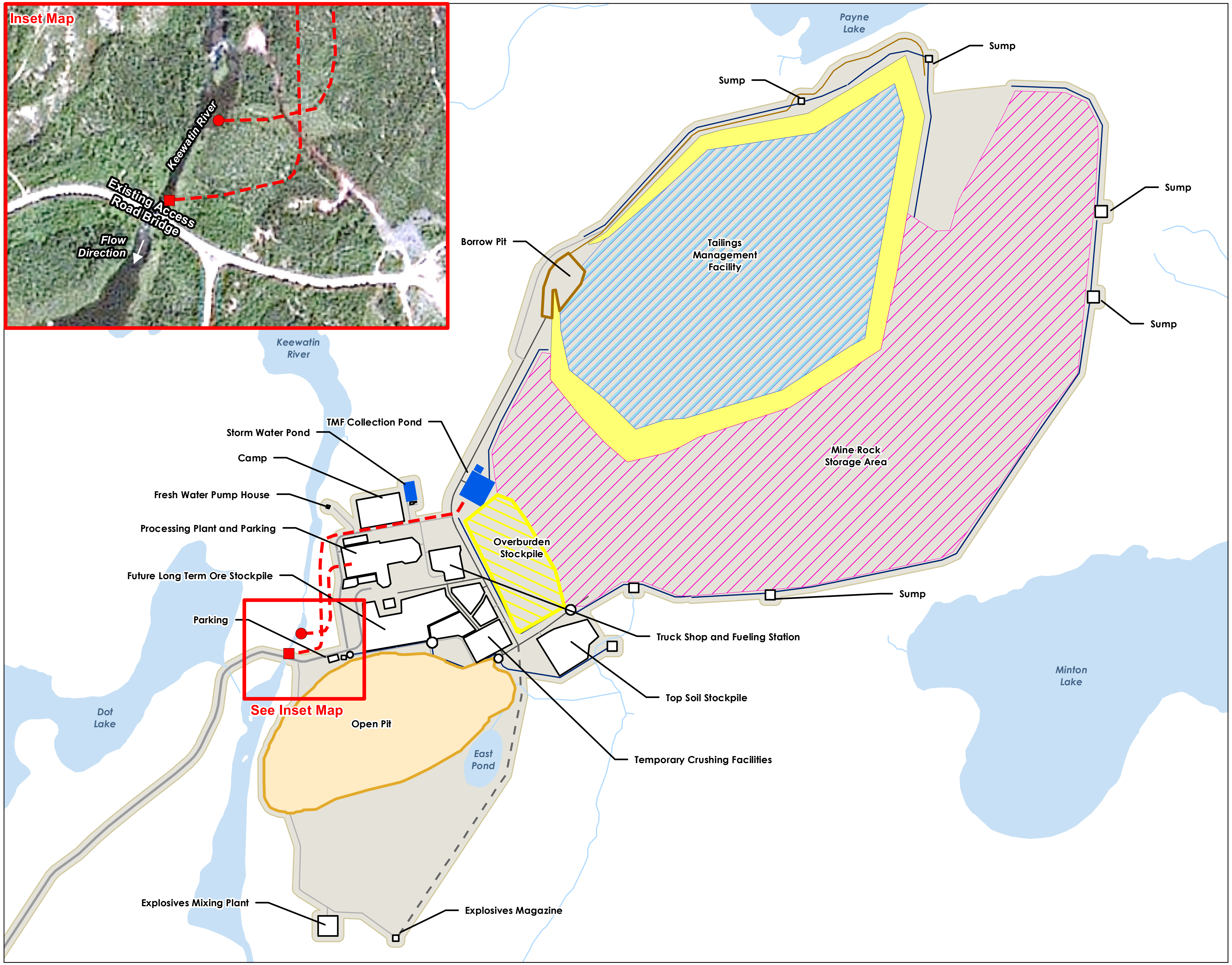
Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-04-15

Client/Project
111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-17

Title
Location of Groundwater Interceptor Wells and Mine Effluent Discharge Infrastructure at the Gordon Mine Site

G:_GIS_Project_Folder\111473008_LLGP_EA\figures\Ch10_Fish_and_Fish_Habitat\Map10-17_FISH_Gordon_IntakesEffluentPonds_20200721.mxd Revised: 2020-07-21 By: ACampigotto



Stantec

ALAMOS GOLD INC.

Project Infrastructure

- Project Development Area
- Proposed Open Pit
- Proposed Borrow Pit
- Proposed Mine Rock Stockpile
- Proposed Overburden Stockpile
- Proposed Tailings Management Facility
- Proposed Tailings Management Facility Pond
- Other Proposed Ponds
- Other Proposed Areas
- Drainage Ditch
- Access Road
- Haul Road
- Inplant Road
- Toe Road
- Future Access Road

MacLellan Features

- Intake
- Effluent Location
- Intake/Effluent Pipeline

Landbase

- Existing Access Road
- Watercourse
- Waterbody

N

0 250 500 Metres

(At original document size of 11x17)
1:20,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Project Infrastructure features provided by QPit and Ausenco.
4. Imagery: SPOT-7 imagery, BlackBridge Gemoatics Corp. July 2015.

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-07-21
Technical Review by SNelson on 2020-07-21
Senior GIS Review by GKroupa on 2020-04-15

Client/Project
111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
10-18

Title
Location of the Existing Mine Access Road Bridge and the Proposed Raw Water Intake and Mine Effluent Discharge Infrastructure at the MacLellan Mine Site

Appendix 10A FIGURES

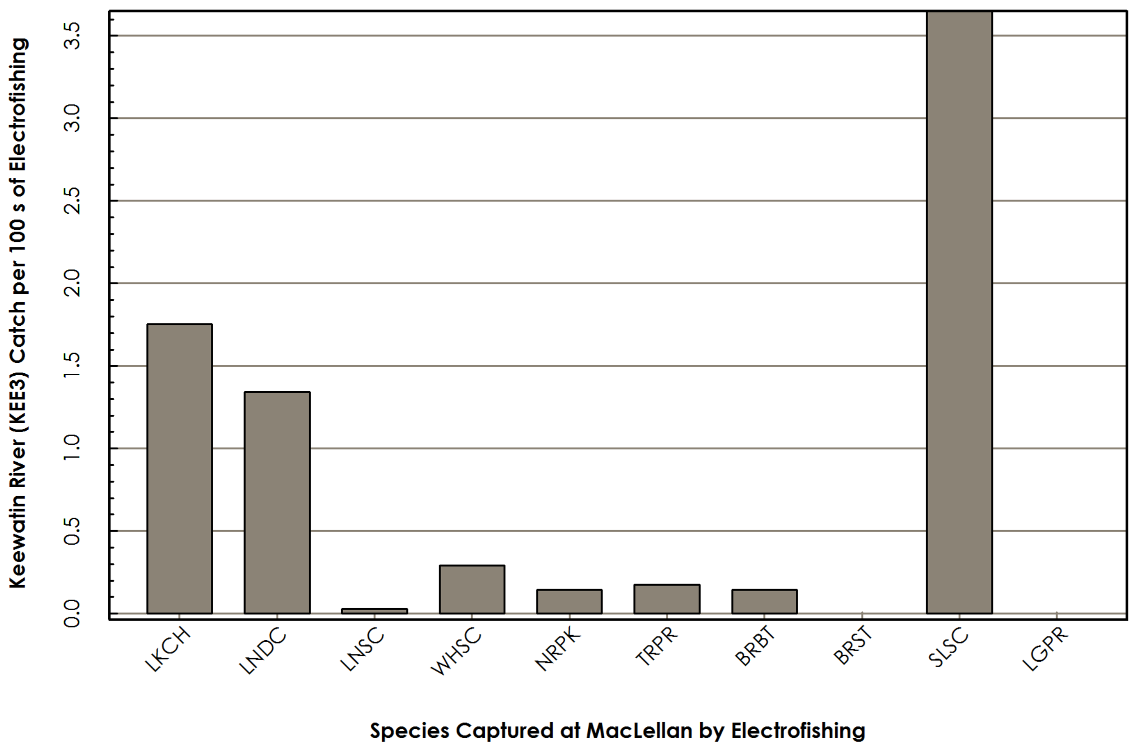


Figure 10A-1 Catch per Unit Effort by Electrofishing in the Keewatin River Between Burge Lake and the Lynn River Confluence, Summer 2016

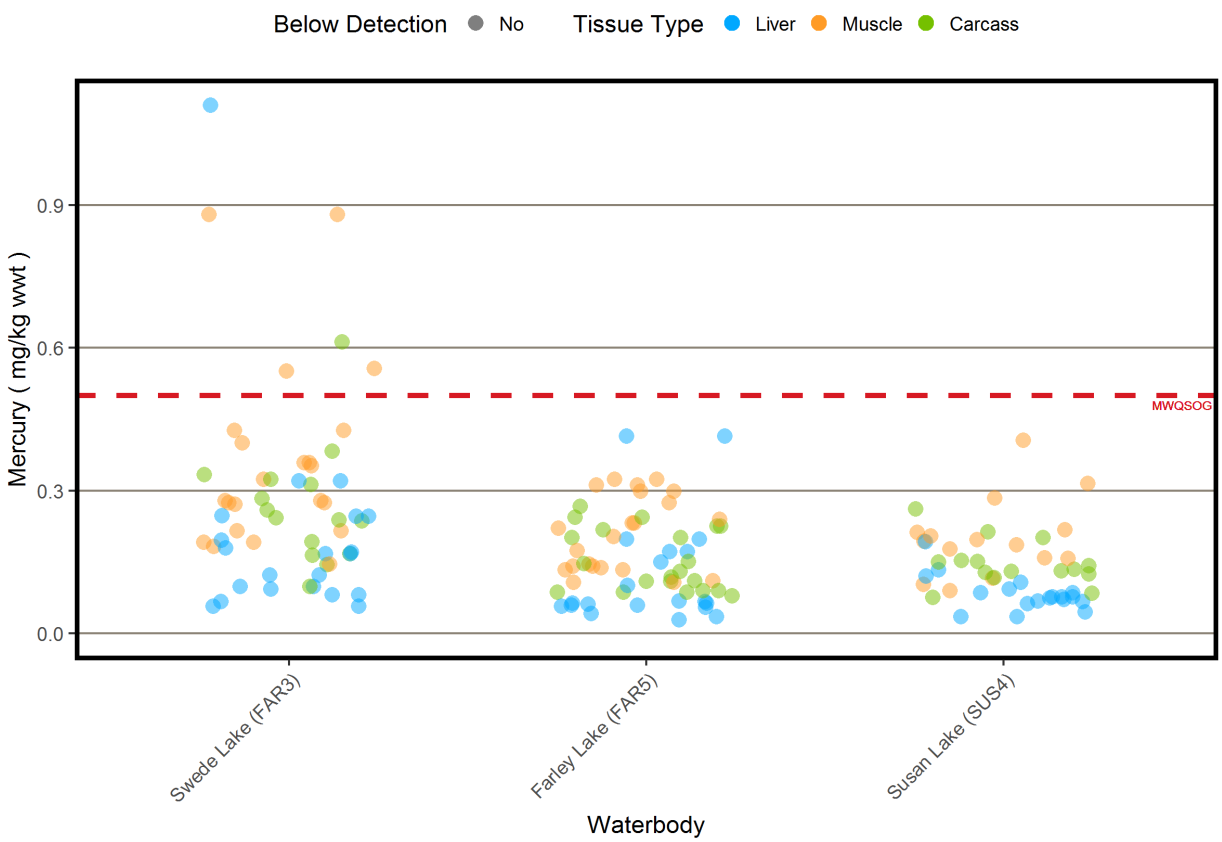


Figure 10A-2 Total Mercury Concentrations (mg/kg w/w) in Northern Pike Tissues from Gordon Site Lakes, Summer 2015 and 2016

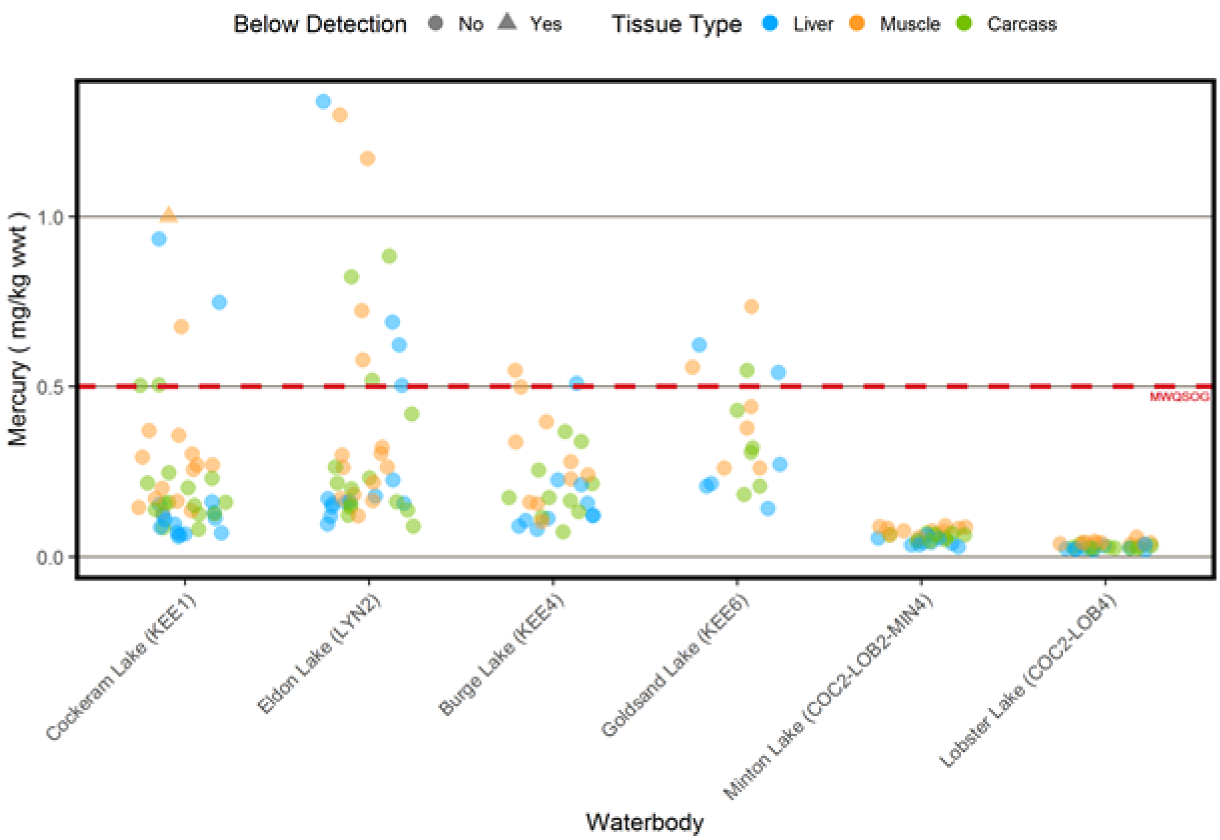


Figure 10A-3 Total Mercury Concentrations (mg/kg w/w) in Northern Pike Tissues from MacLellan Site Lakes, Summer 2015 and 2016

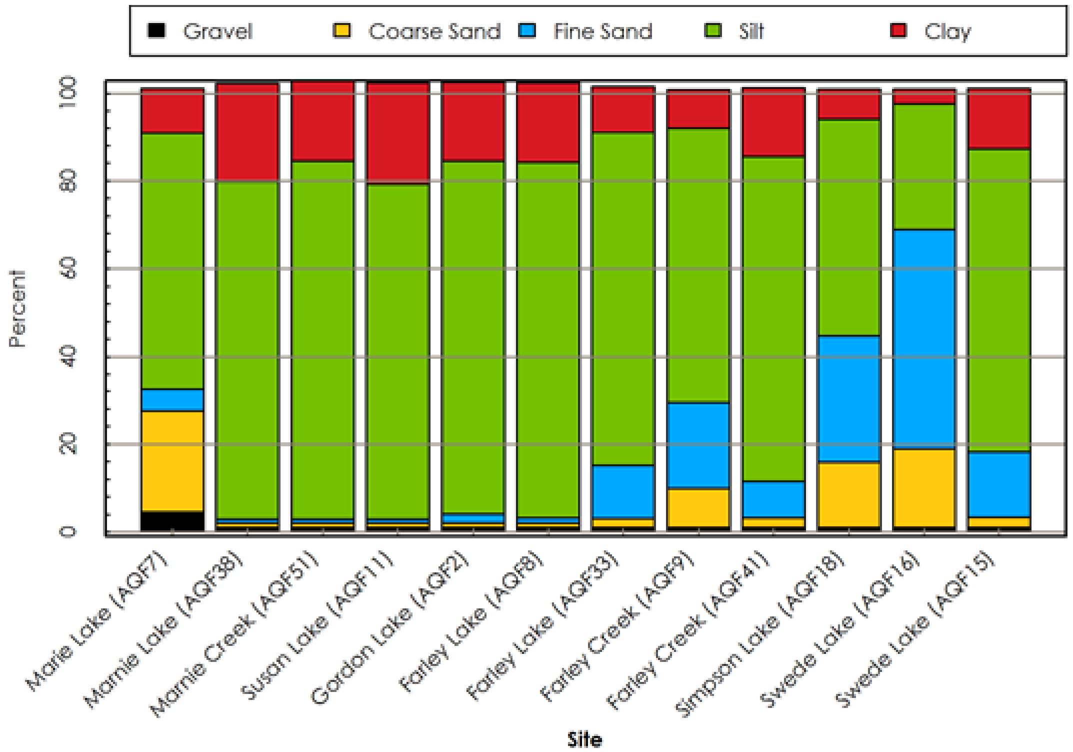


Figure 10A-4 Sediment Particle Distribution in Lakes and Streams at the Gordon Site

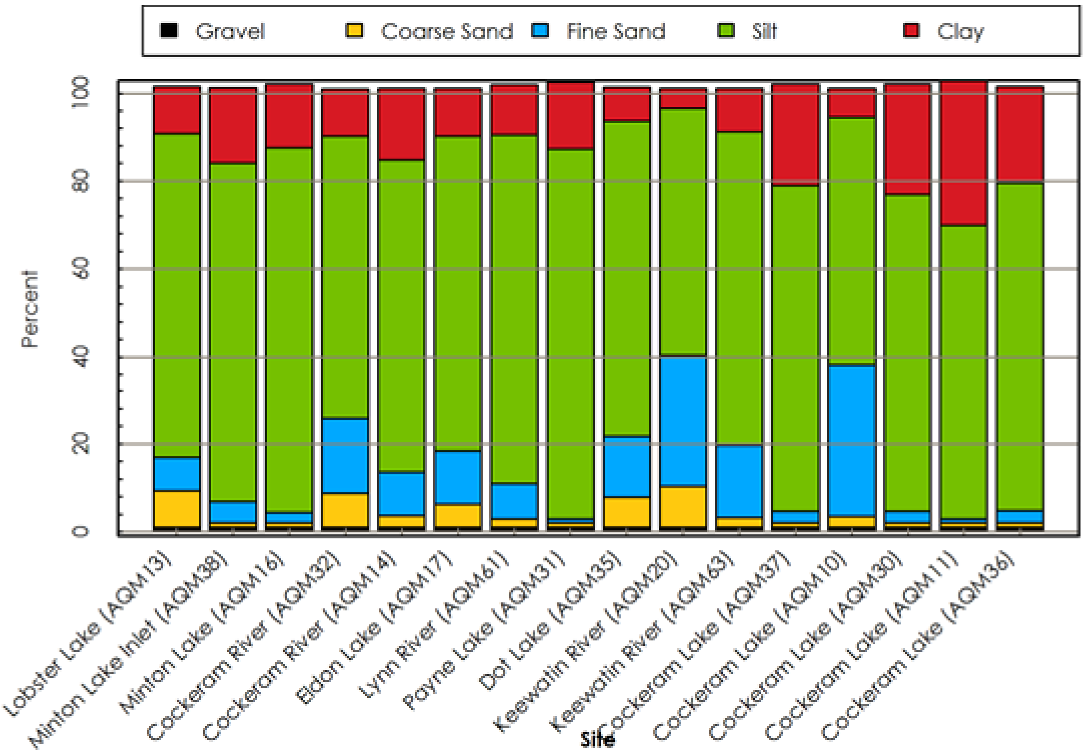


Figure 10A-5 Sediment Particle Size Distribution in Lakes and Streams at the MacLellan Site

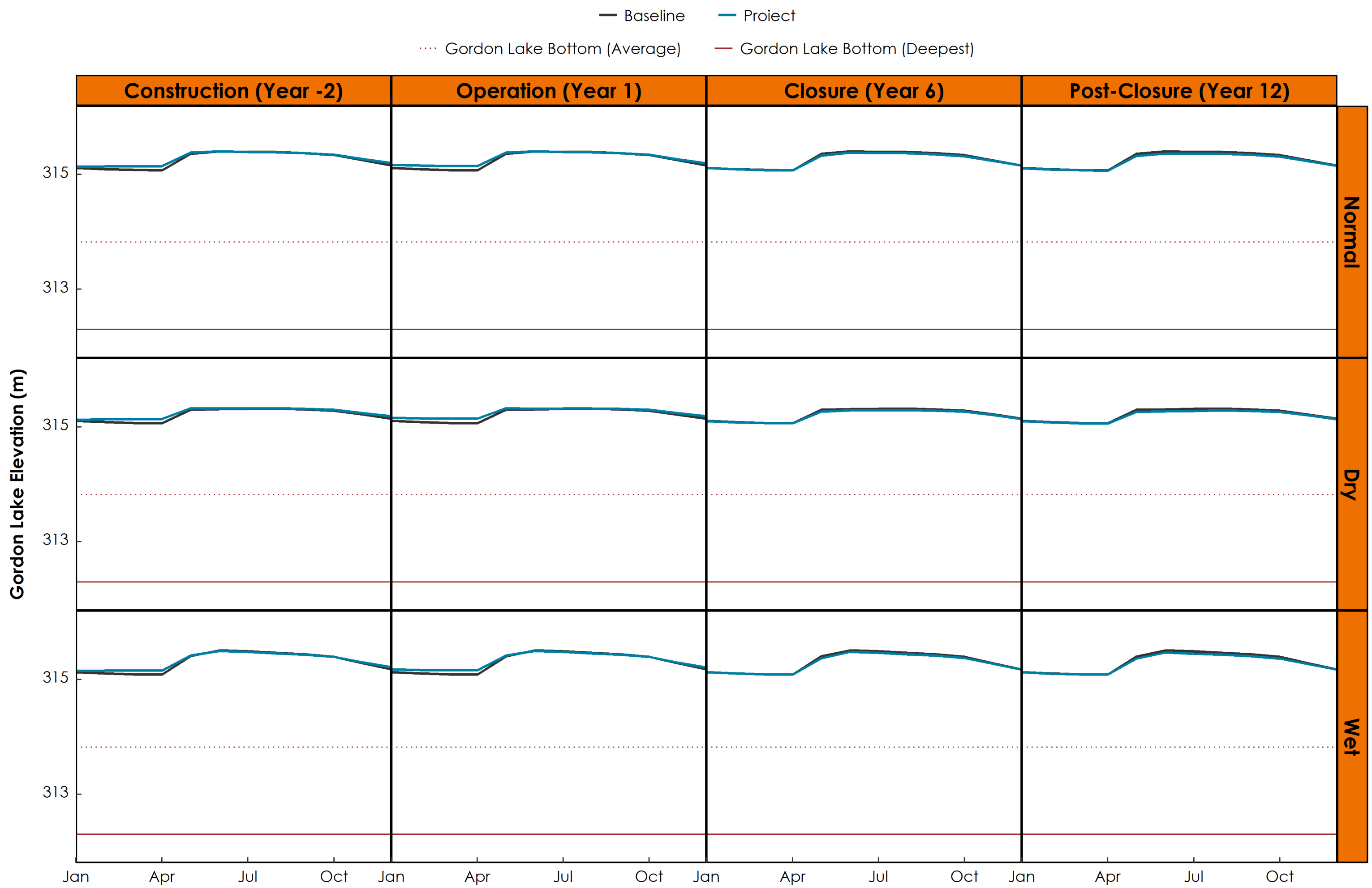


Figure 10A-6 Average Surface Water Elevations in Gordon Lake, by Project Phase, for Normal, Dry, and Wet Climate Scenarios

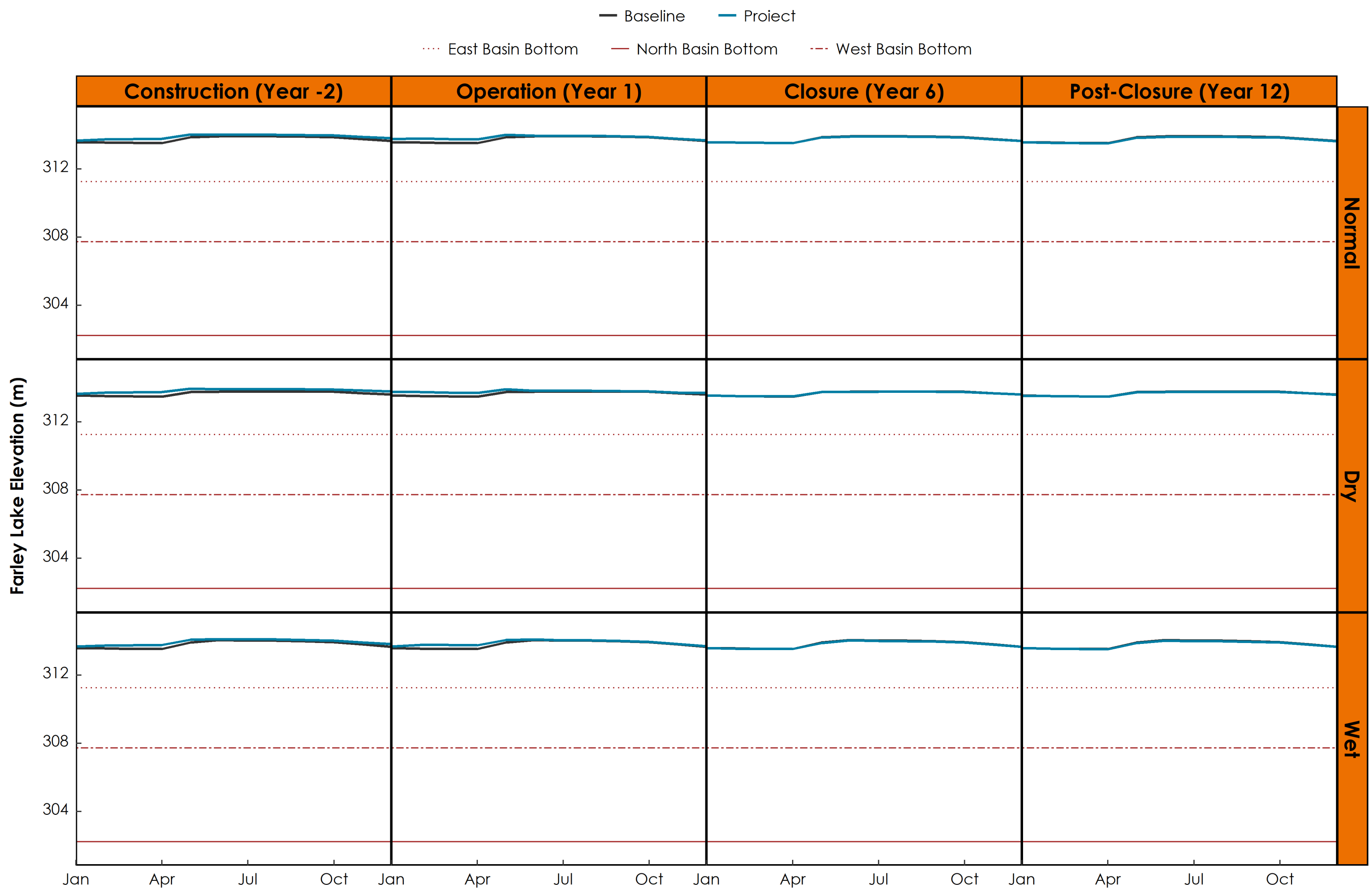


Figure 10A-7 Average Surface Water Elevations in Farley Lake, by Project Phase, for Normal, Dry, and Wet Climate Scenarios

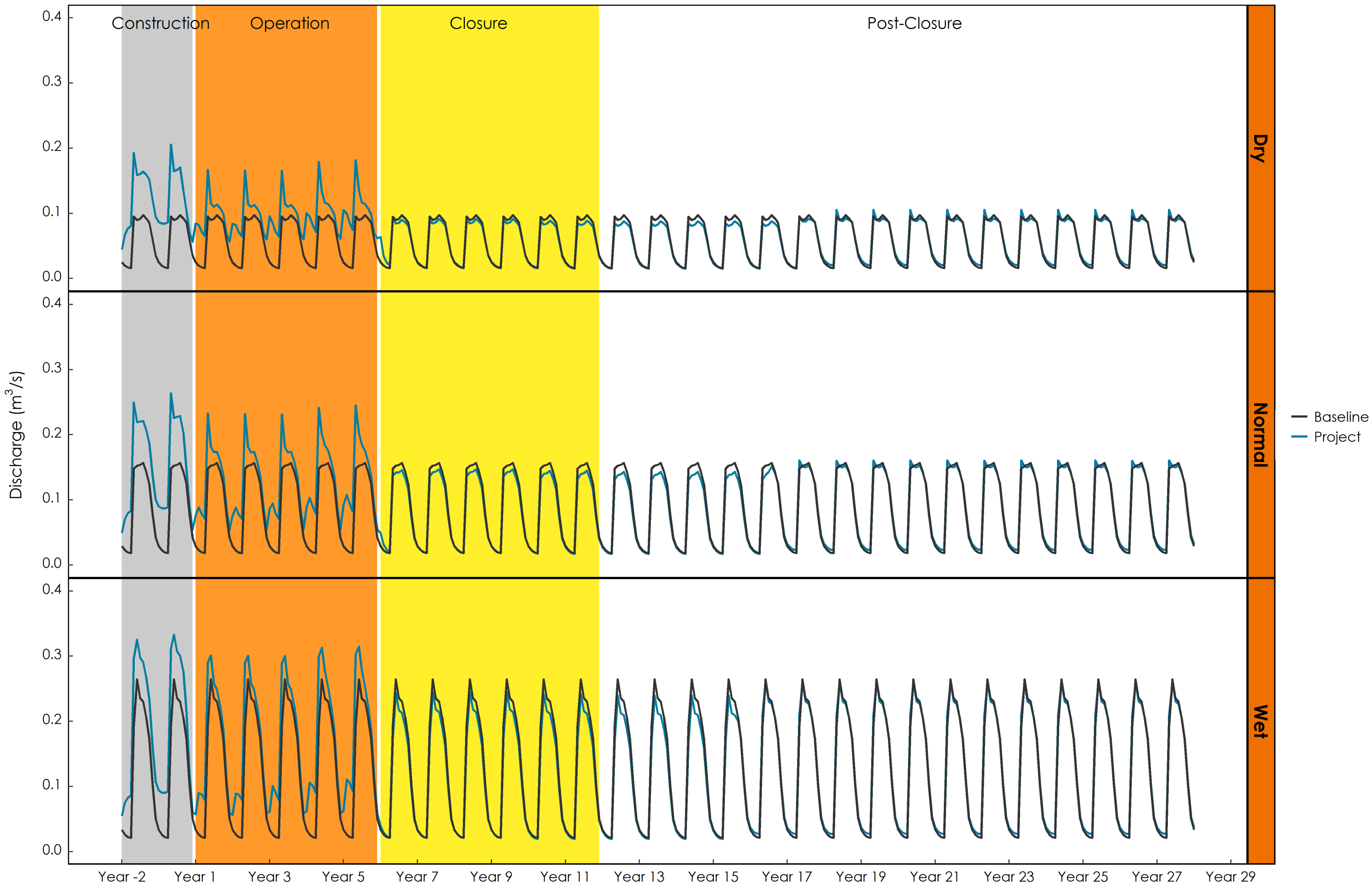


Figure 10A-8 Average Discharge in Farley Creek, by Project Phase, for Normal, Dry, and Wet Climate Scenarios

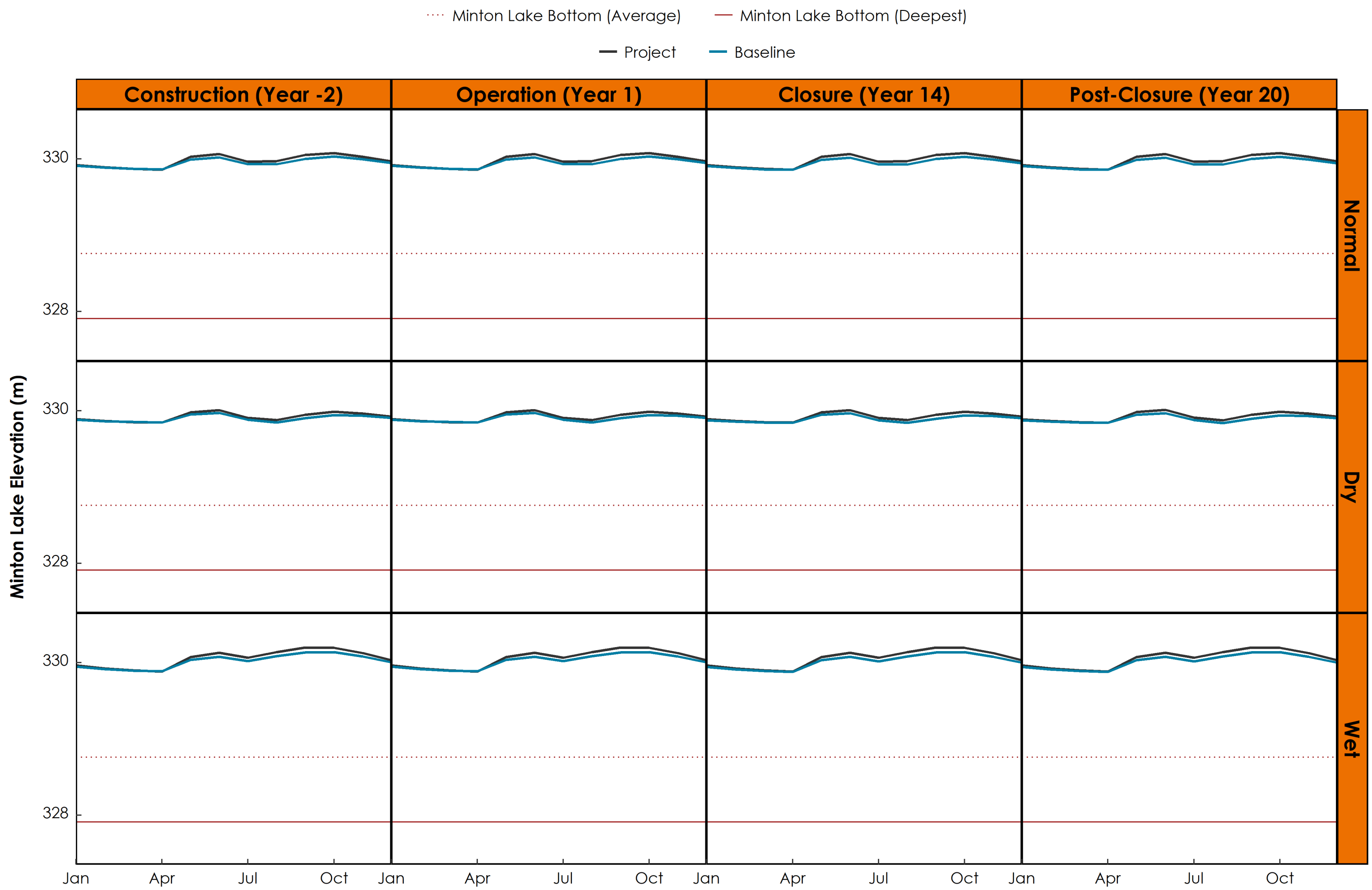


Figure 10A-9 Average Surface Water Elevations in Minton Lake, by Project Phase, for Normal, Dry, and Wet Climate Scenarios

ALAMOS GOLD INC.

Appendix 10B TABLES

Table 10B-1 Fork Length, Weight and Condition by Species and Waterbody/Watercourse for Gordon Site, Summer 2016

Species	Waterbody/Watercourse	Length (cm)				Weight (g)				Fulton's Condition			
		n	Mean (SE)	Min	Max	n	Mean (SE)	Min	Max	n	Mean (SE)	Min	Max
Northern Pike	Swede Lake FAR3	65	48.9 (0.9)	16	79	64	858.9 (31.8)	24.9	1875	64	0.72 (0.01)	0.38	1.01
	Farley Lake FAR5	32	34.8 (3.1)	8.9	56.3	23	739.1 (63.9)	100	1100	23	0.88 (0.09)	0.59	2.5
	Marie Lake FAR5-MAR4	45	50.0 (1.5)	6.9	60.5	45	926.2 (36.1)	125	1300	44	0.70 (0.02)	0.52	1.26
	Marnie Lake FAR5-MAN3	7	65.4 (2.7)	54	75	7	2067.8 (173.3)	1330	2664	7	0.74 (0.04)	0.62	0.88
	Susan Lake SUS4	62	51.4 (0.7)	28	59.5	62	888.3 (24.0)	125	1150	62	0.65 (0.01)	0.49	1.1
White Sucker	Swede Lake FAR3	33	40.1 (1.3)	4	48.4	33	1106.8 (53.6)	1	1700	33	1.62 (0.03)	1.24	1.93
	Farley Lake FAR5	4	50.1 (1.4)	47.5	53.8	4	1762.5 (110.6)	1550	2000	4	1.40 (0.07)	1.22	1.51
	Marnie Lake FAR5-MAN3	31	30.8 (1.6)	16.8	46.1	31	508.8 (71.3)	57.8	1306	31	1.35 (0.03)	0.77	1.61
	East Pit FAR5-B1	102	17.9 (0.7)	10	40.5	102	122.9 (13.9)	10.7	750	102	1.46 (0.04)	0.92	2.54
	Wendy Pit FAR5-B2	125	19.3 (0.5)	10.3	43.7	125	117.8 (16.4)	12.9	1136	125	1.11 (0.01)	0.28	1.64
	Gordon Lake FAR7	2	14.2 (0.8)	13.4	15	2	36.3 (6.6)	29.7	42.9	2	1.25 (0.02)	1.23	1.27
Brook Stickleback	Swede Lake FAR3	3	3.8 (0.2)	3.4	4.2	3	0.5 (0.0)	0.5	0.6	3	1.02 (0.13)	0.81	1.27
	Marnie Lake FAR5-MAN3	34	4.8 (0.1)	4	6	9	1.2 (0.1)	0.6	1.6	9	1.07 (0.11)	0.73	1.72
	East Pit FAR5-B1	5	5.1 (0.2)	4.5	5.6	5	1.3 (0.2)	0.9	1.8	5	0.94 (0.05)	0.78	1.06
	Wendy Pit FAR5-B2	7	4.6 (0.1)	4.3	5	7	0.9 (0.1)	0.5	1.3	7	0.87 (0.07)	0.55	1.09
	Diversion Channel FAR6	1	5.4	5.4	5.4	-	-	-	-	-	-	-	-
	Unnamed Lake North of Diversion Channel FAR6-A2	101	5.5 (0.1)	4	7.6	100	1.8 (0.1)	0.5	5.8	100	1.04 (0.02)	0.59	1.69
	Gordon Lake FAR7	120	5.0 (0.1)	3	6.2	120	1.4 (0.1)	0.2	2.8	120	0.98 (0.01)	0.67	1.4
	Susan Lake SUS4	153	4.3 (0.0)	3.5	5.6	153	0.8 (0.0)	0.4	1.7	153	1.01 (0.01)	0.59	1.29
Lake Whitefish	Swede Lake FAR3	23	38.1 (1.8)	19.1	53	23	1231 (133.0)	97.1	2100	23	1.91 (0.08)	1.34	2.97
Slimy Sculpin	Farley Lake FAR5	2	7.4 (0.4)	7	7.8	-	-	-	-	-	-	-	-
Spottail Shiner	Swede Lake FAR3	126	4.4 (0.1)	3.1	9.2	126	1.1 (0.1)	0.3	11.6	126	1.22 (0.02)	0.77	2.14
Walleye	Swede Lake FAR3	133	42.1 (0.5)	23.2	53.8	133	906.2 (21.8)	125	1450	133	1.18 (0.01)	0.62	1.54
Yellow Perch	Swede Lake FAR3	19	13.0 (0.7)	9.5	19.8	18	36.3 (5.7)	12.8	111.7	18	1.42 (0.03)	1.08	1.68

Table 10 B-2 Fork Length, Weight, and Condition by Species and Waterbody for MacLellan Site, Summer 2016

Species	Waterbody	Length (cm)				Weight (g)				Fulton's Condition			
		n	Mean (SE)	Min	Max	n	Mean (SE)	Min	Max	n	Mean (SE)	Min	Max
Northern Pike	Cockeram Lake KEE1	55	55.7 (1.5)	7.8	80	57	1234.2 (92.9)	1.8	3950	55	0.67 (0.01)	0.39	0.99
	Unnamed Lake Downstream of Minton Lake COC2-LOB2-MIN2	21	45.8 (2.8)	34	70.6	21	963.6 (165.5)	250	3000	21	0.89 (0.05)	0.6	1.15
	Minton Lake COC2-LOB2-MIN4	21	38.4 (2.0)	12.6	49	21	518.6 (53.9)	12.6	919.9	21	0.87 (0.09)	0.61	2.7
	Lobster Lake COC2-LOB4	24	43.9 (0.7)	37.3	51.5	24	765.2 (42.5)	488.7	1191	24	0.90 (0.04)	0.46	1.55
Lake Whitefish	Cockeram Lake KEE1	16	31.6 (2.9)	15.5	48	16	684.0 (169.2)	50	1800	16	1.42 (0.08)	0.47	1.7
White Sucker	Cockeram Lake KEE1	71	27.6 (2.6)	2.5	55.8	48	578.4 (122.0)	0.2	2700	48	1.30 (0.07)	0.61	3.15
	Unnamed Lake Downstream of Minton Lake COC2-LOB2-MIN2	5	32.4 (0.8)	30.5	34.5	5	798.0 (55.5)	685	985	5	2.33 (0.05)	2.16	2.41
Yellow Perch	Cockeram Lake KEE1	59	6.3 (0.3)	3.1	15.5	29	3.5 (1.7)	0.3	50	28	1.06 (0.04)	0.7	1.63
Brook Stickleback	East Pond KEE3-B2-A2	30	5.0 (0.1)	4.4	6.1	-	-	-	-	-	-	-	-
	Dot Lake KEE3-DOT2	125	5.3 (0.0)	4.4	6.4	125	1.2 (0.0)	0.6	2.1	125	0.76 (0.01)	0.48	1.21
	Payne Lake KEE3-PAY2	90	6.4 (0.1)	4.9	7.6	90	2.3 (0.1)	1.1	4.1	90	0.88 (0.01)	0.64	1.2
	Minton Lake COC2-LOB2-MIN4	39	5.7 (0.1)	4.8	6.9	39	1.5 (0.1)	1	2.7	39	0.81 (0.01)	0.65	1.02
	Unnamed Lake Upstream of Minton Lake COC2-LOB2-MIN5-A1	30	5.9 (0.1)	4.1	7.4	30	1.9 (0.1)	0.7	3.6	30	0.88 (0.03)	0.59	1.35
	Lobster Lake COC2-LOB4	75	5.1 (0.1)	4.1	6.3	75	1.2 (0.0)	0.6	1.8	75	0.88 (0.02)	0.44	1.73
Emerald Shiner	Cockeram Lake KEE1	57	6.8 (0.3)	2.6	10.6	30	1.2 (0.2)	0.2	4.3	27	0.93 (0.05)	0.55	1.52
Logperch	Cockeram Lake KEE1	29	3.8 (0.0)	3.3	4.1	29	0.5 (0.0)	0.3	0.9	29	1.01 (0.07)	0.55	2.5
Lake Chub	Cockeram Lake KEE1	1	10.1	-	-	-	-	-	-	-	-	-	-
Spottail Shiner	Cockeram Lake KEE1	209	4.8 (0.0)	3.9	8.2	207	1.3 (0.0)	0.4	5.3	206	1.16 (0.01)	0.48	1.88
Troutperch	Cockeram Lake KEE1	2	7.5 (0.0)	7.5	7.5	-	-	-	-	-	-	-	-
Walleye	Cockeram Lake KEE1	45	38.4 (1.2)	15.8	55	41	640.2 (49.1)	100	1700	41	0.99 (0.01)	0.66	1.2

Table 10 B-3 Fork Length, Weight, and Condition by Species and Watercourse for MacLellan Site, Summer 2016

Species	Watercourse	Length (cm)				Weight (g)				Fulton's Condition			
		n	Mean (SE)	Min	Max	n	Mean (SE)	Min	Max	n	Mean (SE)	Min	Max
Northern Pike	Keewatin River KEE2	28	28.4 (4.9)	2.9	76.5	23	709.8 (171.6)	2.7	3058	18	0.75 (0.11)	0.46	2.62
	Keewatin River KEE3	15	31.6 (5.7)	6.8	66.2	13	1180.4 (217.5)	354	3225	8	0.65 (0.03)	0.45	0.77
	Outlet of Unnamed Lake Downstream of Minton Lake COC2-LOB2-MIN1	1	38.3	-	-	1	406.6	-	-	1	0.72 (NA)	0.72	0.72
Lake Whitefish	Keewatin River KEE2	2	31.9 (1.9)	30	33.7	1	525	525	525	1	1.94	1.94	1.94
	Keewatin River KEE3	10	6.5 (0.1)	6.1	6.9	-	-	-	-	-	-	-	-
White Sucker	Keewatin River KEE2	14	42.5 (1.2)	29.5	48	14	1186.1 (67.2)	800	1700	14	1.58 (0.12)	1.33	3.12
	Keewatin River KEE3	27	3.1 (0.1)	2.7	3.9	-	-	-	-	-	-	-	-
	Dot Lake outlet KEE3-DOT1	-	-	-	-	36	0.2 (0.0)	0.1	0.3	-	-	-	-
	Cockeram River COC1	2	3.6 (0.0)	3.6	3.6	-	-	-	-	-	-	-	-
	Outlet of Unnamed Lake Downstream of Minton Lake COC2-LOB2-MIN1	1	14.2			1	37.4	-	-	1	1.31	-	-
Yellow Perch	Keewatin River KEE2	7	6.8 (0.9)	3	9.7	1	8	-	-	1	3.05 (NA)	3.05	3.05
	Keewatin River KEE3	8	3.9 (0.0)	3.8	4	-	-	-	-	-	-	-	-
Brook Stickleback	Keewatin River KEE2	1	4.5	-	-	-	-	-	-	-	-	-	-
	Dot Lake outlet KEE3-DOT1	45	5.2 (0.1)	3.5	6.4	20	0.8 (0.1)	0.1	1.4	20	0.59 (0.04)	0.23	0.88
	Inlet of Minton Lake COC2-LOB2-MIN5	3	5.5 (0.0)	5.4	5.5	-	-	-	-	-	-	-	-
	Outlet of Lobster Lake COC2-LOB3	11	4.5 (0.2)	3.6	5.6	-	-	-	-	-	-	-	-
Slimy Sculpin	Keewatin River KEE2	3	10.5 (0.5)	9.8	11.4	3	15.6 (1.4)	13.9	18.3	3	1.33 (0.07)	1.24	1.48
	Keewatin River KEE3	51	6.9 (0.3)	4.2	12.7	51	5.1 (0.7)	0.9	23.5	51	1.20 (0.02)	0.91	1.53
Burbot	Cockeram River COC1	1	36	-	-	-	-	-	-	-	-	-	-
Lake Chub	Cockeram River COC1	10	10.2 (0.5)	7.9	12.3	-	-	-	-	-	-	-	-
Longnose Dace	Keewatin River KEE2	17	6.7 (0.4)	5.1	10.2	17	3.5 (0.7)	1.3	11.8	17	1.01 (0.02)	0.78	1.19
	Keewatin River KEE3	30	6.4 (0.4)	3.3	11.5	31	4.1 (0.9)	0.3	19.7	30	1.07 (0.04)	0.8	1.71

Appendix 10C PHOTOS

Photo 10 C-1 MacLellan Site Existing Access Road Bridge over the Keewatin River, Looking Downstream

Appendix 10D GORDON SITE TEMPERATURE MODEL

Stantec

Memo

To:	LLGP Surface Water and Fish and Fish Habitat Technical Teams (Stantec)	From:	Alice Kruchten (Stantec) Brad Horne (Stantec)
	Winnipeg, MB		Burnaby, BC
File:	111473010 – LLGP 2020 File	Date:	May 15, 2020

Reference: Results of Preliminary Farley Lake Temperature Model – Additional Inflows from Project-Related Water Management Strategies

INTRODUCTION

Water management strategies at the Gordon site for the Lynn Lake Gold Project (LLGP) include:

1. **Dewatering of the historical East and Wendy Pits** – this is anticipated to occur during construction; water will be pumped to Farley Lake
2. **Operation of groundwater interceptor wells in the vicinity of the pits** - this is anticipated to occur from construction through to decommissioning to locally draw down the water table in the vicinity of the historical East and Wendy Pits; water will be pumped to Gordon Lake and Farley Lake, respectively (Golder 2020).

It is anticipated that water temperatures in Farley Lake will be affected by these water management strategies, as the additional inflows from the historical pits and from the interceptor wells may not be the same temperatures as Farley Lake and Farley Lake outflows throughout the year. These additional water sources may alter water temperatures in Farley Lake if the inflow water temperatures are different enough, and their volumes are large enough, compared to water temperatures and water volumes in Farley Lake. These differences will be influenced by the time of year because water temperatures in Farley Lake vary significantly across seasons.

Water temperature changes in Farley Lake have the potential to alter the growth and survival of fish and aquatic biota (i.e., plankton, benthic invertebrates) upon which fish depend for food. This is because water temperature is one of the primary abiotic factors affecting physiological and biological processes in fish and aquatic biota. Water temperature also affects various chemical processes in lakes, such as the rate of organic matter decomposition, exchange of metals and ions at the water and sediment interface, and oxidation-reduction potential.

OBJECTIVE

The objective of this memo is to describe a simple, conceptual-level mass-balance model used to predict water temperatures in Farley Lake during pit dewatering and groundwater interceptor well operation at the Gordon site. It is important to note the assumptions and limitations of the water temperature model that inform the methods and results used; as this model was intended to provide a preliminary prediction of Farley Lake temperatures from Project-related inputs, there are many considerations that can have significant impact on these predictions.

Reference: **Results of Preliminary Farley Lake Temperature Model – Additional Inflows from Project-Related Water Management Strategies**

MODEL STRUCTURE

A monthly-timestep Excel based model was used to model water temperatures in Farley Lake. Figure 1 illustrates the conceptual model used to predict water temperatures in Farley Lake during dewatering of Wendy and East pits and pumping of groundwater interceptor wells.

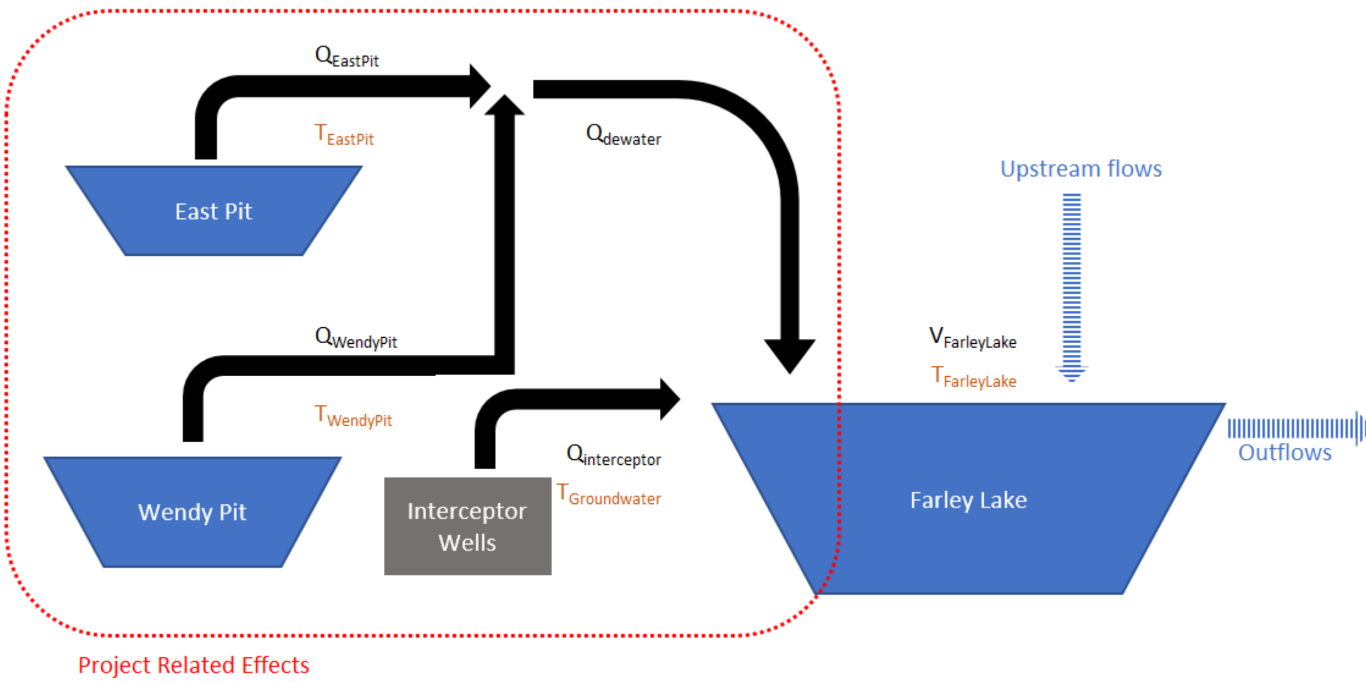


Figure 1 Conceptual Water Temperature Model at the Gordon Site

MODEL INPUTS

Farley Lake volume as well as the duration and average monthly inflow rates for pit dewatering and groundwater interceptor well operation were based on the Gordon site water balance model (Stantec 2020). Flow rates used as model inputs are shown in Table 1. Water volumes in Wendy and East pits were provided by bathymetry surveys conducted in 2015 by Golder (2015) and water volume in Farley Lake (724,960 m^3) was provided by a bathymetry survey conducted in 2015 by Stantec (Stantec 2017).

Table 1: Pumping Rates and Durations used in the Water Temperature Model

Input	Average Flow Rate (m^3/day)	Start Date – End Date	Estimated Duration
Wendy Pit Dewatering	2,370	Jan 2021 – Dec 2021	12 months
East Pit Dewatering	6,216	Jan 2021 – Nov 2021	11 months
Groundwater Interceptor Wells	8,330	Jan 2021 – Oct 2034	Year-round

A summary of the water temperature input data for the model is provided in Table 2. Baseline water temperature data incorporated into the model was based on:

1. Data collected in the East Pit (AQF6) and Wendy Pit (AQF4) during the 2015 to 2018 water quality monitoring program. Baseline water temperature data below the thermocline was averaged monthly to represent water temperature in the pits when fully mixed.
2. Data collected at the Farley Lake outlet (QF05) during the 2017 to 2019 hydrology program. Monthly temperature data was averaged to estimate baseline water temperatures in Farley Lake.
3. Groundwater temperature was assumed to be a constant 6ºC year-round as this was the background overburden geomean temperature

Table 2: Average Monthly Water Temperatures used in the Water Temperature Model (Assumes Full Mixing of East Pit and Wendy Pit)

	Average Water Temperature (ºC)			
Month	East Pit	Wendy Pit	Farley Lake	Groundwater
Jan	3.23	3.60	0.3	6.0
Feb	3.16	3.50	-0.2	6.0
Mar	3.10	3.73	-0.1	6.0
Apr	3.11	3.66	0.1	6.0
May	3.12	3.59	7.7	6.0
Jun	3.20	3.61	16.3	6.0
Jul	3.27	3.63	19.8	6.0
Aug	3.30	3.70	17.3	6.0
Sep	3.23	3.60	11.0	6.0
Oct	3.23	3.60	2.4	6.0
Nov	3.23	3.60	0.9	6.0
Dec	3.23	3.60	0.6	6.0

Pit dewatering rates and start and end dates for interceptor well operation and pit dewatering (referred to as "Project-related inflows") were adopted from the Gordon site water balance model (Stantec 2020).

LIMITATIONS AND ASSUMPTIONS

The following limitations were identified, and assumptions made when predicting water temperatures in Farley Lake with the mass-balance model:

1. Water in the open pits is fully mixed prior to dewatering; water temperature from near the bottom of the pits was conservatively assumed to be representative of the water temperature when the pit is fully mixed.

2. Wendy Pit and East Pit are dewatered simultaneously and water from both pits is pumped directly to Farley Lake
3. Groundwater interceptor wells begin pumping during construction while Wendy and East pits are being dewatered
4. Monthly average water temperature at the Farley Lake outlet (QF05) was assumed to represent of water temperature throughout Farley Lake. This assumption was validated by comparing these data to water temperature data collected in the north basin (AQF33), west basin (AQF34) and east basin (AQF9) in Farley Lake.
5. Inflows to Farley Lake from Gordon Lake (QF03) and from north (QF04) and south (QP02) inlets were assumed to be the same temperature as Farley Lake during that month.
6. The volume of Farley Lake does not change during pit dewatering or groundwater interceptor well pumping.
7. Physical processes that affect water temperature in lakes and reservoirs (e.g., evaporation, solar radiation, advection, convection, conduction) were not modeled. Monthly baseline water temperature data was assumed to account for these physical processes to a certain extent.
8. The effects of freezing and melting of ice, processes that respectively release and absorb energy, were not modeled.
9. Water from Wendy Pit, East Pit, and the groundwater interceptor wells was assumed to mix thoroughly and instantaneously with water in Farley Lake for each monthly timestep.

RESULTS

Without mitigation, monthly water temperatures in Farley Lake are predicted to increase during fall and winter (October to April) and decrease during the spring (May and June) and summer (July to September) compared to baseline during construction and operation phases (Table 3). The overall effect of dewatering the open pits and operating the groundwater interceptor wells on water temperatures in Farley Lake is a general flattening of the annual thermal regime in the lake; lower maximum temperatures in summer and higher minimum temperatures in winter (Figure 2).

Increases in fall and winter water temperatures in Farley Lake would be greater during operations (up to 6°C higher than baseline) than during construction (up to 5°C higher than baseline) because of the greater influence of the warmer groundwater interceptor well inflows without the influence of the cooler pit water (Table 3). Conversely, decreases in spring and summer water temperatures in Farley Lake would be greater during construction (up to 13°C lower than baseline) than during operations (up to 9°C lower than baseline) because of the greater cooling effect of combined pit water and groundwater interceptor inflows during construction compared to the cooling effect of just the groundwater interceptor well inflows during operations (Table 3).

Table 3: Predicted Monthly Water Temperatures in Farley Lake During Construction (Year 2021 and 2022) and Operations (Year 2023 to 2027)

	Water Temperature (ºC)				
		Construction		Operation	
Month	Baseline (Measured)	Predicted	Maximum Predicted Change	Predicted	Maximum Predicted Change
January	0.3	2.1	+1.8	5.9	+5.6
February	-0.2	3.1	+3.3	5.0	+5.2
March	-0.1	3.7	+3.8	4.3	+4.4
April	0.1	4.1	+4.0	4.0	+3.9
May	7.7	4.7	-3.0	5.5	-2.2
June	16.3	5.7	-10.6	8.3	-8.0
July	19.8	6.9	-12.9	10.9	-8.9
August	17.3	7.1	-10.2	11.6	-5.7
September	11.0	6.5	-4.5	10.3	-0.7
October	2.4	5.5	+3.1	7.6	+5.2
November	0.9	5.2	+4.3	6.1	+5.2
December	0.6	5.2	+4.6	5.1	+4.5

DISCUSSION

Water temperatures in Farley Lake predicted by the current model are conservative and simplistic (i.e., model does not account for the physical processes that influence water temperature in lakes such as evaporation, convection, conduction, advection, and solar radiation). An example of the conservatism used in the model is the assumption that all water in the open pits will be at the temperature of the coldest part of the water column while being pumped to Farley Lake. This is conservative because, although water in the hypolimnion (i.e., below the thermocline) represents the largest volume of water on the pits, it ignores the volume of water in the epilimnion (i.e., above the thermocline) which has water temperatures that are higher than the hypolimnion during most of the open-water season (i.e., May to October) due to the influence of solar radiation. An example of the simplicity of the model is the complete exclusion of the physical factors that affect water temperature in lakes, reservoirs, and pit lakes (e.g., solar radiation, advection, evaporation). These processes are particularly influential during the open-water season in shallow lakes such as Farley Lake (most of the lake is <2m deep). As a result of this conservatism and simplicity, as well as the other assumptions listed above, results of the model are considered to more representative of a “worst-case” scenario with larger water temperature changes than in Farley Lake and Farley Creek than are likely be realized during construction and operation of the LLGP. However, the results highlight the potential effect of discharging large volumes of water (Figure 3), at relatively consistent temperatures, on water temperatures in Farley Lake.

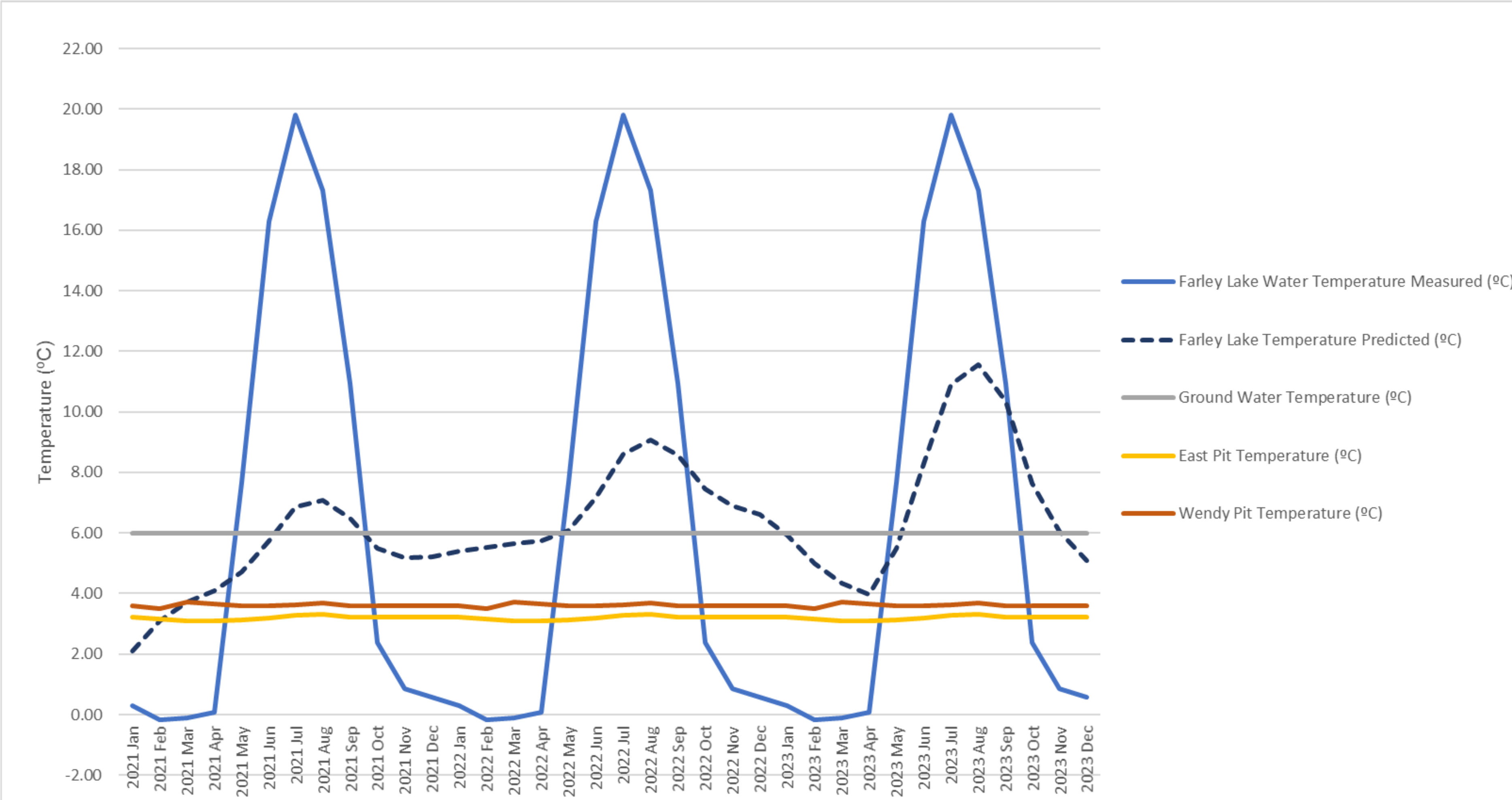


Figure 2 Farley Lake Temperature Model Results – 2021 to 2024

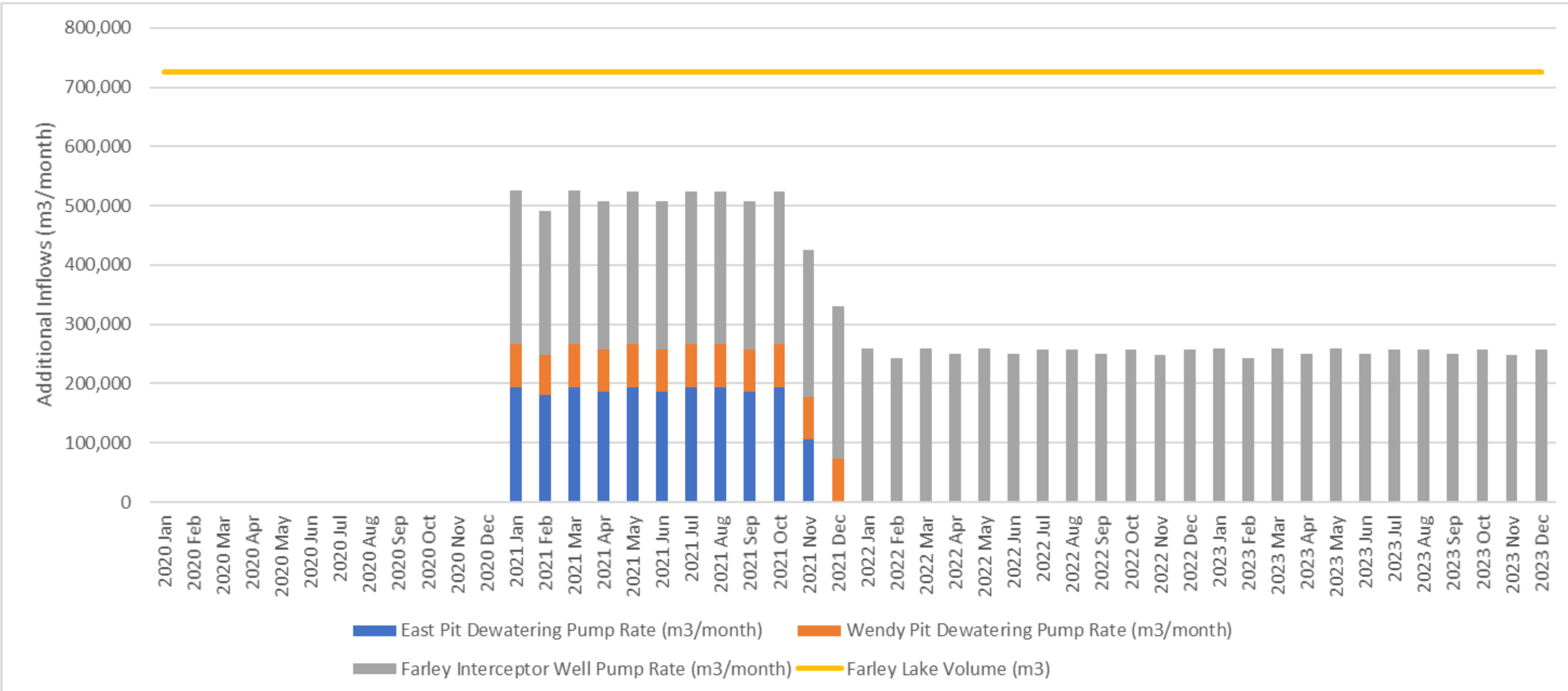


Figure 3 Farley Lake Anticipated Additional Inflows - 2020 to 2024

CLOSURE

This memorandum describes the methods and results of a simple mass-balance model used to predict potential changes in water temperatures in Farley Lake due to construction and operation of the LLGP at the Gordon site. Assumptions and limitations of the model are provided.

Please do not hesitate to contact the undersigned if you have any questions.

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Alamos Gold Inc.

Lynn Lake Gold Project
Environmental Impact Statement
Chapter 11 – Assessment of Potential Effects on Vegetation and Wetlands

Stantec

Prepared by:

Stantec Consulting Ltd.

May 25, 2020

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Acronyms and Abbreviations

Alamos	Alamos Gold Inc.
cm	centimetre
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
ha	hectare
km	kilometre
LAA	Local Assessment Area
m	metre
masl	metres above sea level
MB CDC	Manitoba Conservation Data Centre
MCC	Manitoba Conservation and Climate
PDA	Project Development Area
PR	provincial road
RAA	Regional Assessment Area
SARA	*Species at Risk Act*
SOCC	species of conservation concern
TK	Traditional Knowledge
TLRU	Traditional Land and Resource Use
VC	valued component

11.0 ASSESSMENT OF POTENTIAL EFFECTS ON VEGETATION AND WETLANDS

Vegetation and Wetlands is considered a valued component (VC) because biodiversity and associated ecosystem functions that vegetation and wetlands provide are essential to maintaining the health of natural ecosystems. The distribution and diversity of native vegetation and wetlands directly affect ecosystem functions (i.e., carbon sequestration, forage, habitat), environmental cycles (i.e., nutrient cycling, water cycling) and cultural benefits (i.e., spiritual and recreational values). The vegetation and wetlands VC includes native plant communities, wetlands, plant species and communities of conservation concern, and traditional use plant species.

Project activities have the potential to affect the distribution and abundance of:

- Native plant communities (uplands and wetlands), including ecological communities of conservation concern.
- Species of conservation concern (SOCC).
- Traditional use plants.
- Wetland functions.

Vegetation and wetlands was selected as a VC because it is valued by the community, but also because it has the potential to be affected by the development of the Project. In addition to physical damage or removal by Project activities, changes to air quality (Chapter 6) can affect plant growth and development. Changes to groundwater (Chapter 8) and surface water (Chapter 9) can change plant community composition. Therefore, the residual effects related to air quality, groundwater and surface water VCs were included in the assessment of potential Project effects on vegetation and wetlands.

Effects to vegetation and wetlands may also affect wildlife and wildlife habitat (Chapter 12), land and resource use (Chapter 15) associated with trapping and hunting, current use of lands and resources for traditional purposes (Chapter 17), and human health (Chapter 18) through collection and use of plant species.

11.1 SCOPE OF ASSESSMENT

The scope of the assessment of potential effects to the Vegetation and Wetlands VC was guided by the federal Environmental Impact Statement (EIS) Guidelines (Appendix 4A), the Manitoba Sustainable Development (now Manitoba Conservation and Climate; MCC) *Environment Act* Proposal Report Guidelines, as well as the relevant federal and provincial laws, regulations, and guidelines protecting vegetation and wetlands in Canada and Manitoba.

In addition to regulations, policies, and guidelines, this section describes how engagement with the public and local Indigenous communities has influenced the scope of the assessment; the understanding of potential effects and pathways between the Project and vegetation and wetlands during all phases of the Project; measurable parameters to be used to quantify potential effects of the Project on vegetation and wetlands; spatial and temporal boundaries of the assessment; and the approach for characterizing and determining the significance of residual effects.

11.1.1 Regulatory and Policy Setting

The following sections describe the federal and provincial regulations and guidelines that govern the management and protection of vegetation and wetlands in Canada and Manitoba.

11.1.1.1 Federal

Federal Policy on Wetland Conservation

The Federal Policy on Wetland Conservation (Government of Canada 1991) includes the principle of no net loss of wetland function in areas of high historical wetland loss. The federal policy applies to projects occurring on federal land and waters or those projects that receive federal funds. It also applies to wetlands of international importance, as determined by the Ramsar Convention, Ramsar, Iran, 1971. Although no wetlands of international importance (Ramsar Convention 2017) are affected by the Project, this policy is used as guidance to maintain consistency with national priorities for wetland conservation. However, the Project is not located in an area of high historical wetland loss or federal lands; therefore, wetland compensation may not be required under this policy.

Species at Risk Act

The *Species at Risk Act* (SARA), was implemented to protect species at risk in Canada and their critical habitat. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was established by the SARA to assess and designate the status of wildlife species, including plants, as extinct, extirpated, endangered, threatened, or special concern. Species status is designated using science and traditional knowledge to assess species at risk of extinction or extirpation from Canada. The potential for the Project to affect plant species listed by COSEWIC is included as part of this assessment.

11.1.1.2 Provincial

In addition to federal regulations and policies, several provincial regulations and policies are considered in the assessment of effects on vegetation and wetlands.

The Water Rights Act

The construction of water control works that temporarily or permanently alter the level or flow of water in a waterbody, including wetlands, is regulated by *The Water Rights Act*. It was amended in 2018 to include wetland offsetting requirements for wetland loss (Government of Manitoba 2019). Alteration or loss of class 3 (seasonal), class 4 (semi-permanent) or class 5 (permanent) wetlands will require a license and a restoration or enhancement plan prior to disturbance. Wetlands in this assessment are not classified to wetland class, but are classified to wetland type (marsh, swamp, fen, bog). Marsh and swamp wetlands described in this assessment may require a license and restoration or enhancement plan prior to disturbance.

The Conservation Agreements Act

The Conservation Agreements Act enables protection and enhancement of natural ecosystems, wildlife or fisheries habitat and plant or animal species by imposing restrictions on the use of the land. Conservation agreements can be established between landowners and conservation agencies such as Manitoba Habitat Heritage Corporation, Ducks Unlimited Canada, or Nature Conservancy of Canada. Disturbance of land that has a conservation agreement may be restricted.

The Ecological Reserves Act

Unique, rare, and representative natural features, including habitats, geological features and ecosystems, and modified ecosystems offering opportunities for research may be designated as ecological reserves under *The Ecological Reserves Act*. Areas are designated as ecological reserves by the Government of Manitoba and access and use of these areas requires prior approval.

The Endangered Species and Ecosystems Act

The Endangered Species and Ecosystems Act enables the protection and enhancement of the survival of endangered and threatened species and species of special concern in the province, reintroduction of extirpated species, and conservation and protection of endangered or threatened ecosystems. The *Threatened, Endangered and Extirpated Species Regulation* (1998) under the Act designates plant and animal species that are threatened, endangered, or extirpated in Manitoba.

Other SOCC in Manitoba are ranked for rarity by the Manitoba Conservation Data Centre (MB CDC 2018). SOCC ranked S1 (very rare throughout its range), S2 (rare throughout its range – 6 to 20 occurrences), and S3 (uncommon throughout its range – 21 to 100 occurrences) by the MB CDC not listed under *The Endangered Species and Ecosystems Act* are not protected; however, they are important contributors to biodiversity in Manitoba and are considered rare or uncommon.

The Environment Act

The Environment Act enables the protection and maintenance of the environment in Manitoba to provide social and economic development, recreation, and leisure for current and future generations. This Act applies to Provincial Crown land. If a Pesticide Use Permit is required, the permit is issued under the *Non-Essential Pesticide Use Regulation*.

The Forest Act

The Forest Act regulates and administers, with respect to Crown timber, matters relating for forestry. This includes management, use and conservation of Crown forest lands and timber, as well as afforestation (establishing forest on land with no previous forest cover), reforestation, tree preservation and tree improvement.

The Forest Health Protection Act

Forest threats including insects, diseases, and organisms set out in Schedule A and invasive forest threats set out in Schedule B are regulated through *The Forest Health Protection Act*. Schedule A includes Dutch elm disease, dwarf mistletoe, and emerald ash borer. Schedule 2 includes oak wilt, sudden oak death, and mountain pine beetle. Programs to protect and promote the health of trees and forests in Manitoba, such as the Dutch Elm Disease Management Program, are administered under the Act. The Forestry and Peatlands Branch of MCC monitors for forest insects and diseases such as Dutch elm disease and emerald ash borer. Care must be taken to prevent introduction of an invasive forest threat and identification of an invasive forest threat must be reported.

The Wildfires Act

The burning of land, timber and debris is regulated under *The Wildfires Act*. A burning permit is required for outdoor fires in certain areas of Manitoba within the wildfire season. Fires must not be started if conditions could lead to the fire burning out of control and controls must be in place prior to burning material, including a minimum 6 m wide strip of land free of inflammable material, or covered by snow or water. Burning material also cannot be placed where it could cause a fire to spread and burning must be supervised until the fire is out.

The Mines and Minerals Act

The Mines and Minerals Act regulates mining activities in Manitoba and strives for sustainable resource development through reducing negative effects to the environment, promoting conservation and reclamation policies and practices that are good for the economy and the environment. The *Mine Closure Regulation* under the Act outlines "satisfactory conditions" that must be adhered to for revegetation. Deviation from these guidelines requires detailed reasoning be submitted. Vegetation must be self-sufficient six years post reclamation (planting).

The Noxious Weeds Act

The Noxious Weeds Act and *Noxious Weeds Regulation* designates certain plant species as Tier 1, 2, or 3, and specifies requirements for control or elimination. Tier 1 species are those that are considered to have the most potential for negative effects though they may not yet be present in Manitoba. Under the Act, Tier 1 species must be destroyed or eradicated immediately upon discovery. Tier 2 species are already established in Manitoba and have been observed to spread easily. Tier 2 species infestations under five acres (two hectares) must be eradicated; whereas, infestations larger than five acres must be controlled and kept from spreading. Tier 3 species are all other designated species that do not require immediate control unless the spread of the occurrence poses a threat to the economy, environment, or the well-being of residents. The control of noxious non-native species (hereafter referred to as regulated weeds) are considered in this assessment.

11.1.2 The Influence of Engagement on the Assessment

Engagement has been ongoing prior to and throughout the EIS process, and will continue with local Indigenous communities, stakeholders, the public, and government agencies through the life of the Project. More detail on the Engagement process can be found in Chapter 3.

Engagement feedback related to vegetation and wetlands has been addressed through direct responses, updates to baseline information, and in the EIS, as appropriate. Key feedback that influenced the vegetation and wetlands effects assessment is provided below.

11.1.2.1 Indigenous Engagement

As part of the information sharing throughout the engagement process, Project-related information was provided by Indigenous communities in the form of traditional land and resource use (TLRU) studies and other forms of information sharing (Chapter 17).

A Project-specific TLRU study was completed collaboratively with Marcel Colomb First Nation with a final report provided to the community on January 11, 2018 (Stantec 2018). The TLRU study included interviews with participants selected by Marcel Colomb First Nation regarding traditional land use in the Project area, including availability of traditional resources, access to traditional resources or areas, occupancy, cultural sites and areas, and experience of TLRU.

A Project-specific TLRU study was completed in collaboration with Peter Ballantyne Cree Nation but has not yet been released by community leadership for use in the environmental assessment. The TLRU study included interviews with community members in Kinoosao, Saskatchewan.

A TLRU study (Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project) was completed by an independent consultant for the Manitoba Metis Federation (SVS 2020), the results of which were received in February 2020. The study documents harvesting and land use by the Manitoba Métis Community within a 100 kilometres (km) radius of the Project.

Some engaged Indigenous communities provided information on traditional plant use, and that information has been incorporated into this assessment. Field assistants from Indigenous communities also helped with rare plant field surveys and provided additional information about traditional use of plants when possible. Traditional Knowledge (TK) and TLRU information was considered during the preparation of this assessment and has been incorporated, where applicable.

TK and TLRU information (Chapter 17) contributed to the understanding of the existing ecological conditions, was used to identify vegetation and wetland resources that are used traditionally and informed the assessment of potential Project effects. Generally, issues and concerns related to effects of industrial development on vegetation and wetlands, as reported by Indigenous communities through the review of Project-specific and publicly available TK and TLRU information, included the effects of industrial development on:

- Gathering plants for food (berries and herbs) and medicinal purposes.

- Gathering of plants and vegetation for making skis and snowshoes, and wood for fuel.

11.1.3 Potential Effects, Pathways and Measurable Parameters

Table 11-1 describes potential effects, effect pathways and measurable parameters of Project activities on vegetation and wetlands.

Table 11-1 Potential Effects, Effects Pathways and Measurable Parameters for Vegetation and Wetlands

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in Landscape Diversity	• Fragmentation of native plant community patches arising from native vegetation clearing	• Number of native plant community cover type patches • Patch area (ha) of native plant community cover types • Perimeter (edge) length (km) of native plant community cover type patches
Change in Community Diversity	• Direct loss or alteration of native vegetation communities, including ecological communities of management concern arising from native vegetation clearing • Indirect alteration of native vegetation communities, including ecological communities of management concern from the introduction or establishment of regulated weeds, vegetation control (i.e., herbicide application) or deposition of dust and contaminants	• Area (ha) of native upland and wetland plant communities • Area (ha) of rare ecological communities • Risk of non-native invasive species introduction, spread and control on plant communities • Area (ha) affected by deposition of dust and contaminants
Change in Species Diversity	• Direct loss of plant SOCC or traditional use plant species due to vegetation clearing • Indirect loss of plant SOCC or traditional use plant species due to the introduction or establishment of regulated weeds, vegetation control (i.e., herbicide application) or deposition of dust and contaminants	• Number of SOCC occurrences • Number of traditional plant resources • Area (ha) of Species at Risk critical habitat • Rare plant potential
Change in Wetland Functions	• Direct loss or alteration of wetland area or change in wetland type from vegetation clearing or alteration of surface or groundwater flow patterns • Indirect loss or alteration of wetland area, structure, or function (i.e., nutrient cycling and carbon sequestration)	• Area (ha) of type of wetland • Change in wetland distribution and functions

11.1.4 Boundaries

11.1.4.1 Spatial Boundaries

The following spatial boundaries are used to assess Project effects, including residual and cumulative environmental effects, on vegetation and wetlands in the region surrounding the Gordon and MacLellan sites and access roads (Map 11-1):

- Project Development Area (PDA): encompasses the immediate area in which Project activities and components may occur plus a 30-metre (m) buffer and is the anticipated area of direct physical disturbance associated with construction and operation of the Project (i.e., the Project footprint).
- Local Assessment Area (LAA): is a 1-km buffer of the PDA, plus a 100-m buffer around the furthest groundwater drawdown contour, Gordon Lake, Farley Lake and Farley Creek. The Gordon site LAA is 4,265 ha and the MacLellan site LAA is 3,519 ha. Although there is no Project disturbance planned along Provincial Road (PR) 391 between the Gordon and MacLellan sites, there will be increased traffic from the mines, which may result in increased dust deposition on vegetation. Therefore, the LAA was extended to cover a 1-km buffer around PR 391 between the Gordon and MacLellan LAAs.
- Regional Assessment Area (RAA): is a 12-km buffer surrounding the PDA and covers 176,378.8 ha. The RAA was chosen to give a regional context of plant communities and species diversity and is large enough to encompass species dispersal and large natural disturbances, such as fire, and to provide context for consideration of cumulative effects.

11.1.4.2 Temporal Boundaries

The temporal boundaries for the Project consist of the following phases:

- Construction – two years (scheduled to be carried out concurrently from Year -2 to Year -1 at both sites).
- Operation – 13 years (scheduled to be carried out from Year 1 to Year 6 at the Gordon site and from Year 1 to Year 13 at the MacLellan site).
- Decommissioning/closure – five to six years of active closure (scheduled to begin in Year 6 at the Gordon site and in Year 14 at the MacLellan site). Active closure will be followed by post-closure, which is the time period during which active reclamation measures are complete, but monitoring is still required. The expected duration for post-closure is approximately 10 years. Pit filling is expected to take 11 years at the Gordon site and 21 years at the MacLellan site under average conditions (Chapter 9, Section 9.4.1). Permanent closure will occur when the site is stable, and monitoring is no longer required. For vegetation and wetlands this would occur when vegetation has sufficiently re-established to control erosion and is on a trajectory to a self-sustaining cover with the desired composition. The duration and conditions for post-closure monitoring and permanent closure will be detailed in subsequent submissions of the Closure Plan to regulatory agencies as Project design and execution progresses.

11.1.5 Residual Effects Characterization

Table 11-2 provides the definition of terms used to characterize residual effects of Project activities on vegetation and wetlands.

Table 11-2 Definition of Terms used to Characterize Residual Effects on Vegetation and Wetlands

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Positive –** a residual effect that moves measurable parameters in a direction beneficial to vegetation and wetlands relative to baseline **Adverse –** a residual effect that moves measurable parameters in a direction detrimental to vegetation and wetlands relative to baseline
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	**Low –** a measurable change in distribution and abundance of vegetation and wetlands, but no loss within the LAA of: • Large intact native vegetation patches • Upland or wetland land units • Plant SOCC • Traditional plant use species And, changes in distribution of existing regulated weeds, and no new regulated weeds introduced **Moderate –** Loss within the LAA of: • Large intact native vegetation patches • Upland or wetland land units • Plant SOCC • Traditional plant use species Or, changes in distribution of regulated weeds in the LAA, and likely introduction of new regulated weeds **High –** Loss within the RAA of: • Large intact native vegetation patches • Upland or wetland land units • Plant SOCC • Traditional plant use species Or, changes in distribution of regulated weeds in the RAA, and likely introduction of new regulated weeds
Geographic Extent	The geographic area in which a residual effect occurs	**PDA –** residual effects are restricted to the PDA **LAA –** residual effects extend into the LAA **RAA –** residual effects interact with those of other projects in the RAA

Table 11-2 Definition of Terms used to Characterize Residual Effects on Vegetation and Wetlands

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	**Not Applicable –** seasonal aspects are unlikely to affect vegetation and wetlands **Applicable –** seasonal aspects may affect vegetation and wetlands
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	**Single event** **Multiple irregular event –** occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	**Short-term –** residual effect restricted to duration of the construction phase **Medium-term –** residual effect extends through operation **Long-term –** residual effect extends beyond operation
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	**Reversible –** the residual effect is likely to be reversed after activity completion and reclamation **Irreversible –** the residual effect is unlikely to be reversed
Ecological and Socio-economic Context	Existing condition and trends in the area where residual effects occur	**Undisturbed –** area is relatively undisturbed or not adversely affected by human activity **Disturbed –** area has been substantially previously disturbed by human development or human development is still present

11.1.6 Significance Definition

A significant adverse residual effect on vegetation and wetlands is defined as one that:

- Threatens the long-term persistence or viability of a plant species or community in the RAA, including effects that are contrary to or inconsistent with the goals, objectives or activities of recovery plans, action plans and management plans, or
- Threatens the long-term persistence or viability of wetland functions and vegetation species of interest to Indigenous communities or contravenes federal or provincial guidelines within the RAA.

11.2 EXISTING CONDITIONS FOR VEGETATION AND WETLANDS

Existing conditions for vegetation and wetlands were compiled through a review of published literature, existing vegetation databases, and field surveys. Detailed information is provided in the Vegetation Baseline Technical Data Report (TDR) and associated Validation Report provided in Volume 4, Appendix L. The existing conditions and the methods used to characterize baseline conditions are summarized below.

11.2.1 Methods

11.2.1.1 Existing Data

The following reports and publicly available data were reviewed as part of the vegetation and wetlands assessment:

- Farley Lake Project Feasibility Study (Kilborn Manitoba Limited 1989).
- Farley Lake Project Environmental Impact Assessment (Goodwin Mining Services Ltd. and Agassiz North Associates Limited 1994).
- MacLellan Mine Project: Draft 2012 Environmental Baseline Study (Tetra Tech 2013).
- Manitoba Forest Resource Inventory (Government of Manitoba 1999).
- A preliminary land use classification created by Stantec (Wood et al. 2002).
- Bing® maps satellite imagery (Microsoft 2015).
- Google® maps satellite imagery (Google 2015).
- MB CDC SOCC records (MB CDC 2018).
- Terrestrial Ecozones, Ecoregions and Ecodistricts of Manitoba (Smith et al. 1998).
- Forest Ecosystem Classification for Manitoba (Zoladeski et al. 1995).

11.2.1.2 Vegetation and Wetland Communities Mapping

Vegetation and wetland communities were mapped using SPOT-6/7 satellite imagery acquired on July 13, 2015. Imagery was segmented into objects based on spectral signature, textural patterns, size, and shape of features. Once images were segmented into objects, field data was used to select representative objects that represented different land cover classes. A supervised classification of objects was conducted to give land cover classes for the RAA. The Land Cover dataset was derived from this information and classes were adopted from the Canadian Forest Service (2003) for uplands and the Canadian Wetland Classification system (National Wetlands Working Group 1997) and Alberta Wetland Inventory Classification System for wetlands (Alberta Environment and Sustainable Resource Development 2015).

Sixty ground plot surveys (vegetation type characterization) were conducted to gather information on vegetation and wetland plant community composition in the LAA and RAA. Survey sites were selected to evaluate each plant community type, where possible, within the LAA and unique microsites. Target survey sites were chosen through aerial imagery interpretation prior to arriving on site. Survey sites were chosen to be representative of vegetative types in the area and for potential to support SOCC with actual survey locations chosen in the field. Twenty-eight of the sites were in upland areas, while thirty-two sites were in wetlands.

Vegetation surveys were conducted within a 20 m by 20 m plot. Thirty vegetation surveys were conducted in the PDA, 12 in the LAA and 18 in the RAA (Volume 4, Appendix L, Map 4). Surveys were completed in 2015 on: June 2 and 3, July 13 to 15, and August 20 to 25. The following data was recorded within each plot:

- Tree layer – canopy and subcanopy species composition, average tree height, percent cover by species, and diameter at breast height for representative trees. In more mature forests (13-18 m tall trees and diverse canopy, or >18 m tall trees), an average mature tree was cored to estimate forest age.

- Shrub layer – shrub species greater than 20 centimetres (cm) in height, average height, and percent cover by species.

- Ground cover layer – a rare plant meander survey was completed, which involved walking around the entire plot. Ground cover and shrub species less than 20 cm in height were recorded along with the percent cover by species.

Environmental parameters such as slope percent, slope position, aspect, land use and structural stage were recorded at each survey location. Moisture regime, and nutrient regime were recorded by assessing presence/absence of vegetation indicator species at each survey location. These parameters were used to assist in vegetation type and wetland classification. Vegetation types were classified using the Forest Ecosystem Classification for Manitoba (Zoladeski et al. 1995). The province of Manitoba currently does not have a recognized wetland classification system; therefore, wetland classification was based on the Canadian Wetland Classification System (National Wetlands Working Group 1997), the Alberta Wetland Classification System (Alberta Environment and Sustainable Resource Development 2015) and using Climatic and Physiographic Controls on Wetland Type and Distribution in Manitoba, Canada (Halsey et al. 1997).

11.2.1.3 Species of Conservation Concern

Prior to conducting field surveys, MB CDC SOCC records were searched (MB CDC 2015) and a list of plant SOCC with potential to occur in the RAA was compiled (Volume 4, Appendix L).

Manitoba has not released guidelines on surveys for plant SOCC; therefore, the Guidelines for Rare Vascular Plant Surveys (Alberta Native Plant Council 2012) were followed. The rare plant survey guidelines stipulate that the study area be surveyed multiple times per growing season to account for flowering periods and moisture conditions. Rare plant surveys occurred over three periods in 2015: June 2 and 3, July 13 to

15, and August 20 to 25. Rare plant surveys were timed to target the flowering period of rare species with the potential to inhabit the LAA and RAA. A meander survey was completed at each ground survey plot location within a 20 m by 20 m plot and continued until no new plant species were found. Occurrences of SOCC were also looked for while traveling between vegetation survey locations.

11.2.1.4 Traditional Plant Use

Traditional plant use data was identified through Project-specific engagement with Marcel Colomb First Nation, Mathias Colomb Cree Nation, Peter Ballantyne Cree Nation, Manitoba Metis Federation, Métis Nation-Saskatchewan Eastern Region 1, Nisichawayasihk Cree Nation, O-Pipon-Na-Piwin Cree Nation, Métis Nation-Saskatchewan Northern Region 1, Barren Lands First Nation, Hatchet Lake First Nation, Northlands Denesuline First Nation and Sayisi Dene First Nation. TK from Indigenous assistants during field surveys were recorded, when provided.

Plants listed by participating First Nations were considered traditionally used by Indigenous communities. Using Aboriginal Plant Use in Canada's Northwest Boreal Forest (Marles et al. 2008) and the MB CDC plant species list (MB CDC 2018), corresponding scientific names of the common names provided by Indigenous communities were searched to compile a list of potential species in Manitoba (Volume 4, Appendix L). The list of potential plant species was compared to the comprehensive species list observed in the RAA to assess the effect of the Project on traditional plant use. Some traditionally used species may not have been documented because traditionally used species names did not correspond to recognized common names used in Manitoba. Traditionally used species that did not correspond are nevertheless listed in this assessment (see Table 11-4).

11.2.1.5 Regulated Weeds

Observations of regulated weeds were recorded during field surveys (Volume 4, Appendix L).

11.2.1.6 Wetland Functions

Change in wetland type and wetland area was used as a proxy for wetland function, because different types of wetlands provide different functions (e.g., flood attenuation, water filtration and water storage; Volume 4, Appendix L).

11.2.2 Overview

The RAA is located within the Boreal Shield Ecozone, Churchill River Upland Ecoregion, Reindeer Lake Ecodistrict, which is dominated by black spruce (*Picea mariana*) dominated uplands and permafrost and non-permafrost wooded bogs and patterned fens (Smith et al. 1998). Almost half of the LAA is upland (6,992 ha, 46%), much of the other half is wetland (6,452 ha, 42%), with the remaining areas classified as water (1,353 ha, 9%) and anthropogenic (484 ha, 3%; Table 11-3). Conifer-dominated forests are the most common forest type occurring throughout the LAA and RAA, with most being dense, followed by open and sparse. Based on field observations (Volume 4, Appendix L), mixedwood forests were also present in the LAA and RAA but were much less common as deciduous tree species generally require more nutrient rich soil (Zoladeski et al. 1995). Mixedwood forests were more commonly observed in and around the Gordon LAA (Map 11-3a). Deciduous-dominated forests are absent from the LAA (Table 11-3).

Of the wetland area in the LAA, 81% is organic wetland (bogs and fens); the remaining area is mineral wetland (marshes and swamps; Table 11-3). Treed bogs were the most common organic wetland (2,641 ha) observed during field studies, followed by shrubby fens (1,110 ha), shrubby bogs (860 ha) and treed fens (226 ha). Bog wetlands were generally located in and around the MacLellan and PR 391 LAAs; whereas, fens were more common around Gordon LAA (Figure 11-3a and Figure 11-3b). Treed swamps (1,019 ha) were the most abundant mineral wetland. Water, which includes lakes and streams covers 9% (1,262 ha) of the LAA. See Appendix 11A for the corresponding plant communities for the land cover provided in Table 11-3.

Table 11-3 Land Cover within the LAA and RAA

Cover Type	Land Cover Class	Description	LAA		RAA	
			ha	%	ha	%
Native Upland	Barren[a]	Naturally unvegetated (i.e., rock outcrop, beaches)	0.0	0.0	0.9	0.0
	Conifer Dense[a]	>60% crown closure, with ≥ 75% coniferous tree cover	2,963.7	20.1	29,040.1	16.5
	Conifer Open[a]	26-60% crown closure, with ≥ 75% coniferous tree cover	1,608.0	10.9	18,512.5	10.5
	Conifer Sparse[a]	10-25% crown closure, with ≥75% coniferous tree cover	1,242.6	8.4	21,814.9	12.4
	Mixedwood Dense[a]	>60% crown closure, with neither coniferous nor deciduous trees comprising ≥ 75% total tree cover	362.5	2.5	2,969.7	1.7
	Mixedwood Open[a]	26 - 60% crown closure, with neither coniferous nor deciduous trees comprising ≥ 75% total tree cover	103.6	0.7	1,317.3	0.7
	Deciduous[a]	>75% Deciduous tree cover	0.0	0.0	155.1	0.1
	Shrubland[a]	≥ 20% shrub cover	655.9	4.5	6,778.6	3.8
Upland Subtotal			*6,936.5*	*47.2*	*80,589.2*	*45.7*
Water	Water	Lakes, rivers, or streams	1,262.0	8.6	27,480.8	15.6
Water Subtotal			*1,262.0*	*8.6*	*27,480.8*	*15.6*
Wetland	Bog Shrubby[b]	Isolated from surface or groundwater influence with >40 cm peat accumulation, >25% shrub cover and tree cover that is ≤ 25%	859.8	5.8	13,266.9	7.5
	Bog Treed[b]	Isolated from surface or groundwater influence with	2,640.5	18.0	28,979.8	16.4

Table 11-3 Land Cover within the LAA and RAA

		>40 cm peat accumulation, >25% tree cover by coniferous species				
	Fen Graminoid[b]	Connected to surface or groundwater with >40 cm peat accumulation, ≤ 25% shrub and tree cover	32.2	0.2	532.0	0.3
Wetland	Fen Pattern[c]	Connected to surface or groundwater with a pattern of strings and flarks	15.9	0.1	442.7	0.3
	Fen Shrubby[b]	Connected to surface or groundwater with >40 cm peat accumulation, >25% shrub and ≤ 25% tree cover	1,109.7	7.5	12,553.8	7.1
	Fen Treed[b]	Connected to surface or groundwater with >40 cm peat accumulation, >25% tree cover	225.7	1.5	2,809.9	1.6
	Marsh[b]	< 40 cm peat accumulation with < 25% shrub and tree cover	16.0	0.1	383.6	0.2
	Swamp Shrubby[b]	< 40 cm peat accumulation with >25% shrub cover and ≤ 25% tree cover	108.1	0.7	1,168.4	0.7
	Swamp Treed[b]	< 40 cm peat accumulation with >25% tree cover	1,018.7	6.9	6,603.2	3.7
Wetland Subtotal			*6,026.6*	*41.0*	*66,740.2*	*37.8*
Anthropogenic	Development	Disturbed land, settlements, roads, industrial development	484.5	3.3	1,568.7	0.9
Anthropogenic Subtotal			*484.5*	*3.3*	*1,568.7*	*0.9*
		Grand Total	**14,709.6**	**100**	**176,378.8**	**100**

Source:
[a] Canadian Forest Service 2003
[b] Alberta Environment and Sustainable Resource Development 2015
[c] Halsey et al. 1997

The MB CDC lists 19 plant SOCC for the Churchill River Upland (Volume 4, Appendix L, Table 4-1), which have potential to occur in the Project RAA. None of the species listed by the MB CDC are listed under Schedule 1 of SARA. Flooded jellyskin lichen (*Leptogium rivulare*), found in northern Manitoba (Environment Canada 2013a), is provincially ranked S1 (MB CDC 2018), and is listed by COSEWIC as special concern (COSEWIC 2015). No federally protected plant species listed under SARA grow in the habitat types found in the RAA (Government of Canada 2019). A search of the MB CDC database and review of previous reports resulted in three recorded occurrences of rare plant species within the RAA, but not within the PDA (MB CDC 2018). Lake Quillwort (*Isoetes lacustris*, provincially ranked S2) was recorded at the south end of Hughes Lake, near PR 391 and small water-lily (*Nymphaea tetragona*, provincially ranked S2?) was recorded in the area of Cartwright Lake south of PR 391. Northern woodsia (*Woodsia alpina*, provincially ranked S2) was recorded in the MacLellan site LAA in a previous study (Map 11-3a and 11-3b).

Shrubby willow (*Salix arbusculoides*), which is ranked as S2S3 within the province of Manitoba (MB CDC 2018), was recorded at four sites within the RAA (Map 11-3a and 11-3b). Boreal locoweed (*Oxytropis borealis*), listed as an S1S2 species (MB CDC 2018), was observed at one location at the Gordon site (Map 11-3a).

Several vascular and non-vascular species are traditionally used by Indigenous communities for food (berries and herbs), building (skis and cabins) and medicinal uses, and were identified during community engagement (Table 11-4). All of the species identified by Indigenous communities were recorded in the RAA and are common species in Manitoba, with the exception of small water-lily (*Nymphaea tetragona*) and shrubby willow (described above). Small water-lily is ranked S2? provincially and was observed south of PR 391 outside of the LAA. Although most species identified by Indigenous communities are common, not all were frequently observed during field surveys. Dwarf birch (*Betula pumula*) was only observed at three survey locations and had an average percent cover of 25%, which ranged from 1% to 45% (Table 11-4). Mooseberry (*Viburnum edule*) was only observed at one survey location in trace amounts (Table 11-4). Red raspberry (*Rubus idaeus*) and smooth wild strawberry (*Fragaria virginiana*) were also observed at one survey location each, and only in small amounts (1%). There are a few species of willow and moss that were more infrequently observed compared to other species (Table 11-4); however, specific species were not named by Indigenous communities. No visual health effects from mine tailings were evident during vegetation surveys. There are no historical tailings present at either of the mine sites.

Table 11-4 Plants of Interest to Indigenous Communities Identified During Engagement

Plants of Interest to Indigenous Communities	Scientific name of Potential Species in Manitoba	Species Recorded in RAA	Plant Conservation Status Rank (MB CDC 2018)	Number of Observations	Average Percent Cover	Min Percent Cover	Max Percent Cover	Standard Deviation of Percent Cover
Acorus calamus (sweet flag)/ muskrat root	*Acorus americanus*	-	S4S5	0	N/A	N/A	N/A	N/A
bear root	*Hedysarum alpinum*	-	S4S5	0	N/A	N/A	N/A	N/A
beaver pineapple	*Matricaria discoidea*	-	SNA	0	N/A	N/A	N/A	N/A
blueberries	*Vaccinium angustifolium, Vaccinium caespitosum, Vaccinium myrtilloides*	*Vaccinium myrtilloides*	S5	30	16.6	0.1	70	18.6
		Vaccinium uliginosum	S5	18	5.1	0.1	25	6.3
birch	*Betula glandulosa, Betula neoalaskana, Betula occidentalis, Betula papyrifera, Betula pendula, Betula pumila*	*Betula glandulosa*	S5	21	9.2	0.1	30	10.4
		Betula papyrifera	S5	23	6.7	0.1	25	7.3
		Betula pumila	S5	3	25.3	1	45	18.3
buffalo berries	*Shepherdia argentea, Shepherdia canadensis*	-	S3S4 S5	0 0	N/A N/A	N/A N/A	N/A N/A	N/A N/A
chaga fungus	*Inonotus obliquus*	-	N/A	0	N/A	N/A	N/A	N/A
choke cherries	*Prunus virginiana*	-	S5	0	N/A	N/A	N/A	N/A
cloudberries	*Rubus chamaemorus*	*Rubus chamaemorus*	S5	19	3.2	0.1	20	5.7

Table 11-4 Plants of Interest to Indigenous Communities Identified During Engagement

Plants of Interest to Indigenous Communities	Scientific name of Potential Species in Manitoba	Species Recorded in RAA	Plant Conservation Status Rank (MB CDC 2018)	Number of Observations	Average Percent Cover	Min Percent Cover	Max Percent Cover	Standard Deviation of Percent Cover
cranberries	*Viburnum species, Vaccinium oxycoccos, Vaccinium vitis-idaea*	*Vaccinium oxycoccos*	S5	29	0.4	0.1	3	0.6
		Vaccinium vitis-idaea	S5	46	2.7	0.1	15	3.7
		Viburnum edule	S5	1	0.1	0.1	0.1	0.0
frog ears moss	*unknown*	-	N/A	0	N/A	N/A	N/A	N/A
green birch	*Alnus viridis, Alnus incana, Alnus viridis* ssp. *crispa, Alnus incana* ssp. *rugosa*	*Alnus viridis*	S5	15	15.5	1	50	15.1
jack pine	*Pinus banksiana*	*Pinus banksiana*	S5	27	22.1	1	60	18.2
Labrador tea	*Rhododendron groenlandicum*	*Rhododendron groenlandicum*	S5	48	34.2	0.1	80	20.5
mint	*Mentha canadensis, Mentha spicata*	-	S5 SNA	0 0	N/A N/A	N/A N/A	N/A N/A	N/A N/A
moss	*Dicranum groenlandicum, dicranum species, Pleurozium schreberi, Hylocomium splendens, Ptilium crista-castrensis, Tomentypnum nitens, sphagnum species, Sphagnum fuscum*	*Dicranum polysetum*	S4S5	38	0.3	0.1	1	0.4
		Dicranum polysetum	S4S5	38	0.3	0.1	1	0.4
		Pleurozium schreberi	S4S5	35	21.0	0.1	90	26.2
		Tomenthypnum nitens	S4S5	5	0.7	0.1	2	0.7
		Hylocomium splendens	S4S5	13	10.3	0.1	70	18.8
		Ptilium crista-castrensis	S4S5	1	0.1	0.1	0.1	0.0
		Sphagnum fuscum	S4S5	20	26.4	0.1	80	24.8
		Sphagnum angustifolium	S4S5	23	14.6	0.1	70	19.0

Table 11-4 Plants of Interest to Indigenous Communities Identified During Engagement

Plants of Interest to Indigenous Communities	Scientific name of Potential Species in Manitoba	Species Recorded in RAA	Plant Conservation Status Rank (MB CDC 2018)	Number of Observations	Average Percent Cover	Min Percent Cover	Max Percent Cover	Standard Deviation of Percent Cover
moss	*Dicranum groenlandicum, dicranum species, Pleurozium schreberi, Hylocomium splendens, Ptilium crista-castrensis, Tomentypnum nitens, sphagnum species, Sphagnum fuscum*	*Sphagnum capillifolium*	S4S5	4	6.8	1	20	7.8
		Sphagnum magellanicum	S4S5	9	8.1	0.1	40	11.8
		Sphagnum majus	SNR	1	0.1	0.1	0.1	0.0
		Sphagnum squarrosum	S4S5	10	7.9	0.1	20	7.5
		Sphagnum teres	S4S5	2	0.1	0.1	0.1	0.0
		Sphagnum warnstorfii	S4	9	4.2	0.1	10	4.3
pin cherries	*Prunus pensylvanica*	-	S5	0	N/A	N/A	N/A	N/A
pineapple root	*Matricaria discoidea*	-	SNA					
pond lily	*Nuphar microphylla, Nuphar variegata, Nymphaea leibergii, Nymphaea loriana, Nymphaea odorata, Nymphaea tetragona**	*Nuphar variegata*	S5	2	0.1	0.1	0.1	0.0
		*Nymphaea tetragona**	S2?	N/A	N/A	N/A	N/A	N/A
poplar	*Populus alba, Populus balsamifera, Populus deltoides, Populus grandidentata, Populus tremuloides*	*Populus tremuloides*	S5	7	3.5	0.1	15	5.0

Table 11-4 Plants of Interest to Indigenous Communities Identified During Engagement

Plants of Interest to Indigenous Communities	Scientific name of Potential Species in Manitoba	Species Recorded in RAA	Plant Conservation Status Rank (MB CDC 2018)	Number of Observations	Average Percent Cover	Min Percent Cover	Max Percent Cover	Standard Deviation of Percent Cover
raspberries	*Rubus species, Rubus arcticus, Rubus idaeus, Rubus pubescens*	*Rubus arcticus*	S5	8	0.3	0.1	1	0.4
		Rubus idaeus	S5	1	1.0	1	1	0.0
rat root	*Acorus americanus*	-	S4S5	0	N/A	N/A	N/A	N/A
saskatoon	*Amelanchier alnifolia*	-	S5	0	N/A	N/A	N/A	N/A
seneca root	*Polygala senega*		S4	0	N/A	N/A	N/A	N/A
spruce	*Picea glauca, Picea mariana*	*Picea mariana*	S5	53	36.2	0.1	105	25.9
strawberries	*Fragaria vesca, Fragaria virginiana*	*Fragaria virginiana*	S5	1	1.0	1	1	0.0
true tinder fungus	*Inonotus obliquus*	-	N/A	0	N/A	N/A	N/A	N/A
wild carrot	*Daucus carota*	-	SNA	0	N/A	N/A	N/A	N/A
willows	*Salix species*	*Salix* species	N/A	33	13.7	0.1	66	16.2
		*Salix arbusculoides**	S2S3	4	16.3	3	40	14.4
		Salix bebbiana	S5	6	8.2	0.1	20	8.5
		Salix candida	S5	2	5.0	5	5	0.0
		Salix discolor	S5	3	9.3	1	20	7.9
		Salix lutea	N/A	1	5.0	5	5	0.0
		Salix maccalliana	S4	15	11.6	0.1	45	12.4
		Salix myrtillifolia	S5	9	2.7	0.1	10	3.2
		Salix pedicellaris	S5	4	4.3	1	10	3.7
		Salix planifolia	S5	3	7.3	2	15	5.6

Table 11-4 Plants of Interest to Indigenous Communities Identified During Engagement

Plants of Interest to Indigenous Communities	Scientific name of Potential Species in Manitoba	Species Recorded in RAA	Plant Conservation Status Rank (MB CDC 2018)	Number of Observations	Average Percent Cover	Min Percent Cover	Max Percent Cover	Standard Deviation of Percent Cover
willows	*Salix species*	*Salix pseudomonticola*	S4S5	1	5.0	5	5	0.0
		Salix pyrifolia	S4S5	1	0.1	0.1	0.1	0.0
		Salix scouleriana	S4	4	11.5	0.1	40	16.5

Note:
Berry picking, medicinal plants, and variety of herbs were also mentioned by Indigenous communities, but insufficient information was available to identify plant species.
- species not recorded in the RAA
* species is a SOCC
N/A data not available

11.3 PROJECT INTERACTIONS WITH VEGETATION AND WETLANDS

Table 11-5 identifies, for each potential effect, the physical activities that might interact with vegetation and wetlands and result in the identified environmental effect. These interactions are indicated by check mark and are discussed in detail in Section 11.4, in the context of effects pathways, standard and project-specific mitigation/enhancement, and residual effects. A justification for no effect is provided following the table.

Project activities for each phase are described in detail in Chapter 2, Section 2.3 and 2.4. Project related emissions and discharges are described in Chapter 2, Section 2.8.

The potential interactions between Project activities and the environment were considered for the construction, operation, and decommissioning/closure phases of the Project. The identification of Project activities and their potential interactions was based on engagement with interested parties, the professional judgment of technical specialists involved in the assessment, and a review of existing conditions. The selection of interactions is informed by the potential effects and effects pathways for each VC as described in Section 11.1.3.

Emissions, discharges, and wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many and varied Project activities. Rather than acknowledging this by placing a check mark against each of these activities, “Emissions, Discharges and Wastes” have been consolidated as an integrated activity for efficiency with relevant detail described in the text. This category includes the emissions, discharges, and wastes generated by all project activities under each Project phase.

Table 11-5 Potential Project-Environment Interactions with Vegetation and Wetlands

Project Activities and Components	Environmental Effects							
	Change in Landscape Diversity		Change in Community Diversity		Change in Species Diversity		Change in Wetland Functions	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
Construction								
Site Preparation at Both Sites (removal of existing buildings; removal of contaminated materials; vegetation clearing and earthworks; development of temporary construction camp at the MacLellan site)	✓	✓	✓	✓	✓	✓	✓	✓
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	–	–	–	–	–	–	–	–
Mine Components at Both Sites (construction of: ore pads; ore, overburden and mine rock storage areas; mill feed storage area and crushing plant, ore milling and processing plant, and Tailings Management Facility at the MacLellan site; water management facilities [e.g., sumps, ponds and ditches])	–	–	–	–	–	–	–	–
Utilities, Infrastructure, and Other Facilities at Both Sites (construction of: buildings and yards; access roads [i.e., upgrades at the Gordon and MacLellan sites] and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at the MacLellan site; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities)	–	–	–	–	–	–	–	–
Water Development and Control at Both Sites (dewatering of existing pits at the Gordon site and underground workings at the MacLellan site; re-alignment of existing diversion channel at the Gordon site; interceptor wells at the Gordon site)	✓	✓	✓	✓	✓	✓	✓	✓
Emissions, Discharges, and Wastes[1]	–	–	✓	✓	✓	✓	✓	✓
Employment and Expenditure[2]	–	–	–	–	–	–	–	–

Table 11-5 Potential Project-Environment Interactions with Vegetation and Wetlands

Project Activities and Components	Environmental Effects							
	Change in Landscape Diversity		Change in Community Diversity		Change in Species Diversity		Change in Wetland Functions	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
Operation								
Open Pit Mining at Both Sites (drilling; blasting; removal, loading and on-site hauling of mined material [i.e., ore, overburden, and mine rock])	–	–	–	–	–	–	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA, including truck transportation of ore from the Gordon site to the MacLellan site)	–	–	–	–	–	–	–	–
Storage/Stockpiling of Ore, Overburden, and Mine Rock at Both Sites	–	–	–	–	–	–	–	–
Ore Milling and Processing at the MacLellan Site (ore crushing and conveyance; ore milling)	–	–	–	–	–	–	–	–
Water Management at Both Sites (mine water collection and storage; process water supply for the MacLellan site including water intake at the Keewatin River at the MacLellan site; pumping fresh/fire water from Farley Lake at Gordon site; operation of interceptor wells at the Gordon site)	–	–	–	–	–	–	✓	✓
Tailings Management at the MacLellan Site	–	–	–	–	–	–	–	–
Utilities, Infrastructure, and Other Facilities at Both Sites (presence and operation of: buildings and yards; access roads and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at the MacLellan site; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities; explosives storage, maintenance of access roads and bridges)	–	–	–	–	–	–	–	–
Emissions, Discharges, and Wastes[1]	–	–	✓	✓	–	–	✓	✓

Table 11-5 Potential Project-Environment Interactions with Vegetation and Wetlands

Project Activities and Components	Environmental Effects: Change in Landscape Diversity – Gordon Site	Change in Landscape Diversity – MacLellan Site	Change in Community Diversity – Gordon Site	Change in Community Diversity – MacLellan Site	Change in Species Diversity – Gordon Site	Change in Species Diversity – MacLellan Site	Change in Wetland Functions – Gordon Site	Change in Wetland Functions – MacLellan Site
Employment and Expenditure[2]	–	–	–	–	–	–	–	–
Decommissioning/Closure								
Decommissioning at Both Sites	–	–	–	–	–	–	–	–
Reclamation at Both Sites	✓	✓	✓	✓	✓	✓	✓	✓
Post-Closure at Both Sites (long-term monitoring)	✓	✓	✓	✓	✓	✓	✓	✓
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	–	–	–	–	–	–	–	–
Emissions, Discharges, and Wastes[1]	–	–	✓	✓	✓	✓	✓	✓
Employment and Expenditure[2]	–	–	–	–	–	–	–	–

NOTES:
✓ = Potential interaction
– = No interaction
[1] Emissions, Discharges, and Wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many Project activities. Rather than acknowledging this by placing a check mark against each of these activities, "Emissions, Discharges and Wastes" have been introduced as an additional component under each Project phase.
[2] Project employment and expenditures are generated by most Project activities and components and are the main drivers of many socio-economic effects. Rather than acknowledging this by placing a check mark against each of these activities, "Employment and Expenditures" have been introduced as an additional component under each Project phase.

During construction, interactions between the Project and vegetation and wetlands will occur during site preparation, water development and control, and through emissions, discharges and wastes at both sites. Project-related transportation, construction of mine components and utilities, infrastructure and other facilities at both sites are not expected to interact with vegetation and wetlands because vegetation clearing will occur at the site preparation stage of construction for the entire PDA.

No further vegetation clearing is planned during operation; therefore, effects to vegetation and wetlands are not anticipated, except from water management and emissions, discharges and wastes at both sites. Dust deposition wastes and emissions, silt and water effluent, or changes to groundwater and surface water hydrology may affect species diversity, community diversity and wetland functions. No effects to landscape diversity are anticipated during operation.

Decommissioning of mines will occur within existing disturbance and not result in greater fragmentation, and thus not negatively interact with vegetation and wetlands. However, reclamation at both sites may positively effect landscape, community and species diversity and wetland functions by reclaiming to native upland or native wetland state in some areas. Post-closure monitoring may have further positive interactions with vegetation and wetlands as native uplands and wetland reclamation matures. There may also be effects to wetlands from the gradual filling of the open pits at both sites during decommissioning/closure. Emissions, discharges, and wastes may still affect community diversity, species diversity and wetland function post-decommissioning/closure.

11.4 ASSESSMENT OF RESIDUAL ENVIRONMENTAL EFFECTS ON VEGETATION AND WETLANDS

11.4.1 Analytical Assessment Techniques

Analysis of change in landscape diversity (number of habitat patches, patch area and patch perimeter), used the land cover spatial dataset (described in Section 11.2.1.2) within the RAA, and compared change in number, habitat patch area and perimeter for each habitat patch in each Project scenario in the RAA. A patch is defined as a contiguous area of vegetation that is uninterrupted by anthropogenic disturbance. Patches are created by anthropogenic disturbance bisecting existing continuous vegetation areas. Changes to patch area and perimeter may also occur due to anthropogenic disturbance removing a portion of an existing patch.

Baseline habitat patch metrics were calculated by buffering areas classified as “development” in the land cover spatial dataset by a set distance. Since effects of vegetation clearing may be measurable two to three tree lengths into the remaining forested plant community (Environment Canada 2013b; Harper et al. 2005), the Town of Lynn Lake and PR 391 were buffered by 200 m to account for high use by people and other development was buffered by 100 m. Buffering of development was completed to account for edge effects on vegetation and wildlife. The land cover dataset was reviewed for areas that may be non-wildlife habitat areas (i.e., abandoned land or agricultural areas), but none were found within the RAA. Areas classified as barren land are natural features, such as rock outcrops, which may be used by wildlife, and were included as wildlife habitat. Construction and operation habitat patch metrics were calculated in the same manner as existing conditions, but also includes the PDA as high use buffered by 200 m.

Closure habitat patch metrics were calculated in the same manner as existing conditions, with the addition of reclaimed native upland and reclaimed upland areas being buffered by 100 m. A 100-m buffer around reclaimed areas was applied to account for edge effects present while vegetation is recovering. The open pits that will be reclaimed to open water were not buffered as the edge will be considered a naturalized edge (neither disturbance nor habitat) after closure because reclamation of open pits will not include contouring to create wetland habitat.

Change to community diversity was estimated by comparing changes to area of native upland and wetland land cover types in the LAA in each scenario to existing conditions. Indirect effects of regulated weed introduction and establishment on community diversity were assessed by predicting change in regulated weed introduction and establishment during construction/operation and decommissioning/closure compared to existing conditions.

Changes to species diversity were evaluated by assessing potential changes to SOCC occurrences in the LAA from direct and indirect effects of each scenario compared to existing conditions. Direct effects of the Project would be from clearing of vegetation, and indirect effects from dust deposition, changes in surface and ground water hydrology. Historical SOCC data and field observations, combined with available literature on SOCC ecology were used to evaluate potential effects to known SOCC occurrences and potentially undocumented occurrences.

Change in wetland functions was assessed by evaluating the change in wetland area during construction, operation and decommissioning/closure and comparing this to existing conditions. Effect of ground water drawdown on wetland functions was assessed by evaluating the potential area of direct and indirect effects (LAA) on wetland type. Wetland functions for each wetland type were considered in this assessment.

11.4.2 Change in Landscape Diversity

11.4.2.1 Project Pathways

The construction phase at the Gordon and MacLellan sites will result in fragmentation of native plant community patches as a result of vegetation clearing for site preparation, water development and control as well as through emissions, discharges, and wastes.

11.4.2.2 Mitigation

Effects to fragmentation will be mitigated at both the Gordon and MacLellan sites during construction and operation through restriction of construction activity to the approved PDA. Native areas disturbed by the Project will be reseeded using a native upland seed mix; however, the tailings management facility will be partially capped and seeded with a reclamation seed mix (Appendix 23B). Approximately 75% of the tailings management facility will be capped, which will be subject to confirmation of capping material availability during detailed design.

The implementation of these mitigation measures will be the responsibility of Alamos and or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans, conceptual closure plans, and contract documents.

The mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

11.4.2.3 Project Residual Effects

The landscape of the RAA is relatively anthropogenically undisturbed. At baseline, there are 23 habitat patches, 4 of which are large patches with an average area of 41,865 ha and an average perimeter of 152 km (Table 11-5). Patches 1-4, which are the largest habitat patches in the RAA, are divided from each by existing roadways within the RAA. Small habitat patches (Patches 5-22) are located within areas of existing development mainly around the Town of Lynn Lake, Gordon and MacLellan sites (Map 11-2a). Patch 1 covers most of the north portion of the RAA and is composed mainly of conifer (38%), bog (24%), and water (17%) land cover classes (Appendix 11B).

Wildfires have occurred within the RAA and are a natural disturbance on the landscape that result in a mosaic of various successional stages within habitat patches. Wildfire disturbances since 1990 are displayed on Volume 4, Appendix L, Map 6. Forest fires release nutrients back into the landscape and fire adapted species, such as jack pine (*Pinus banksiana*) that have serotinous cones, fire facilitates cone opening and seed dispersion (Scott 1996). Depending on severity of the fire and timing, reclamation efforts may be setback.

Fragmentation of the landscape occurs through anthropogenic vegetation clearing. When vegetation is cleared, edge effects to the remaining portion of the patch occur through changes to microclimate (i.e., light intensity, evaporation). These changes to the microclimate influence species composition and density, resulting in changes to plant community composition along the edge and for a distance into the remaining patch (Bramble and Byrnes 1983; Luken et al. 1992; Wagner et al 2014).

Gordon Site

Habitat Patches 18-21 are located within existing development at the Gordon site. Patch 18 (55% mixedwood), 20 (71% conifer), 22 (100% conifer) are all upland habitat patches (Appendix 11B and Map 11-2a). Patch 19 (58% fen, 17% swamp and 14% bog) and 21 (99% conifer and 1% bog) are a mix of upland and wetland land covers.

Construction at the Gordon site, in conjunction with the MacLellan site are anticipated to affect the largest patch north of PR 391 (Patch 1). Patch 1 will be reduced in size by 645.7 ha (<1%), and the perimeter will be reduced by 18.6 km (6%; Table 11-5). Construction of the Gordon site will result in an expansion of the existing developed area, and no new habitat patches are anticipated to be created in or around this site (Map 11-2b). During construction and operation of the Gordon site, Patches 18, 19 and 20 will be lost (Map 11-2b and Appendix 11B). At decommissioning/closure, the reclamation of the Gordon site will result in increased area of Patch 1 (see decommissioning/closure section below for the MacLellan site for more information). During construction, there will be a temporary adverse reduction in habitat patch area. However, at closure, since there is no loss of large intact patches from the LAA and reclamation of the Project will result in an increase in patch area and a reduction in patch perimeter, this will result in a low magnitude, positive change to landscape diversity in the RAA for the long-term.

MacLellan Site

Habitat patches 5-11 are located within existing development at the MacLellan site (Map 11-2a). All of which are a mix of upland and wetland land covers except Patch 10, which is 100% conifer and Patch 11 which is 60% bog and 40% swamp (Appendix 11A). Patch 5 is mostly conifer (46%) and bog (23%). Patch 6 is mostly swamp (42%) followed by fen (30%) and bog (23%). Patch 7 is 89% conifer and 11% fen. Patch 8 is 62% bog, and 38% conifer. Patch 9 is 59% bog, 41% conifer and <1% swamp.

Patches 5, 6, 8,10 will be totally lost during construction and operation at the MacLellan site, and Patch 7 will have 62% of the patch removed (Table 11-6). During construction and operation, a portion of Patch 1 will be retained, which has been called Patch 23. At decommissioning/closure, Patch 1 will increase in size from existing conditions by 508.6 ha (<1%) due to reclamation of the Gordon and MacLellan sites. The remaining area of Patch 7, Patch 11 and Patch 23 will have been engulfed by Patch 1 at closure (Map 11-2c and Appendix 11B). The perimeter of Patch 1 will decrease by 13.4 km (4%).

Increasing the number of patches and patch perimeter and reducing the size of patches increases edge effects to vegetation and wetlands during construction and operation. Edge effects occur as a result of vegetation clearing. Clearing of vegetation results in changes to microclimate (i.e., light intensity, evaporation), which influence species composition and density (Bramble and Byrnes 1983; Luken et al. 1992; Wagner et al 2014). The effects of vegetation clearing are further discussed in Section 11.4.3, and the effects of the number of patches, patch size and perimeter on wildlife habitat are discussed in Chapter 12.

Decommissioning/closure of the Gordon and MacLellan sites will result in an increase in the size of habitat Patch 1 because areas that are currently classified as developed within the Gordon and MacLellan sites at existing conditions will mostly be reclaimed to native upland or reclaimed upland plant communities. Reclaiming these areas and the resultant increase in contiguous plant communities within Patch 1 and a reduction in patch perimeter will result in reduction of edge effects to vegetation and facilitation of species dispersal across reclaimed areas. This will result in a low magnitude, positive change to landscape diversity in the RAA for the long-term.

Table 11-6 Habitat Patch Area and Perimeter at Existing Conditions, Construction/Operation and Decommissioning/Closure

Patch	Habitat Patch Area (ha)			Habitat Patch Perimeter (km)			Change in Patch Area from Existing Conditions				Change in Patch Perimeter from Existing Conditions			
	Existing Conditions	Construction & Operation	Closure	Existing Conditions	Construction & Operation	Closure	Construction & Operation		Closure		Construction & Operation		Closure	
							ha	%	ha	%	km	%	km	%
1	105,307.0	104,678.5	105,815.7	323.7	304.4	310.2	-628.6	-0.6	508.6	0.5	-19.2	-5.9	-13.4	-4.1
2	7,354.2	7,354.2	7,354.2	49.5	49.5	49.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	2,340.8	2,340.8	2,340.8	49.4	49.4	49.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	52,456.8	52,456.8	52,456.8	183.5	183.5	183.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	3.5	0.0	0.0	1.3	0.0	0.0	-3.5	-100.0	-3.5	-100.0	-1.3	-100.0	-1.3	-100.0
6	6.9	0.0	0.0	1.7	0.0	0.0	-6.9	-100.0	-6.9	-100.0	-1.7	-100.0	-1.7	-100.0
7	0.2	0.1	0.0	0.2	0.1	0.0	-0.1	-62.1	-0.2	-100.0	-0.1	-44.2	-0.2	-100.0
8	0.2	0.0	0.0	0.4	0.0	0.0	-0.2	-100.0	-0.2	-100.0	-0.4	-100.0	-0.4	-100.0
9	0.8	0.8	0.8	0.4	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.2	0.0	0.0	0.2	0.0	0.0	-0.2	-100.0	-0.2	-100.0	-0.2	-100.0	-0.2	-100.0
11	0.7	0.7	0.0	0.7	0.6	0.0	0.0	-2.6	-0.7	-100.0	-0.1	-13.9	-0.7	-100.0
12	6.4	6.4	6.4	2.2	2.2	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	10.7	10.7	10.7	2.6	2.6	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	20.6	20.6	20.6	2.6	2.6	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	2.9	2.9	2.9	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	7.2	7.2	7.2	1.3	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	3.8	3.7	3.7	0.9	0.9	0.9	-0.1	-2.5	-0.1	-2.5	0.0	-0.3	0.0	-0.3
18	0.2	0.0	0.0	0.2	0.0	0.0	-0.2	-100.0	-0.2	-100.0	-0.2	-100.0	-0.2	-100.0
19	1.0	0.0	0.0	0.7	0.0	0.0	-1.0	-100.0	-1.0	-100.0	-0.7	-100.0	-0.7	-100.0
20	1.0	0.0	0.0	0.5	0.0	0.0	-1.0	-100.0	-1.0	-100.0	-0.5	-100.0	-0.5	-100.0
21	0.1	0.1	0.1	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 11-6 Habitat Patch Area and Perimeter at Existing Conditions, Construction/Operation and Decommissioning/Closure

Patch	Habitat Patch Area (ha)			Habitat Patch Perimeter (km)			Change in Patch Area from Existing Conditions				Change in Patch Perimeter from Existing Conditions			
	Existing Conditions	Construction & Operation	Closure	Existing Conditions	Construction & Operation	Closure	Construction & Operation		Closure		Construction & Operation		Closure	
							ha	%	ha	%	km	%	km	%
22	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.1	0.0	0.0	N/A	0.0	N/A	0.1	N/A	0.0	N/A

Note:
N/A Indicates that this patch was created at decommissioning/closure and percent change from existing conditions cannot be calculated.

11.4.3 Change in Community Diversity

11.4.3.1 Project Pathways

Vegetation clearing during construction at both the Gordon and MacLellan sites will result in portions of native plant communities being lost or altered. During operation, dust from road use, drilling, blasting and rock removal from open pit mines will likely result in increased dust deposition on surrounding native plant communities. Dust deposition on plants may affect native plant communities at both Gordon and MacLellan sites. Both construction and operation may indirectly alter the native plant communities as a result of introduction and/or establishment of invasive species.

11.4.3.2 Mitigation

Mitigation measures proposed are generally considered to be industry standards and are effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Effects to vegetation and wetland plant communities will be mitigated at both the Gordon and MacLellan sites during construction and operation through mitigation measures described below:

- Equipment will arrive at Project site clean and free of soil and vegetative debris. Equipment will be inspected and if deemed to be in appropriate condition, will be approved for use and identified with a suitable marker or tag. Equipment that does not arrive at the Project site in appropriate condition will not be allowed on the construction footprint until it has been cleaned, re-inspected, and deemed suitable for use.
- Sensitive areas, such as wetlands, will be buffered by 30 m and clearly marked prior to clearing.
- Silt fencing will be installed and maintained to reduce deleterious substances from entering adjacent to wetlands or waterbodies (Chapter 23, Section 23.5.13).
- Vegetation clearing will occur during dry and frozen conditions, when possible.
- A protective layer such as matting or biodegradable geotextile and clay ramps or other approved materials will be used between wetland root/seed bed and construction equipment if ground conditions are encountered that create potential for rutting, admixing or compaction.

- A native seed mix will be used to assist in reducing invasive plant species spread and establishment as well as for erosion control on exposed soils.
- Topsoil and subsoil piles will be monitored for invasive plant species growth during construction and corrective measures (e.g., spraying, mowing, hand-pulling) will be implemented to avoid growth and establishment.
- Certified No.1 seed will be used to reseed areas, unless Certified No. 1 seed is not available for selected reclamation species (i.e., native species).
- Unless a certificate of weed analysis can be provided, construction material sources used for supplies of sand, gravel, rock, straw, and mulch will be visually inspected to determine whether they are free of invasive species propagules to the extent possible. If sources are suspected as having invasive species propagules, they should be sampled, and lab analyzed to determine whether they meet the requirements of the responsible regulatory agency prior to obtaining or transporting material to the Project site. If sampling cannot be completed, post construction monitoring for invasive species will be completed.
- If pesticide is required, a pesticide use permit will be obtained under *The Environment Act* (Manitoba).
- Native areas disturbed by the Project will be reseeded using a native upland seed mix; however, the tailings management facility will be partially capped and seeded with a reclamation seed mix (Appendix 23B). Approximately 75% of the tailings management facility will be capped, which will be subject to confirmation of capping material availability during detailed design.
- Dust suppression, as described in Chapter 6, will be applied.

The implementation of these mitigation measures will be the responsibility of Alamos and or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans, conceptual closure plans, and contract documents.

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

11.4.3.3 Project Residual Effects

Gordon Site

Construction and operation at the Gordon site is anticipated to cover 269.4 ha of the LAA, and would directly affect mostly shrubby fen (41.6 ha, 11% of LAA), mixedwood dense (40.0 ha, 15% of LAA), conifer sparse (28.4 ha, 8% of LAA), conifer dense (22.2 ha, 2% of LAA) and open conifer (20.4 ha, 4% of LAA; Appendix 11C-1). These plant communities are common and distributed throughout the Gordon LAA (Map 11-3a), and less than 50% of each will be affected by the Project. Of the plant communities that are relatively uncommon in the LAA (having less than two percent cover in the LAA), shrubby swamp (1.0% of LAA), treed fen (0.7% of LAA), marsh (0.2% of LAA) and patterned fen (<0.1% of LAA), marsh and patterned fen will not be directly affected by development of the Gordon site. However, 4% (1.8 ha) of shrubby swamp and 2% (0.5 ha) of treed fen will be directly affected by development of the Gordon site (Appendix 11C-1).

Dust created during construction and operation at the Gordon site will deposit on adjacent vegetation, which can affect plant community composition (Farmer 1991). Plants absorb gaseous substances through stomates when photosynthesizing. They also absorb particulate matter that is deposited on leaf surfaces or is deposited on the ground and is mobilized by the addition of water and is absorbed by the root system (Hosker and Lindberg 1982). Sometimes these substances are essential for metabolic processes; other times, these substances can be toxic or can detoxify contaminants. Depending on the substance, concentration and exposure duration and frequency, chronic exposure at sublethal levels may reduce plant productivity, reduce plant defenses to disease and insects, and may result in changes to plant community structure or loss of sensitive plant species (Hosker and Lindberg 1982). Generally, more exposure and deposition occurs at forest edges. Deposition of evergreen species would occur year-round, where deciduous species, or species covered by snow will likely have relatively lower exposure levels (Hosker and Lindberg 1982). In a study using *Potentilla anserine* (silverweed), plants were exposed to two concentrations of copper (200 µg/g and 500 µg/g) and nickel (100 µg/g and 250 µg/g), which was added to the soil in a water solution. Plant flower and ramet production were measured. It was observed that at the highest concentration of copper and nickel, 43% of plants did not produce any flowers or ramets, and only 50% produced at least one flower during the growing season. At the lower concentration of copper and nickel exposure 87% of plants produced at least one flower in the growing season compared to the control (Saikkonen et al. 1998). It was also found that exposure to copper and nickel resulted in reduced plant productivity. Dust deposition has been shown to also inhibit germination (Anderson 1914) and increase fungal growth and insect infestation (Taylor et al. 1986). These changes in reproduction, germination and growth could alter community composition. The maximum average annual copper deposition (includes wet and dry deposition) is expected to be 1.32×10^2 g/m^2/year (equal to 132 µg/g/year) and the maximum average annual nickel deposition (includes wet and dry deposition) is predicted to be 2.79×10^2 g/m^2/year (equal to 279 µg/g/year; Chapter 6, Section 6.4.1).

Rain events will wash some of the dust off the leaves, but it has been found that wet vegetation has greater deposition levels than dry vegetation (Chamberlain 1967). Changes to plant community composition may occur due to reduced flower production, and therefore, seed and berry production, and plant productivity as result of predicted annual dust deposition. Although a change in plant community composition is anticipated, it is unknown how different plants will respond to dust deposition, including different vascular plant species and non-vascular species.

During decommissioning/closure of the Gordon site, areas disturbed by the Project will be reclaimed. Areas of Project disturbance, other than the open pit and the existing access road, will be reclaimed to native plant communities. The open pit will be allowed to fill naturally over ten years and is intended to be reclaimed to water. The mine rock storage area at the Gordon site will be capped with borrow material and seeded with an upland native plant community mix dominated by native trees and grasses. The existing access road into the Gordon site will remain in place and will not be reclaimed (Map 11-4a). All areas of upland and wetland areas disturbed by the Project will be reclaimed to native upland (Map 11-4a). Topsoil will be left rough and loose to facilitate seed and moisture capture and retention (Mougeot 1996). Reclamation will target the establishment of structural layers of pre-disturbance communities. Plant composition and specific species abundance will likely differ from existing conditions; however, reclaimed communities will be dominated by native plant species. Based on past evidence of reclamation in the Yukon, successful revegetation was achieved within 10 years post-reclamation (Mougeot 1996). Loss of entire plant communities from the LAA is not expected.

Noxious weeds such as common dandelion (*Taraxacum officinale*) and quack-grass (*Elymus repens*; Government of Manitoba 2017) were recorded in the LAA during baseline field surveys. On the existing reclaimed storage/stockpile areas at the Gordon site, common dandelion occupied 5% cover and quack-grass occupied 10% cover in a 20 m x 20 m survey plot. Common dandelion was also seen in the existing pits at the Gordon site in trace amounts. Regulated weed species colonize disturbed sites and forest edges due to the increase in bare ground and light, which can change species composition and diversity of plant communities (University of Manitoba 2018). Prevention of regulated weed spread, and establishment will be achieved through mitigation such as monitoring stockpiles and controlling exiting populations, using certified clean seed, keeping equipment free of soil and debris and revegetation of disturbed land with native vegetation (Polster 2003). Common dandelion may be controlled through mechanical removal, or through pesticide application. Populations of common dandelion have also been controlled by competition with aggressive grass species (Stewart-Wade et al. 2002). Similarly, quack-grass may be controlled by mowing or though competition with a clover-grass cover crop (Ringselle et al. 2015). With application of mitigation measures control of existing regulated weed populations and prevention of establishment the effect of regulated weeds on community diversity will be low.

No rare ecological communities were identified within the LAA during field surveys, nor were any identified from a search of the MB CDC (MB CDC 2019). There is little data or literature on the location and environmental requirements of plant communities of conservation concern in the Churchill River Upland Ecoregion; therefore, effects to plant community of conservation concern are uncertain.

With mitigation and reclamation, the Project will result in an increase in 156.7 ha of reclaimed native upland, which replaces 119.4 ha of lost native upland plant communities in the LAA. Over the life of the Project there will be an increase in 15.5 ha of water and a decrease of 66.5 ha of wetland plant communities in the LAA (Appendix 11C-1). This change in plant community diversity will occur once during construction and operation at the Gordon site; however, indirect effects to plant communities from dust deposition will occur continuously. The irreversible loss of wetland plant communities is predicted because disturbed areas will be reclaimed to upland (Map 11-4a). It is expected that revegetation of disturbed areas will be self-sufficient ten years after completion of reclamation as per Best Management Practice 14 (Mining Association of Manitoba Inc. 2015) based on past evidence of reclamation in the Yukon (Mougeot 1996). If it is determined that revegetation is not self-sufficient, additional revegetation effort may be required.

Since no loss of any one native upland or wetland plant community is anticipated, effects to community diversity are expected to be adverse, occur during construction and last ten years post-closure, be low in magnitude, restricted to a single event in the PDA and long-term in duration and irreversible.

MacLellan Site

Construction and operation at the MacLellan site are anticipated to cover 937.9 ha and would mostly directly affect conifer dense (220.3 ha, 32% of LAA), treed bog (199.5 ha, 26% of LAA), conifer open (169.8 ha, 36% of LAA) landcover types (Appendix 11C-2). These landcover types are common and distributed throughout the MacLellan site LAA (Map 11-3b), and less than 50% of each will be affected by the Project. Of the plant communities that are relatively uncommon in the MacLellan LAA (having less than 2% cover in the LAA), treed fen (1.7% of LAA), shrubby swamp (1.0% of LAA), graminoid fen (0.9% of LAA), shrubland (0.8% of LAA) and patterned fen (0.5% of LAA), less than 50% of the area these plant communities at existing conditions in the LAA will be disturbed by development of the MacLellan site (Appendix 11C-2).

During decommissioning/closure of the MacLellan site, areas disturbed by the Project will be reclaimed thirteen years post-construction. Areas of Project disturbance, other than the open pit, tailings management facility and the existing access road, will be reclaimed to native plant cover. The open pit will be allowed to fill naturally over 50 years and is predicted to be reclaimed to water; the tailings management facility at the MacLellan site will be partially capped (approximately 75%), with borrow material and seeded to promote an upland plant community dominated by reclamation species (reclaimed upland). The existing access road into the MacLellan site will remain in place, and not be reclaimed (Map 11-4b). Upland and wetland areas that were disturbed by the Project will be reclaimed to reclaimed native upland (Map 11-4b). As with the Gordon site, reclamation at the MacLellan site will target the establishment of structural layers of pre-disturbance communities. Plant composition, specific species and species abundance will likely differ from existing conditions; however, reclaimed communities will be dominated by native plant species. Reclamation to native plant communities will be accomplished by removing Project infrastructure, recontouring so that the disturbed area drains into the open pit, replacing stockpiled topsoil, scarifying to make the surface rough and loose, and seeding with native upland species. The mine rock storage area also will be capped and seeded with a native seed mix. Loss of entire plant communities from the MacLellan site LAA is not expected.

No occurrences of species listed as noxious weeds in Manitoba were observed at the MacLellan site during field surveys. Regulated weed species colonize disturbed sites and forest edges due to the increase in bare ground and light, which can change species composition and diversity of plant communities (University of Manitoba 2018). Prevention of regulated weed spread, and establishment will be achieved through mitigation such as monitoring stockpiles and controlling exiting populations, using certified clean seed, keeping equipment free of soil and debris and revegetation of disturbed land with native vegetation (Polster 2003). With application of mitigation measures to prevent establishment of regulated weeds, the effect of regulated weeds on community diversity is predicted/anticipated to be low.

No rare ecological communities were identified within the LAA during field surveys, nor were any identified from a search of the MB CDC (MB CDC 2019). There is little data or literature on the location and environmental requirements of plant communities of conservation concern in the Churchill River Upland Ecoregion; therefore, effects to plant community of conservation concern are uncertain.

With mitigation and reclamation, the Project will result in an increase in 607.2 ha of reclaimed native upland and 236.9 ha of reclaimed upland, which replaces a portion of the 490.4 ha of lost native upland plant communities in the LAA. The Project will also result in the loss of 370.9 ha of wetland plant communities, and an addition of 576.3 ha of reclaimed upland and 61.8 ha of water in the LAA (Appendix 11C-2). This change in plant community diversity will occur once during construction and operation at the MacLellan site; however, indirect effects to plant communities from dust deposition will occur continuously. The irreversible loss of native upland and wetland plant communities is predicted because it is assumed that the tailings management area will be reclaimed upland at closure, which will not be considered a native plant community, and the LAA surrounding the existing access road into the MacLellan site may be developed during construction and operation (Map 11-4b). It is expected that revegetation of disturbed areas will be self-sufficient ten years after completion of reclamation as per Best Management Practice 14 (Mining Association of Manitoba Inc. 2015). If it is determined that revegetation is not self-sufficient, additional revegetation effort may be required. Adverse effects to community diversity are expected to occur during construction and last through operation, be low in magnitude, restricted to a single event in the PDA, long-term in duration and irreversible.

11.4.4 Change in Species Diversity

11.4.4.1 Project Pathways

Vegetation clearing during construction at both the Gordon and MacLellan sites will result in direct loss of one SOCC and occurrences of traditional use species from site preparation. Indirect effects to SOCC and species of traditional use may also occur from dust deposition and from the introduction and spread of regulated weed species or herbicide application to control the spread of regulated weed species.

11.4.4.2 Mitigation

Mitigation measures proposed are generally considered to be industry standards and are effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Effects to species diversity will be mitigated at both the Gordon and MacLellan sites during construction and operation through:

- Avoiding known occurrences of SOCC.
- If avoidance of plant SOCC is not possible, seed collection or transplant of the plant should be considered.
- Not broad-spraying herbicide within 30 m of plant species or ecological communities of conservation concern, wetlands, or waterbodies. Spot spraying, wicking, mowing, or hand picking are acceptable measures for control of regulated weeds in these areas.
- Dust suppression, as described in Chapter 6 will be applied.

The implementation of these mitigation measures will be the responsibility of Alamos and or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans, conceptual closure plans, and contract documents.

11.4.4.3 Project Residual Effect

Gordon Site

Construction at the Gordon site is anticipated to directly affect one known plant SOCC occurrence, boreal locoweed (O*xytropis borealis*), which was observed on a reclaimed mine rock stockpile. No other occurrences of boreal locoweed are known within the RAA. Boreal locoweed is listed as an S1S2 species (very rare to rare throughout its range, and maybe known from 5-20 occurrences). Since this species cannot be avoided, seed collection will be completed and spread in an appropriate habitat within the RAA, outside of the LAA. Seed collection is considered experimental and may not be successful.

There were no other occurrences of plant SOCC within the PDA. One occurrence of shrubby willow (*Salix arbusculoides*), ranked S2S3 (maybe known from 6 to 20 or 21 to 100 occurrences, and may be rare or uncommon throughout its range, MB CDC 2018), was observed 200 m north of the Gordon site PDA (Map 11-3a). This occurrence may be indirectly affected by open pit dewatering during construction and operation. Dewatering is needed to empty the open pit during construction for mine operation and is expected to lower water levels by 1 m within 800 m of the open pit (Chapter 8, Section 8.4.2.3). Shrubby willow was observed in a fen community and requires subgygric to subhydric soil moisture conditions for seed production and germination (Flora of North America 2020). Drier conditions during construction/operation and post-closure due to ground water drawdown will likely lead to the loss of this occurrence. Indirect effects of dewatering may last approximately 10 years post-reclamation due to natural refilling of the open pit (Chapter 8, Section 8.1.4.2). A second occurrence of shrubby willow was observed approximately 9 km east of the Gordon site, south of PR 391, and is unlikely to be affected by the Project.

One occurrence of quillwort (*Isoetes lacustris*), ranked S2 (known from 6 to 20 occurrences and is considered rare throughout its range) was observed approximately 5 km to the west of the Gordon site PDA (Map 11-3c). Dust deposition is expected to be nil at this location (Volume 5, Appendix A, Map 24), and is also unlikely to be affected by the Project. Effects to undocumented SOCCs are unknown. Undocumented SOCCs occurrences are a result of a species not being observed during field surveys because for many species, the number of plants fluctuate in response to climatic conditions (e.g., annuals may not germinate in dry years) and occur in low numbers.

Dust deposition and the chemicals contained within the dust have been shown to affect plant productivity (Section 11.4.3.3). Depending on the substance, concentration and exposure duration and frequency, chronic exposure at sublethal levels may reduce plant productivity, reduce plant defenses to disease and insects, and may result in loss of sensitive plant species (Hosker and Lindberg 1982). Sensitive plant species may be SOCC or species traditionally used by Indigenous communities. There may also be perceived loss of traditional plant use species due to dust deposition; plants and berries covered in dust may be avoided by Indigenous communities due to the potential for human health risks from inhalation of dust while picking vegetation or from ingestion of dust on vegetation (Chapter 18, Section 18.4.2.3).

Dewatering will also affect the distribution and abundance of plants of interest to Indigenous communities. Plants listed in Table 11-6 that are found in wetlands (i.e., cloudberry, willows, alder, black spruce, pond lily and mosses) will be especially vulnerable to groundwater drawdown. Plants of interest to Indigenous communities that are located near the PDA or along PR 391, where increased dust deposition is anticipated, may also be considered lost during construction and operation at Gordon. Dust deposition at the Gordon site is expected to be highest approximately within 700 m east of the Project Boundary (Volume 5, Appendix A, Map 24).

Although most species identified by Indigenous communities are common to Manitoba, a few were infrequently observed during field surveys, such as dwarf birch, mooseberry, red raspberry and smooth wild strawberry (Table 11-4). Though common in Manitoba, these upland species require medium to high nutrient regime (carbon to nitrogen ratio; United States Department of Agriculture 2020a, b and c, Zoladeski et al. 1995), which are not generally present in most of the upland plant communities in the LAA and RAA. Most of the plant communities, with the exception of the mixedwood plant communities, have medium to low nutrient regimes (Zoladeski et al. 1995). There are also a few species of willow and moss that were infrequently observed during field surveys (Table 11-4), but because specific species of willow or moss were not identified by Indigenous communities, it is likely that the uncommonness of some of these species of willow or moss will not have an impact on the potential use of these genera of species. There are similar proportions of each plant community within the LAA compared with the RAA (within ±7%, Table 11-3); therefore, it is likely the species are present in similar abundance. Much of the effect to upland species diversity will occur due to vegetation clearing within the PDA, and effects to wetland species diversity may occur within the LAA, which may result in a change in spatial distribution of traditional use species within the LAA.

Development of the Gordon site will adversely affect known plant SOCCs and species of traditional use during construction and operation, but with mitigation and reclamation, these effects will be moderate to high in magnitude. The uncertainty in magnitude is attributed to the lack of information on SOCC and traditional use species abundance in the RAA. Effects will be continuous, restricted to the LAA and be long-term. These affects may be reversible for shrubby willow if there are propagules available for reestablishment of these species 10 years post reclamation because this species produces a high abundance of seed (United States Department of Agriculture 2020d) and the variety of habitats the species can grow in (Flora of North America 2020). However, seed production information on boreal locoweed is unavailable; therefore, it is assumed that the loss of this occurrence is irreversible.

MacLellan Site

Construction and operation at the MacLellan site are not anticipated to affect known plant SOCC occurrences because there were no observations of plant SOCC within the PDA during field surveys (Map 11-3b). Three SOCC occurrences were however observed near the PDA, two shrubby willow occurrences and one occurrence of northern woodsia. One occurrence of shrubby willow was observed 20 m east of the MacLellan PDA, and another occurrence was observed 140 m southeast of the MacLellan PDA. Dewatering is needed to empty the open pit during construction for mine operation and is expected to lower water levels by 1 m within 1,200 m of the open pit (Chapter 8, Section 8.4.2.3) Therefore, both of these occurrences may be indirectly affected by drawdown from dewatering of the open pit, and will likely last through post-closure until the open pit fills (Chapter 8, Section 8.1.4.2). The northern woodsia, ranked S2 (MB CDC 2018), was observed 170 m west of the MacLellan PDA and although located in upland area, it may still be indirectly affected by drawdown.

According to the MB CDC, small water-lily has been found historically approximately 12 km southwest of the Gordon PDA, south of PR 391 (MB CDC 2019). Small water-lily is ranked S2? (known from 6-20 occurrences and is considered rare throughout its range, but there is uncertainty in this species rank; MB CDC 2018). It can be found in ponds, lakes, and slow-flowing streams (Flora of North America 2017); habitat for this species is available within both the Gordon and MacLellan site LAAs. This species is unlikely to be affected by the Project. Effects to undocumented SOCCs are unknown. Undocumented SOCCs occurrences are a result of a species not being observed during field surveys because for many species, the number of plants fluctuate in response to climatic conditions (e.g., annuals may not germinate in dry years) and occur in low numbers.

Similar to the discussion of effects to traditionally used species at the Gordon sites due to dewatering, there is potential for indirect adverse effects to plants of interest to Indigenous communities at the MacLellan site. There are similar proportions of each plant community within the LAA compared with the RAA (within ±7%, Table 11-3); therefore, it is likely that the abundance of microsites that support these species would be relatively similar in the RAA compared with the LAA. Much of the effect to upland species diversity will occur due to vegetation clearing within the PDA, and effects to wetland species diversity may occur within the LAA, which may result in a change in spatial distribution of traditional use species within the LAA.

Development of the MacLellan site will indirectly adversely affect plant SOCCs and traditional use species during construction and operation; however, with mitigation and reclamation, these effects will be moderate to high in magnitude. The uncertainty in magnitude is attributed to the lack of information on species abundance in the RAA. The effect will be continuous in the LAA and be long-term. These effects may be reversible if there are propagules available for reestablishment of these species post-closure. These effects may be reversible for shrubby willow if there are propagules available for reestablishment of these species because this species produces a high abundance of seed (United States Department of Agriculture 2020) and the variety of habitats the species can grow in (Flora of North America 2020). However, seed production information on northern woodsia is unavailable; therefore, it is assumed that the loss of this occurrence is irreversible.

11.4.5 Change in Wetland Functions

11.4.5.1 Project Pathways

Vegetation clearing during construction at both the Gordon and MacLellan sites will result in direct loss of wetland area. Direct and indirect affects to wetlands may also occur as a result of changes to surface or groundwater flow patterns during construction and operation of the Project, as well as from natural infill of open pits post reclamation.

Effects to wetlands in the LAA can be quantified by a change in wetland abundance, altered water inputs and exports, ground water drawdown, which will affect nutrient cycling, decomposition, carbon sequestration, water filtration and storage. Changes may also affect wildlife habitat and traditional plant use.

11.4.5.2 Mitigation

Mitigation measures proposed are generally considered to be industry standards and are effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Effects to species diversity will be mitigated at both the Gordon and MacLellan sites during construction and operation through the following mitigation measures.

- Using sediment fencing and/or other appropriate measures to prevent erosion and siltation into adjacent wetlands (Chapter 23, Section 23.5.13)
- Identifying wetland boundaries for wetlands adjacent to the PDA, and establishment of a 30 m buffer.
- Directing grading away from wetlands, where practicable.

- Reducing the removal of vegetation in wetlands to the extent practicable.
- Conducting ground level cutting/mowing/mulching of wetland vegetation instead of grubbing, where practicable.
- Reducing grading within wetland boundaries unless required for site specific purposes.
- Using protective layers such as matting or biodegradable geotextile and clay ramps or other approved materials between wetland root/seed bed and construction equipment if ground conditions are encountered that create potential for rutting, admixing or compaction.
- Maintaining cross drainage to allow water to move freely from one side of the road to the other in areas of permanent or temporary access roads.
- Using frost packing, snow, ice, geotextile swamp mats or access mats for access through wet areas.

Compensation for wetland loss will not be completed under the Federal Policy on Wetland Conservation because this Project is not located in an area of high historical wetland loss or located on federal lands.

The implementation of these mitigation measures will be the responsibility of Alamos and or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans, conceptual closure plans, and contract documents.

11.4.6 Project Residual Effects

Gordon Site

During construction at the Gordon site, a total of 66.5 ha of wetland function and services (nutrient cycling, decomposition, carbon sequestration, water filtration and storage and habitat) will be directly lost. Construction at the Gordon site will result in the direct loss of shrubby fen (41.6 ha, 11% of LAA), shrubby bog (10.7 ha, 5% of LAA), treed swamp (2.3 ha, 1% of LAA), treed bog (7.9 ha, 2% of LAA), shrubby swamp (1.8 ha, 4% of LAA) and treed fen (0.5 ha, 2% of LAA; Table 11-7). The loss of wetland functions (water storage and filtration) of the above wetland area is considered irreversible because this area will be reclaimed to native upland.

Construction and operation at the Gordon site will require dewatering of the open pit and will result in groundwater drawdown of at least 1 m within 800 m of the open pit. Groundwater drawdown during construction and operation may alter the class, plant species composition and decomposition rates of 412.0 ha of fen (10% of LAA), 10.2 ha of marsh (0.1% of LAA) and 237.8 ha of swamp wetland area (6% of LAA; Table 11-7). Fens are affected by ground and surface mineral soil waters. Water levels in fens are at or near the peat surface and can be relatively rich in mineral elements (Halsey et al. 1997). Swamps and marshes have fluctuating water tables and may be connected to ground water tables (Halsey et al. 1997). However, bog wetlands are not anticipated to be indirectly affected by groundwater drawdown because bogs typically receive water only from precipitation and have low water flow (Halsey et al. 1997). They develop in areas of restricted surface water flow along drainage divides, in stagnation zones of peatland complexes in the lee of surface water flow obstructions and in small, isolated basins. The water table is generally 40 to 60 cm below the peat surface (Halsey et al. 1997).

Currently in the LAA and RAA wetland functions are relatively undisturbed by anthropogenic development, because much of the RAA is undeveloped and composed of four large contiguous patches (Section 11.2.2.5). There are also areas of discontinuous permafrost with the LAA (Section 11.2.2.3), which may thaw as a result of dewatering. As water flow changes in the landscape, flow channels that are created may saturate areas of permafrost, which will result in thaw (Haynes et al. 2018). Dewatering and the thaw of permafrost in fen wetlands will result in decomposition of peat due to aeration, compaction and lowering of the peat profile due to decomposition (Haynes et al. 2018). With the thawing of permafrost and increased decomposition of peat, carbon sequestration is reduced.

Direct and indirect effects to wetlands functions will be reduced by the Project, but loss of any particular type of wetland function is not expected in the RAA. However, there will be moderate magnitude, long-term loss of 660.0 ha of wetland as a result of clearing for development of the Gordon site, as well as from dewatering of the open pit, and natural refilling of the open pit post reclamation. In addition, 10 years after reclamation, measurable changes to groundwater recharge/discharge, water storage sediment retention and carbon sequestration are not anticipated, and wetland function should begin to recover. Therefore, effects to wetland function are predicted to be continuous, moderate in magnitude, long-term in duration, restricted to the LAA, and reversible/irreversible.

MacLellan Site

During construction at the MacLellan site, a total of 370.9 ha of wetland will be directly lost. Construction at the MacLellan site will result in the direct loss of treed bog (199.5 ha, 26% of LAA), treed swamp (70.6 ha, 21% of LAA), shrubby bog (41.9, 20% of LAA) treed fen (15.0 ha, 24% of LAA), shrubby fen (21.6 ha, 19% of LAA), shrubby swamp (12.1 ha, 33% of LAA), patterned fen (5.1 ha, 32% of LAA) and graminoid fen (5.0 ha, 16% of LAA; Table 11-8). The loss of wetland functions (water storage and filtration) of the above wetland area is considered irreversible because this area will be reclaimed to native upland or reclaimed upland. Construction and operation at the MacLellan site will require dewatering of the open pit and will result in groundwater drawdown of at least 1 m within 1,200 m of the open pit. Groundwater drawdown during construction and operation may alter the class, plant species composition and decomposition rates of 114.4 ha of fen and 379.2 ha of swamp wetland area (Table 11-8). Similar effects of dewatering are expected at MacLellan, with the thawing of permafrost, increased decomposition of peat and decrease in carbon sequestration. Direct and indirect effects to wetlands functions will be reduced by the project; however, loss of a type of wetland function is not expected in the RAA.

Construction and operation at the MacLellan site are not expected to result in the permanent loss of wetland plant community cover type in the RAA, though there will be permanent loss of 370.9 ha of wetland area in the LAA. There is potential that 603.2 ha of wetland function indirectly lost by construction and operation of the MacLellan site. However, 50 years after reclamation, measurable changes to groundwater recharge/discharge, water storage, sediment retention and carbon sequestration are not anticipated, and wetland function should begin to recover. Therefore, effects to wetland functions are predicted to be continuous, moderate in magnitude, long-term in duration, restricted to the LAA, and reversible/ irreversible.

Table 11-7 Wetlands within Gordon LAA

Land Cover Type	Description	Existing Conditions	Construction & Operation	Closure	Change from Existing Conditions			
					Construction & Operation		Closure	
		Area (ha)	Area (ha)	Area (ha)	ha	%	ha	%
Bog Shrubby	Isolated from surface or groundwater influence with >40 cm peat accumulation, >25% shrub cover and tree cover that is ≤ 25%	194.6	183.9	183.9	-10.7	-5.5	-10.7	-5.5
Bog Treed	Isolated from surface or groundwater influence with >40 cm peat accumulation, >25% tree cover by coniferous species	435.8	427.9	427.9	-7.9	-1.8	-7.9	-1.8
Fen Pattern	Connected to surface or groundwater with a pattern of strings and flarks, with >6% tree cover	0.0	0.0	0.0	0.0	N/A	0.0	N/A
Fen Shrubby	Connected to surface or groundwater with >40 cm peat accumulation, >25% shrub and ≤ 25% tree cover	383.9	342.3	342.3	-41.6	-10.8	-41.6	-10.8
Fen Treed	Connected to surface or groundwater with >40 cm peat accumulation, >25% tree cover	28.1	27.6	27.6	-0.5	-1.7	-0.5	-1.7
Marsh	< 40 cm peat accumulation with < 25% shrub and tree cover	10.2	10.2	10.2	0.0	0.0	0.0	0.0
Swamp Shrubby	< 40 cm peat accumulation with >25% shrub cover and ≤ 25% tree cover	42.2	40.4	40.4	-1.8	-4.2	-1.8	-4.2
Swamp Treed	< 40 cm peat accumulation with >25% tree cover	195.6	193.3	193.3	-2.3	-1.2	-2.3	-1.2
Wetland Total		**1,290.4**	**1,225.6**	**1225.6**	**-64.7**	**-5.0**	**-64.7**	**-5.0**

Land Cover Type Source
Wetland classification from Alberta Environment and Sustainable Resource Development. 2015 and Halsey et al. 1997, National Wetland Working Group 1997.

Table 11-8 Wetlands within MacLellan LAA

Land Cover Type	Description	Existing Conditions	Construction & Operation	Closure	Change from Existing Conditions			
					Construction & Operation		Closure	
		Area (ha)	Area (ha)	Area (ha)	ha	%	ha	%
Bog Shrubby	Isolated from surface or groundwater influence with >40 cm peat accumulation, >25% shrub cover and tree cover that is ≤ 25%	207.7	165.8	165.8	-41.9	-20.2	-41.9	-20.2
Bog Treed	Isolated from surface or groundwater influence with >40 cm peat accumulation, >25% tree cover by coniferous species	773.9	574.4	574.4	-199.5	-25.8	-199.5	-25.8
Fen Graminoid	Connected to surface or groundwater with >40 cm peat accumulation, ≤ 25 % shrub and tree cover	32.2	27.2	27.2	-5.0	-15.5	-5.0	-15.5
Fen Pattern	Connected to surface or groundwater with a pattern of strings and flarks, with >6% tree cover	15.9	10.8	10.8	-5.1	-32.1	-5.1	-32.1
Fen Shrubby	Connected to surface or groundwater with >40 cm peat accumulation, >25% shrub and ≤ 25% tree cover	114.4	92.7	92.7	-21.6	-18.9	-21.6	-18.9
Fen Treed	Connected to surface or groundwater with >40 cm peat accumulation, >25% tree cover	61.6	46.5	46.5	-15.0	-24.4	-15.0	-24.4
Marsh	< 40 cm peat accumulation with < 25% shrub and tree cover	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Swamp Shrubby	< 40 cm peat accumulation with >25% shrub cover and ≤ 25% tree cover	36.8	24.8	24.8	-12.1	-32.7	-12.1	-32.7
Swamp Treed	< 40 cm peat accumulation with >25% tree cover	342.4	271.7	271.7	-70.6	-20.6	-70.6	-20.6
Wetland Total		**1,584.8**	**1,213.9**	**1,213.9**	**-370.9**	**-23.4**	**-370.9**	**-23.4**

Land Cover Type Source
Wetland classification from Alberta Environment and Sustainable Resource Development. 2015 and Halsey et al. 1997, National Wetland Working Group 1997.

11.4.7 Summary of Project Residual Environmental Effects on Vegetation and Wetlands

Table 11-9 summarizes the residual environmental effects on vegetation and wetlands during the construction, and operation, and decommissioning/closure phases of the Project. Timing is not applicable because areas of vegetation and wetlands that require clearing will be entire stripped during construction, and remain cleared until reclamation; therefore, seasonal aspects are unlikely to affect vegetation and wetlands.

Table 11-9 Project Residual Effects on Vegetation and Wetlands

Residual Effect	Residual Effects Characterization								
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context
Gordon and MacLellan Sites									
Change in Landscape Diversity	C, O, D	A/P	L	RAA	LT	N/A	S	R	D
Change in Community Diversity	C, O, D	A	L	PDA	LT	N/A	C	I	D
Change in Species Diversity	C, O, D	A	M-H	LAA	LT	N/A	C	I/R	U
Change in Wetland Functions	C, O, D	A	M	LAA	LT	N/A	C	I/R	U

KEY
See Table 11-2 for detailed definitions

Project Phase
C: Construction
O: Operation
D: Decommissioning

Direction:
P: Positive
A: Adverse

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term

N/A: Not applicable

Timing:
N/A: Not Applicable
A: Applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

11.5 ASSESSMENT OF CUMULATIVE ENVIRONMENTAL EFFECTS ON VEGETATION AND WETLANDS

The Project residual effects described in Section 11.4, are likely to interact cumulatively with residual environmental effects from other physical activities (past, present, and reasonably foreseeable).

The effects of past and current projects relative to conditions prior to historical mining activities contribute to baseline conditions upon which Project effects are assessed. Conditions prior to historical mining activities are generally considered to be similar to currently undisturbed areas of the RAA.

The resulting cumulative environmental effects (future scenario with the Project) are assessed in this section. Cumulative environmental effects (the future scenario without the Project) are also described. This is followed by an analysis of the Project contribution to cumulative effects. Future projects and activities that are reasonably foreseeable are defined as those that (a) have been publicly announced with a defined project execution period and with sufficient project details that allow for a meaningful assessment, (b) are currently undergoing an environmental assessment or (c) are in a permitting process.

The assessment of cumulative effects is initiated with a determination of whether two conditions exist:

- The Project has residual environmental effects on the VC, and
- The residual effects could act cumulatively with residual effects of other past, present, or reasonably foreseeable future physical activities.

If either is not met, the assessment of cumulative effects concludes with a statement that further assessment of cumulative effects is not warranted because the Project does not interact cumulatively with other projects or activities.

11.5.1 Project Residual Effects Likely to Interact Cumulatively

Chapter 4, Table 4D-1, Environmental Assessment Scope and Methods, presents the Project and physical activities inclusion list, which identifies other projects and physical activities that might act cumulatively with the Project. The RAA was chosen to give a regional context of plant communities and species diversity and is large enough to encompass species dispersal and large natural disturbances, such as fire. Cumulative effects of projects on the inclusion list within the RAA are assessed. Where residual environmental effects from the Project act cumulatively with residual effects from other projects and physical activities (Table 11-10), a cumulative effects assessment is undertaken to determine their significance.

Table 11-10 Interactions with the Potential to Contribute to Cumulative Effects

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Environmental Effects			
	Change in Landscape Diversity	Change in Community Diversity	Change in Species Diversity	Change in Wetland Functions
Past and Present Physical Activities and Resource Use				
Mineral Development				
• “A” Mine	–	–	–	–
• EL Mine	–	–	–	–
• Fox Mine	–	–	–	–
• Farley Mine	–	–	–	–
• Ruttan Mine	–	–	–	–
• MacLellan Mine (Historical)	–	–	–	–
• Burnt Timber Mine	–	–	–	–
• Farley Lake Mine	–	–	–	–
• Keystone Gold Mine	–	–	–	–
• East/West Tailings Management Areas	–	–	–	–
Mineral Exploration	✓	✓	✓	✓
Water and Waste Projects (sewage plants, waste disposal grounds)	–	–	✓	✓
Residential and Community Development (including cottage subdivisions)	✓	✓	✓	–
Infrastructure Development (transmission line, airport, highways, roads, rail)	–	–	–	–
Other Resource Activities (hunting, fishing, berry picking)	–	–	✓	–
Future Physical Activities				
Mineral Development	✓	✓	✓	✓
Mineral Exploration	✓	✓	✓	✓
Traditional Land Use	–	–	✓	–
Resource Use Activities	✓	✓	✓	✓
Recreation	–	✓	✓	✓

NOTES:

✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with Project residual environmental effects.

– = Interactions between the residual effects of other projects and residual effects of the Project are not expected.

For a detailed description and mapped locations of Projects and Physical Activities, where applicable, see Chapter 4, Table 4D-2 and Maps 4-3 and 4-4.

Environmental effects identified in Table 11-10 as not likely to interact cumulatively with residual effects of other projects and physical activities (no check mark) are not discussed further. The assessment of the cumulative environmental effects that are likely to result from the Project in combination with other projects and physical activities are discussed in the following sections. Due to the uncertainty of each project's development, mitigation and reclamation, the assessment of cumulative effects is qualitative.

11.5.2 Change in Landscape Diversity

11.5.2.1 Cumulative Effect Pathways

Landscape diversity within the LAA is relatively undisturbed and composed of mainly four large contiguous patches of vegetation and wetland communities with an average area of 41,865 ha and an average perimeter of 152 km. Expansion of ongoing projects and future projects may interact cumulatively with the Project as a result of vegetation clearing. Clearing of vegetation in addition to what is proposed by the Project may fragment habitat patches, reduce patch area, and increase patch perimeter. Effects are most likely to occur during mineral development and residential development in Lynn Lake and surrounding area due to vegetation clearing. Mineral exploration, mineral development, mining exploration and resource use activities would also affect landscape diversity through vegetation clearing.

11.5.2.2 Mitigation for Cumulative Effects

Project-specific mitigation presented in Section 11.4.2.3, such as restricting clearing to the PDA to reduce potential project effects on landscape diversity, will also reduce potential cumulative effects. It is expected that ongoing and future projects will be developed using standard mitigation measures as appropriate to reduce cumulative effects to landscape diversity.

11.5.2.3 Residual Cumulative Effects

Future mineral development and residential development in Lynn Lake and surrounding area will require vegetation clearing, which will reduce patch area and increase patch perimeter. Cumulative effects on landscape diversity are predicted to be low in magnitude because the landscape within the RAA is relatively intact. Although areas of habitat patches may be reduced and the perimeter may increase, it is unlikely that large habitat patches will be lost from the RAA. Residual cumulative effects will occur continuously following the construction of the future projects and may be reversible or irreversible depending on the type of project and whether it will be a permanent feature on the landscape.

11.5.3 Change in Community Diversity

11.5.3.1 Cumulative Effect Pathways

Almost half of the RAA is upland (80,589.5 ha, 46%), much of the other half is wetland (66,741.5 ha, 38%), with most of the remaining areas classified as water (27,480 ha, 15%). Only 1,568.3 ha (1%) of the RAA has been disturbed by anthropogenic development (Table 11-3). Expansion of ongoing projects and future projects may interact cumulatively with the Project as a result of clearing of vegetation and dust deposition on vegetation. Clearing of vegetation and dust creation as a result of mineral and residential development, travel along gravel roads, in addition to what is proposed by the Project, may result in a reduction of native upland and wetland plant community area or a change in plant community composition. Effects are most likely to occur during mineral exploration, resource use activities, residential development, and travel along gravel roads. Mineral exploration, mineral development, and mining exploration would also affect community diversity through vegetation clearing and dust deposition.

11.5.3.2 Mitigation for Cumulative Effects

Project-specific mitigation presented in Section 11.4.3.2, such as monitoring soil stockpiles for regulated weeds and controlling as required and using dust suppression to reduce potential project effects on community diversity, will also reduce potential cumulative effects. It is expected that ongoing and future projects will implement standard mitigation measures as appropriate to reduce cumulative effects to community diversity.

11.5.3.3 Cumulative Effects

Cumulative effects on community diversity are predicted to be low in magnitude because the landscape within the RAA is largely intact. Areas of native upland and wetland plant communities may be reduced, and it is possible that future development could remove a plant community that only occupies a small area (i.e., barren land [<1 ha], deciduous forest [155 ha]) from the RAA. The magnitude of cumulative effects on community diversity are predicted to be medium to high. The uncertainty of the magnitude prediction is due to uncertainty of where all future development may occur and whether uncommon land units would be avoided. Residual cumulative effects will occur continuously following the construction of the future projects and may be reversible or irreversible depending on the type of project and whether it will be a permanent feature on the landscape.

11.5.4 Change in Species Diversity

11.5.4.1 Cumulative Effect Pathways

Expansion of ongoing projects and future projects may interact cumulatively with the Project as a result of clearing of vegetation and indirect loss due to the introduction and spread of regulated weeds and dust deposition. Clearing of vegetation, spread of regulated weeds and dust creation in addition to what is proposed by the Project may result in a reduction of native upland and wetland plant community area, thus affecting SOCC habitat, or through competition with regulated weed species and reduced productivity from dust deposition. Effects are most likely to occur during mineral development, residential development, and from travel along gravel roads, but may also occur during recreation and through traditional use. Mineral exploration, mineral development, mining exploration, and resource use activities would also affect species diversity through vegetation clearing and dust deposition.

11.5.4.2 Mitigation for Cumulative Effects

Project-specific mitigation presented in Section 11.4.4.2, such as avoiding known SOCC occurrences to reduce potential project effects on species diversity will also reduce potential cumulative effects. It is expected that ongoing and future projects will implement standard mitigation measures as appropriate to reduce cumulative effects to species diversity. It is also expected that responsible recreational and traditional use will be undertaken reducing the introduction and spread of regulated weeds and potential effects of vegetation harvesting.

11.5.4.3 Cumulative Effects

Cumulative effects on species diversity are predicted to be medium to high in magnitude because the location and abundance of SOCC is unknown. It is possible that future development could remove an uncommon plant community supporting SOCC or uncommon species of traditional use. No known project development is planned in areas of known SOCC occurrences in the RAA. Additionally, information on SOCC occurrences and abundance of plant species of interest to Indigenous communities is not known from the Churchill River Upland Ecoregion. Over-picking of species could result in the decline of some species; however, this is unlikely because Indigenous communities manage the resource for continued collection. Residual cumulative indirect effects may also occur from regulated weed species introduction and spread or from reduced productivity from dust deposition. Residual cumulative effects will occur continuously following the construction of the future projects and may be reversible or irreversible depending on the type of project and whether it will be a permanent feature on the landscape, and the resilience of SOCCs.

11.5.5 Change in Wetland Functions

11.5.5.1 Cumulative Effect Pathways

Expansion of ongoing projects and future projects may interact cumulatively with the Project as a result of wetland clearing and alterations to surface run-off and groundwater inputs. Clearing of wetland area as a result of mineral development and mineral and mining exploration, in addition to what is proposed by the Project, may result in a reduction of wetland plant community area or a change in plant community composition. The east/west tailing management areas would also impact wetland functions through vegetation clearing.

11.5.5.2 Mitigation for Cumulative Effects

Project-specific mitigation presented in Section 11.4.5.2, such as using sediment fencing and/or other appropriate measures to prevent erosion and siltation into adjacent wetlands to reduce potential project effects on wetland functions will reduce potential cumulative effects. It is expected that ongoing and future projects will implement standard mitigation measures as appropriate to reduce cumulative effects to wetland functions.

11.5.5.3 Cumulative Effects

Cumulative effects on wetland function may occur from future mineral development and residential development, resource use and recreation, which will result in a reduction of wetland area from the RAA, in addition to what is planned by the Project. Cumulative effects on wetland functions are predicted to be low in magnitude because the landscape within the RAA is largely intact, and wetlands occupy more than 35% of the RAA. No wetland class would likely be lost as a result of cumulative effects. Areas of wetland plant communities may be reduced although it is unlikely a wetland community type would be lost from the RAA. Residual cumulative effects will occur continuously following the construction of the future projects and may be reversible or irreversible depending on the type of project and whether it will be a permanent feature on the landscape.

11.5.6 Cumulative Effects Without the Project

The cumulative effects to vegetation and wetlands without the Project, but with reasonably foreseeable future project effects in the RAA, are anticipated to be relatively similar to baseline conditions. It is assumed that future projects may involve vegetation clearing, and soil disturbance; however, these changes would be localized and low in magnitude.

11.5.7 Summary of Cumulative Effects

Table 11-11 summarizes cumulative environmental effects on vegetation and wetlands.

Table 11-11 Residual Cumulative Effects

Residual Cumulative Effect	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context
Residual Cumulative Change in Landscape Diversity								
Without the Project	A	L	RAA	LT	N/A	IR	R/I	D/U
With the Project	A/P	L	RAA	LT	N/A	C	R/I	D/U
Contribution from the Project to the residual cumulative effect	During construction there will be a temporary adverse effect on landscape diversity as there is a loss of habitat patch during this phase. However, Closure of the Gordon and MacLellan sites will result in an increase in the size of habitat Patch 1 because areas that are currently classified as developed within the Gordon and MacLellan sites at existing conditions will mostly be reclaimed to native upland or reclaimed upland plant communities.							
Residual Cumulative Change in Community Diversity								
Without the Project	A	L	RAA	LT	N/A	IR	R/I	D/U
With the Project	A	L	RAA	LT	N/A	C	R/I	D/U

Table 11-11 Residual Cumulative Effects

Residual Cumulative Effect	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context
Contribution from the Project to the residual cumulative effect	The Project will result in a loss of 609.9 ha (1%) of native upland plant communities and 437.4 ha (1%) of wetland plant communities in the RAA. There will also be an additional of 1003.0 ha of reclaimed area.							
Residual Cumulative Change in Species Diversity								
Without the Project	A	L	RAA	LT	N/A	IR	R/I	D/U
With the Project	A	L	RAA	LT	N/A	C	R/I	D/U
Contribution from the Project to the residual cumulative effect	Although the Project will adversely affect known plant SOCC occurrences at both Gordon and MacLellan sites in the long-term., the Project will only affect a small portion of the relatively undisturbed RAA.							
Residual Cumulative Change in Wetland Functions								
Without the Project	A	L	RAA	LT	N/A	IR	R/I	D/U
With the Project	A	L	RAA	LT	N/A	C	R/I	D/U
Contribution from the Project to the residual cumulative effect	The Project will result in the permanent loss of 437.4 ha (1%) of wetland functions in the RAA.							

KEY
See Table 11-2 for detailed definitions

Direction:
P: Positive
A: Adverse

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term;
MT: Medium-term
LT: Long-term

N/A: Not applicable

Timing:
N/A: Not Applicable
A: Applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

The Project will redevelop two existing mine sites, only one of which has been reclaimed. Both mine sites have existing access roads and are linked to PR 391. When current and reasonably foreseeable future project effects on vegetation and wetlands are considered, the Project's contributions to cumulative change in landscape diversity is anticipated to be adverse and low in magnitude during the Project, and then positive in post-closure. Cumulative change in community diversity, species diversity and wetland functions are all anticipated to be adverse in direction, but low in magnitude with proposed mitigation.

11.6 EFFECTS TO FEDERAL LANDS

Federal lands within the LAA and RAA for Vegetation and Wetlands consist of Black Sturgeon Reserve.

No direct effects to vegetation and wetlands on Federal Lands are expected as Federal Lands are not intersected by the Project (Map 11-1). Weeds, if introduced and become established during project activities, could spread to the Black Sturgeon Reserve. Maintaining cross drainage to allow water to move freely from one side of the road to the other in areas of permanent or temporary access roads should maintain wetland function and effects are not expected on Federal Lands.

These effects are anticipated to be similar to other receptors in the LAA as described in Sections 11.4 and 11.5.

11.7 DETERMINATION OF SIGNIFICANCE

11.7.1 Significance of Project Residual Effects

A significant adverse residual effect on vegetation and wetlands is defined as one that:

- Threatens the long-term persistence or viability of a plant species or community in the RAA, including effects that are contrary to or inconsistent with the goals, objectives or activities of recovery plans, action plans and management plans, or
- Threatens the long-term persistence or viability of wetland functions and vegetation species of interest to Indigenous communities or contravenes federal or provincial guidelines within the RAA.

With mitigation and environmental protection measures, the residual environmental effects on vegetation and wetlands are predicted to be not significant.

11.7.2 Significance of Cumulative Effects

The Project is anticipated to have a positive effect on landscape diversity at decommissioning/closure, and only affect a small portion of the relatively intact and undisturbed RAA. Therefore, the Project will not threaten the long-term persistence or viability of a plant species, community, or wetland functions within the RAA. With mitigation and environmental protection measures, the residual cumulative environmental effects on vegetation and wetlands are predicted to be not significant for landscape diversity, community diversity and wetland functions. Cumulative effects will reduce patch size and increase patch perimeter, reduce native upland and wetland plant communities in the RAA. This may result in the loss of undocumented SOCC occurrences due to the reduction of potential SOCC habitat. The reduction in the plant communities may reduce abundance and distribution of species of traditional use and wetland functions. However, these effects are not considered significant.

11.7.3 Significance of Effects on Federal Lands

The only federal land within the LAA and RAA is Black Sturgeon Reserve. Based on these results in Section 11.6, the residual environmental effects from changes to the vegetation and wetlands are predicted to be not significant.

11.8 PREDICTION CONFIDENCE

Prediction confidence is high for landscape diversity; however, prediction confidence is moderate for community diversity, species diversity and wetland functions. Confidence is moderate because it is unknown if searches for SOCC and avoidance of known occurrences will be conducted. It is also unknown if future development will be reclaimed or the timing of reclamation. Effects to community diversity, species diversity and wetland functions can be avoided or mitigated through restricting clearing to the PDA, dust suppression and control of regulated weeds. Additional mitigation options for SOCC occurrences that are likely to be directly affected by the project, such as seed collection and transplant, are considered experimental and may not be successful.

11.9 FOLLOW-UP AND MONITORING

Monitoring of soil stockpiles for regulated weeds during construction and operation will be conducted annually during the growing season. Intervention mechanisms (e.g., spraying and hand-pulling) will be implemented where necessary to control introduction and spread of regulated weeds (Chapter 23, Section 23.5.12).

Post-reclamation monitoring will be completed five years after revegetation to determine revegetation success. Re-vegetation success issues identified during monitoring will be addressed by applying supplementary mitigation measures, such as reseeding and regulated weed mitigation. Reclaimed areas will be considered successfully reclaimed when re-vegetation is assessed to be composed of mostly native species that are self-sufficient (Chapter 23, Section 23.6).

Soil stockpiles will be monitored during construction and operation. Post reclamation re-vegetation success monitoring will be conducted to facilitate self-sufficient re-vegetation post reclamation (Chapter 23, Section 23.5.2).

In the event that an unexpected deterioration of the environment is observed as part of follow-up and/or monitoring, intervention mechanisms will include the adaptive management process described in Chapter 23, Section 23.2. This may include an investigation of the cause of the deterioration and identification of existing and/or new mitigation measures to be implemented to address it.

11.10 SUMMARY OF COMMITMENTS

The following summarizes proposed measures to mitigate Project adverse residual effects for vegetation and wetlands:

- Effects to fragmentation will be mitigated at both the Gordon and MacLellan sites during construction and operation through restriction of construction activity to the approved PDA.
- Equipment will arrive at the Project sites clean and free of soil and vegetative debris. Equipment will be inspected and if deemed to be in appropriate condition, will be approved for use and identified with a suitable marker or tag. Equipment that does not arrive at the Project sites in appropriate condition will not be allowed on the construction footprint until it has been cleaned, re-inspected, and deemed suitable for use.
- Sensitive areas, such as wetlands, will be buffered by 30 m and clearly marked prior to clearing.
- Silt fencing will be installed and maintained to reduce deleterious substances from entering adjacent to wetlands or waterbodies (Chapter 23, Section 23.5.13).
- Vegetation clearing will occur during dry and frozen conditions. If clearing must occur in non-ideal conditions, construction matting will be used.
- A native seed mix will be used to assist in reducing invasive plant species spread and establishment as well as for erosion control on exposed soils.
- Topsoil and subsoil piles will be monitored for invasive plant species growth during construction and corrective measures (e.g., spraying, mowing, hand-pulling) will be implemented to avoid growth and establishment.
- Certified No.1 seed will be used to reseed areas, unless Certified No. 1 seed is not available for selected reclamation species (i.e., native species).
- Unless a certificate of weed analysis can be provided, construction material sources used for supplies of sand, gravel, rock, straw, and mulch will be visually inspected to determine whether they are free of invasive species propagules to the extent possible. If sources are suspected as having invasive species propagules, they should be sampled, and lab analyzed to determine whether they meet the requirements of the responsible regulatory agency prior to obtaining or transporting material to the Project site. If sampling cannot be completed, post construction monitoring for invasive species will be completed.
- If pesticide is required, a pesticide use permit will be obtained under *The Environment Act* (Manitoba).
- Native areas disturbed by the Project will be reseeded using a native upland seed mix; however, the tailings management facility will be partially capped and seeded with a reclamation seed mix.

Approximately 75% of the tailings management facility will be capped, which will be subject to confirmation of capping material availability during detailed design.

- Known occurrences of SOCC will be avoided. If avoidance of plant SOCC is not possible, seed collection or transplant of the plant should be considered.
- Herbicide will not occur within 30 m of plant species or ecological communities of conservation concern, wetlands, or waterbodies. Spot-spraying, wicking, mowing, or hand picking are acceptable measures for control of regulated weeds in these areas.
- Dust suppression, as described in Chapter 6 will be applied.
- Grading will be directed away from wetlands, where possible.
- The removal of vegetation in wetlands will be reduced to the extent possible.
- Ground level cutting/mowing/mulching of wetland vegetation instead of grubbing, will be conducted where possible.
- Grading within wetland boundaries will be reduced unless required for site specific purposes.
- A protective layer such as matting or biodegradable geotextile and clay ramps or other approved materials will be used between wetland root/seed bed and construction equipment if ground conditions are encountered that create potential for rutting, admixing or compaction.
- Cross drainage will be maintained to allow water to move freely from one side of the road to the other in areas of permanent or temporary access roads.
- Frost packing, snow, ice, geotextile swamp mats or access mats will be used for access through wet areas.

11.11 REFERENCES

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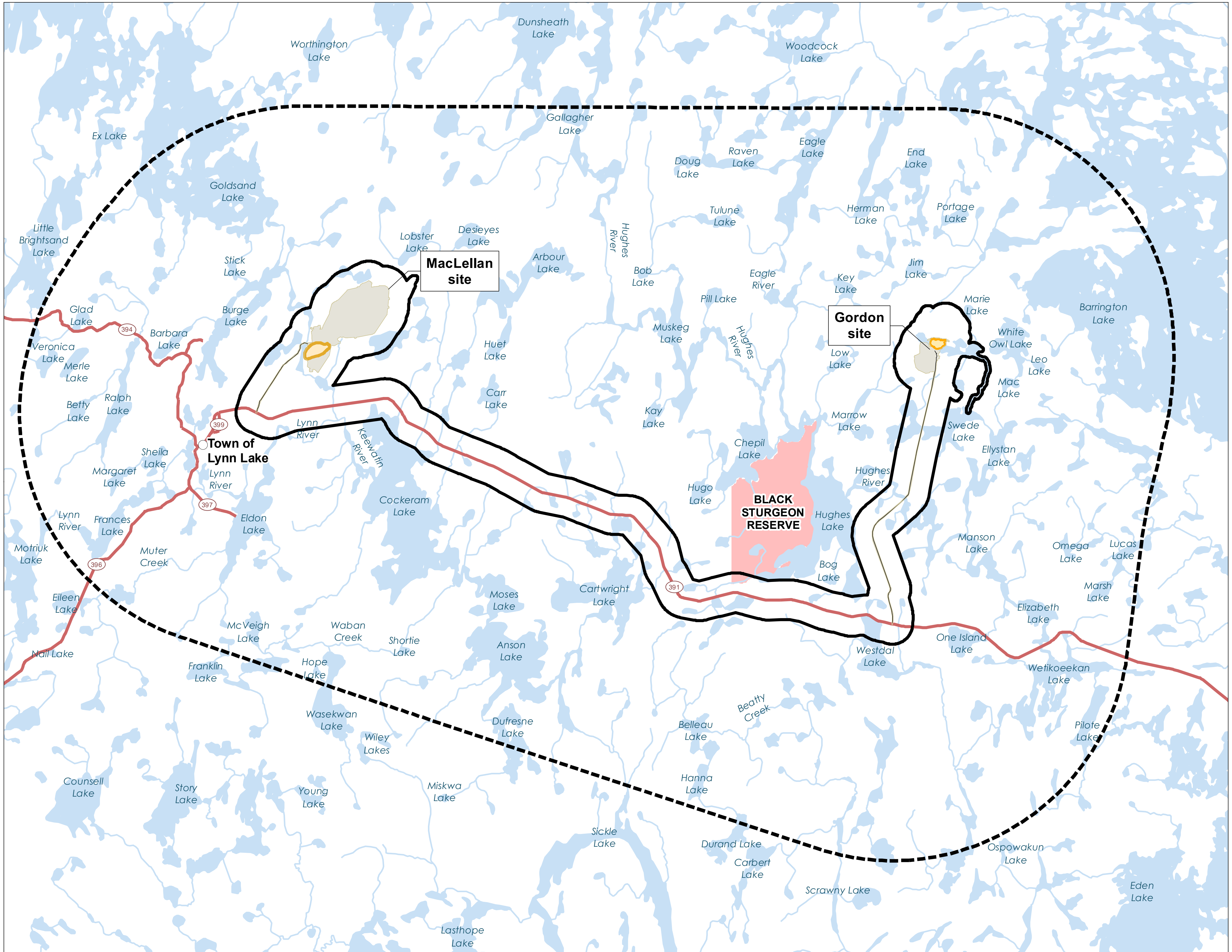


Stantec

Alamos Gold Inc.

Project Infrastructure

- Proposed Open Pit
- Project Development Area

Study Area

- Vegetation and Wetlands Local Assessment Area (LAA)
- Vegetation and Wetlands Regional Assessment Area (RAA)

Landbase

- Existing Access Road
- Highway
- Watercourse
- Waterbody
- First Nation Reserve

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-03-11
Technical Review by JFeschuk on 2020-03-11
Senior GIS Review by GKroupa on 2020-03-11

Client/Project 111473008

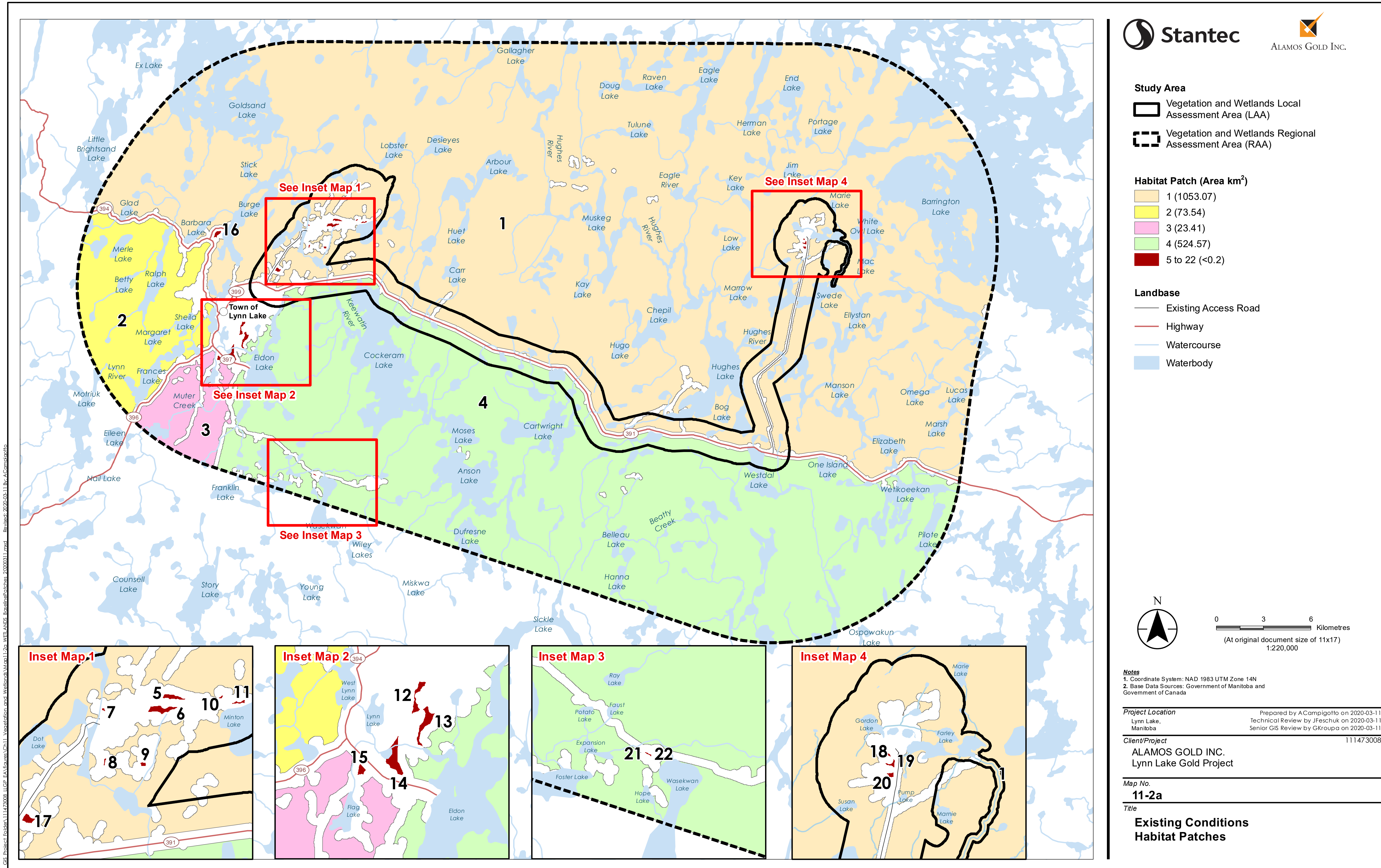
ALAMOS GOLD INC.
Lynn Lake Gold Project

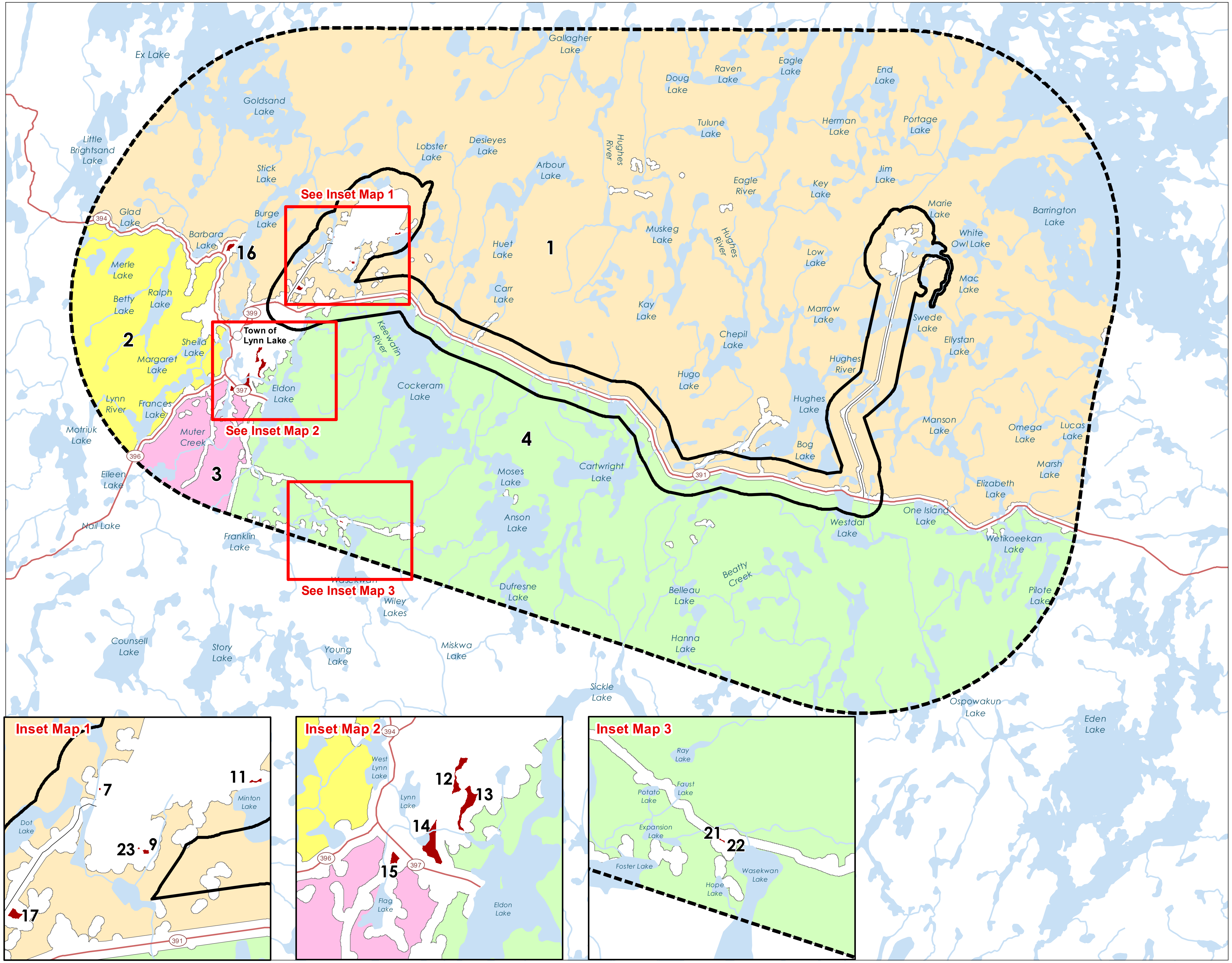
Map No.

11-1

Title

Vegetation and Wetlands Spatial Boundaries


Stantec
Alamos Gold Inc.
Study Area
Vegetation and Wetlands Local Assessment Area (LAA)
Vegetation and Wetlands Regional Assessment Area (RAA)
Habitat Patch (Area km²)
1 (1053.07)
2 (73.54)
3 (23.41)
4 (524.57)
5 to 22 (<0.2)
Landbase
Existing Access Road
Highway
Watercourse
Waterbody
N
0 3 6 Kilometres
(At original document size of 11x17)
1:220,000
Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada
Project Location
Lynn Lake, Manitoba
Prepared by ACampigotto on 2020-03-11
Technical Review by JFeschuk on 2020-03-11
Senior GIS Review by GKroupa on 2020-03-11
Client/Project
111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project
Map No.
11-2a
Title
Existing Conditions
Habitat Patches
See Inset Map 1
See Inset Map 2
See Inset Map 3
See Inset Map 4
Town of Lynn Lake
Inset Map 1
Inset Map 2
Inset Map 3
Inset Map 4
Gallagher Lake
Ex Lake
Goldsand Lake
Little Brightsand Lake
Glad Lake
Barbara Lake
Merle Lake
Betty Lake
Ralph Lake
Sheila Lake
Margaret Lake
Lynn River
Frances Lake
Motriuk Lake
Muter Creek
Eileen Lake
Nail Lake
Franklin Lake
Eldon Lake
Keewatin River
Cockeram Lake
Moses Lake
Anson Lake
Cartwright Lake
Dufresne Lake
Belleau Lake
Beatty Creek
Hanna Lake
Wiley Lakes
Miskwa Lake
Young Lake
Story Lake
Counsell Lake
Sickle Lake
Ospowakun Lake
Pilote Lake
Wetikoekan Lake
One Island Lake
Westdal Lake
Elizabeth Lake
Marsh Lake
Omega Lake
Lucas Lake
Manson Lake
Ellystan Lake
Swede Lake
Barrington Lake
White Owl Lake
Mac Lake
Marie Lake
Jim Lake
Key Lake
Low Lake
Marrow Lake
Hughes River
Hughes Lake
Bog Lake
Hugo Lake
Chepil Lake
Kay Lake
Muskeg Lake
Eagle River
Tulune Lake
Herman Lake
Portage Lake
End Lake
Eagle Lake
Raven Lake
Doug Lake
Arbour Lake
Desieyes Lake
Lobster Lake
Stick Lake
Burge Lake
Huet Lake
Carr Lake



Stantec

Alamos Gold Inc.

Study Area

- Vegetation and Wetlands Local Assessment Area (LAA)
- Vegetation and Wetlands Regional Assessment Area (RAA)

Habitat Patch (Area km²)

- 1 (1046.78)
- 2 (73.54)
- 3 (23.41)
- 4 (524.57)
- 5 to 22 (<0.2)

Landbase

- Existing Access Road
- Highway
- Watercourse
- Waterbody

N

0 3 6 Kilometres

(At original document size of 11x17)
1:220,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

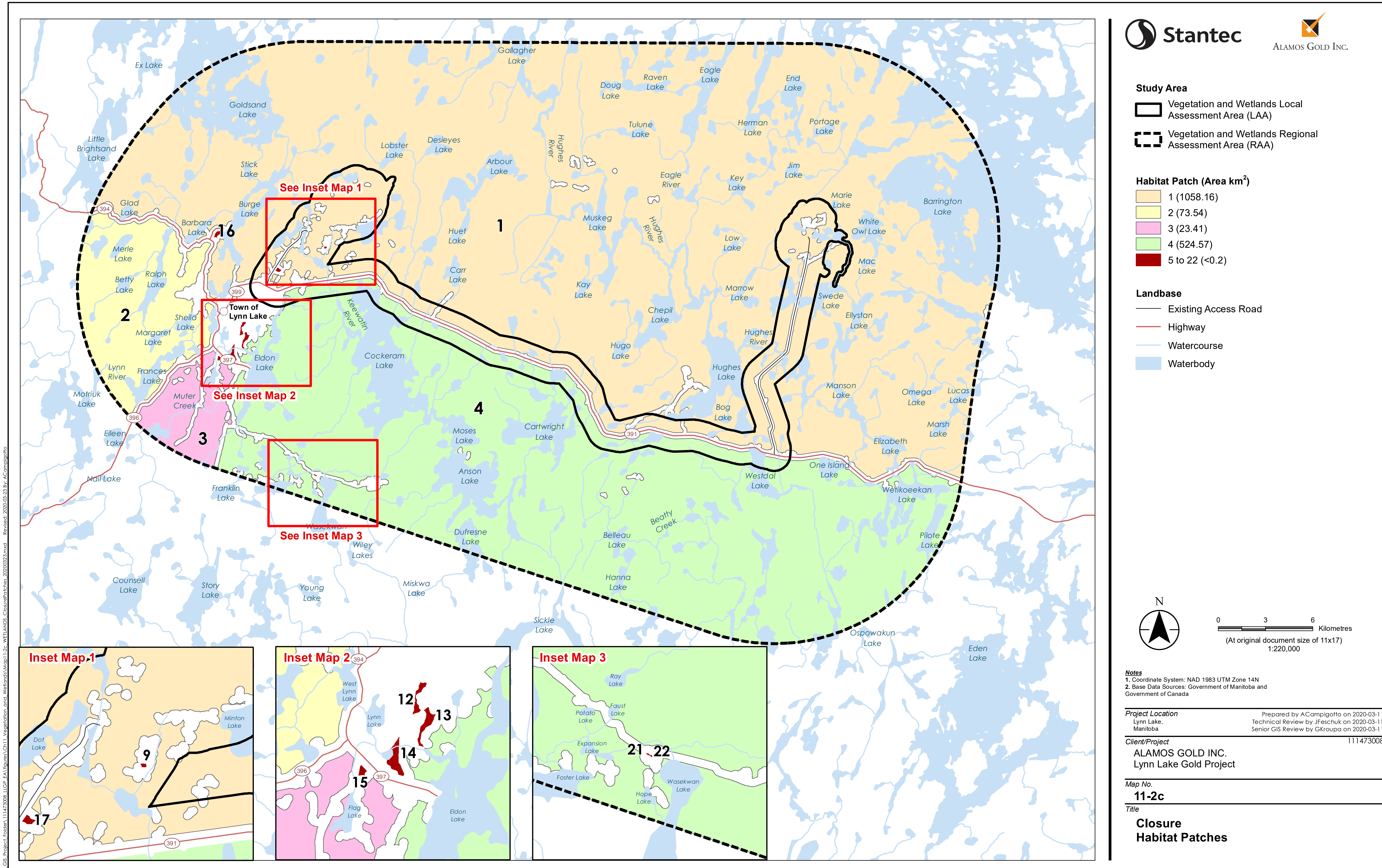
Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-03-11
Technical Review by JFeschuk on 2020-03-11
Senior GIS Review by GKroupa on 2020-03-11

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
11-2b

Title
Construction and Operation Habitat Patches


Stantec
Alamos Gold Inc.
Study Area
Vegetation and Wetlands Local Assessment Area (LAA)
Vegetation and Wetlands Regional Assessment Area (RAA)
Habitat Patch (Area km2)
1 (1058.16)
2 (73.54)
3 (23.41)
4 (524.57)
5 to 22 (<0.2)
Landbase
Existing Access Road
Highway
Watercourse
Waterbody
N
0 3 6 Kilometres
(At original document size of 11x17)
1:220,000
Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada
Project Location
Lynn Lake, Manitoba
Prepared by ACampigotto on 2020-03-11
Technical Review by JFeschuk on 2020-03-11
Senior GIS Review by GKroupa on 2020-03-11
Client/Project
111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project
Map No.
11-2c
Title
Closure Habitat Patches
See Inset Map 1
See Inset Map 2
See Inset Map 3
Town of Lynn Lake
Inset Map 1
Inset Map 2
Inset Map 3
1
2
3
4
9
12
13
14
15
16
17
21
22
Gallagher Lake
Ex Lake
Goldsand Lake
Little Brightsand Lake
Glad Lake
Barbara Lake
Merle Lake
Ralph Lake
Betty Lake
Sheila Lake
Margaret Lake
Lynn River
Frances Lake
Motriuk Lake
Muter Creek
Eileen Lake
Nail Lake
Franklin Lake
Counsell Lake
Story Lake
Young Lake
Miskwa Lake
Sickle Lake
Wiley Lakes
Dufresne Lake
Belleau Lake
Hanna Lake
Beatty Creek
Pilote Lake
Ospowakun Lake
Eden Lake
Wetikoeekan Lake
One Island Lake
Westdal Lake
Elizabeth Lake
Marsh Lake
Omega Lake
Lucas Lake
Manson Lake
Ellystan Lake
Swede Lake
Mac Lake
White Owl Lake
Barrington Lake
Marie Lake
Jim Lake
Portage Lake
End Lake
Herman Lake
Eagle Lake
Raven Lake
Doug Lake
Tulune Lake
Key Lake
Eagle River
Hughes River
Muskeg Lake
Low Lake
Marrow Lake
Chepil Lake
Hughes Lake
Bog Lake
Hugo Lake
Kay Lake
Carr Lake
Huet Lake
Arbour Lake
Desieyes Lake
Lobster Lake
Stick Lake
Burge Lake
Keewatin River
Cockeram Lake
Eldon Lake
Moses Lake
Cartwright Lake
Anson Lake
Dot Lake
Minton Lake
West Lynn Lake
Lynn Lake
Flag Lake
Ray Lake
Faust Lake
Potato Lake
Expansion Lake
Foster Lake
Wasekwan Lake
Hope Lake
391
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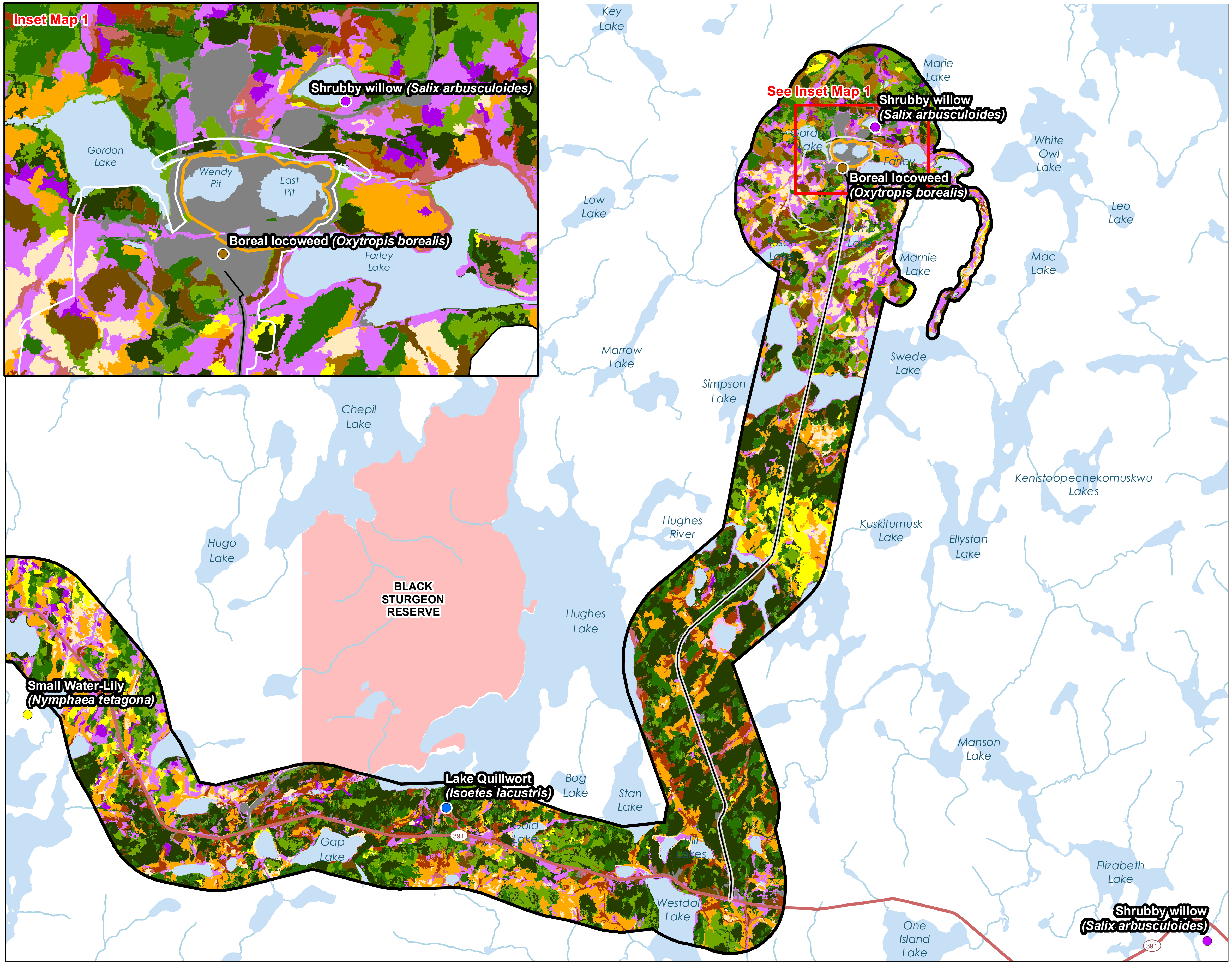

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ALAMOS GOLD INC.

Project Infrastructure

- Proposed Open Pit
- Project Development Area

Study Area

- Vegetation and Wetlands Local Assessment Area (LAA)

SOCC Locations

- Shrubby Willow (*Salix arbusculoides*)
- Small Water-Lily (*Nymphaea tetragona*)
- Lake Quillwort (*Isoetes lacustris*)
- Boreal locoweed (*Oxytropis borealis*)

Land Use/Land Cover

Upland

- Conifer Dense
- Conifer Open
- Conifer Sparse
- Mixedwood Dense
- Mixedwood Open
- Shrubland

Anthropogenic

- Development

Wetland

- Bog Shrubby
- Bog Treed
- Fen Shrubby
- Fen Treed
- Marsh
- Swamp Shrubby
- Swamp Treed

Landbase

- Existing Access Road
- Highway
- Watercourse
- Waterbody
- First Nation Reserve

N

0 1 2 Kilometres

(At original document size of 11x17)
1:75,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.

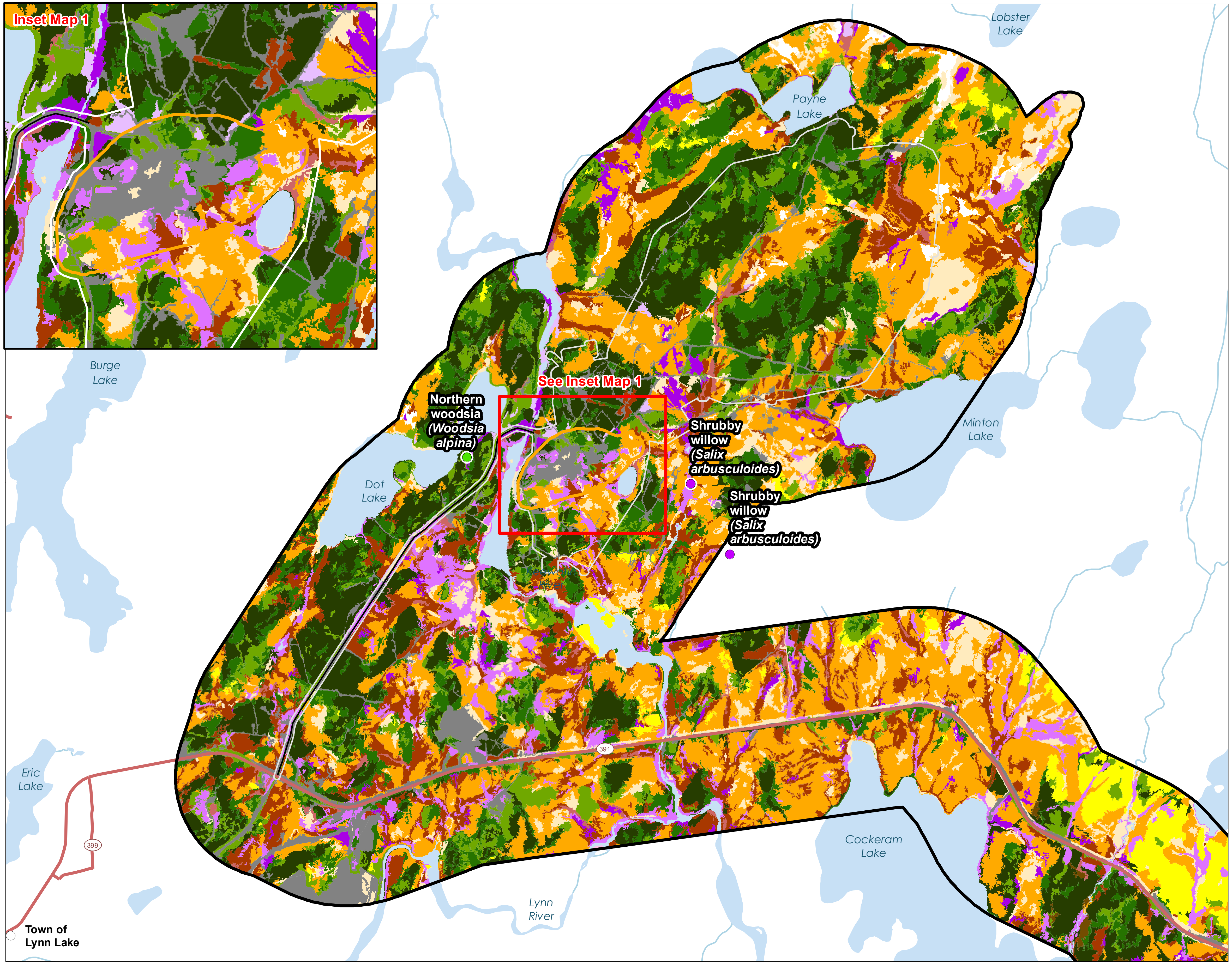
Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-03-11
Technical Review by JFeschuk on 2020-03-11
Senior GIS Review by GKroupa on 2020-03-11

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
11-3a

Title
Existing Conditions and Land Cover Classes - Gordon Site



Stantec

Alamos Gold Inc.

Project Infrastructure

- Proposed Open Pit
- Project Development Area

Study Area

- Vegetation and Wetlands Local Assessment Area (LAA)

SOCC Locations

- Shrubby Willow *(Salix arbusculoides)*
- Northern Woodsia *(Woodsia alpina)*

Land Use/Land Cover

Upland
- Conifer Dense
- Conifer Open
- Conifer Sparse
- Mixedwood Dense
- Shrubland

Anthropogenic
- Development

Wetland
- Bog Shrubby
- Bog Treed
- Fen Pattern
- Fen Shrubby
- Fen Treed
- Marsh
- Swamp Shrubby
- Swamp Treed

Landbase

- Existing Access Road
- Highway
- Watercourse
- Waterbody

N

0 0.75 1.5 Kilometres

(At original document size of 11x17)
1:40,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.

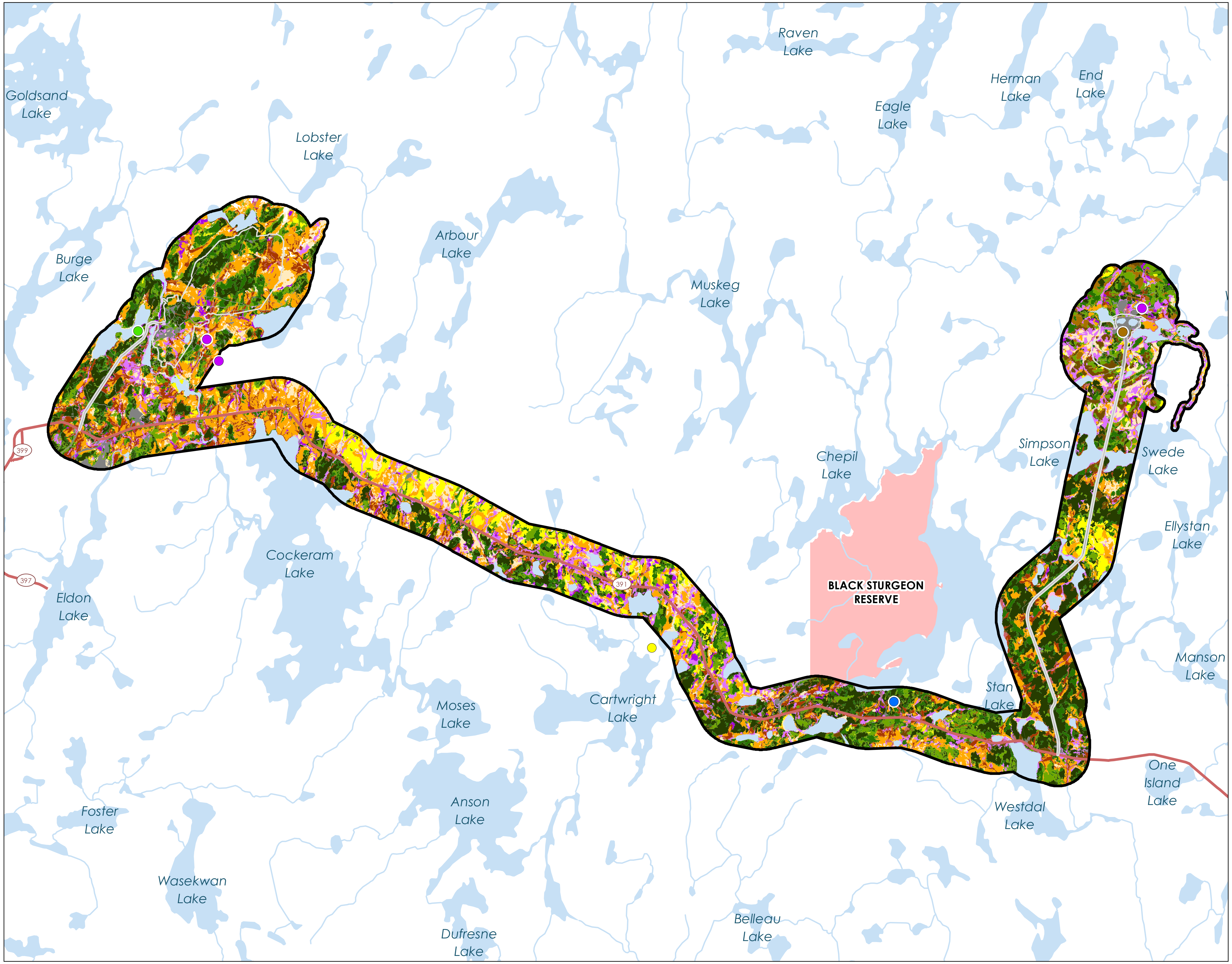
Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-03-11
Technical Review by JFeschuk on 2020-03-11
Senior GIS Review by GKroupa on 2020-03-11

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
11-3b

Title
Existing Conditions and Land Cover Classes - MacLellan Site



Stantec

ALAMOS GOLD INC.

Project Infrastructure

Project Development Area

Study Area

Vegetation and Wetlands Local Assessment Area (LAA)

SOCC Locations

- Shrubby Willow *(Salix arbusculoides)*
- Small Water-Lily *(Nymphaea tetragona)*
- Northern Woodsia *(Woodsia alpina)*
- Lake Quillwort *(Isoetes lacustris)*
- Boreal locoweed *(Oxytropis borealis)*

Land Use/Land Cover

Upland
- Conifer Dense
- Conifer Open
- Conifer Sparse
- Mixedwood Dense
- Mixedwood Open
- Shrubland

Anthropogenic
- Development

Wetland
- Bog Shrubby
- Bog Treed
- Fen Pattern
- Fen Shrubby
- Fen Treed
- Marsh
- Swamp Shrubby
- Swamp Treed

Landbase

- Highway
- Existing Access Road
- Watercourse
- Waterbody
- First Nation Reserve

N

0 2 4 Kilometres

(At original document size of 11x17)
1:130,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake,
Manitoba

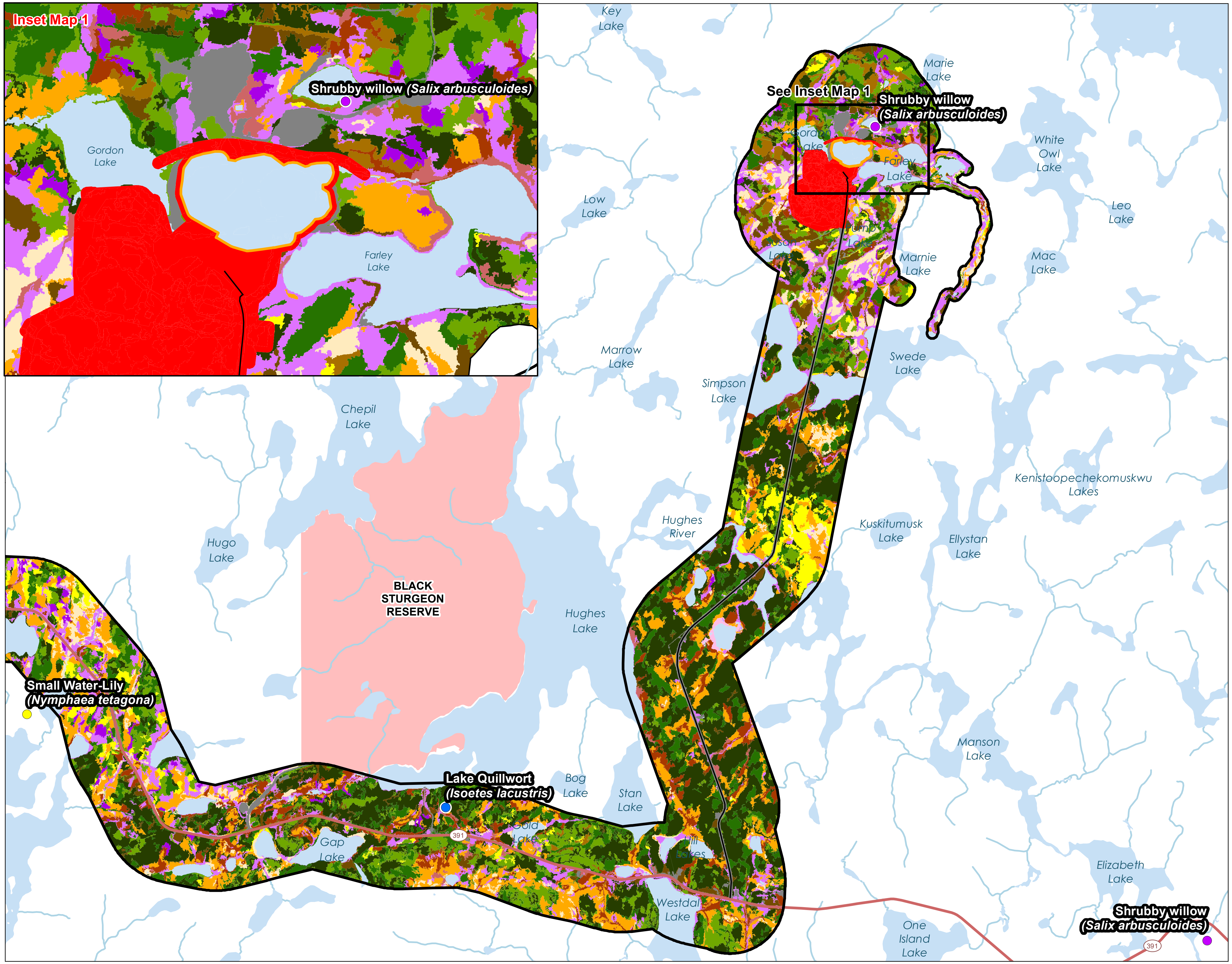
Prepared by ACampigotto on 2020-03-11
Technical Review by JFeschuk on 2020-03-11
Senior GIS Review by GKroupa on 2020-03-11

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
11-3c

Title
Existing Conditions and Land Cover Classes - Highway 391



Stantec

ALAMOS GOLD INC.

Project Infrastructure

Proposed Open Pit

Study Area

Vegetation and Wetlands Local Assessment Area (LAA)

SOCC Locations

- Shrubby Willow (*Salix arbusculoides*)
- Small Water-Lily (*Nymphaea tetragona*)
- Lake Quillwort (*Isoetes lacustris*)

Land Use/Land Cover

Upland	Wetland
Reclaimed Upland	Bog Shrubby
Reclaimed Native Upland	Bog Treed
Conifer Dense	Fen Pattern
Conifer Open	Fen Shrubby
Conifer Sparse	Fen Treed
Mixedwood Dense	Marsh
Mixedwood Open	Swamp Shrubby
Shrubland	Swamp Treed

Anthropogenic

Development

Landbase

Existing Access Road	Waterbody
Highway	First Nation Reserve
Watercourse	

N

0 1 2 Kilometres

(At original document size of 11x17)
1:75,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-03-11
Technical Review by JFeschuk on 2020-03-11
Senior GIS Review by GKroupa on 2020-03-11

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
11-4a

Title
Closure Land Cover Classes - Gordon Site

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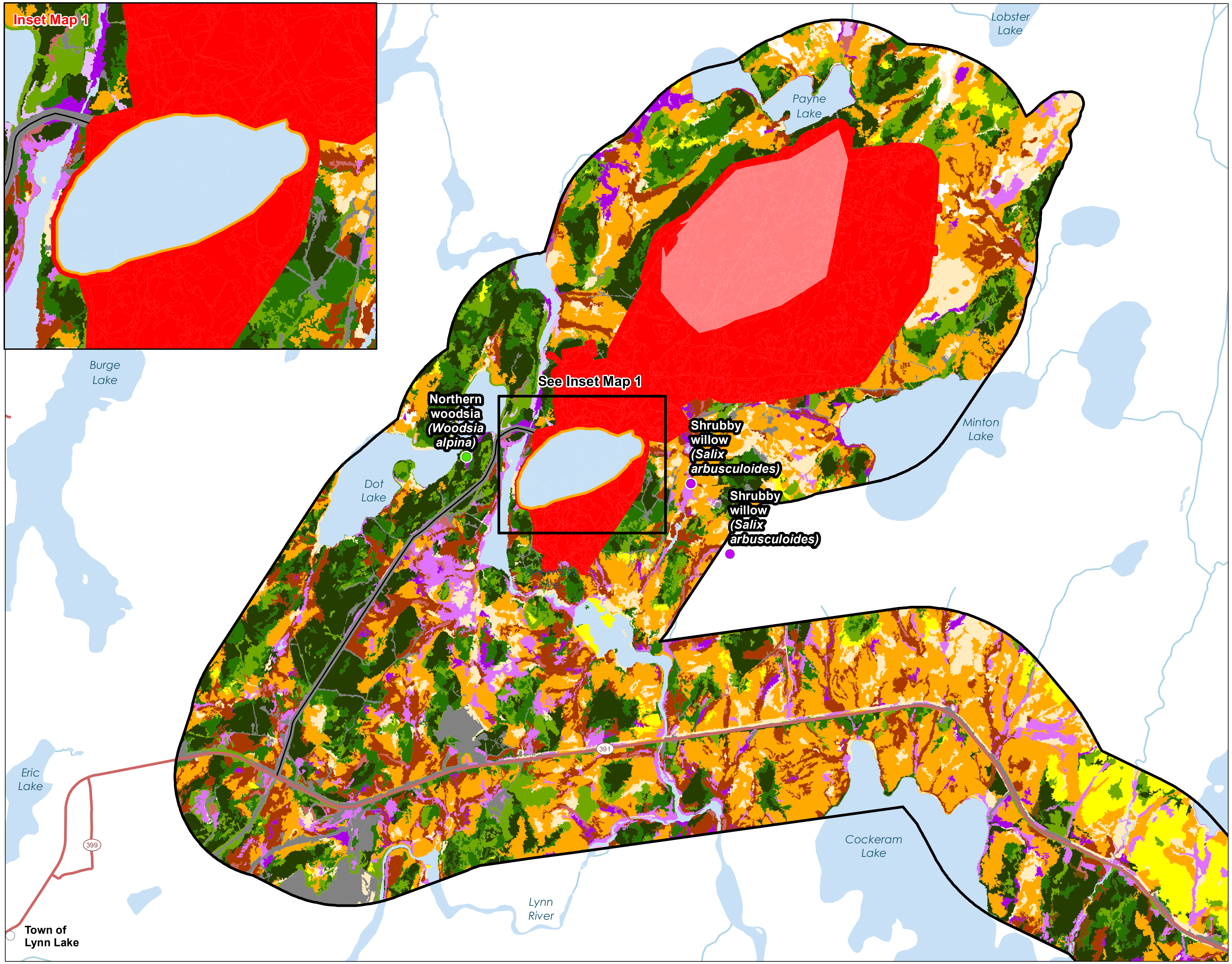


Stantec

Alamos Gold Inc.

Project Infrastructure
Proposed Open Pit

Study Area
Vegetation and Wetlands Local Assessment Area (LAA)

SOCC Locations
Shrubby Willow *(Salix arbusculoides)*
Northern Woodsia *(Woodsia alpina)*

Land Use/Land Cover

Upland	Wetland
Reclaimed Upland	Bog Shrubby
Reclaimed Native Upland	Bog Treed
Conifer Dense	Fen Pattern
Conifer Open	Fen Shrubby
Conifer Sparse	Fen Treed
Mixedwood Dense	Marsh
Shrubland	Swamp Shrubby
Anthropogenic	Swamp Treed
Development	

Landbase
Existing Access Road
Highway
Watercourse
Waterbody

N

0 0.75 1.5 Kilometres
(At original document size of 11x17)
1:40,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.

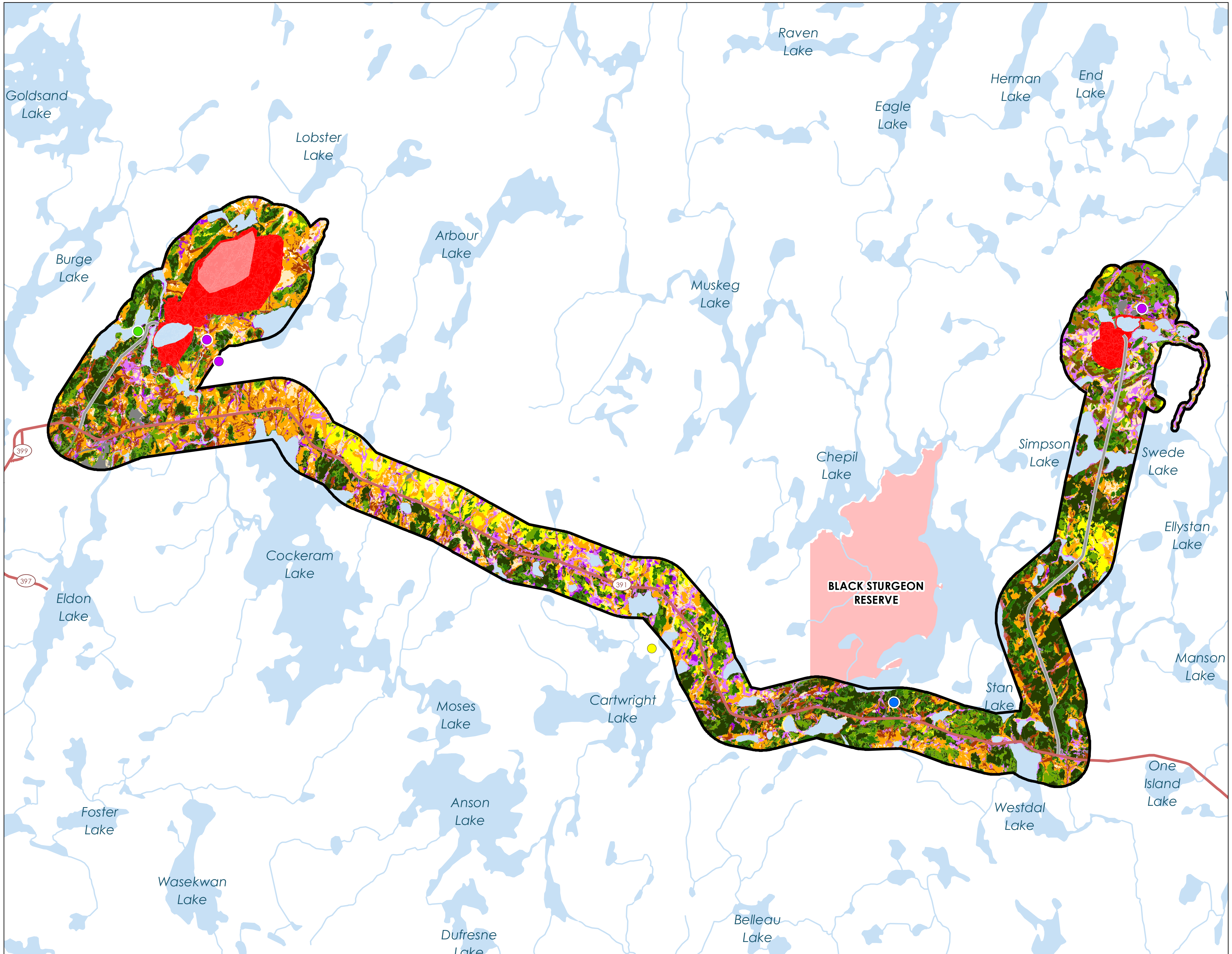
Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-03-11
Technical Review by JFeschuk on 2020-03-11
Senior GIS Review by GKroupa on 2020-03-11

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
11-4b

Title
Closure Land Cover Classes - MacLellan Site



Stantec

Alamos Gold Inc.

Study Area

Vegetation and Wetlands Local Assessment Area (LAA)

SOCC Locations

- Shrubby Willow *(Salix arbusculoides)*
- Small Water-Lily *(Nymphaea tetragona)*
- Northern Woodsia *(Woodsia alpina)*
- Lake Quillwort *(Isoetes lacustris)*

Land Use/Land Cover

Upland
- Reclaimed Upland
- Reclaimed Native Upland
- Conifer Dense
- Conifer Open
- Conifer Sparse
- Mixedwood Dense
- Mixedwood Open
- Shrubland

Wetland
- Bog Shrubby
- Bog Treed
- Fen Pattern
- Fen Shrubby
- Fen Treed
- Marsh
- Swamp Shrubby
- Swamp Treed

Anthropogenic
- Development

Landbase

- Highway
- Existing Access Road
- Watercourse
- Waterbody
- First Nation Reserve

N

0 2 4 Kilometres

(At original document size of 11x17)
1:130,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-03-11
Technical Review by JFeschuk on 2020-03-11
Senior GIS Review by GKroupa on 2020-03-11

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
11-4c

Title
Closure Land Cover Classes - Highway 391

Appendix 11A LAND COVER AND PLANT COMMUNITY CORRESPONDENCE TABLE

Land Cover and Plant Community Correspondence Table

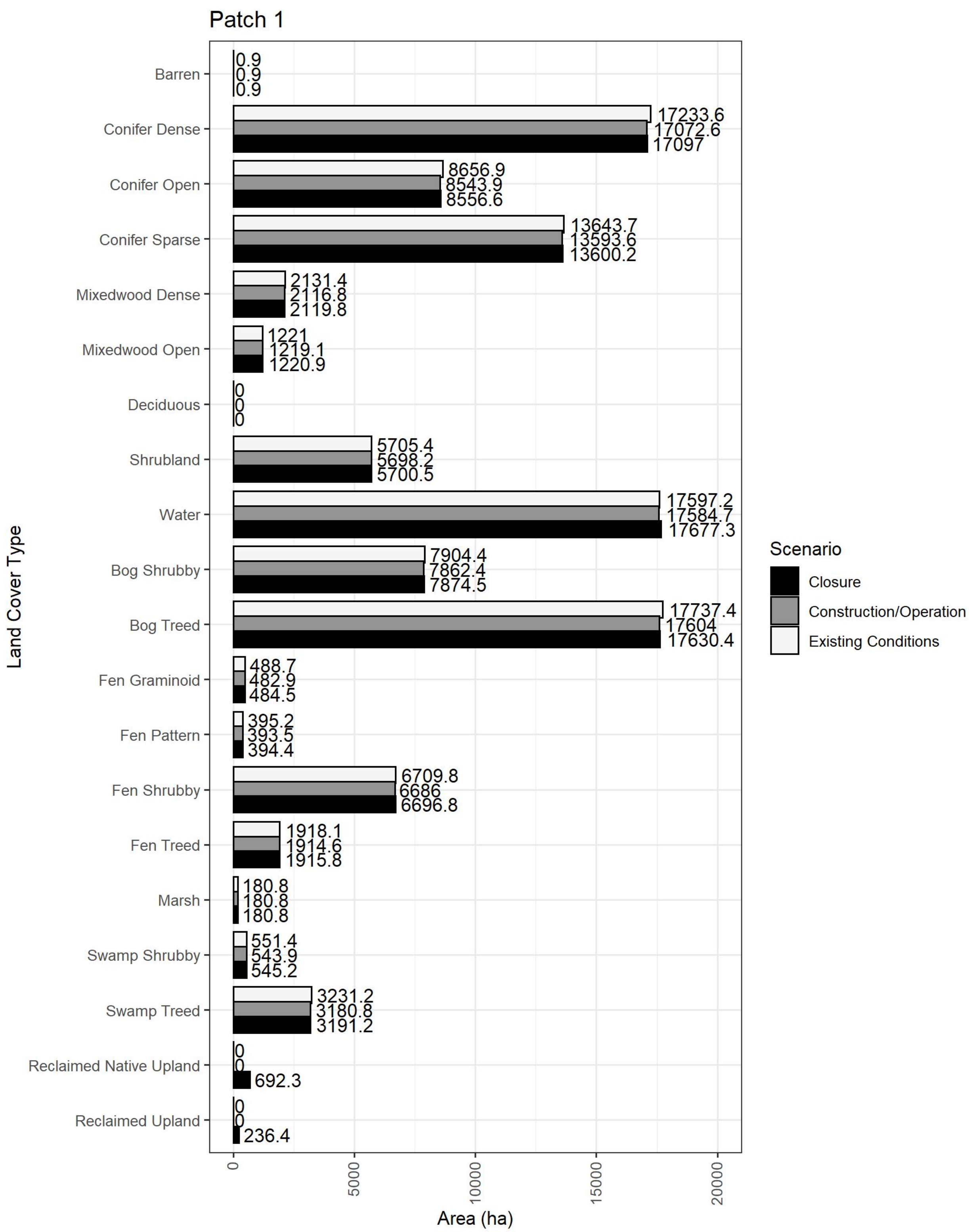
Land Cover Type	Land Cover Description	Corresponding Plant Community and Source			
		Forest Ecosystem Classification for Manitoba Plant Communities[a]	Canadian Wetland Classification Plant Communities[b]	Alberta Wetland Classification System[c]	Climatic and Physiographic Controls on Wetland Type and Distribution in Manitoba, Canada[d]
Conifer Dense	>60% crown closure, with ≥75% coniferous tree cover	V20 - Tamarack/Labrador Tea V26 - Jack Pine-Black Spruce/Lichen V27 - Black Spruce/Shrub- and Herb-Poor V28 - Jack Pine-Black Spruce/Feather Moss V29 - Black Spruce/Feather Moss	Upland	N/A	N/A
Conifer Open	26-60% crown closure, with ≥75% coniferous tree cover	V20 - Tamarack/Labrador Tea V26 - Jack Pine-Black Spruce/Lichen V27 - Black Spruce/Shrub- and Herb-Poor V28 - Jack Pine-Black Spruce/Feather Moss V29 - Black Spruce/Feather Moss	Upland	N/A	N/A
Conifer Sparse	10-25% crown closure, with ≥ 75% coniferous tree cover	V20 - Tamarack/Labrador Tea V26 - Jack Pine-Black Spruce/Lichen V27 - Black Spruce/Shrub- and Herb-Poor V28 - Jack Pine-Black Spruce/Feather Moss V29 - Black Spruce/Feather Moss	Upland	N/A	N/A
Mixedwood Dense	>60% crown closure, with neither coniferous or deciduous trees comprising ≥ 75% total tree cover	V4 - White Birch Hardwood and Mixedwood V17 - Black Spruce Mixedwood/Shrub- and Herb-Rich	Upland	N/A	N/A
Mixedwood Open	26 - 60% crown closure, with neither coniferous or deciduous trees comprising ≥ 75% total tree cover	V4 - White Birch Hardwood and Mixedwood V17 - Black Spruce Mixedwood/Shrub- and Herb-Rich	Upland	N/A	N/A
Shrubland	≥ 20% shrub cover	N/A	Upland	N/A	N/A
Reclaimed Native Upland	Reclaimed upland planted with native trees and grasses	N/A	Upland	N/A	N/A

Land Cover Type	Land Cover Description	Corresponding Plant Community and Source			
		Forest Ecosystem Classification for Manitoba Plant Communities[a]	Canadian Wetland Classification Plant Communities[b]	Alberta Wetland Classification System[c]	Climatic and Physiographic Controls on Wetland Type and Distribution in Manitoba, Canada[d]
Water	Lakes, rivers, or streams	N/A	N/A	N/A	N/A
Bog Shrubby	Isolated from surface or groundwater influence with >40 cm peat accumulation, >25% shrub cover and tree cover that is ≤ 25%	N/A	Bog	Bog Shrubby	Open Bog
Bog Treed	Isolated from surface or groundwater influence with >40 cm peat accumulation, >25% tree cover by coniferous species	V33 - Black Spruce/Sphagnum	Bog	Bog Wooded, coniferous	Wooded or Forested Bog
Fen Pattern	Connected to surface or groundwater with a pattern of strings and flarks, with >6% tree cover	N/A	Fen	N/A	Patterned fen
Fen Shrubby	Connected to surface or groundwater with >40 cm peat accumulation, >25% shrub and ≤ 25% tree cover	N/A	Fen	Fen Shrubby	Open Fen
Fen Treed	Connected to surface or groundwater with >40 cm peat accumulation, >25% tree cover	V32 - Black Spruce/Herb Poor/Sphagnum (Feather Moss)	Fen	Fen Wooded, coniferous	Wooded or Forested Fen
Marsh	< 40 cm peat accumulation with < 25% shrub and tree cover	N/A	Marsh	Marsh	Marsh
Swamp Shrubby	< 40 cm peat accumulation with >25% shrub cover and ≤ 25% tree cover	N/A	Swamp	Swamp Shrubby	deciduous swamp
Swamp Treed	< 40 cm peat accumulation with >25% tree cover	V31 - Black Spruce/Herb Rich/Sphagnum (Feather Moss)	Swamp	Swamp Wooded, coniferous	forested swamp
Development	Disturbed land, settlements, roads, industrial development	N/A	N/A	N/A	N/A

Land Cover Type	Land Cover Description	Corresponding Plant Community and Source			
		Forest Ecosystem Classification for Manitoba Plant Communities[a]	Canadian Wetland Classification Plant Communities[b]	Alberta Wetland Classification System[c]	Climatic and Physiographic Controls on Wetland Type and Distribution in Manitoba, Canada[d]

Source:
[a] Zoladeski et al. 1995
[b] National Wetlands Working Group 1997
[c] Alberta Environment and Sustainable Resource Development 2015
[d] Halsey et al. 1997

Appendix 11B HABITAT PATCH AREA AT EXISTING CONDITIONS, CONSTRUCTION/OPERATION AND CLOSURE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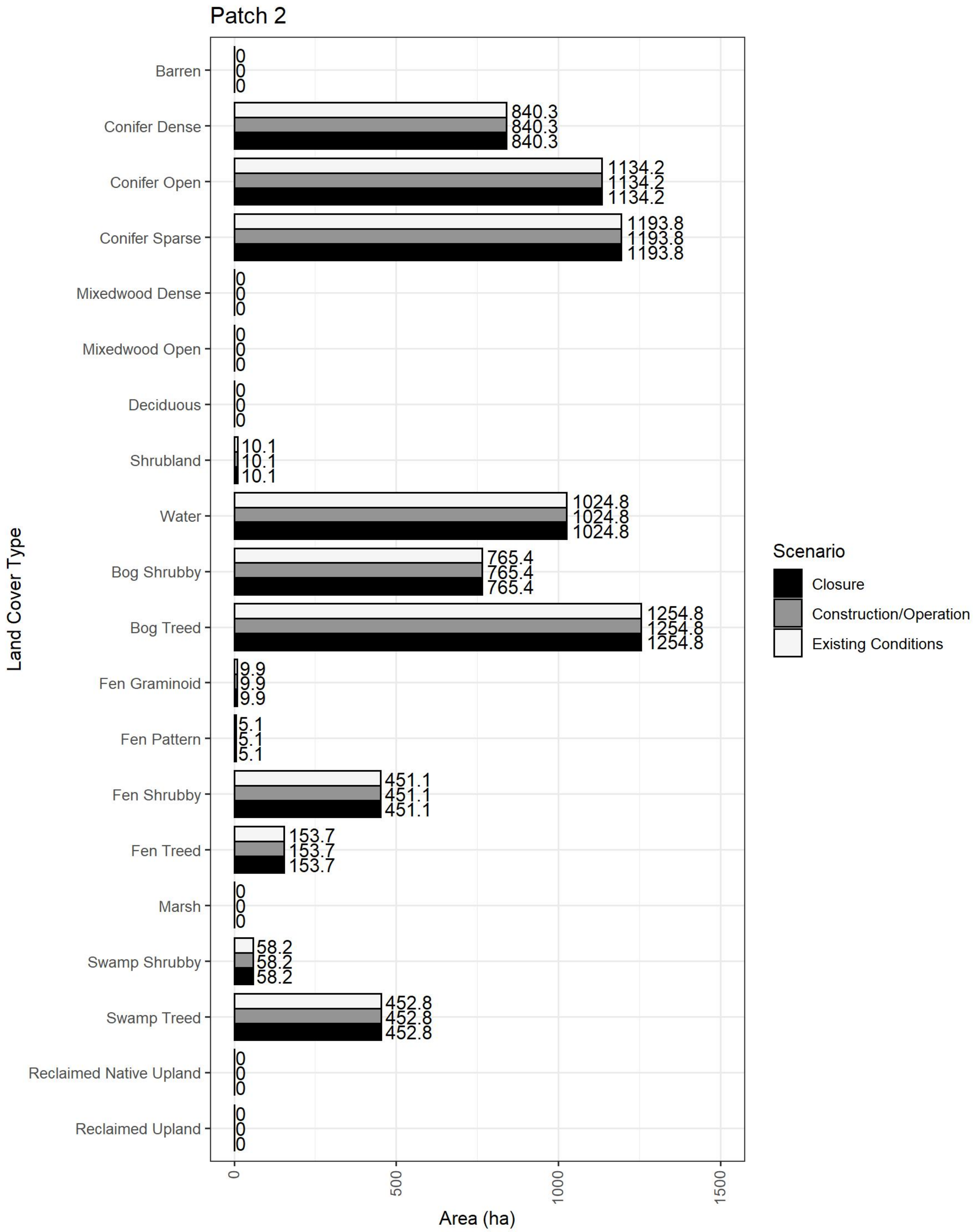
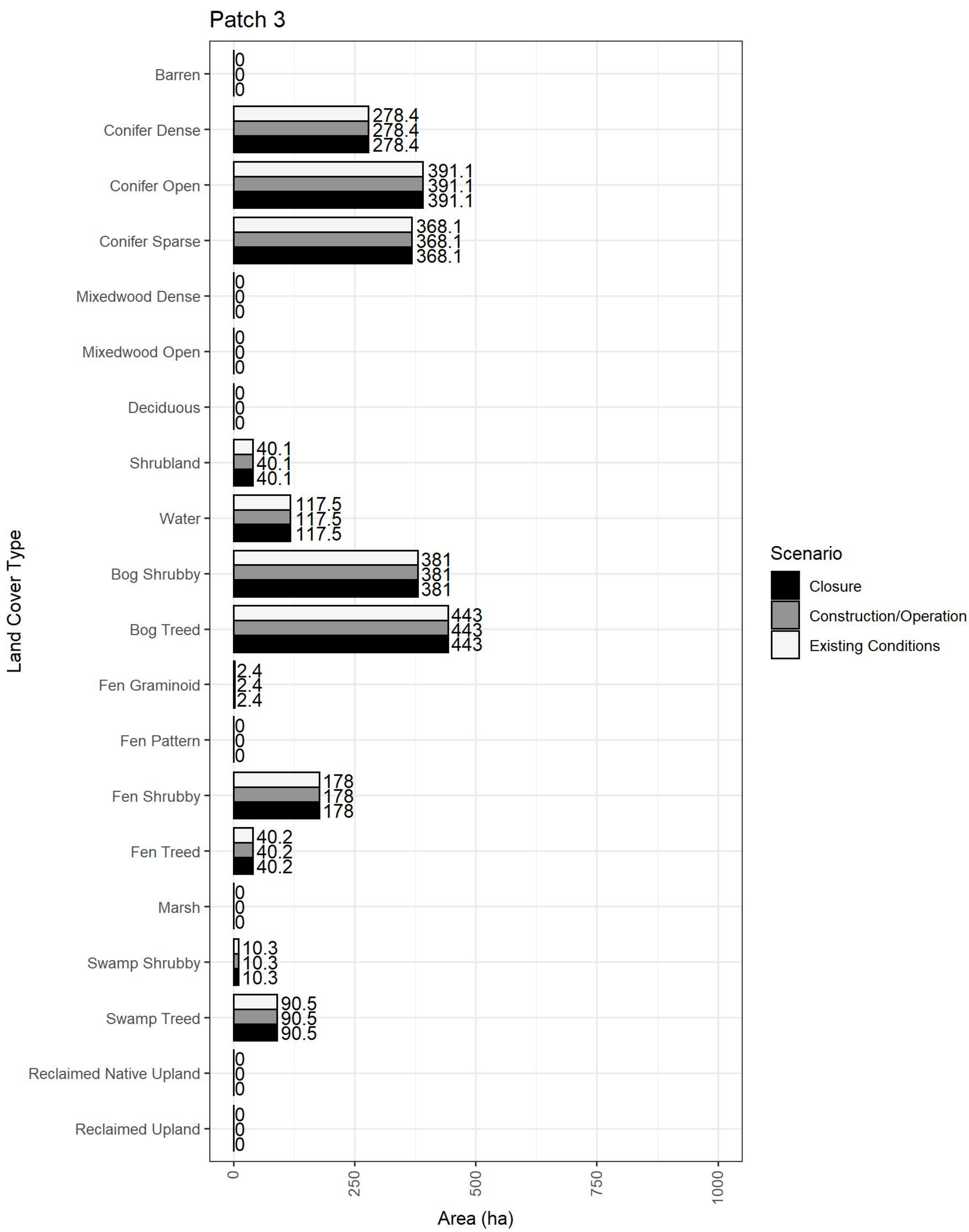
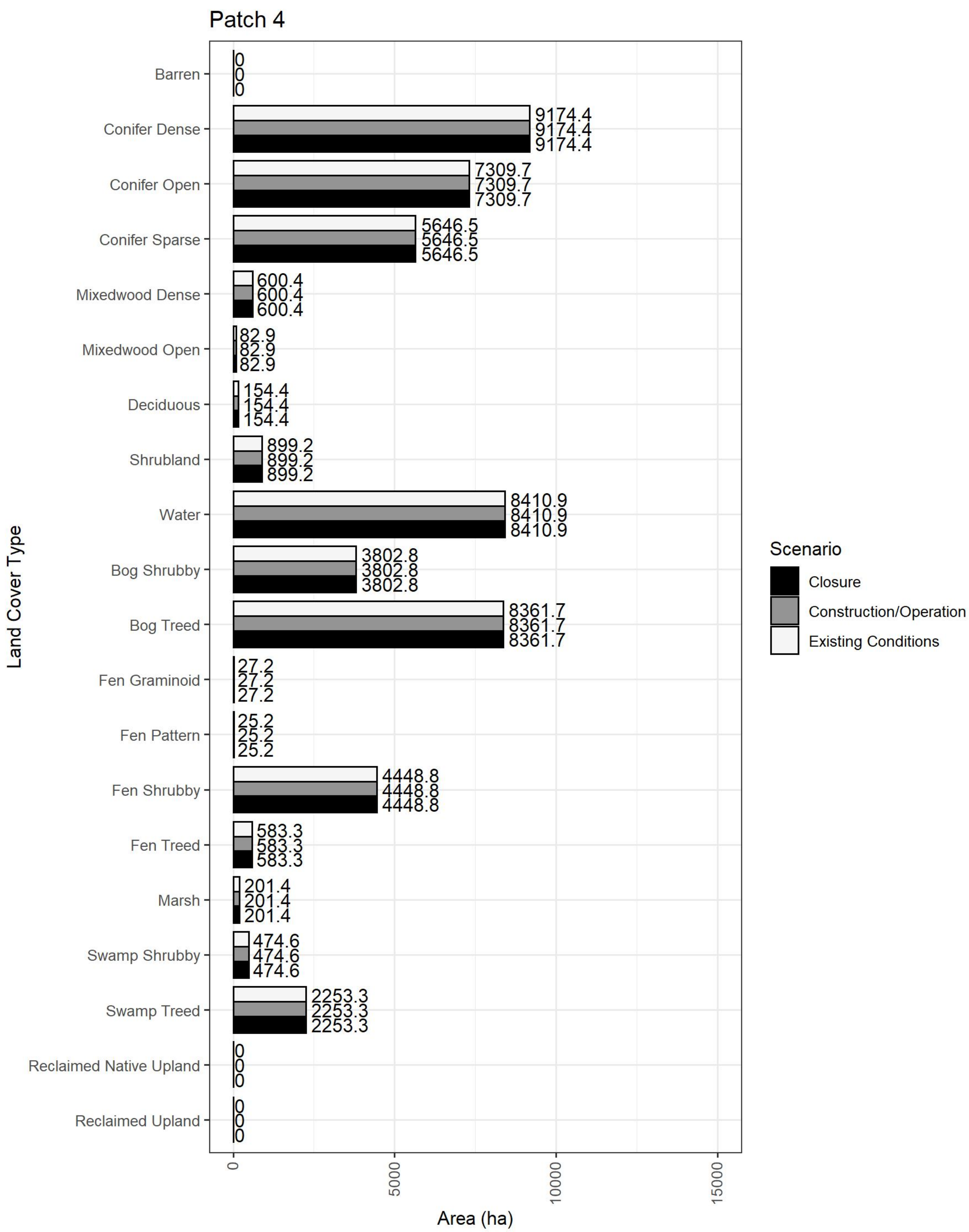
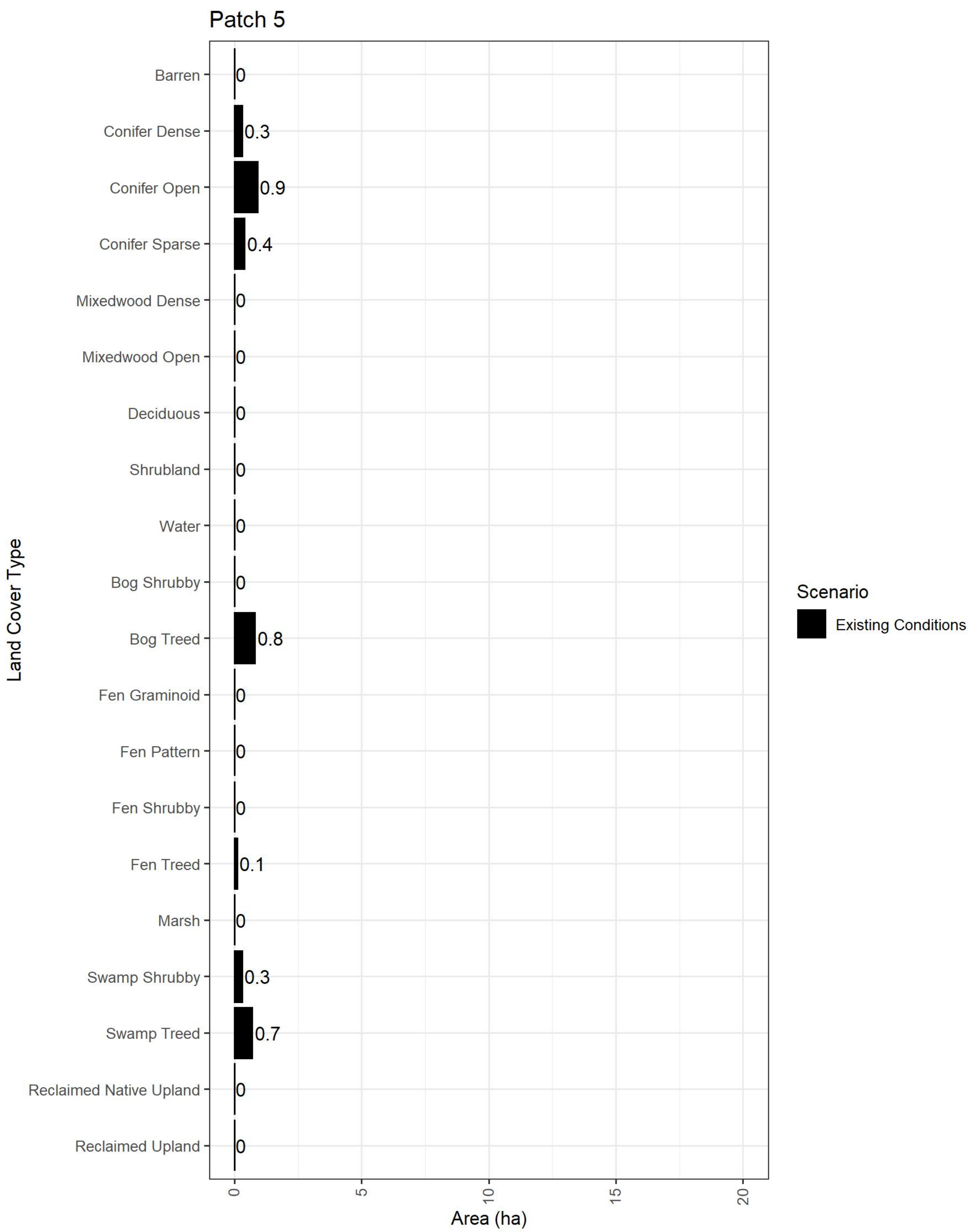
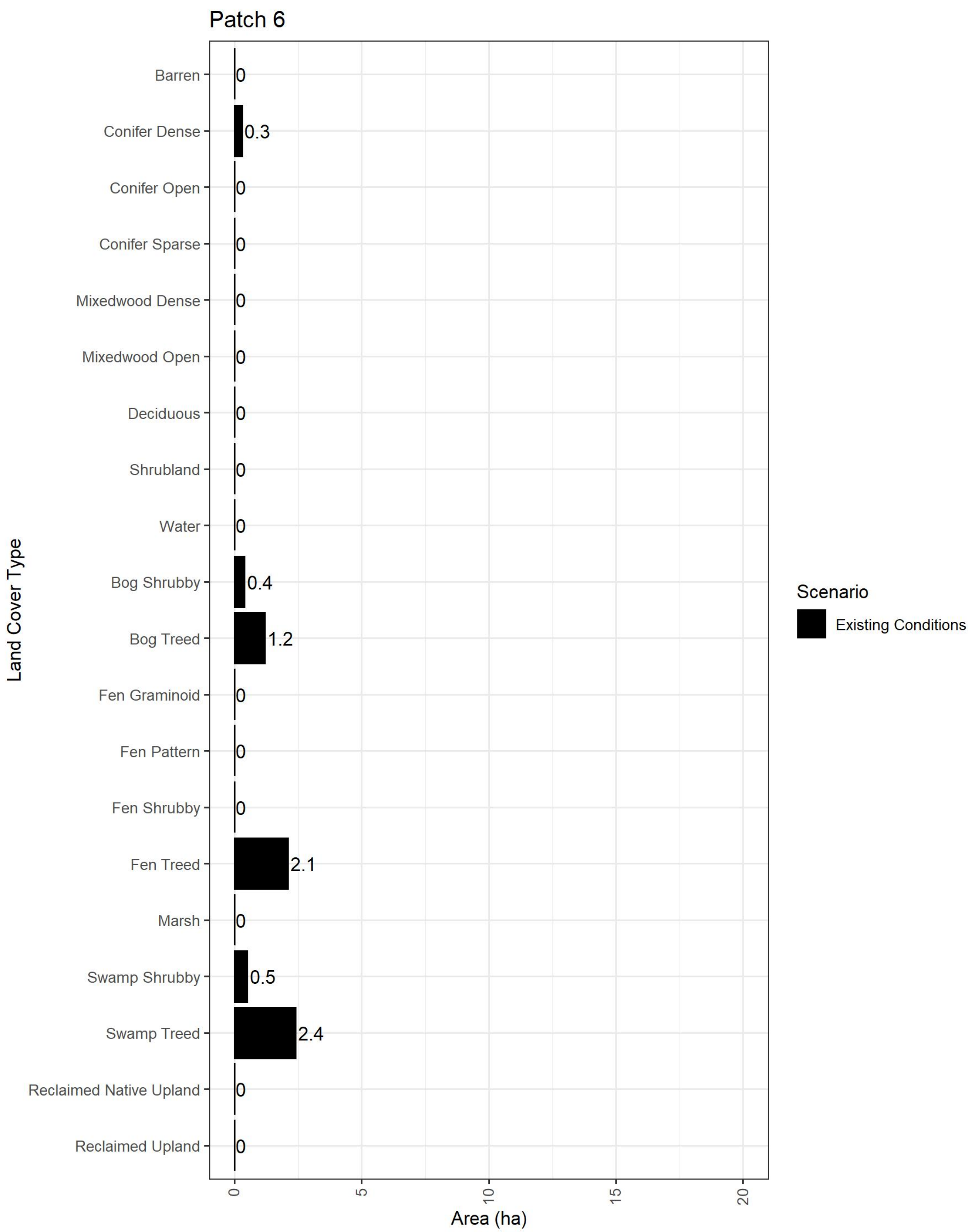
Barren
Conifer Dense
Conifer Open
Conifer Sparse
Mixedwood Dense
Mixedwood Open
Deciduous
Shrubland
Water
Bog Shrubby
Bog Treed
Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
0.9
0.9
0.9
17233.6
17072.6
17097
8656.9
8543.9
8556.6
13643.7
13593.6
13600.2
2131.4
2116.8
2119.8
1221
1219.1
1220.9
0
0
0
5705.4
5698.2
5700.5
17597.2
17584.7
17677.3
7904.4
7862.4
7874.5
17737.4
17604
17630.4
488.7
482.9
484.5
395.2
393.5
394.4
6709.8
6686
6696.8
1918.1
1914.6
1915.8
180.8
180.8
180.8
551.4
543.9
545.2
3231.2
3180.8
3191.2
0
0
692.3
0
0
236.4
Land Cover Type
0
5000
10000
15000
20000
Area (ha)
Scenario
Closure
Construction/Operation
Existing Conditions

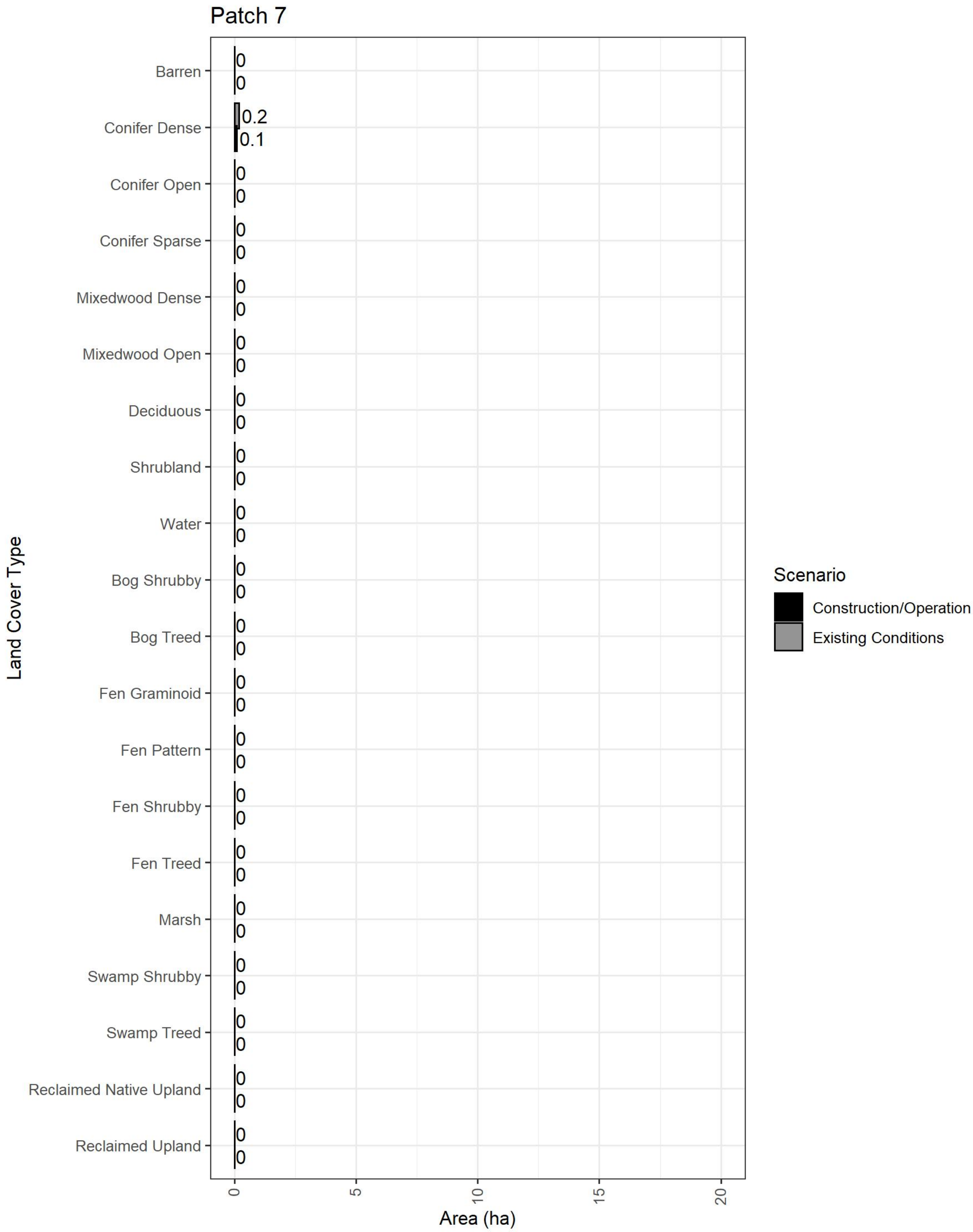

Patch 2
Land Cover Type
Barren
Conifer Dense
Conifer Open
Conifer Sparse
Mixedwood Dense
Mixedwood Open
Deciduous
Shrubland
Water
Bog Shrubby
Bog Treed
Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
0 0 0
840.3 840.3 840.3
1134.2 1134.2 1134.2
1193.8 1193.8 1193.8
0 0 0
0 0 0
0 0 0
10.1 10.1 10.1
1024.8 1024.8 1024.8
765.4 765.4 765.4
1254.8 1254.8 1254.8
9.9 9.9 9.9
5.1 5.1 5.1
451.1 451.1 451.1
153.7 153.7 153.7
0 0 0
58.2 58.2 58.2
452.8 452.8 452.8
0 0 0
0 0 0
0
500
1000
1500
Area (ha)
Scenario
Closure
Construction/Operation
Existing Conditions

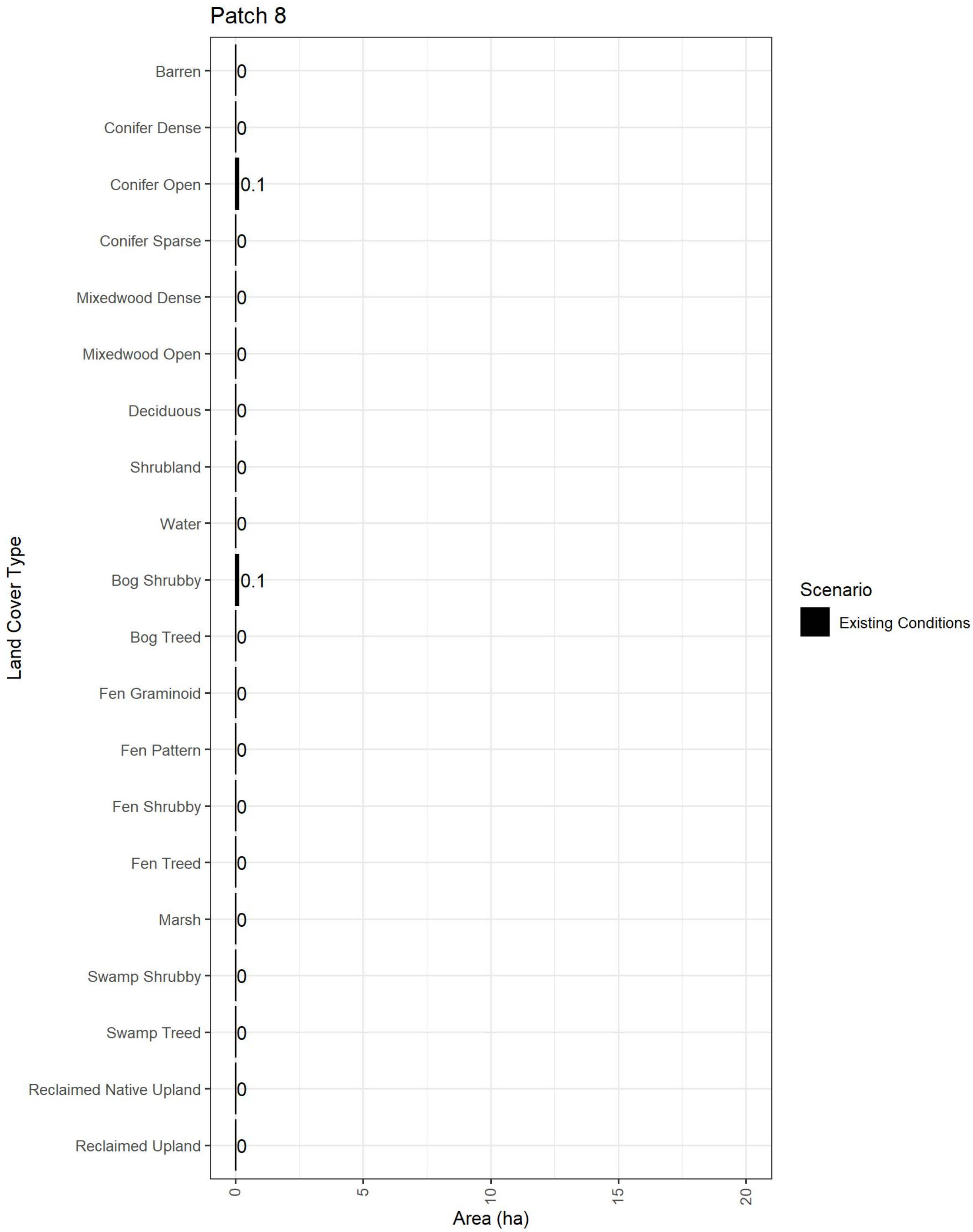

Patch 3
Land Cover Type
Barren
Conifer Dense
Conifer Open
Conifer Sparse
Mixedwood Dense
Mixedwood Open
Deciduous
Shrubland
Water
Bog Shrubby
Bog Treed
Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
0 0 0
278.4 278.4 278.4
391.1 391.1 391.1
368.1 368.1 368.1
0 0 0
0 0 0
0 0 0
40.1 40.1 40.1
117.5 117.5 117.5
381 381 381
443 443 443
2.4 2.4 2.4
0 0 0
178 178 178
40.2 40.2 40.2
0 0 0
10.3 10.3 10.3
90.5 90.5 90.5
0 0 0
0 0 0
0
250
500
750
1000
Area (ha)
Scenario
Closure
Construction/Operation
Existing Conditions

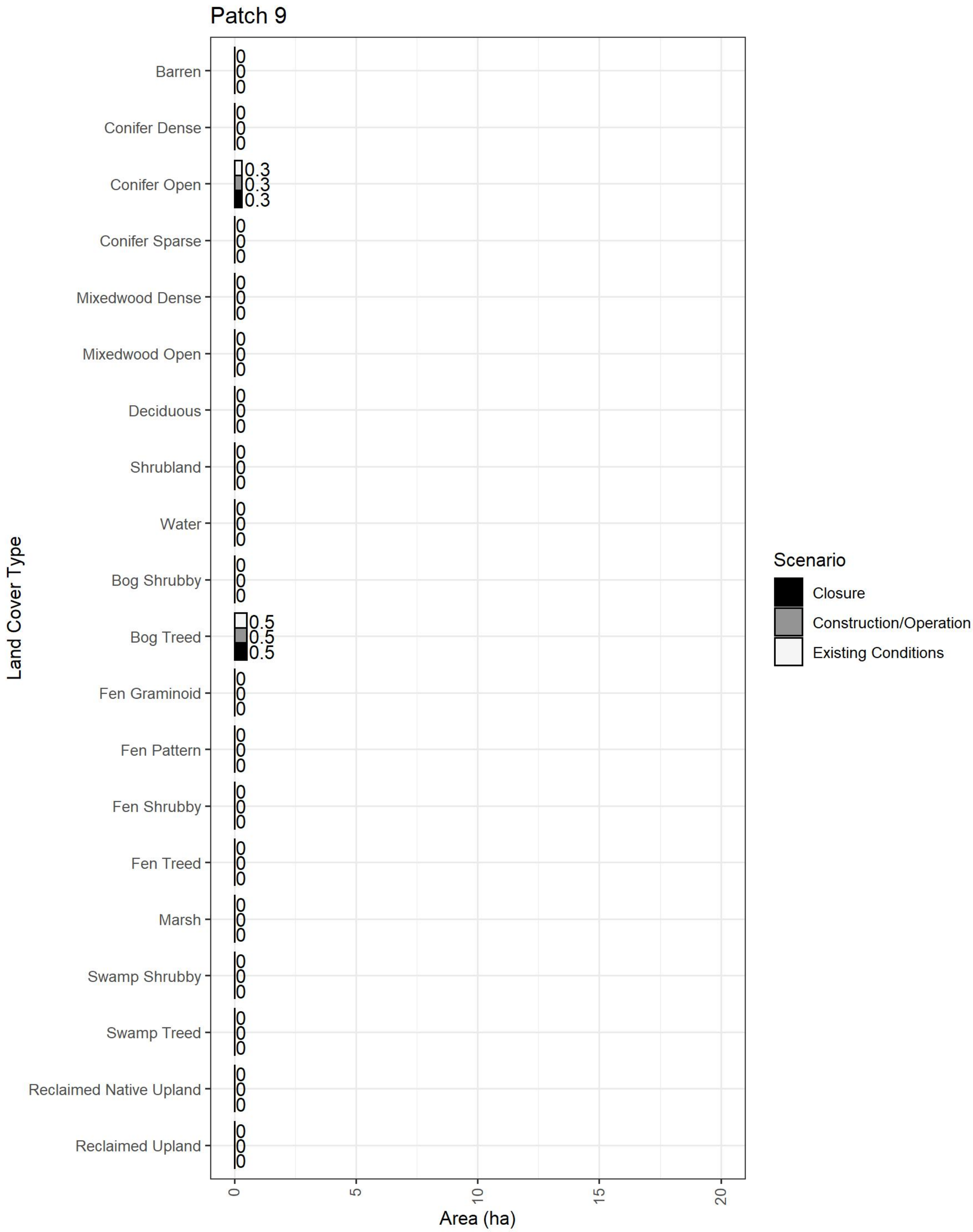

Patch 4
Land Cover Type
Barren
Conifer Dense
Conifer Open
Conifer Sparse
Mixedwood Dense
Mixedwood Open
Deciduous
Shrubland
Water
Bog Shrubby
Bog Treed
Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
0 0 0
9174.4 9174.4 9174.4
7309.7 7309.7 7309.7
5646.5 5646.5 5646.5
600.4 600.4 600.4
82.9 82.9 82.9
154.4 154.4 154.4
899.2 899.2 899.2
8410.9 8410.9 8410.9
3802.8 3802.8 3802.8
8361.7 8361.7 8361.7
27.2 27.2 27.2
25.2 25.2 25.2
4448.8 4448.8 4448.8
583.3 583.3 583.3
201.4 201.4 201.4
474.6 474.6 474.6
2253.3 2253.3 2253.3
0 0 0
0 0 0
0
5000
10000
15000
Area (ha)
Scenario
Closure
Construction/Operation
Existing Conditions

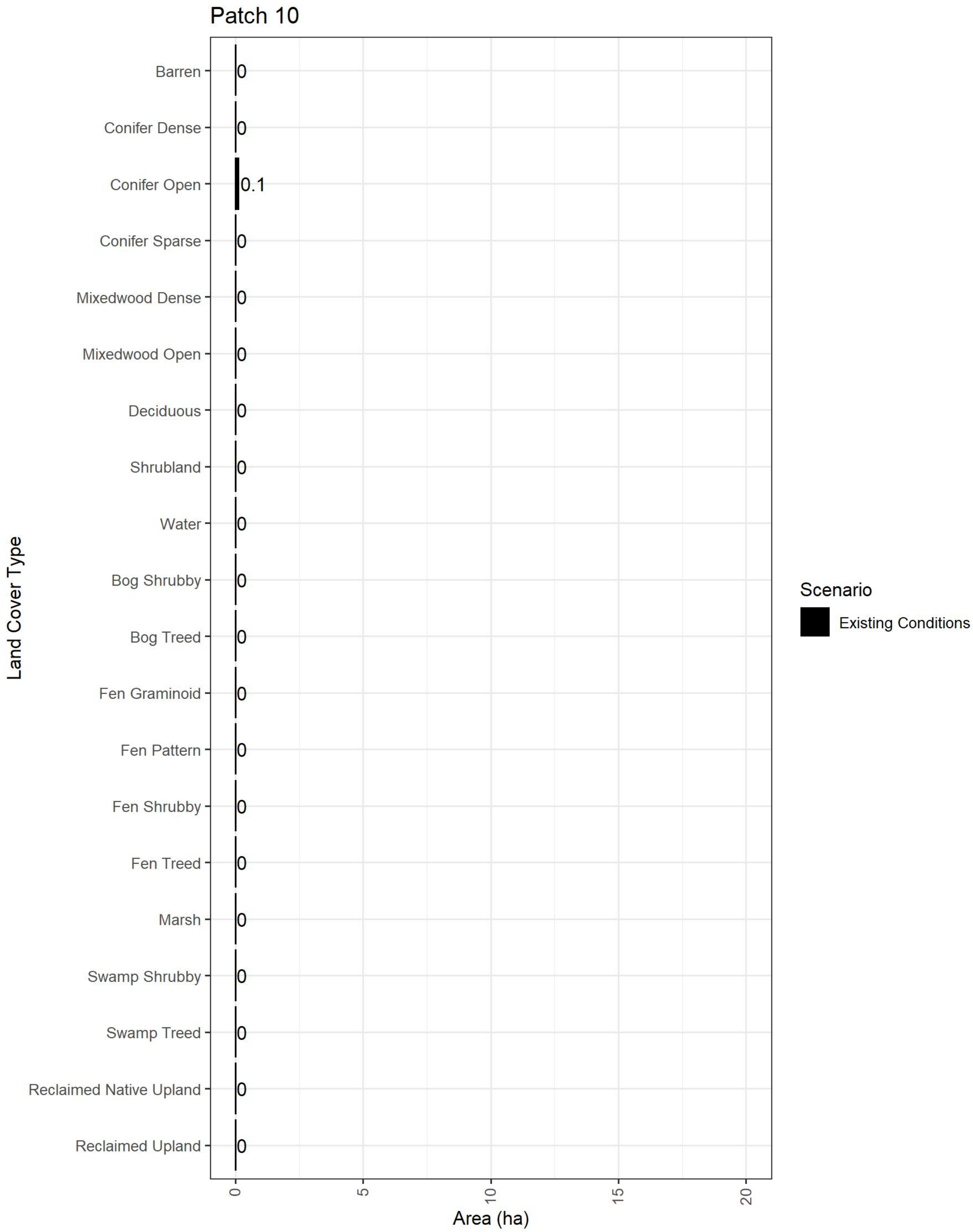

Patch 5
Land Cover Type
Barren
Conifer Dense
Conifer Open
Conifer Sparse
Mixedwood Dense
Mixedwood Open
Deciduous
Shrubland
Water
Bog Shrubby
Bog Treed
Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
0
0.3
0.9
0.4
0
0
0
0
0
0
0.8
0
0
0
0.1
0
0.3
0.7
0
0
0
5
10
15
20
Area (ha)
Scenario
Existing Conditions

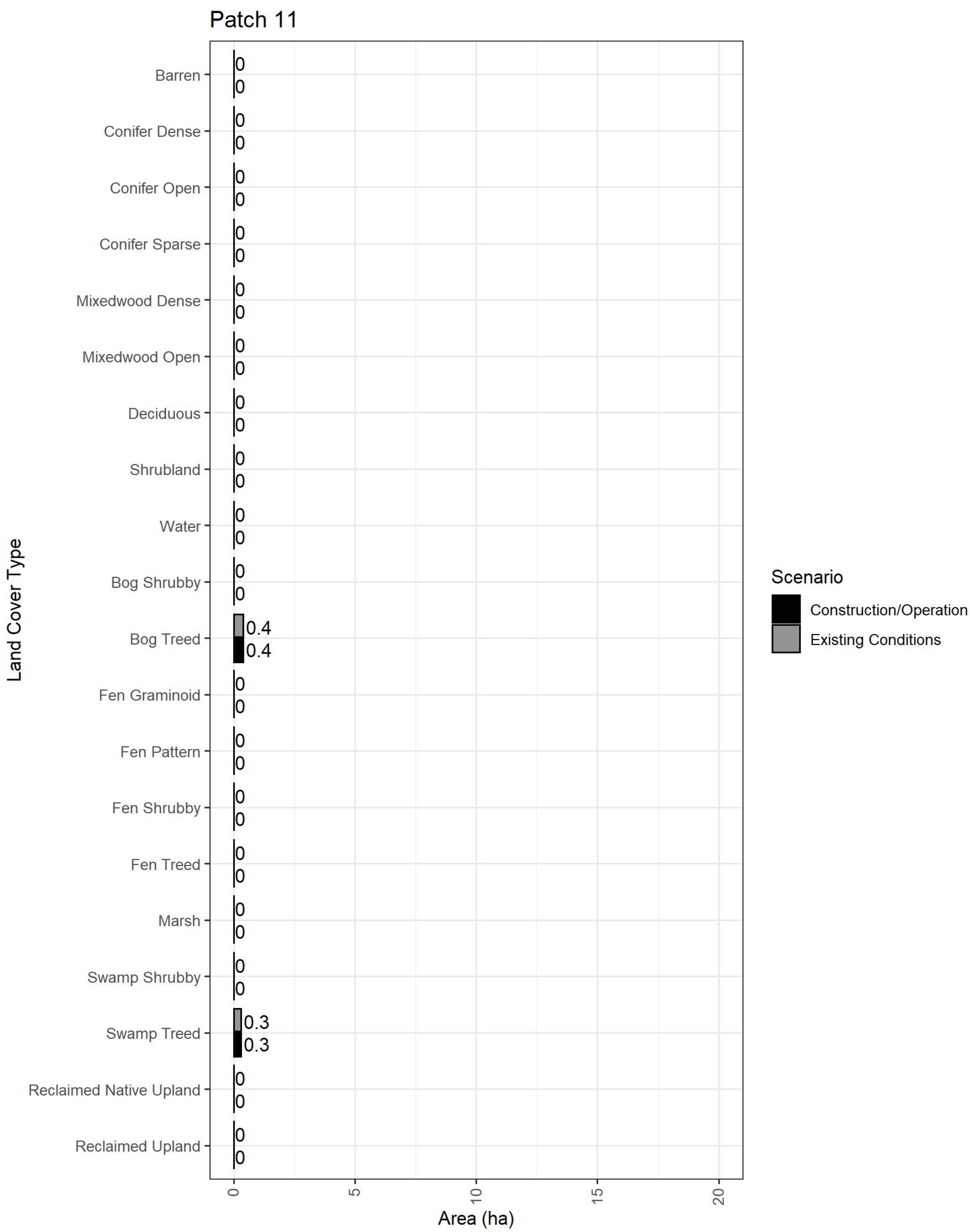

Patch 6
Land Cover Type
Barren
Conifer Dense
Conifer Open
Conifer Sparse
Mixedwood Dense
Mixedwood Open
Deciduous
Shrubland
Water
Bog Shrubby
Bog Treed
Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
0
0.3
0
0
0
0
0
0
0
0.4
1.2
0
0
0
2.1
0
0.5
2.4
0
0
0
5
10
15
20
Area (ha)
Scenario
Existing Conditions

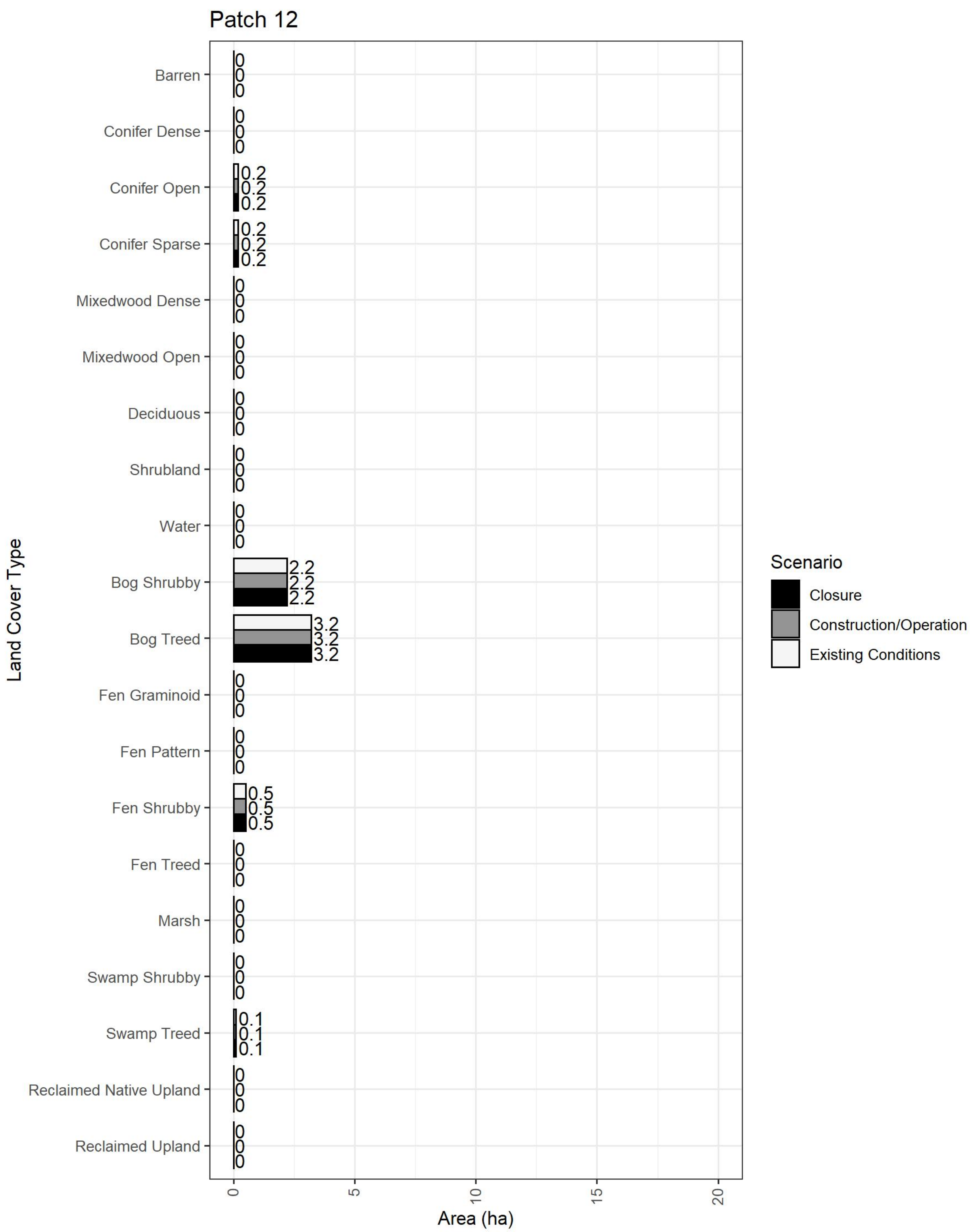

Patch 7
Land Cover Type
Barren
0
0
Conifer Dense
0.2
0.1
Conifer Open
0
0
Conifer Sparse
0
0
Mixedwood Dense
0
0
Mixedwood Open
0
0
Deciduous
0
0
Shrubland
0
0
Water
0
0
Bog Shrubby
0
0
Bog Treed
0
0
Fen Graminoid
0
0
Fen Pattern
0
0
Fen Shrubby
0
0
Fen Treed
0
0
Marsh
0
0
Swamp Shrubby
0
0
Swamp Treed
0
0
Reclaimed Native Upland
0
0
Reclaimed Upland
0
0
0
5
10
15
20
Area (ha)
Scenario
Construction/Operation
Existing Conditions

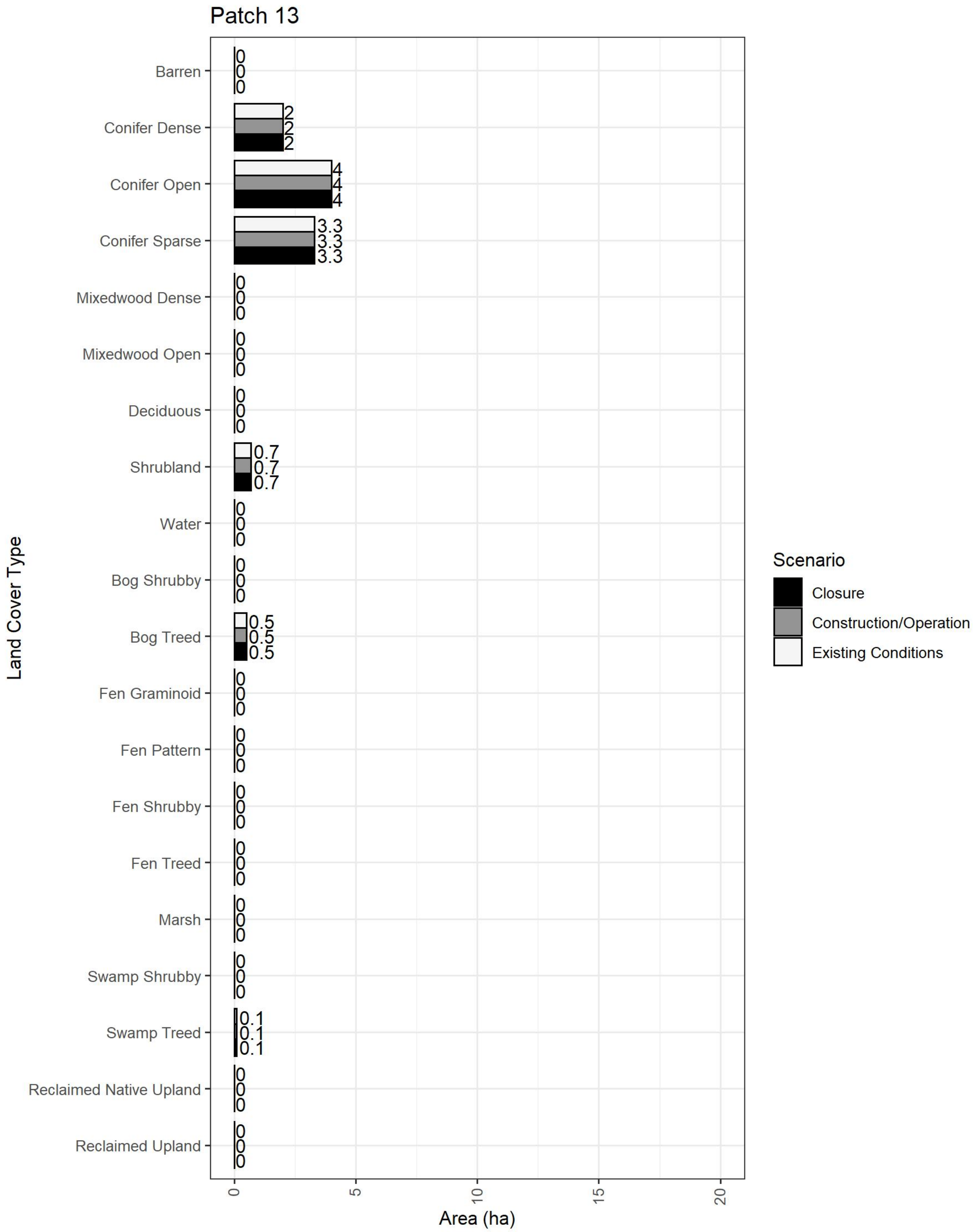

Patch 8
Land Cover Type
Barren
Conifer Dense
Conifer Open
Conifer Sparse
Mixedwood Dense
Mixedwood Open
Deciduous
Shrubland
Water
Bog Shrubby
Bog Treed
Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
0
0
0.1
0
0
0
0
0
0
0.1
0
0
0
0
0
0
0
0
0
0
0
5
10
15
20
Area (ha)
Scenario
Existing Conditions

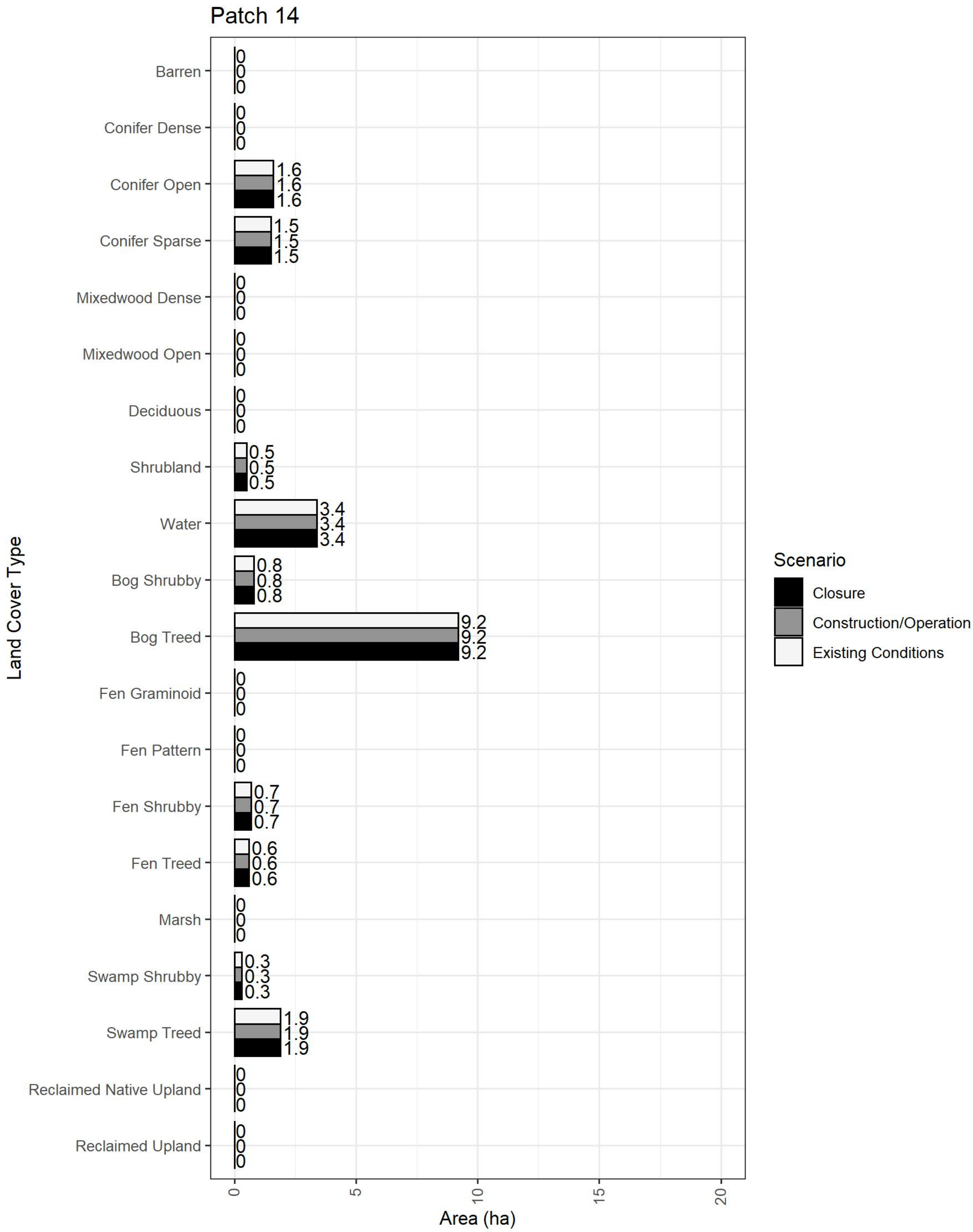

Patch 9
Land Cover Type
Barren
Conifer Dense
Conifer Open
Conifer Sparse
Mixedwood Dense
Mixedwood Open
Deciduous
Shrubland
Water
Bog Shrubby
Bog Treed
Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
0.3
0.5
0
5
10
15
20
Area (ha)
Scenario
Closure
Construction/Operation
Existing Conditions

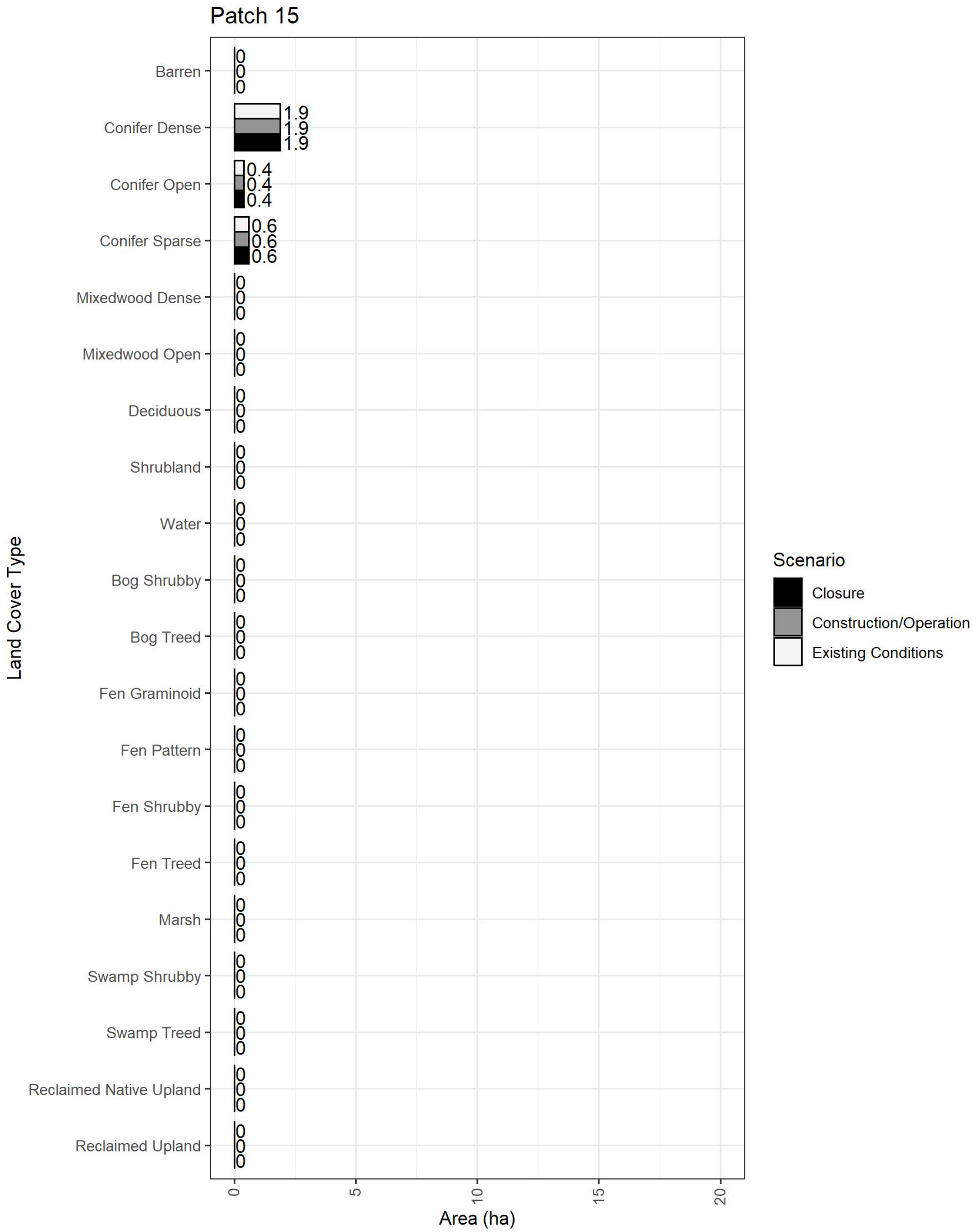

Patch 10
Land Cover Type
Barren 0
Conifer Dense 0
Conifer Open 0.1
Conifer Sparse 0
Mixedwood Dense 0
Mixedwood Open 0
Deciduous 0
Shrubland 0
Water 0
Bog Shrubby 0
Bog Treed 0
Fen Graminoid 0
Fen Pattern 0
Fen Shrubby 0
Fen Treed 0
Marsh 0
Swamp Shrubby 0
Swamp Treed 0
Reclaimed Native Upland 0
Reclaimed Upland 0
0
5
10
15
20
Area (ha)
Scenario
Existing Conditions

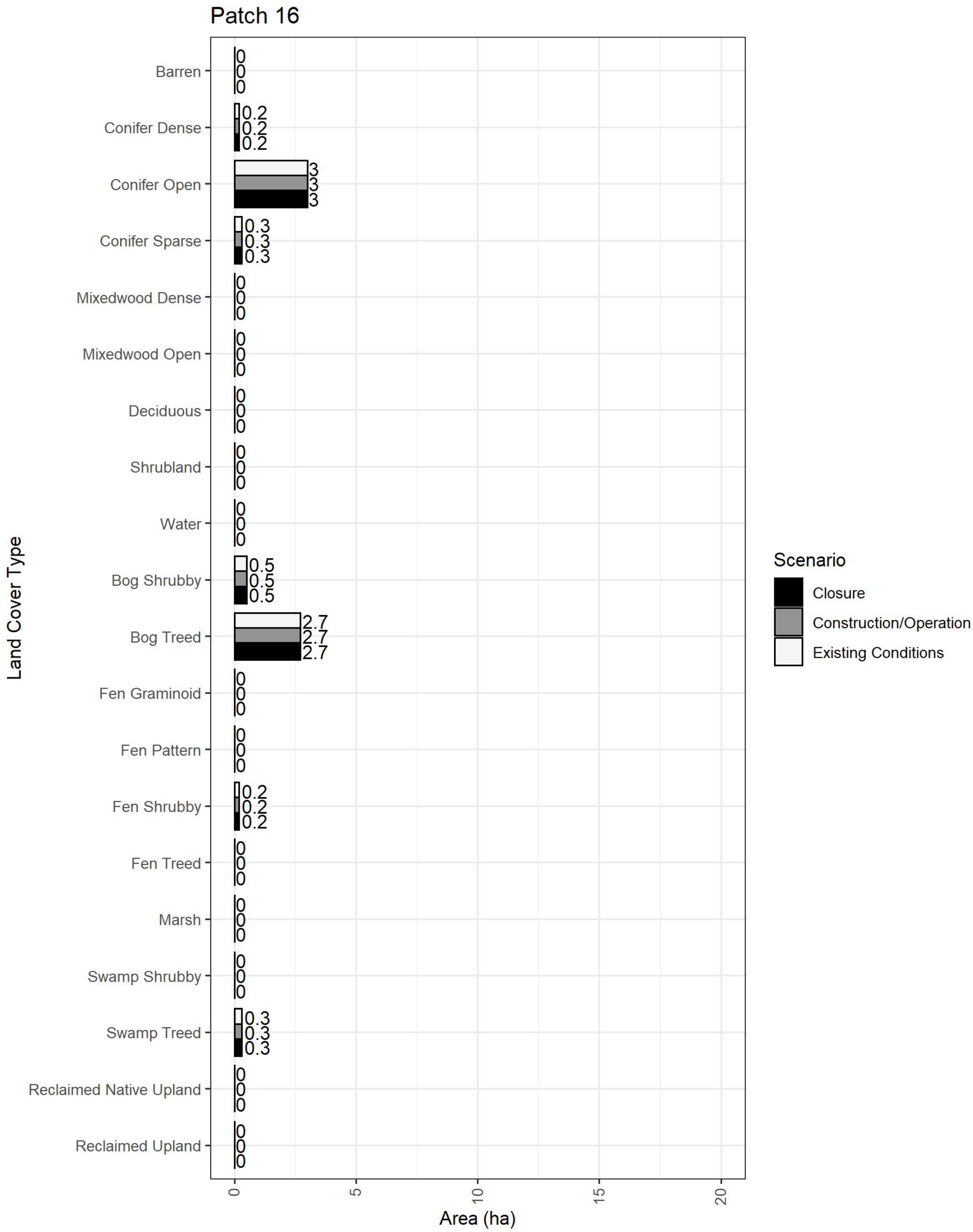

Patch 11
Land Cover Type
Barren
Conifer Dense
Conifer Open
Conifer Sparse
Mixedwood Dense
Mixedwood Open
Deciduous
Shrubland
Water
Bog Shrubby
Bog Treed
Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
0.4
0.4
0.3
0.3
0
5
10
15
20
Area (ha)
Scenario
Construction/Operation
Existing Conditions

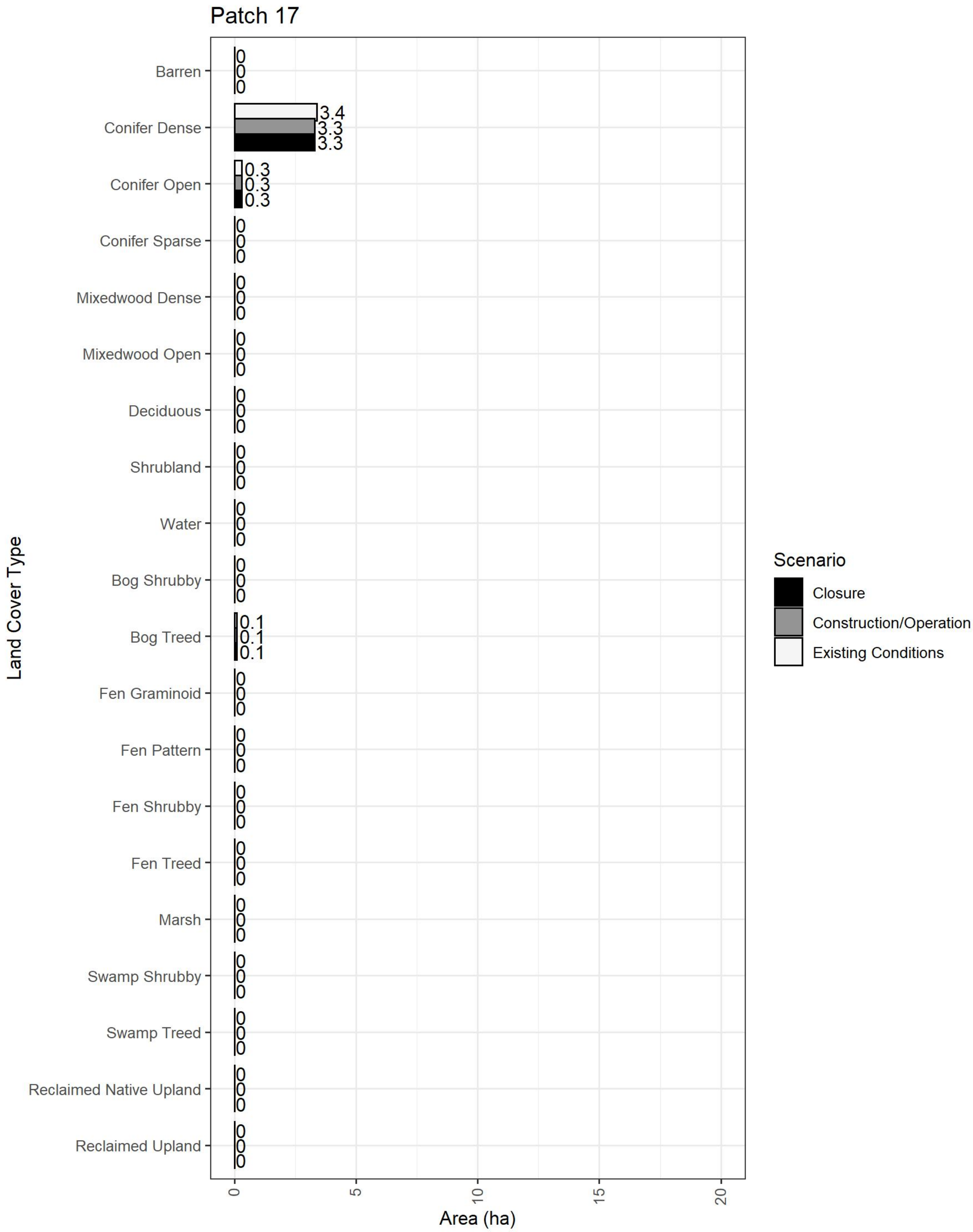

Patch 12
Land Cover Type
Barren
Conifer Dense
Conifer Open
Conifer Sparse
Mixedwood Dense
Mixedwood Open
Deciduous
Shrubland
Water
Bog Shrubby
Bog Treed
Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
0 0 0
0 0 0
0.2 0.2 0.2
0.2 0.2 0.2
0 0 0
0 0 0
0 0 0
0 0 0
0 0 0
2.2 2.2 2.2
3.2 3.2 3.2
0 0 0
0 0 0
0.5 0.5 0.5
0 0 0
0 0 0
0 0 0
0.1 0.1 0.1
0 0 0
0 0 0
0
5
10
15
20
Area (ha)
Scenario
Closure
Construction/Operation
Existing Conditions


Patch 13
Land Cover Type
Barren
Conifer Dense
Conifer Open
Conifer Sparse
Mixedwood Dense
Mixedwood Open
Deciduous
Shrubland
Water
Bog Shrubby
Bog Treed
Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
0 0 0
2 2 2
4 4 4
3.3 3.3 3.3
0 0 0
0 0 0
0 0 0
0.7 0.7 0.7
0 0 0
0 0 0
0.5 0.5 0.5
0 0 0
0 0 0
0 0 0
0 0 0
0 0 0
0 0 0
0.1 0.1 0.1
0 0 0
0 0 0
0
5
10
15
20
Area (ha)
Scenario
Closure
Construction/Operation
Existing Conditions


Patch 14
Land Cover Type
Barren
Conifer Dense
Conifer Open
Conifer Sparse
Mixedwood Dense
Mixedwood Open
Deciduous
Shrubland
Water
Bog Shrubby
Bog Treed
Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
0 0 0
0 0 0
1.6 1.6 1.6
1.5 1.5 1.5
0 0 0
0 0 0
0 0 0
0.5 0.5 0.5
3.4 3.4 3.4
0.8 0.8 0.8
9.2 9.2 9.2
0 0 0
0 0 0
0.7 0.7 0.7
0.6 0.6 0.6
0 0 0
0.3 0.3 0.3
1.9 1.9 1.9
0 0 0
0 0 0
0
5
10
15
20
Area (ha)
Scenario
Closure
Construction/Operation
Existing Conditions


Patch 15
Barren
Conifer Dense
Conifer Open
Conifer Sparse
Mixedwood Dense
Mixedwood Open
Deciduous
Shrubland
Water
Bog Shrubby
Bog Treed
Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
Land Cover Type
1.9
0.4
0.6
0
0
5
10
15
20
Area (ha)
Scenario
Closure
Construction/Operation
Existing Conditions


Patch 16
Land Cover Type
Barren
Conifer Dense
Conifer Open
Conifer Sparse
Mixedwood Dense
Mixedwood Open
Deciduous
Shrubland
Water
Bog Shrubby
Bog Treed
Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
0 0 0
0.2 0.2 0.2
3 3 3
0.3 0.3 0.3
0 0 0
0 0 0
0 0 0
0 0 0
0 0 0
0.5 0.5 0.5
2.7 2.7 2.7
0 0 0
0 0 0
0.2 0.2 0.2
0 0 0
0 0 0
0 0 0
0.3 0.3 0.3
0 0 0
0 0 0
0
5
10
15
20
Area (ha)
Scenario
Closure
Construction/Operation
Existing Conditions


Patch 17
Land Cover Type
Barren
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Conifer Open
Conifer Sparse
Mixedwood Dense
Mixedwood Open
Deciduous
Shrubland
Water
Bog Shrubby
Bog Treed
Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
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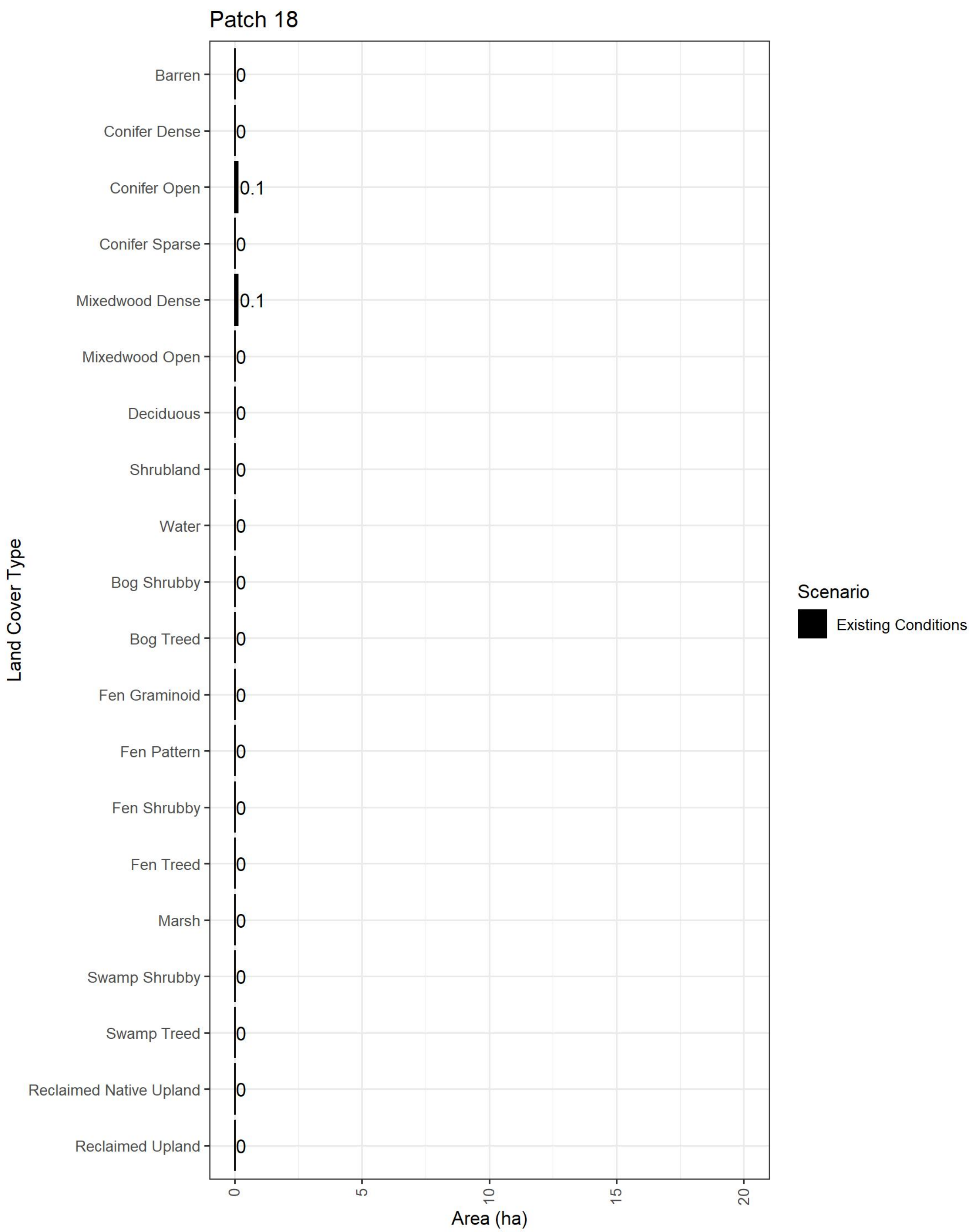
Area (ha)
Scenario
Closure
Construction/Operation
Existing Conditions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Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
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Reclaimed Upland
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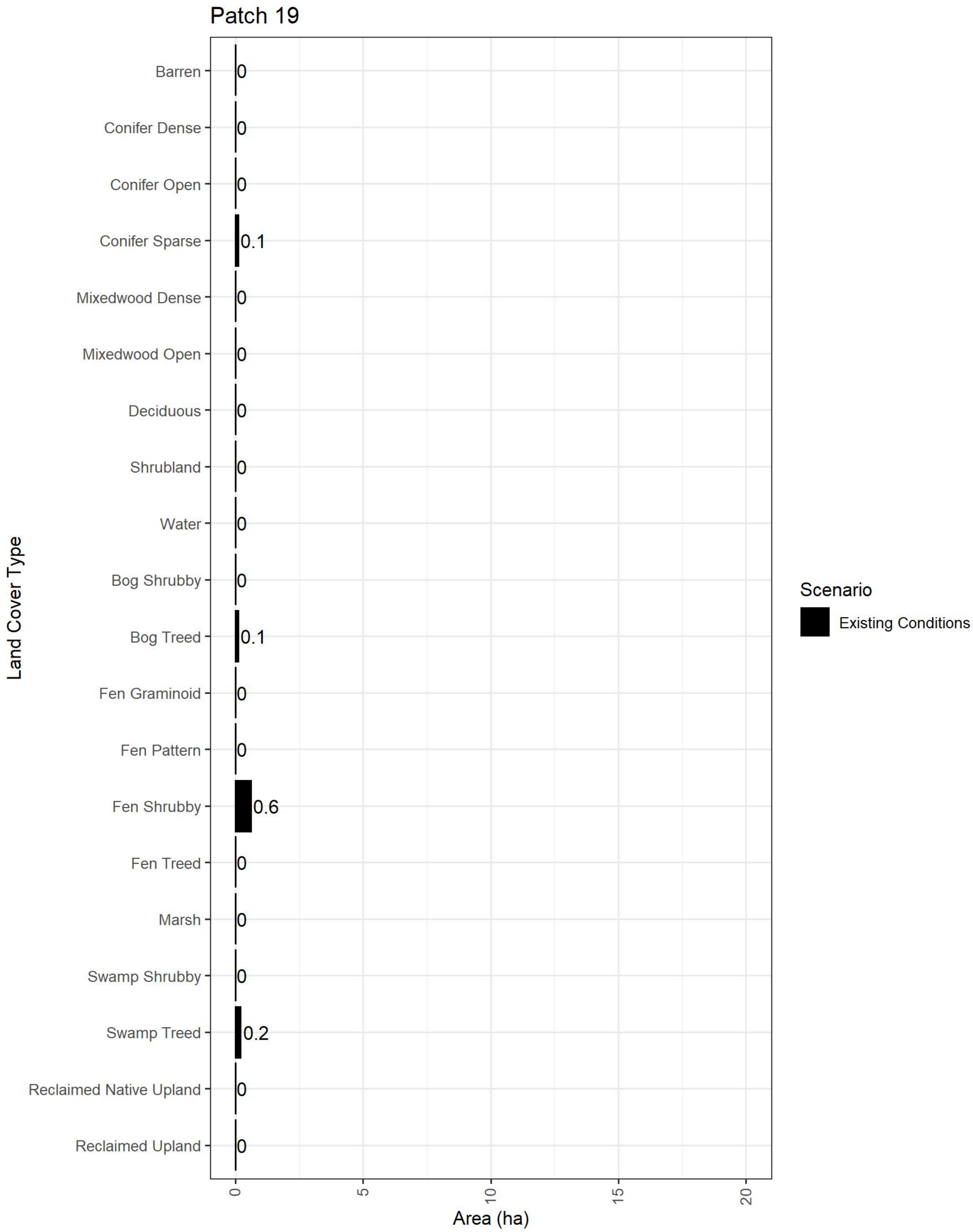
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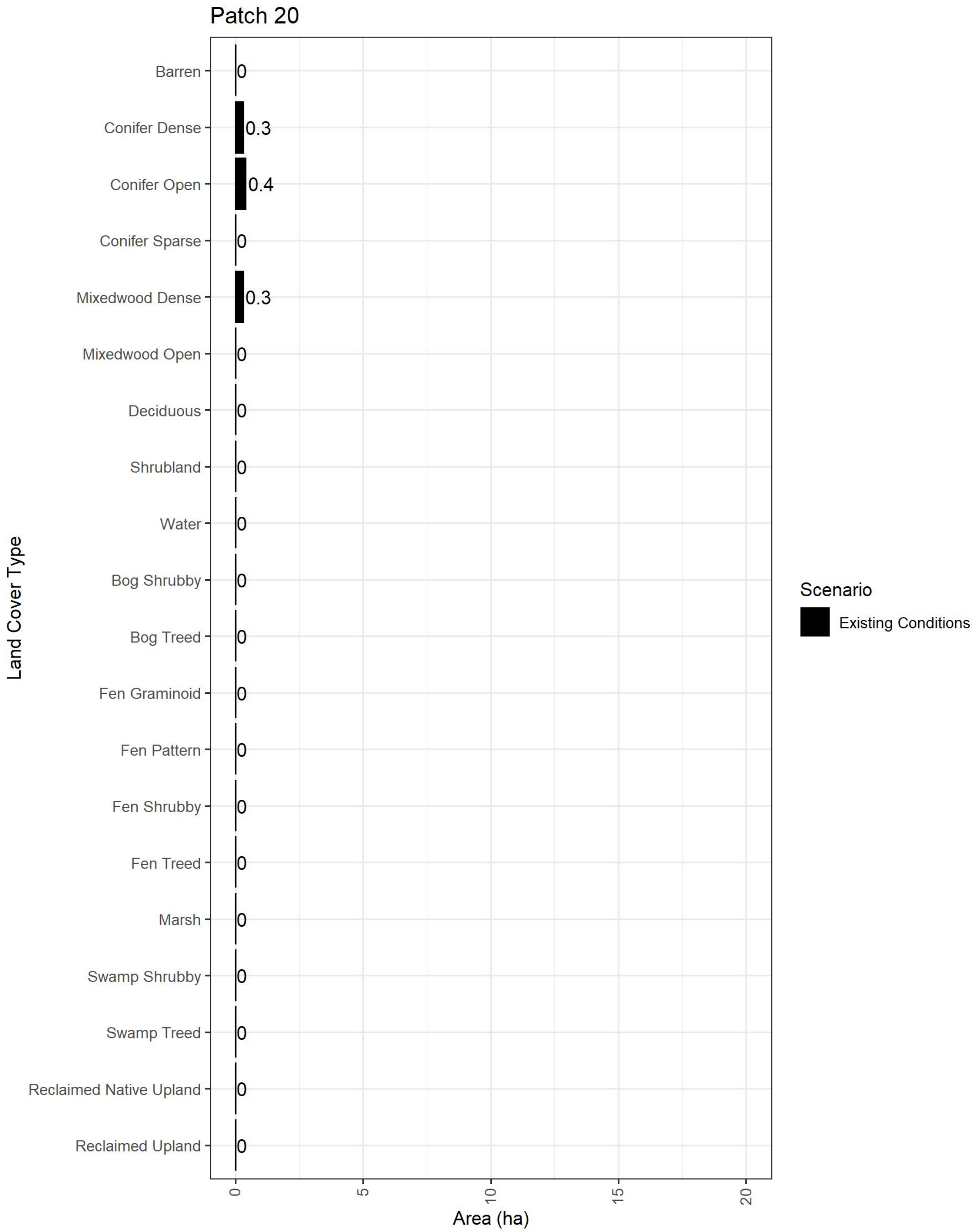
Area (ha)
Scenario
Existing Conditions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Fen Treed
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Swamp Treed
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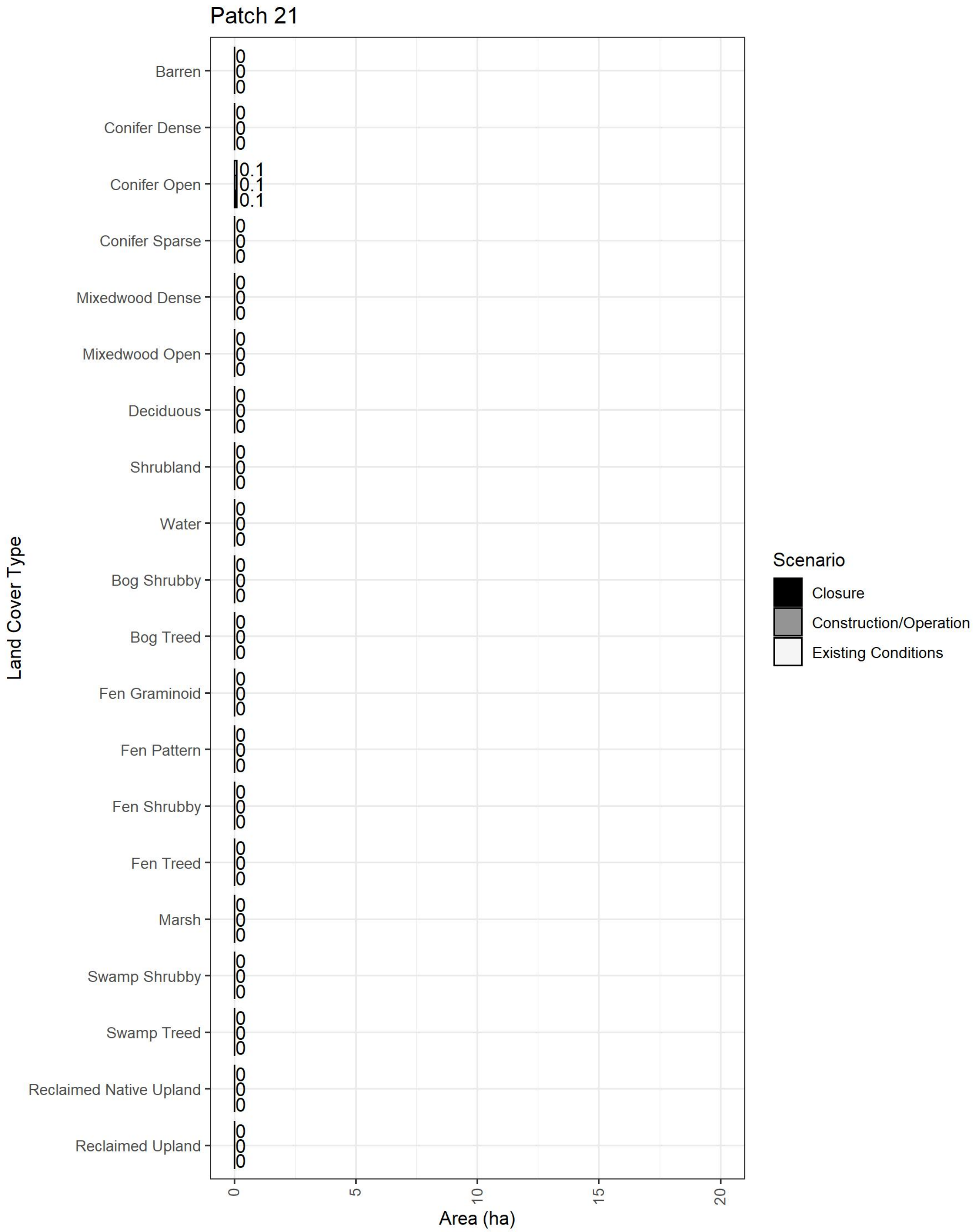
Area (ha)
Scenario
Existing Conditions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Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
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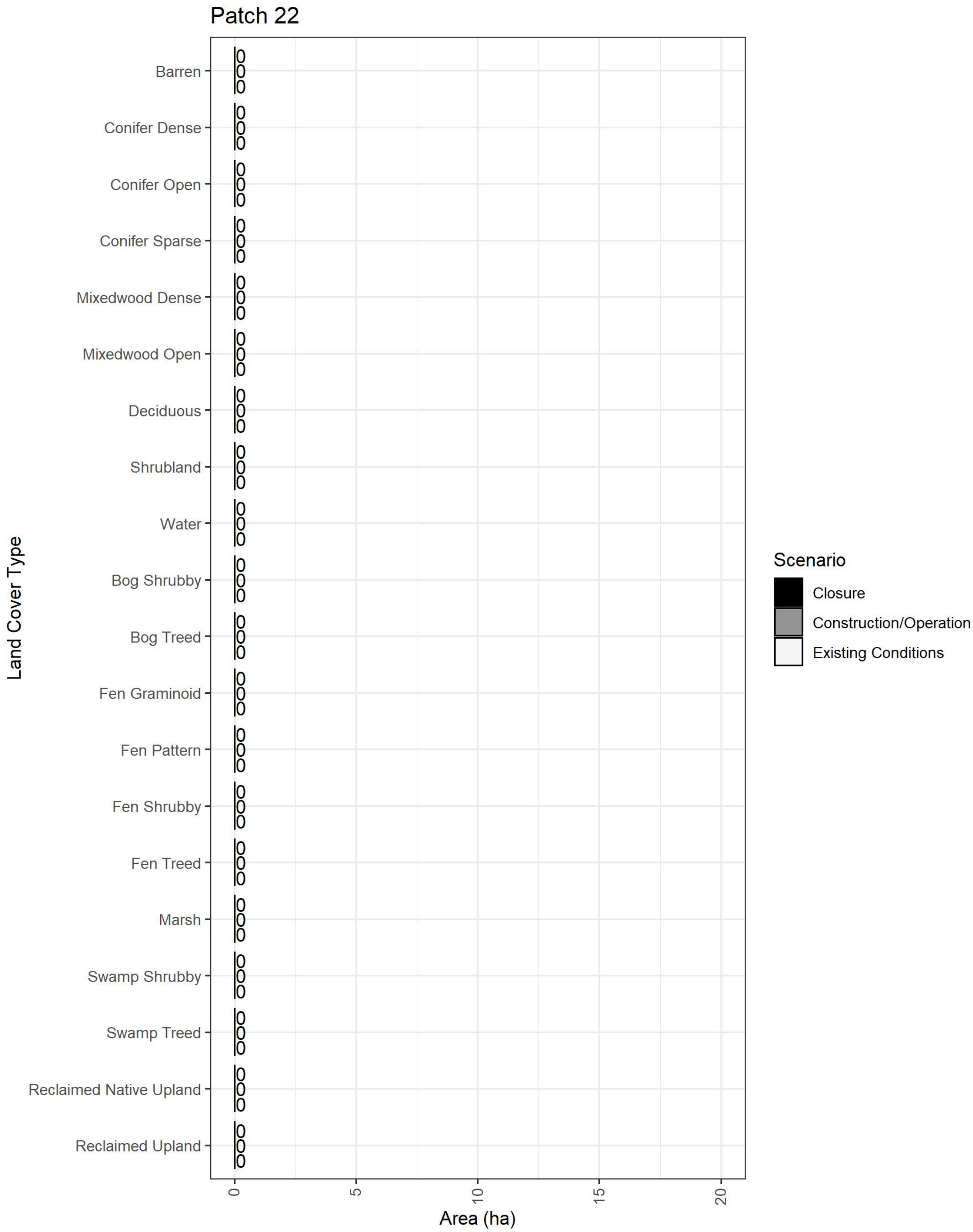
Area (ha)
Scenario
Closure
Construction/Operation
Existing Conditions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Bog Treed
Fen Graminoid
Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
Reclaimed Upland
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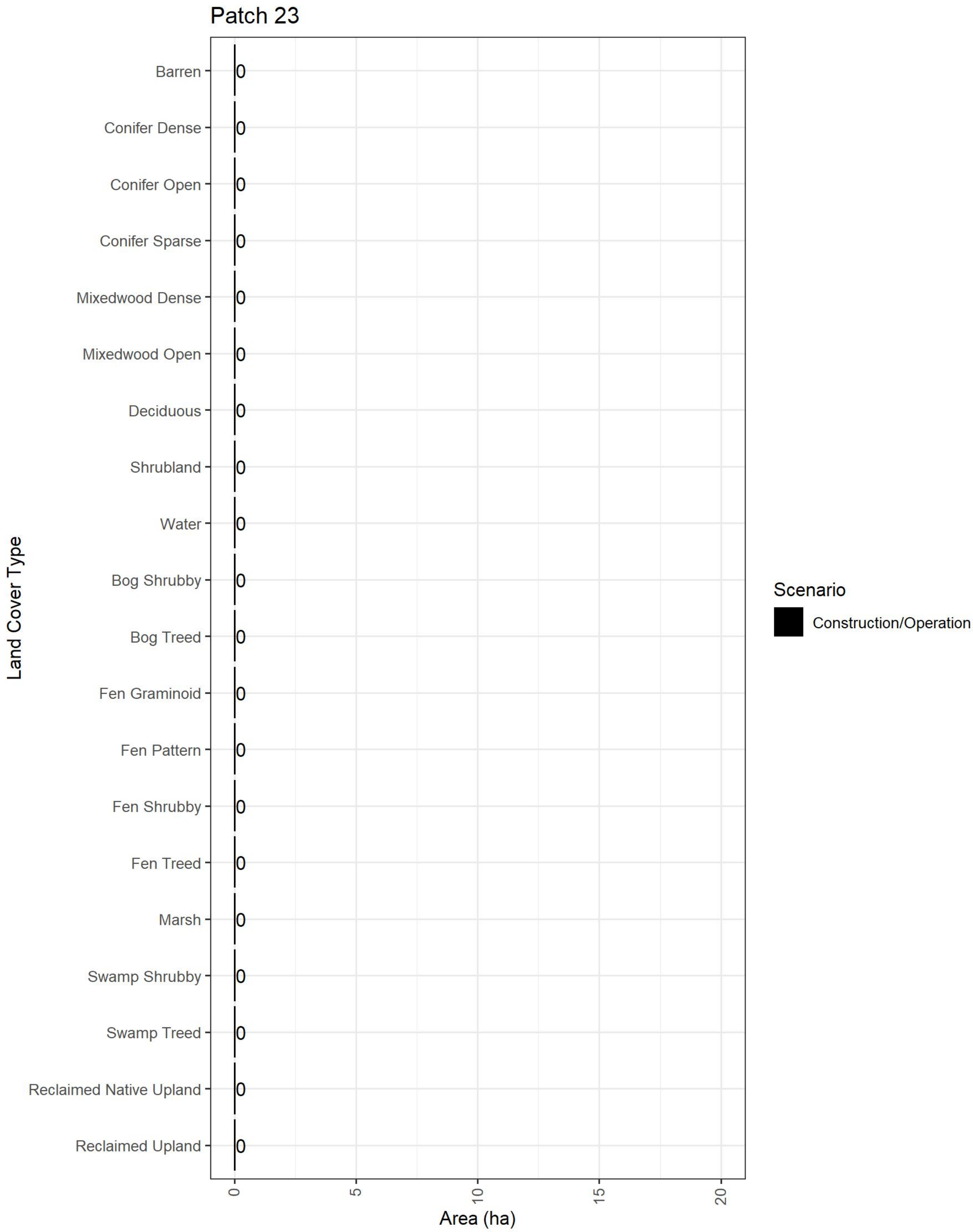
Area (ha)
Scenario
Closure
Construction/Operation
Existing Conditions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Bog Treed
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Fen Pattern
Fen Shrubby
Fen Treed
Marsh
Swamp Shrubby
Swamp Treed
Reclaimed Native Upland
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Area (ha)
Scenario
Construction/Operation

Appendix 11C CHANGE IN VEGETATION AND WETLAND LAND COVER TYPES IN THE GORDON AND MACLELLAN LAA DURING CONSTRUCTION/OPERATION AND DECOMMISSIONING/CLOSURE

Table 11C-1 Change in Vegetation and Wetland Land Cover Types in the Gordon LAA

Land Cover Type	Description	Existing Conditions	Construction & Operation	Decommissioning / Closure	Change from Existing Conditions			
					Construction & Operation		Decommissioning/ Closure	
		Area (ha)	Area (ha)	Area (ha)	ha	%	ha	%
Conifer Dense[a]	>60% crown closure, with ≥75% coniferous tree cover	1,094.5	1,072.3	1,072.3	-22.2	-2.0	-22.2	-2.0
Conifer Open[a]	26-60% crown closure, with ≥75% coniferous tree cover	463.8	443.4	443.4	-20.4	-4.4	-20.4	-4.4
Conifer Sparse[a]	10-25% crown closure, with ≥ 75% coniferous tree cover	355.8	327.4	327.4	-28.4	-8.0	-28.4	-8.0
Mixedwood Dense[a]	>60% crown closure, with neither coniferous or deciduous trees comprising ≥ 75% total tree cover	272.7	232.7	232.7	-40.0	-14.7	-40.0	-14.7
Mixedwood Open[a]	26 - 60% crown closure, with neither coniferous or deciduous trees comprising ≥ 75% total tree cover	96.2	93.7	93.7	-2.5	-2.6	-2.5	-2.6
Shrubland[a]	≥ 20% shrub cover	141.6	135.7	135.7	-5.9	-4.1	-5.9	-4.1
Reclaimed Native Upland	Reclaimed upland planted with native trees and grasses	0.0	0.0	156.7	0.0	N/A	156.7	N/A
Upland subtotal		*2,437.9*	*2,424.5*	*2,305.2*	*2,461.8*	*-119.4*	*-4.9*	*37.3*
Water	Lakes, rivers, or streams	430.3	417.1	446.1	-13.3	-3.1	15.8	3.7
Water subtotal		*430.3*	*417.1*	*446.1*	*-13.3*	*-3.1*	*15.8*	*3.7*

Table 11C-1 Change in Vegetation and Wetland Land Cover Types in the Gordon LAA

Land Cover Type	Description	Existing Conditions	Construction & Operation	Decommissioning / Closure	Change from Existing Conditions			
					Construction & Operation		Decommissioning/ Closure	
		Area (ha)	Area (ha)	Area (ha)	ha	%	ha	%
Bog Shrubby[b,c]	Isolated from surface or groundwater influence with >40 cm peat accumulation, >25% shrub cover and tree cover that is ≤ 25%	194.6	183.9	183.9	-10.7	-5.5	-10.7	-5.5
Bog Treed[b,c]	Isolated from surface or groundwater influence with >40 cm peat accumulation, >25% tree cover by coniferous species	435.8	427.9	427.9	-7.9	-1.8	-7.9	-1.8
Fen Pattern[b,c,d]	Connected to surface or groundwater with a pattern of strings and flarks, with >6% tree cover	0.0	0.0	0.0	0.0	N/A	0.0	N/A
Fen Shrubby[b,c]	Connected to surface or groundwater with >40 cm peat accumulation, >25% shrub and ≤ 25% tree cover	383.9	342.3	342.3	-41.6	-10.8	-41.6	-10.8
Fen Treed[b,c]	Connected to surface or groundwater with >40 cm peat accumulation, >25% tree cover	28.1	27.6	27.6	-0.5	-1.7	-0.5	-1.7

Table 11C-1 Change in Vegetation and Wetland Land Cover Types in the Gordon LAA

Land Cover Type	Description	Existing Conditions	Construction & Operation	Decommissioning / Closure	Change from Existing Conditions			
					Construction & Operation		Decommissioning/ Closure	
		Area (ha)	Area (ha)	Area (ha)	ha	%	ha	%
Marsh[b,c]	< 40 cm peat accumulation with < 25% shrub and tree cover	10.2	10.2	10.2	0.0	0.0	0.0	0.0
Swamp Shrubby[b,c]	< 40 cm peat accumulation with >25% shrub cover and ≤ 25% tree cover	42.2	40.4	40.4	-1.8	-4.2	-1.8	-4.2
Swamp Treed[b,c]	< 40 cm peat accumulation with >25% tree cover	195.6	193.3	193.3	-2.3	-1.2	-2.3	-1.2
Wetland Subtotal		*1,290.4*	*1,225.6*	*1,225.6*	*-64.7*	*-5.0*	*-64.7*	*-5.0*
Development	Disturbed land, settlements, roads, industrial development	119.5	316.8	131.1	197.4	165.2	11.7	9.8
Development Subtotal		*119.5*	*316.8*	*131.1*	*197.4*	*165.2*	*11.7*	*9.8*
Total		**4,264.7**	**4,264.7**	**4,264.7**	**0.0**	**N/A**	**0.0**	**N/A**

Note:
N/A denotes no data
Numbers may not sum due to rounding
Source:
[a] Canadian Forest Service 2003
[b] Alberta Environment and Sustainable Resource Development 2015
[c] National Wetland Working Group. 1997
[d] Halsey et al. 1997

Table 11C-2 Change in Vegetation and Wetland Land Cover Types in the MacLellan LAA

Land Cover Type	Description	Existing Conditions	Construction & Operation	Decommis-sioning/ Closure	Change from Existing Conditions			
					Construction & Operation		Decommissioning/ Closure	
		Area (ha)	Area (ha)	Area (ha)	ha	%	ha	%
Conifer Dense[a]	>60% crown closure, with ≥75% coniferous tree cover	696.3	476.0	476.0	-220.3	-31.6	-220.3	-31.6
Conifer Open[a]	26-60% crown closure, with ≥75% coniferous tree cover	469.2	299.4	299.4	-169.8	-36.2	-169.8	-36.2
Conifer Sparse[a]	10-25% crown closure, with ≥ 75% coniferous tree cover	295.8	197.5	197.5	-98.3	-33.2	-98.3	-33.2
Mixedwood Dense[a]	>60% crown closure, with neither coniferous or deciduous trees comprising ≥ 75% total tree cover	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mixedwood Open[a]	26 - 60% crown closure, with neither coniferous or deciduous trees comprising ≥ 75% total tree cover	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shrubland[a]	≥ 20% shrub cover	29.0	26.9	26.9	-2.0	-7.0	-2.0	-7.0
Reclaimed Native Upland	Reclaimed upland planted with native trees and grasses	0.0	0.0	607.2	0.0	0.0	607.2	0.0
Reclaimed Upland	Reclaimed upland planted with reclamation species	0.0	0.0	236.9	0.0	0.0	236.9	0.0
Upland subtotal		*1,490.2*	*999.9*	*1,844.0*	*-490.4*	*-32.9*	*353.7*	*23.7*
Water	Lakes, rivers, or streams	299.6	295.4	361.4	-4.2	-1.4	61.8	20.6
Water subtotal		*299.6*	*295.4*	*361.4*	*-4.2*	*-1.4*	*61.8*	*20.6*

Table 11C-2 Change in Vegetation and Wetland Land Cover Types in the MacLellan LAA

Land Cover Type	Description	Existing Conditions	Construction & Operation	Decommis-sioning/ Closure	Change from Existing Conditions			
					Construction & Operation		Decommissioning/ Closure	
		Area (ha)	Area (ha)	Area (ha)	ha	%	ha	%
Bog Shrubby[b,c]	Isolated from surface or groundwater influence with >40 cm peat accumulation, >25% shrub cover and tree cover that is ≤ 25%	207.7	165.8	165.8	-41.9	-20.2	-41.9	-20.2
Bog Treed[b,c]	Isolated from surface or groundwater influence with >40 cm peat accumulation, >25% tree cover by coniferous species	773.9	574.4	574.4	-199.5	-25.8	-199.5	-25.8
Fen Graminoid[b,c]	Connected to surface or groundwater with >40 cm peat accumulation, ≤ 25% shrub and ≤ 25% tree cover	32.2	27.2	27.2	-5.0	-15.5	-5.0	-15.5
Fen Pattern[b,c]	Connected to surface or groundwater with a pattern of strings and flarks, with >6% tree cover	15.9	10.8	10.8	-5.1	-32.1	-5.1	-32.1
Fen Shrubby[b,c]	Connected to surface or groundwater with >40 cm peat accumulation, >25% shrub and ≤ 25% tree cover	114.4	92.7	92.7	-21.6	-18.9	-21.6	-18.9
Fen Treed[b,c]	Connected to surface or groundwater with >40 cm peat accumulation, >25% tree cover	61.6	46.5	46.5	-15.0	-24.4	-15.0	-24.4
Marsh[b,c]	< 40 cm peat accumulation with < 25% shrub and tree cover	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 11C-2 Change in Vegetation and Wetland Land Cover Types in the MacLellan LAA

Land Cover Type	Description	Existing Conditions	Construction & Operation	Decommis-sioning/ Closure	Change from Existing Conditions			
					Construction & Operation		Decommissioning/ Closure	
		Area (ha)	Area (ha)	Area (ha)	ha	%	ha	%
Swamp Shrubby[b,c]	< 40 cm peat accumulation with >25% shrub cover and ≤ 25% tree cover	36.8	24.8	24.8	-12.1	-32.7	-12.1	-32.7
Swamp Treed[b,c]	< 40 cm peat accumulation with >25% tree cover	342.4	271.7	271.7	-70.6	-20.6	-70.6	-20.6
Wetland Subtotal		*1,584.8*	*1,213.9*	*1,213.9*	*-370.9*	*-23.4*	*-370.9*	*-23.4*
Development	Disturbed land, settlements, roads, industrial development	143.9	1,009.4	99.2	865.5	601.6	-44.7	-31.0
Development Subtotal		*143.9*	*1,009.4*	*99.2*	*865.5*	*601.6*	*-44.7*	*-31.0*
Total		**3,518.5**	**3,518.5**	**3,518.5**	**0.0**	**N/A**	**0.0**	**N/A**

Note:
N/A denotes no data
Numbers may not sum due to rounding
Source:
[a] Canadian Forest Service 2003
[b] Alberta Environment and Sustainable Resource Development 2015
[c] National Wetland Working Group. 1997
[d] Halsey et al. 1997

Lynn Lake Gold Project
Environmental Impact Statement
Chapter 12 – Assessment of Potential Effects on Wildlife and Wildlife Habitat

Prepared by:

Stantec Consulting Ltd.

May 25, 2020

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Acronyms and Abbreviations

AAQC	ambient air quality criteria
Alamos	Alamos Gold Inc.
AMSL	above mean sea level
CAAQS	Canadian Ambient Air Quality Standard
cm	centimetre
COPC	chemical(s) of potential concern
COSEWIC	Committee on the Status of Endangered Wildlife Species in Canada
DARD	Department of Agriculture and Resource Development
dBA	decibels
ECCC	Environment and Climate Change Canada
ERA	ecological risk assessment
ESEA	*Endangered Species and Ecosystems Act*
ESS	environmentally sensitive site
ha	hectare
IBA	important bird area
km	kilometre
km/h	kilometer per hour
KMU	Kamuchawie Management Unit
LAA	Local Assessment Area
m	metres
MB BBA	Manitoba Breeding Bird Atlas
MB ESEA	*The Endangered Species and Ecosystems Act* (Manitoba)
MBCA	*Migratory Bird Convention Act*

MB CDC	Manitoba Conservation Data Centre
MI	Manitoba Infrastructure
MVKT	million vehicle kilometers travelled
NO_2	nitrogen dioxide
PDA	Project Development Area
$PM_{2.5}$	fine particulate matter
PR	provincial road
RAA	Regional Assessment Area
RQ	risk quotient
SAR	species at risk
SARA	*Species at Risk Act*
SO^2	sulphur dioxide
SOCC	species of conservation concern
TEK	traditional ecological knowledge
TLRU	traditional land and resource use
TMF	tailings management facility
VC	valued component

12.0 ASSESSMENT OF POTENTIAL EFFECTS ON WILDLIFE AND WILDLIFE HABITAT

Wildlife and wildlife habitat is a valued component (VC) because it provides ecological, aesthetic, recreational, economic, and cultural value to stakeholders, the public, Indigenous communities, local businesses, and government agencies. Having access to wildlife and wildlife habitat is important to communities, particularly resource users that continue to practice traditional and recreational hunting and trapping activities throughout the region.

Wildlife and wildlife habitat was selected as a VC not only because of its importance to people but also for its potential to be affected by the Project. Changes to vegetation and wetlands (Chapter 11) resulting from Project-related land clearing would reduce wildlife habitat in the region. Changes in air and water quality resulting from atmospheric emissions (Chapter 6) and surface water discharges (Chapter 9) could release chemicals into ambient air, soil, surface water and sediment, which in turn may affect wildlife health. As such, the residual effects related to the vegetation and wetlands, atmospheric environment, and surface water VCs were used to support the assessment of potential Project effects on wildlife and wildlife habitat.

Changes in wildlife and wildlife habitat may have an effect on other VCs. For example, changes in wildlife and wildlife habitat have the potential to affect land and resource use associated with hunting and trapping (Chapter 15). The location of hunting and trapping areas used by Indigenous communities may change if the Project alters the distribution and abundance of wildlife species of cultural importance (Chapter 17).

In this assessment, the term “wildlife” encompasses birds, mammals, amphibians, and insects, including species at risk (SAR) and species of conservation concern (SOCC). SAR are those species designated under Schedule 1 of the federal *Species at Risk Act* (SARA) and SOCC are those species under *The Endangered Species and Ecosystems Act* (ESEA) in Manitoba, those identified as at risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or as provincially rare (Ranks S1, S2, and S3) by the Manitoba Conservation Data Centre (MB CDC). Reptiles (e.g., turtles and snakes) are not expected to occur in the region (MHA 2019) and thus are not discussed in this assessment. Fish (and fish habitat) are discussed in Chapter 10.

Numerous wildlife species inhabit the region due to the widespread availability of wetlands, rivers, lakes, and forests. As it is not feasible to assess all species having potential to occur in the region, the assessment of wildlife and wildlife habitat focused on a select group of species and species assemblages that are representative of the wildlife species in the region, are known to occupy the Regional Assessment Area (RAA), and have the greatest potential to be affected by the Project (Table 12-1).

Table 12-1 Focal Species and Species Assemblages for the Evaluation of Wildlife and Wildlife Habitat

Wildlife Group	Species Assemblage	Focal Specie(s) and Rationale for Selection
Mammals	Large Mammals	Moose (*Alces alces*), gray wolf (*Canis lupus*), and black bear (*Ursus americanus*) are assessed as species that provide ecological, cultural, subsistence, and/or economic value to resource users and Indigenous community members.
	Furbearers	American marten (*Martes americana*) is assessed as a representative furbearer species that provides ecological, cultural, and economic value to resource users and Indigenous community members.
Birds	Migratory Birds	Migratory bird species, including those protected under the *Migratory Birds Convention Act* (MBCA) that provide ecological and cultural value (e.g., songbirds) and subsistence value to resource users and Indigenous community members (e.g., ducks and geese).
	Other Birds	Non-migratory birds present in the RAA year-round that provide ecological and cultural value (e.g., eagles, owls, ravens) and subsistence value to resource users and Indigenous community members (e.g., grouse and ptarmigan).
Amphibians	Frogs	Wood frog (*Lithobates sylvaticus)* and boreal chorus frog (*Pseudacris maculate)* are bioindicators of wetland ecosystem function and inhabit a variety of waterbodies throughout the RAA.
SAR/SOCC	Mammals	Wolverine (*Gulo gulo*), boreal woodland caribou (*Rangifer tarandus caribou*; hereafter woodland caribou), and little brown myotis (*Myotis lucifugus*) are assessed as SAR known to occupy the RAA. Northern myotis (*Myotis septentrionalis*) is also assessed due to its conservation status (i.e., SARA-listed as endangered) and potential to inhabit existing mine infrastructure.
	Birds	Common nighthawk (*Chordeiles minor*), olive-sided flycatcher (*Contopus cooperi*), barn swallow (*Hirundo rustica*), and rusty blackbird (*Euphagus carolinus*) are assessed as SAR known to breed within the RAA and have the potential to be affected by the Project.
	Insects	Yellow banded bumble bee (*Bombus terricola*) and transverse lady beetle (*Coccinella transversalis*) are insect SAR and SOCC, respectively, that are assessed given their range overlap with the Project and generalist habitat use.

There are several SAR and SOCC that are not assessed as they are unlikely to be affected by the Project. Horned grebe (*Podiceps auritus*), yellow rail (*Coturnicops noveboracensis*), short-eared owl (*Asio flammeus*), bank swallow (*Riparia riparia*), and evening grosbeak (*Coccothraustes vespertinus*) are SAR not assessed as they are not known to regularly occupy the RAA and are unlikely to be affected by the Project due to a lack of suitable breeding habitat in the RAA. Similarly, trumpeter swan (*Cygnus buccinator*) is a SOCC not assessed for the same reasons. The Project does not overlap the modern range of barren-ground caribou (*Rangifer tarandus groenlandicus*) and are not assessed. Northern leopard frog (*Lithobates pipiens*) is not assessed as the species is unlikely to regularly occupy the RAA and they have not been detected in waterbodies with the potential to be affected by the Project.

12.1 SCOPE OF ASSESSMENT

The scope of the assessment of potential effects to the Wildlife and Wildlife Habitat VC was guided by the federal Environmental Impact Statement (EIS) Guidelines (Appendix 4A), the Manitoba Sustainable Development (now Manitoba Conservation and Climate; MCC) *Environment Act* Proposal Report Guidelines, as well as the relevant federal and provincial laws, regulations, and guidelines protecting wildlife and wildlife habitat in Canada and Manitoba.

In addition to regulations, policies, and guidelines, this section describes how engagement with the public and local Indigenous communities has influenced the scope of the assessment; the understanding of potential effects and pathways between the Project and wildlife and wildlife habitat during all phases of the Project; measurable parameters to be used to quantify potential effects of the Project on wildlife and wildlife habitat; spatial and temporal boundaries of the assessment; and the approach for characterizing and determining the significance of residual effects.

12.1.1 Regulatory and Policy Setting

The following sections describe the federal and provincial regulations and guidelines that govern the management and protection of wildlife and wildlife habitat in Canada and Manitoba.

12.1.1.1 Federal Guidance

The assessment of potential Project-related environmental effects on wildlife and wildlife habitat includes consideration of the following federal legislation:

- The *Species at Risk Act* (SARA) provides protection for SAR in Canada. The legislation provides a framework to facilitate recovery of species listed as threatened, endangered, or extirpated and to prevent species listed as special concern from becoming threatened or endangered. SAR and their habitats are protected under SARA which prohibits: 1) the killing, harming, or harassing of endangered or threatened SAR (sections 32 and 36); and 2) the destruction of critical habitat of and endangered or threatened SAR (Sections 58, 60, and 61).
- The *Migratory Birds Convention Act* provides protection for migratory birds, nests, and eggs. Protection is afforded to all native bird species expected to occur in the RAA, except American white pelican (*Pelecanus erythrorhynchos*), double-crested cormorant (*Phalacrocorax auritus*), upland gamebirds, raptors, belted kingfisher (*Megaceryle alcyon*), owls, corvids, and icterid blackbirds, which are protected under provincial legislation described below.

12.1.1.2 Provincial Guidance

The assessment of potential Project-related environmental effects on wildlife and wildlife habitat includes consideration of the following provincial legislation:

- *The Endangered Species and Ecosystems Act* (ESEA) provides protection to threatened and endangered ecosystems and plant and animal SAR in Manitoba. The Act facilitates the management and development of recovery strategies for threatened, endangered, and extirpated or extinct species to prevent further declines and promote recovery. ESEA-listed species are those that “are of ecological, educational, esthetic, historical, medical, recreational and scientific value to Manitoba and the residents of Manitoba” (Government of Manitoba 2019a).
- *The Wildlife Act* provides general provisions for regulating the activities relating to the take and trade of wild animals in Manitoba. A “wild animal" is defined as “an animal or bird of a species or type listed in Schedule A or declared by the regulations to be a wild animal”, and includes select amphibian, reptile and mammal species and most bird species (including those not protected under the MBCA*)* known to exist in Manitoba.

12.1.2 The Influence of Engagement on the Assessment

Engagement has been ongoing prior to and throughout the EIS process, and will continue with local Indigenous communities, stakeholders, the public, and government agencies through the life of the Project. More detail on the Engagement process can be found in Chapter 3.

Engagement feedback related to wildlife and wildlife habitat has been addressed through direct responses, updates to baseline information, and in the EIS, as appropriate. Key feedback that influenced the wildlife and wildlife habitat effects assessment is provided below.

12.1.2.1 Indigenous Engagement

As part of the information sharing throughout the engagement process, Project-related information was provided by Indigenous communities in the form of traditional land and resource use (TLRU) studies and other forms of information sharing.

A Project-specific TLRU study was completed collaboratively with Marcel Colomb First Nation with a final report provided to the community on January 11, 2018 (Stantec 2018). The TLRU study included interviews with participants selected by Marcel Colomb First Nation regarding traditional land use in the Project area, including availability of traditional resources, access to traditional resources or areas, occupancy, cultural sites and areas, and experience of TLRU.

A Project-specific TLRU study was completed in collaboration with Peter Ballantyne Cree Nation but has not yet been released by community leadership for use in the environmental assessment. The TLRU study included interviews with community members in Kinoosao, Saskatchewan.

A TLRU study (Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project) was completed by an independent consultant for the Manitoba Metis Federation (SVS 2020), the results of which were received in February 2020. The study documents harvesting and land use by the Manitoba Métis Community within a 100 km radius of the Project.

Results of the Indigenous engagement specific to wildlife and wildlife habitat have included traditional ecological knowledge (TEK) on the past and present abundance and distribution of wildlife in the region, primarily as it relates to rights-based hunting (e.g., woodland caribou, barren-ground caribou, moose), trapping, and general environmental trends relating to wildlife and wildlife habitat (Stantec 2018; SVS 2020). Concerns raised by Indigenous communities relating to potential Project-related environmental effects can be generalized to include (Chapters 3 and 17):

- The loss or alteration (e.g., fragmentation) of wildlife habitats that affect wildlife populations, particularly as it relates to sensitive species and harvested species (e.g., caribou, moose, waterfowl).
- The increased mortality of wildlife, resulting primarily from vehicle collisions.
- The quality of terrestrial and aquatic environments resulting from potential degradation and contamination (from existing mining activity in the RAA and the Project) of resources.

Results of the Indigenous engagement have helped guide baseline data collection efforts and the assessment of potential Project-related environmental effects on wildlife and wildlife habitat, including species of cultural and subsistence importance (e.g., moose, furbearers).

12.1.2.2 Public Engagement

Four open house public meetings have been held to date in Lynn Lake (in 2015, 2016, 2017 and 2020) for members of the local community including Marcel Colomb First Nation (Chapter 3). Open house attendees were invited to complete questionnaires to provide feedback on the Project, as well as identify issues, concerns or inquiries related to the Project. This engagement process identified wildlife and wildlife habitat as an important concern, and included concerns for changes to wildlife habitat, wildlife mortality, and wildlife health. Feedback was reviewed and incorporated into field study design and final baseline reports used to identify and reduce potential adverse interactions between the Project and wildlife and wildlife habitat.

12.1.2.3 Regulatory Engagement

Alamos Gold Inc. (Alamos) took a proactive approach to resolve regulatory issues and concerns, and to verify technical requirements in a collaborative manner with federal and provincial regulatory agencies (Chapter 3). The objectives of the regulatory engagement process were to provide information needed by regulators to understand the proposed Project and its potential effects, seek information from regulators about potential adverse effects and applicable regulatory requirements to study those effects, and to develop solutions to regulatory concerns and verify conformance with regulatory guidelines through regular lines of communication.

Federal government engagement specific to wildlife and wildlife habitat included a teleconference meeting on January 18, 2019 with the Canadian Environmental Assessment Agency (now the Impact Assessment Agency of Canada) and Environment and Climate Change Canada (ECCC) to discuss the collective understanding of woodland caribou in the RAA and the potential Project-related environmental effects to the species and how effects may relate to the recovery strategy (Government of Canada 2012, ECCC

2019a, pers. comm. 2019a). A second teleconference meeting with the same federal regulators and Manitoba's Department of Agriculture and Resource Development (DARD) was held on December 3, 2019 to further refine the assessment approach as it relates to woodland caribou (pers. comm. 2019b). Results of this engagement have helped guide the assessment of potential Project-related environmental effects on woodland caribou and have supported Alamos' commitment to ongoing baseline data collection for wildlife, including woodland caribou.

Provincial government engagement specific to wildlife and wildlife habitat included a telephone meeting on May 4, 2015, with Manitoba Mineral Resources (now Manitoba Growth, Enterprise, and Trade) to discuss existing knowledge of wildlife and wildlife habitat in the RAA, including at the Project sites and including for amphibians and potential bat hibernacula. Additional provincial government engagement included personal communications with DARD relating to various aspects of wildlife and wildlife habitat relative to the Project RAA and potential Project-related environmental effects (pers. comm. 2015a, 2015b, and 2016a, 2019c). Results of this engagement have helped guide baseline data collection efforts and the assessment of potential Project-related environmental effects on wildlife and wildlife habitat.

12.1.3 Potential Effects, Pathways and Measurable Parameters

Table 12-2 summarizes the potential environmental effects of the Project on wildlife and wildlife habitat, the pathways by which they may affect wildlife and wildlife habitat, and the measurable parameters for evaluating effects. Potential environmental effects and measurable parameters were selected based on professional judgment, recent environmental assessments for mining projects in Canada, and regulatory concern for certain species. The Project includes the use of existing roads and sites that will not result in a change in wildlife movement patterns, beyond potentially altering local movements (e.g., avoidance), which is included in change in habitat.

Table 12-2 Potential Effects, Effects Pathways and Measurable Parameters for Wildlife and Wildlife Habitat

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in habitat	Direct and/or indirect loss or alteration of habitat due to vegetation clearing, sensory disturbance (e.g., avoidance), and/or edge effects.	Amount (ha) of wildlife habitat directly or indirectly (qualitative) lost or altered for focal species (Table 12-1), including for SAR that may be present in the RAA: • Wolverine • Woodland caribou • Common nighthawk • Olive-sided flycatcher • Rusty blackbird And qualitatively for: • Little brown myotis and northern myotis • Barn swallow Number of environmentally sensitive sites (ESS; e.g., bald eagle [*Haliaeetus leucocephalus*] nest) directly or indirectly affected.
Change in mortality risk	Direct change in mortality risk due to vegetation clearing activities, vehicular collisions, human-wildlife conflicts, and indirect change in mortality risk due to predation and harvest pressure.	Change in mortality risk is assessed qualitatively through: • Change in traffic volumes during the life of the Project. • Likelihood of interactions with Project infrastructure, vehicles, and equipment.
Change in wildlife health	Activities associated with construction, operation, and/or decommissioning/closure of the Project may result in increased risk of exposure of wildlife to contaminants.	Ecological risk assessment (ERA) to evaluate the potential that ecological receptors (i.e., mammals, birds, amphibians) may experience adverse health effects as a result of exposure to chemicals of potential concern (COPC) in the LAA (Chapter 18).

12.1.4 Boundaries

12.1.4.1 Spatial Boundaries

The following spatial boundaries are used to assess Project effects, including residual and cumulative environmental effects, on wildlife and wildlife habitat in areas surrounding the Gordon and MacLellan sites and access roads (Map 12-1):

- Project Development Area (PDA): encompasses the immediate area in which Project activities and components may occur plus a 30-metre (m) buffer and is the anticipated area of direct physical disturbance associated with construction and operation of the Project (i.e., the Project footprint).

- Local Assessment Area (LAA): includes components of the PDA plus a 1-km buffer surrounding each component. The LAA was established to consider the area in which Project activities might result in indirect habitat loss due to sensory disturbance (i.e., displacement or avoidance; e.g., Storlie 2006; Laurian et al. 2008; Benitez-Lopez et al. 2010, Shannon et al. 2016) while considering the maximum recommended setback distances for SAR and SOCC (EC 2009; MB CDC 2014).

- Regional Assessment Area (RAA): includes the PDA, LAA, and an approximate 12-km buffer around components of the PDA. The RAA is used to assess cumulative effects and the significance of Project-specific effects on wildlife and wildlife habitat. The size of the RAA is based on the home range size of moose, which were identified by DARD as a key wildlife species of concern. Although moose home ranges vary greatly (<2 km^2 to >500 km^2; Thompson and Vukelich 1981; Stenhouse et al. 1995) depending on geographic location, habitat quality, food availability, sex, and age (Snaith and Beazley 2004), the size of the home range (97 km^2) is similar to previously reported estimates in the boreal forest (Hauge and Keith 1981). While the shape of a home range may vary depending on terrain and habitat availability, a circular home range of 97 km^2 would have a diameter of 11.1 km. Using a conservative approach, a 12-km RAA buffer allows for the typical moose home range at the edges of the PDA to be contained within the RAA boundary.

For the purposes of assessment, Gordon and MacLellan sites are evaluated separately due to the different Project components present at each. Provincial Road (PR) 391 is included with Gordon site, as its use is linked directly to the need to transport ore from Gordon site to the ore milling and processing facility at the MacLellan site.

12.1.4.2 Temporal Boundaries

The temporal boundaries for the Project consist of the following phases:

- Construction – two years (scheduled to be carried out concurrently from Year -2 to Year -1 at both sites).

- Operation – 13 years (scheduled to be carried out from Year 1 to Year 6 at the Gordon site and from Year 1 to Year 13 at the MacLellan site).

- Decommissioning/closure – five to six years of active closure (scheduled to begin in Year 6 at the Gordon site and in Year 14 at the MacLellan site). Active closure will be followed by post-closure, which is the time period during which active reclamation measures are complete, but monitoring is still required. The expected duration for post-closure is approximately 10 years. Pit filling is expected to take 11 years at the Gordon site and 21 years at the MacLellan site under average conditions (Chapter 9, Section 9.4.1). Permanent closure will occur when the site is stable, and monitoring is no longer required. For wildlife and wildlife habitat this will occur when 1) re-vegetation efforts have been successful in reclaiming 90% of the PDA to early-to-mid seral stage habitats and 2) wildlife mitigation is no longer required. It is assumed that the reclaimed habitat will provide habitat for a wide range of wildlife species reflective of similar seral stage habitats within the LAA and RAA that will continue to evolve as the habitat matures. The duration and conditions for post-closure monitoring and permanent closure will be detailed in subsequent submissions of the Closure Plan to regulatory agencies as Project design and execution progresses

12.1.5 Residual Effects Characterization

Table 12-3 presents definitions for the characterization of residual environmental effects on wildlife and wildlife habitat. The criteria describe the potential residual effects that remain after mitigation measures have been implemented.

Table 12-3 Characterization of Residual Effects on Wildlife and Wildlife Habitat

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Positive –** a residual effect that moves measurable parameters in a direction beneficial to wildlife and wildlife habitat relative to baseline. **Adverse –** a residual effect that moves measurable parameters in a direction detrimental to wildlife and wildlife habitat relative to baseline.
Magnitude	The amount of change in wildlife habitat[1]	***Change in Habitat*** **Negligible –** no measurable change in habitat for wildlife, including SAR and SOCC **Low –** Project changes less than 10% of general wildlife habitat in the LAA, or less than 5% of habitat for wildlife SAR and SOCC in the LAA **Moderate –** Project changes 10-20% of general wildlife habitat in the LAA, or 5-10% of habitat for wildlife SAR and SOCC in the LAA **High –** Project changes more than 20% of wildlife habitat in LAA, or more than 10% of habitat for wildlife SAR and SOCC in the LAA
	The change in wildlife abundance and/or distribution	***Change in Mortality Risk and Wildlife Health*** **Negligible –** a measurable change in the abundance of wildlife in the LAA is not anticipated **Low –** a measurable change in the abundance of wildlife in the LAA is not anticipated, although temporary local shifts in distributions in the LAA might occur **Moderate –** a measurable change in the abundance and/or distribution of wildlife in the LAA might occur, but a measurable change on the abundance of wildlife in the RAA is not anticipated **High –** a measurable change in the abundance and/or distribution of wildlife in the RAA might occur
Geographic Extent	The geographic area in which a residual effect occurs	**PDA –** residual effects are restricted to the PDA **LAA –** residual effects extend into the LAA **RAA –** residual effects extend into the RAA

Table 12-3 Characterization of Residual Effects on Wildlife and Wildlife Habitat

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant	**Not Applicable –** Effect does not occur during critical life stage (e.g., migratory bird nesting period) or timing does not affect the VC **Applicable –** Effect occurs during a critical life stage (e.g., migratory bird nesting period)
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	**Single event –** occurs once **Multiple irregular event –** occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	**Short-term –** residual effect restricted to no more than the duration of the construction phase (2 years) **Medium-term –** residual effect extends through the operation phase (13 years) **Long-term –** residual effect extends beyond the life of the Project (>13 years)
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	**Reversible –** the residual effect is likely to be reversed after activity completion and reclamation **Irreversible –** the residual effect is unlikely to be reversed
Ecological and Socio-economic Context	Existing condition and trends in the area where residual effects occur	**Undisturbed –** area is relatively undisturbed or not adversely affected by human activity **Disturbed –** area has been substantially previously disturbed by human development or human development is still present.
[1] Based on benchmarks used for other recent EAs (KHLP 2012; Nalcor 2012; JRP 2014, Manitoba Hydro 2016)		

12.1.6 Significance Definition

A significant adverse residual effect on wildlife and wildlife habitat is defined as one that threatens the long-term persistence or viability of a wildlife species in the RAA, including effects that are contrary or inconsistent with the goals, objectives, and activities of recovery strategies, action plans, and management plans.

12.2 EXISTING CONDITIONS FOR WILDLIFE AND WILDLIFE HABITAT

Residual environmental effects (Section 12.4) are assessed relative to the existing condition for wildlife and wildlife habitat. Existing conditions for wildlife and wildlife habitat for the Project are presented in detail in the Mammal, Bird, and Amphibian Baseline Technical Data Reports (TDRs) and associated Validation Reports provided in Volume 4, Appendices M, N, and O, respectively. The existing conditions and the methods used to characterize baseline conditions are summarized below, including the occurrence of SAR and SOCC and migratory birds in the RAA.

12.2.1 Methods

Existing conditions for wildlife and wildlife habitat were identified through a combination of background (desktop) review and field surveys to better understand the occurrence, distribution, and habitat associations of wildlife within the RAA, including SAR and SOCC (Volume 4, Appendices M, N, and O).

12.2.1.1 Background Review

Background information was obtained through several sources, including historical site studies, literature reviews, federal and provincial databases, not-for-profit publications, and data sources, as well as personal communications with provincial authorities and local resource users (including Indigenous peoples). Table 12.4 provides an overview of some of the key resources used during background reviews to assist in establishing the baseline conditions for wildlife and wildlife habitat.

Table 12-4 Background Review Data Sources

Source	Description
SARA Public Registry	A database listing the status of species covered under the Species at Risk Act, and related documentation (Government of Canada 2019a).
Recovery Strategies for SARA-listed species	Guidance documents aiming to halt and reverse the population decline of SARA-listed species and where feasible, identifying critical habitat (Government of Canada 2012, Government of Canada 2016, MBWCMC 2015).
Management Plans for SARA-listed species	Reports outlining goals for maintaining sustainable populations for species listed as special concern under SARA (Government of Canada 2013a, 2013b, and 2015).
Manitoba Breeding Bird Atlas (MB BBA)	A five-year citizen-science project documenting the abundance and distribution of breeding birds throughout Manitoba (MB BBA 2019a and 2019b).
North American Breeding Bird Survey	A joint effort survey between the U.S. Geological Survey and Environment and Climate Change Canada to monitor bird population trends. In addition to providing long-term trends in regional bird populations, data are typically available for each survey route and year (Pardieck et al. 2019 and Government of Canada 2019b).
Manitoba Conservation Data Centre (MB CDC)	A database for biodiversity in Manitoba, including SAR and SOCC observation data (MB CDC 2019).
COSEWIC Species Database	Database containing regularly updated, species specific COSEWIC designations (COSEWIC 2019).
COSEWIC Assessment and Status Update Reports	Assessment and Status Update Reports providing information on the distribution, habitat requirements, population trends, and threats faced by species at risk (COSEWIC 2001, 2002, 2006, 2007a, 2007b, 2008, 2009, 2011, 2013a. 2013b, 2014, 2015, 2016a and 2016b).

Table 12-4 Background Review Data Sources

Source	Description
Manitoba Endangered Species and Ecosystem Act Species List	A current listing of MB ESEA species designations (Government of Manitoba 2019a).
eBird	A database of locational data for bird species within the RAA (eBird 2019).
Manitoba Sustainable Development	Liaison with the Provincial wildlife authorities (pers. comm. 2015a, 2015b and 2016a.
Local Resource Users	Community and Indigenous engagement regarding current use of lands and resources for traditional purposes (pers. comm. 2015 c, d, e, f, and 2016b).
The Manitoba Herps Atlas	Database containing locational information regarding amphibian species (MHA 2019).
1989 Farley Lake Project Feasibility Study	Report prepared for MinGold Resources Inc. by Kilborn Manitoba Limited, dated March 1989 (MinGold Resources Inc. 1989).
2012 MacLellan Mine Project: Environmental Baseline Study	Draft report prepared for Carlisle Goldfields Ltd. by Tetra Tech, dated March 2013 (Tetra Tech 2013).

12.2.1.2 Field Surveys

Field surveys were conducted in the LAA and RAA in 2015-2017 to fill knowledge gaps identified in the background review to better understand the occurrence, distribution, and habitat associations of wildlife SAR and SOCC. Table 12-5 provides an overview of the field surveys conducted between 2015 and 2017, including the remote camera study which is ongoing. Volume 4, Appendices M, N, and O detail the methods and results of these mammal, bird, and amphibian field surveys, respectively.

Table 12-5 Field Surveys Conducted During Baseline Data Gathering

Survey	Date	Description/Survey Area
Mammals		
Aerial Track Survey	January 18-19, 2016; February 28-29, 2016; December 9-10, 2016; and February 14-15, 2017	LAA and RAA: two 20- x 20-km survey blocks centered over each site, each containing 20 100-m wide transects.
Camera Trap Study	April 2015 – present	52 remote camera survey sites in the RAA, including 40 in the LAA. 32 cameras continue to collect data.
Ground-based Tracking Survey	December 5-8, 2015; February 26 to March 2, 2016; December 3-10, 2016; and February 11-16, 2017	19 survey transects in the RAA, each surveyed twice; 14 of these transects occurred within the LAA.
Beaver Lodge Survey	October 1, 2016	LAA and RAA: three 5 x 5 km survey blocks centered over each site and one reference area.
Bat Hibernacula Survey	July 12-14, 2015 and July 23 to Sept 15, 2016	Search of suitable bat hibernacula in the LAA, focusing on existing mining infrastructure.

Table 12-5 Field Surveys Conducted During Baseline Data Gathering

Survey	Date	Description/Survey Area
Mammals		
Birds		
Waterbird Survey	May 26 & 27, 2015 June 2, 2016	62 waterbodies surveyed in the RAA, including 40 in the LAA and waterbodies ≤ 1 km from the sites.
Raptor Sticknest Survey	May 27, 2015	Search of the LAA (within 1000 m of the PDA) and two reference areas in the RAA.
Common Nighthawk Survey	June 24-28, 2015 June 21-28. 2016	41 survey sites in the RAA using autonomous recording units (ARUs), including 29 sites in the LAA.
Breeding Bird Survey	June 23-30, 2015 June 21-29, 2016	216 point-count survey sites in the RAA, including 156 in the LAA.
Barn Swallow Survey	June 24, 2016	Searches for potential barn swallow nesting habitat and for evidence of current and historical nesting.
Amphibians		
Wetland Survey	May 23-26, 2015 and May 7-10, 2016	Auditory surveys and water quality sampling at 30 sites in the RAA, including 20 in the LAA.

Waterbird migration surveys were not completed as the RAA does not contain concentrations of migratory waterbirds (pers. comm. 2015b). No reptile ranges overlap with the RAA (MHA 2019), so reptile surveys were also not completed. Insect surveys were not completed because the two insect SOCC having potential to occur are generalists and represented by other species or habitats surveyed. No incidental insect observations of insect SOCC were recorded.

12.2.1.3 Habitat Identification

Terrestrial and aquatic habitats were classified through review of orthographic and land use imagery (SPOT-7 1.5 m resolution) using a geographic information system (GIS; ESRI 2014) and refined through field observations. Table 12-6 below outlines the land cover classes that were used to assess change in wildlife habitats. The amount of wildlife habitat was estimated by calculating the area (ha) of land cover classes in the assessment areas. Habitat associations were identified using data from baseline field surveys and peer-reviewed literature to estimate areas of preferred habitat for wildlife including SAR and SOCC. Little brown myotis maternal roosting habitat and hibernacula and barn swallow nesting habitat were assessed qualitatively as these features are not discernable from other anthropogenic developments using the spatial imagery.

Table 12-6 Land Cover Classes used to Identify Wildlife Habitat

Species	Habitat Feature	Land Cover Class / Habitat Type[1]	Constraint(s)
Woodland Caribou	Disturbance Mapping[2]	• Development • Fires	• 500 m buffer around development (i.e., anthropogenic features) • Fires within the last 40 years were considered disturbed • Exclude water (i.e., rivers and lakes)
Common Nighthawk	Potential Breeding Habitat[3]	• Development • Barren • Coniferous Sparse • All bog types • All fen types • All swamp types	• For development, include only idle anthropogenic disturbances (i.e., exclude active mine, road, or residential sites)
Olive-sided Flycatcher	Potential Breeding Habitat[4]	• Open Coniferous • Sparse Coniferous • Open Mixedwood • Shrubland • All bog types • All swamp types	• All terrestrial habitats, except for barren, within 100 m of an aquatic habitat
Rusty Blackbird	Potential Breeding Habitat[5]	• All bog types • All swamp types	• All terrestrial habitats, except for barren, within 100 m of an aquatic habitat
General Wildlife Habitat (for wolverine and other focal species [Table 12-1])		• Native vegetation communities	• None

[1] Table 12-7 (Canadian Forest Service 2003; Alberta Environment and Sustainable Resource Development 2015)
[2] Government of Canada 2012, ECCC 2019a
[3] Volume 4, Appendix N, COSEWIC 2007a and Tetra Tech 2013
[4] Volume 4, Appendix N, COSEWIC 2007b and Tetra Tech 2013
[5] Volume g, Appendix N, COSEWIC 2006 and Tetra Tech 2013

12.2.2 Overview

The Project is located in the Boreal Shield Ecozone, Churchill River Upland Ecoregion, and Reindeer Lake Ecodistrict (Smith et al. 1998), which is characterized by coniferous boreal forest (Table 12-7; Map 12-2) and poorly drained peatlands, underlain with glacial deposits and Precambrian bedrock. Soils in the region are thin, poorly drained, and acidic, with organic soils typical in bogs and peat plateaus, and discontinuous permafrost is widespread.

The terrain consists of mostly hilly, till-covered bedrock, with flat low-lying areas in between. Topography slopes from northwest to southeast from a high of 450 m above mean sea level (AMSL) to a low of 260 m AMSL in the southeast. Steep rocky ridges protrude 30 m to 60 m above lakes and peat-filled depressions.

Surface water features and peat generally occupy the low areas. Wetland types are primarily bog, fen, and swamp communities (Chapter 11). However, numerous lakes and rivers are also present in the RAA. Swede, Simpson, Farley, and Gordon lakes are within the LAA near the Gordon site. The Keewatin River connects Payne, Minton, and Dot lakes near the MacLellan site to Cockeram Lake to the south. These waterbodies are part of the Churchill River watershed that drains into Hudson Bay to the east.

Black spruce (*Pinea mariana*) is the dominant forest cover, although tamarack (*Larix laricina*) is typical on wetter peatland sites. Drier sites are forested with white birch (*Betula papyrifera*), jack pine (*Pinus banksiana*), and occasionally white spruce (*Picea glauca*). Between 1946 and 2019, forest fires have burned 34% of the RAA and 33% of the LAA (Map 12-3). Recent burns are particularly evident north of the Gordon site (2003), north of PR 391 between the sites (2007), and within the MacLellan site PDA (34.8 ha) and surrounding LAA (721.1 ha; 2019). The RAA consists primarily of unoccupied Crown lands and contains one Provincial Park, Burge Lake Provincial Park, 5 km west of MacLellan site. There are no ecological reserves or provincially designated lands for wildlife in the RAA; however, the Eden Lake area of special interest is in the RAA south of the PR 391 and the Gordon site.

A variety of infrastructure and activities in the RAA currently affect wildlife and wildlife habitat use. Within the RAA there are 83 km of provincial roads, with low traffic volumes and low wildlife collision rates (MI 2017). Copper, gold, and nickel mining has occurred in the RAA since the 1960s and several former mine sites are within the RAA. No commercial logging takes place within the RAA but firewood gathering for domestic use likely occurs. Hunting, fishing, and trapping are common recreational and commercial activities in the RAA (Chapter 17). Regulated and rights-based hunting in the area are stable and have not substantively changed in the last decade (pers. comm. 2015b).

Common wildlife species in the Boreal Shield Ecozone include black bear, moose, American marten, snowshoe hare (*Lepus americanus*; Banfield 1974), Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*; USFWS 2019), common loon (*Gavia immer*), hermit thrush (*Catharus guttatus*), Tennessee warbler (*Oreothlypis peregrina*; MB BBA 2019b), boreal chorus frog, and wood frog (MHA 2019).

Several SAR and SOCC are expected to occur in the RAA and there is potential critical habitat for woodland caribou in the western portion of the RAA.

Table 12-7 Land Cover Classes in the PDA, LAA, and RAA

Landscape Type	Land Cover Class	Description	Assessment Areas and Mine Sites				
			RAA	LAA[1]		PDA	
				Gordon	MacLellan	Gordon	MacLellan
			ha (%)	ha (%)	ha (%)	ha (%)	ha (%)
Upland[2]	Barren	Naturally unvegetated (i.e., rock outcrop, beaches)	0.9 (<1.0%)	-	-	-	-
	Conifer Dense	>60% crown closure, with ≥75% coniferous tree cover	29,040.1 (16.5%)	2,312.4 (20.6%)	692 (19.9%)	22.2 (8.2%)	220.3 (23.5%)
	Conifer Open	26-60% crown closure, with ≥75% coniferous tree cover	18,512.5 (10.5%)	1,153.2 (10.3%)	468.3 (13.4%)	20.4 (7.6%)	169.8 (18.1%)
	Conifer Sparse	10-25% crown closure, with ≥75% coniferous tree cover	21,814.9 (12.4%)	895.2 (8.0%)	295.2 (8.5%)	28.4 (10.5%)	98.3 (10.5%)
	Deciduous	>75% deciduous tree cover	155.1 (0.1%)	-	-	-	-
	Mixedwood Dense	>60% crown closure, with neither coniferous nor deciduous trees comprising ≥75% total tree cover	2,969.7 (1.7%)	340.8 (3.0%)	-	40.0 (14.9%)	-
	Mixedwood Open	26-60% crown closure, with neither coniferous or deciduous trees comprising ≥75% total tree cover	1,317.3 (0.7%)	63.6 (0.6%)	-	2.5 (0.9%)	-
	Shrubland	≥20% shrub cover	6,778.6 (3.8%)	615.7 (5.5%)	28.9 (0.8%)	5.9 (2.2%)	2.0 (0.2%)
		Upland Subtotal[4]	**80,589.2 (45.7%)**	**5,380.9 (47.9%)**	**1,484.3 (42.6%)**	**119.4 (44.3%)**	**490.4 (52.3%)**
Wetland[3]	Bog Shrubby	Isolated from surface or groundwater influence with >40 cm peat accumulation, >25% shrub cover and tree cover that is ≤25%	13,266.9 (7.5%)	642.7 (5.7%)	195.5 (5.6%)	10.7 (4.0%)	41.9 (4.5%)

Table 12-7 Land Cover Classes in the PDA, LAA, and RAA

Landscape Type	Land Cover Class	Description	Assessment Areas and Mine Sites				
			RAA	LAA[1]		PDA	
				Gordon	MacLellan	Gordon	MacLellan
			ha (%)	ha (%)	ha (%)	ha (%)	ha (%)
	Bog Treed	Isolated from surface or groundwater influence with >40 cm peat accumulation, > 25% tree cover by coniferous species	28,979.8 (16.4%)	1,909 (17.0%)	763.3 (21.9%)	7.9 (2.9%)	199.5 (21.3%)
Wetland[3]	Fen Graminoid	Connected to surface or groundwater with >40 cm peat accumulation, ≤25% shrub and tree cover	532.0 (0.3%)	-	31.9 (0.9%)	-	5.0 (0.5%)
	Fen Patterned	Connected to surface or groundwater with a pattern of strings and flarks	442.7 (0.3%)	-	15.9 (0.5%)	-	5.1 (0.5%)
	Fen Shrubby	Connected to surface or groundwater with >40 cm peat accumulation, >25% shrub and ≤25% tree cover	12,553.8 (7.1%)	966.2 (8.6%)	109.2 (3.1%)	41.6 (15.4%)	21.6 (2.3%)
	Fen Treed	Connected to surface or groundwater with >40 cm peat accumulation, >25% tree cover	2,809.9 (1.6%)	162.5 (1.4%)	61.6 (1.8%)	0.5 (0.2%)	15.0 (1.6%)
	Marsh	<40 cm peat accumulation with <25% shrub and tree cover	383.6 (0.2%)	15.5 (0.1%)	-	-	-
	Swamp Shrubby	<40 cm peat accumulation with >25% shrub cover and ≤25% tree cover	1,168.4 (0.7%)	74.8 (0.7%)	36.8 (1.1%)	1.8 (0.7%)	12.1 (1.3%)
	Swamp Treed	<40 cm peat accumulation with >25% tree cover	6,603.2 (3.7%)	745.6 (6.6%)	342.2 (9.8%)	2.3 (0.9%)	70.6 (7.5%)
Wetland Subtotal[4]			**66,740.2 (37.8%)**	**4,516.2 (40.2%)**	**1,556.3 (44.7%)**	**64.7 (24.0%)**	**370.9 (39.5%)**

Table 12-7 Land Cover Classes in the PDA, LAA, and RAA

Landscape Type	Land Cover Class	Description	Assessment Areas and Mine Sites				
			RAA ha (%)	LAA[1]		PDA	
				Gordon ha (%)	MacLellan ha (%)	Gordon ha (%)	MacLellan ha (%)
Water	Water	Lakes, rivers, or streams	27,480.8 (15.6%)	943.2 (8.4%)	299.6 (8.6%)	13.3 (4.9%)	4.2 (0.5%)
		Water Subtotal[4]	**27,480.8 (15.6%)**	**943.2 (8.4%)**	**299.6 (8.6%)**	**13.3 (4.9%)**	**4.2 (0.5%)**
Anthropogenic	Development	Disturbed land, settlements, roads, industrial development	1,568.7 (0.9%)	381.9 (3.4%)	143.9 (4.1%)	72.0 (26.7%)	72.4 (7.7%)
		Anthropogenic Subtotal	**1,568.7 (0.9%)**	**381.9 (3.4%)**	**143.9 (4.1%)**	**72.0 (26.7%)**	**72.4 (7.7%)**
		Mine Site Total[4]	**176,378.8 (100.0%)**	**11,222.2 (100.0%)**	**3,484.2 (100.0%)**	**269.4 (100.0%)**	**937.9 (100.0%)**
		Project Grand Total[4]		**14,328.0 (100.0%)**		**1,207.3 (100.0%)**	

[1] LAA for each site is a 1 km buffer of the respective Project components which results in 378 ha of overlap and is excluded in the Project Grand Total.
[2] Canadian Forest Service 2003
[3] Halsey et al. 1997, AESRD 2015
[4] represent actual totals and may differ from land cover sums due to rounding.

12.2.2.1 Wildlife Species

A total of 101 wildlife species were observed during baseline surveys: 20 mammals, 79 birds, and 2 amphibians. Detailed results of the baseline surveys are reported in Volume 4, Appendices M, N and O and summarized by focal wildlife groups (Table 12-1) below and in Section 12.2.2.2.

Mammals

Results of field studies and background data collection indicate that 33 mammal species potentially occur in the RAA, 20 of which were observed during baseline field surveys (Appendix 12A, Table 12A-1), including woodland caribou observed in 2019 (Volume 4, Appendix M). Mammal SAR and SOCC are described in Section 12.2.2.2.

Hunting of big game (e.g., moose, gray wolf, black bear) and trapping of furbearers (e.g., American marten) are common activities undertaken by local resource users (Stantec 2018; SVS 2020; Chapter 17). There are two community, and four privately held traplines overlapping the LAA (Map 12-4) and American marten is the most commonly trapped furbearer in the RAA (pers. comm. 2015a). Discussion of the mammalian wildlife community in the RAA focuses on moose, gray wolf, black bear, and American marten.

Moose

Moose are common throughout the boreal forest in Manitoba. Moose require a variety of forested habitats throughout the year: dense forest provides thermal cover during winter months and transitions to more open forest and aquatic habitats during the summer months that provide foraging opportunities (Banfield 1974, Franzmann et al. 2007).

DARD indicated that moose are generally abundant within the RAA and important to local resource users (pers. comm. 2015b). The Province regulates the hunting of moose in the RAA, allowing a bag limit of one bull moose for both residents and non-resident hunters within Game Hunting Area 9 (Government of Manitoba 2019b). The 2019 hunting season extended from September 16 to October 13, and December 2 to December 22.

Previous site reports (MinGold Resources Inc. 1989 and Tetra Tech 2013), as well as current field studies, indicate that moose are common in the region. Moose tracks were more commonly observed in the Gordon site aerial survey block than the MacLellan site aerial survey block. The highest densities of moose tracks were observed northwest and east of the Gordon site (Volume 4, Appendix M). During the aerial winter surveys conducted during 2016 and 2017, moose tracks were commonly observed using linear landscape features (e.g., frozen creeks and rivers, cut lines, right-of-ways) as movement routes (Volume 4, Appendix M).

Moose is an important resource for Indigenous communities (Stantec 2018; SVS 2020; Chapter 17) and potential Project-related environmental effects on the species' population are a concern to Indigenous communities and other stakeholders (Chapter 3).

Gray Wolf

Gray wolf is a large-bodied, apex predator that is typically distributed relative to available prey (e.g., moose) rather than specific habitats (Banfield 1974). The Province regulates the hunting of gray wolf in the RAA. Game Hunting Area 9 zone 'A' has a bag limit of one wolf for both residents and non-resident hunters (Government of Manitoba 2017b). The 2019 hunting season extends from August 26 to February 29. Gray wolf is a trapped species by Indigenous communities (Stantec 2018; SVS 2020; Chapter 17) and TEK indicates that wolf populations have increased over time (Stantec 2018).

The 1989 Farley Feasibility Study indicated that gray wolves are present within the region (MinGold Resources Inc. 1989) while the 2012 Environmental Baseline Study documented gray wolf sign near the MacLellan site (Tetra Tech 2013). During aerial surveys, gray wolf tracks were observed at similar densities at Gordon and MacLellan sites. Gray wolf was commonly observed using linear landscape features (e.g., frozen creeks and rivers, cut lines, right-of-ways) as transportation corridors during the surveys.

Black Bear

Black bear is a large-bodied generalist omnivore that occupies a variety of habitats in the RAA (Banfield 1974). Black bear is an important species to local resource users and provides economic benefits to local hunting outfitters. Black bears hibernate for winter, selecting dens under fallen trees or digging holes into soil or steep banksides (Banfield 1974), and denning sites are likely to occur throughout the RAA.

The Province regulates the hunting of black bear in the RAA with a bag limit of one adult black bear (excluding a sow with cubs) for both resident and non-resident hunters in zone 'A' (Government of Manitoba 2019b). The 2019 hunting season extends from April 29 to June 30 and August 26 to November 1. Black bear is a species hunted by Indigenous communities (Stantec 2018; SVS 2020; Chapter 17) and TEK indicates that black bear populations have increased over time in some areas (Stantec 2018).

Within the RAA, black bear is considered common and widespread in areas supporting suitable habitat (MinGold Resources Inc. 1989, pers. comm. 2015b). During the remote camera survey, black bear was detected most frequently in coniferous forests, but were also detected in other habitat types in the RAA (Volume 4, Appendix M). Black bear was observed less frequently near existing infrastructure.

American Marten

American marten is a tree-dwelling furbearer typically associated with contiguous patches of mixedwood or coniferous forest (Banfield 1974). The Province regulates the trapping of American marten within the RAA. Trapping is open to registered trappers only, between November 1 and February 28, and there is no limit (Government of Manitoba 2019c). American marten is a trapped species by Indigenous communities (Stantec 2018; SVS 2020; Chapter 17).

Generally common throughout the RAA, American marten and sign (e.g. tracks) were observed during the remote camera study, ground mammal tracking surveys and aerial mammal tracking surveys. Observations were widespread across the RAA, but ground mammal tracking surveys identified American marten tracks more frequently at the MacLellan site compared to the Gordon site (Volume 4, Appendix M).

Birds

Background data collection indicates that 198 bird species have the potential to breed in the RAA: 62 are waterbirds, 4 are upland gamebirds, 18 are raptors, and 114 are passerines or near-passerines (MB BBA 2019b; Volume 4, Appendix N). Several other species may occupy the RAA at other times of the year (e.g., during winter or spring and fall migration) which is also described below.

Results of field surveys confirmed the presence of 80 species in the RAA: 41 species of waterbird, 3 species of upland gamebird, 7 species of raptor, and 29 species of passerine and near-passerine (Volume 4, Appendix N). Three of the species observed in the RAA are SAR (common nighthawk, olive-sided flycatcher, and barn swallow) and described in more detail below. Additional information on the abundance and distribution of migratory birds, including SAR, is provided in Volume 4, Appendix N.

The most common migratory bird species observed breeding in the RAA included Canada goose, mallard, common loon, ruby-crowned kinglet (*Regulus calendula*), Tennessee warbler, and swamp sparrow (*Melospiza georgiana*). Other commonly observed bird species included spruce grouse (*Falcipennis canadensis*), willow ptarmigan (*Lagopus lagopus*), bald eagle, common raven (*Corvus corax*), and gray jay (*Perisoreus canadensis*). Upland game bird species such as willow ptarmigan inhabit the RAA in the winter and are a hunted species by Indigenous communities (Stantec 2018; SVS 2020; Chapter 17).

Year-round habitat for migratory and non-migratory birds in the RAA is a dynamic system of heterogeneous habitat types that vary over space and time. Spatially, the landscape alternates between terrestrial forested habitats in the uplands to wetland and water habitats in the lowlands (Table 12-7). Such mosaics provide higher conservation value and ecological services for bird communities than homogenous habitats (Terraube et al. 2016). Species that favor transitional or edge habitats are less likely to be affected by fragmentation than species dependent on interior forest habitat (Hobson and Bayne 2000).

Temporally, the RAA provides habitats for migratory and non-migratory bird species that can vary over time. While boreal habitats remain relatively stable inter-annually compared to more southern biomes (e.g., stable water regimes), it remains a temporally dynamic ecosystem subject to the influences of climate, fire, insects, disease (Brandt et al. 2013). Evidence suggests that boreal breeding songbirds exhibit some resiliency to anthropogenic disturbance as a result of evolving in a landscape continually affected by natural disturbance (Schmiegelow et al. 1997). More immediately, seasonal changes signal shifts in habitat use by birds and the RAA provides valuable year-round habitat for migratory and non-migratory bird species: migratory and staging habitat in the spring and fall for more northerly breeding species, breeding habitat in the summer months, and overwintering habitat for several hardy species that remain year-round.

Bald eagles are known to nest within the LAA near the MacLellan site along the Keewatin River (Stantec 2018; Volume 4, Appendix N), but background and field investigations did not find evidence of other key habitat features for birds, including sharp-tailed grouse (*Tympanuchus phasianellus*) leks, migration concentrations, and breeding colonies or rookeries (Volume 4, Appendix N).There are no Important Bird Areas (IBA Canada 2018) or other designated lands for birds (e.g., refuges) in the RAA.

Amphibians

Two species of amphibian were detected during baseline field surveys and are known to breed within the RAA: wood frog and boreal chorus frog (Volume 4, Appendix O). Results from the 2015/2016 amphibian baseline studies indicate that boreal chorus frogs and wood frogs are widely dispersed in well-vegetated wetlands throughout the RAA. During the peak frog breeding period in May, both species were observed using the same breeding ponds, indicating overlapping habitat preferences in the RAA. As expected, areas of swift moving water, such as Keewatin River, did not support breeding frogs, but these rivers and streams may still contain suitable habitat such as riparian wetlands along parts of their reaches, or provide overwintering habitat for amphibians.

Insects

The boreal habitats within the RAA support a diverse insect community, including terrestrial insect groups such as beetles (order *Coleoptera*), moths (order *Lepidoptera*), and spiders (order *Araneae*) and semi-aquatic insect groups such as mayflies (order *Ephemeroptera*) and dragonflies (order *Odonata*; Freitag 2019). The RAA has the potential to provide habitat for two insect SAR/SOCC, the yellow-banded bumble bee and the transverse lady beetle, which are discussed in greater detail below.

12.2.2.2 Species at Risk and Species of Conservation Concern

The RAA overlaps the current or historical ranges of 15 SAR (Table 12-8), including four mammals (little brown myotis, northern myotis, wolverine, woodland caribou), nine birds (horned grebe, yellow rail, short-eared owl, common nighthawk, olive-sided flycatcher, bank swallow, barn swallow, evening grosbeak, and rusty blackbird), one amphibian (northern leopard frog, and one insect (yellow-banded bumble bee). The RAA also overlaps the current or historical ranges of three SOCC (Table 12-8), including one mammal (barren-ground caribou), one bird (trumpeter swan), and one insect (transverse lady beetle).

Table 12-8 Wildlife Species at Risk and Species of Conservation Concern with Potential to Occur in the Regional Assessment Area[1]

Common Name	Scientific Name	SARA[2]	COSEWIC[3]	ESEA[4]	MB CDC[5]	Observed in the General Project Area by Tetra Tech (2013)	Observed During Project-specific Baseline Studies (2015-2019)
Mammals							
Little brown myotis	*Myotis lucifugus*	Endangered	Endangered	Endangered	S2N, S5B	--	✓
Northern myotis	*Myotis septentrionalis*	Endangered	Endangered	Endangered	S3S4N, S4B	--	--
Wolverine	*Gulo gulo*	Special Concern	Special Concern	No Status	S3S4	--	✓
Barren-ground caribou	*Rangifer tarandus groenlandicus*	No Status	Threatened	No Status	S5N	--	--
Woodland caribou	*Rangifer tarandus caribou*	Threatened	Threatened	Threatened	S3S4	--	✓
Birds							
Trumpeter swan	*Cygnus buccinator*	No Status	No Status	Endangered	S1B	✓*	--
Horned grebe	*Podiceps auritus*	Special Concern	Special Concern	No Status	S4B	--	--
Common nighthawk	*Chordeiles minor*	Threatened	Threatened	Threatened	S3B	--	✓
Yellow rail	*Coturnicops noveboracensis*	Special Concern	Special Concern	No Status	S3B	--	--
Short-eared owl	*Asio flammeus*	Special Concern	Special Concern	Threatened	S2S3B	--	--
Olive-sided flycatcher	*Contopus cooperi*	Threatened	Special Concern	Threatened	S3B	✓	✓
Bank swallow	*Riparia riparia*	Threatened	Threatened	No Status	S5B	--	--
Barn swallow	*Hirundo rustica*	Threatened	Threatened	No Status	S4B	✓	✓
Evening grosbeak	*Coccothraustes vespertinus*	Special Concern	Special Concern	No Status	S3	--	--

Table 12-8 Wildlife Species at Risk and Species of Conservation Concern with Potential to Occur in the Regional Assessment Area[1]

Common Name	Scientific Name	SARA[2]	COSEWIC[3]	ESEA[4]	MB CDC[5]	Observed in the General Project Area by Tetra Tech (2013)	Observed During Project-specific Baseline Studies (2015-2019)
Rusty blackbird	*Euphagus carolinus*	Special Concern	Special Concern	No Status	S4B	✓	--
Amphibians							
Northern leopard frog	*Lithobates pipiens*	Special Concern	Special Concern	No Status	S4	--	--
Insects							
Yellow-banded bumble bee	*Bombus terricola*	Special Concern	Special Concern	No Status	--	--	--
Transverse lady beetle	*Coccinella transversoguttata*	No Status	Special Concern	No Status	--	--	--

* Observed during the migration season
[1] Carey et al. 2003; Government of Canada 2019b, MB BBA 2019b
[2] Species listed under Schedule 1 of the *Species at Risk Act* (Government of Canada 2019a)
[3] Species listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2019)
[4] Wildlife species at risk in Manitoba listed under the *Endangered Species and Ecosystems Act* (Government of Manitoba 2019a)
[5] Manitoba Conservation Data Centre (MB CDC 2018); ranks are:

S = Province-wide status
1 = Very rare throughout its range or in the province (5 or fewer occurrences, or very few remaining individuals). May be especially vulnerable to extirpation.
2 = Rare throughout its range or in the province (6 to 20 occurrences). May be vulnerable to extirpation.
3 = Uncommon throughout its range or in the province (21 to 100 occurrences).
4 = Widespread, abundant, and apparently secure throughout its range or in the province, with many occurrences, but the element is of long-term concern (>100 occurrences).
5 = Demonstrably widespread, abundant, and secure throughout its range or in the province, and essentially impossible to eradicate under present conditions.
S#S# = Range of uncertainty about the exact rarity of the species.
B = Breeding status of a migratory species.
N = Non-breeding status of a migratory species.

Mammals

Of the five mammal SAR and SOCC with potential to occur in the RAA, two were observed during baseline surveys: little brown myotis and wolverine (Table 12-8; Appendix 12A, Table 12A-1; Volume 4, Appendix M). Woodland caribou was detected in the RAA in April 2019 (Volume 4, Appendix M).

Wolverines use a wide variety of boreal habitats and are typically distributed relative to the availability of a diverse prey base that includes small mammals and large ungulates, although they are most dependent on upland forested habitats (COSEWIC 2014). Wolverine occupy large home ranges and are sparsely dispersed on the landscape, with boreal densities ranging from 0.7-4.8 individuals per 1,000 km^2 (COSEWIC 2014). Wolverine were observed at three cameras trap sites in the LAA and throughout the RAA during aerial track surveys, particularly surrounding the Gordon site (Volume 4, Appendix M). Wolverine is a species trapped by Indigenous communities (Stantec 2018; Chapter 17).

Woodland caribou require large contiguous tracts of lichen-rich mature coniferous forests interspersed with peatland complexes (Government of Canada 2012). The Project is located in the Province of Manitoba's woodland caribou Kamuchawie Management Unit (KMU) – a geographic unit used to facilitate the management of woodland caribou ranges in the province (MBWCMC 2015; Map 12-5). However, no woodland caribou ranges have been delineated in the KMU due to the unavailability of population size, trend, or distribution data (MBWCMC 2015), but woodland caribou are reported to typically occur more than 80 km southwest of the RAA (pers. comm. 2015b). DARD expressed the intention to survey for woodland caribou within the KMU in the winter of 2020 (pers. comm. 2019b), but the survey details or preliminary results from the survey has not yet been shared at the time of writing.

The KMU (1,812,937 ha) is currently 56% undisturbed habitat for woodland caribou (pers. comm. 2019c), which is below the Province's target minimum of 65% (MBWCMC 2015); most disturbance is a result of forest fires (pers. comm. 2019c). Baseline disturbance mapping (Table 12-6) indicates that 77% of the LAA is currently disturbed primarily due to anthropogenic disturbance and the RAA is currently 46% disturbed, primarily due to forest fire (Table 12-9; Map 12-6).

The Project (MacLellan site) also overlaps the Manitoba North Range (MB9), an area delineated as potentially containing critical habitat for woodland caribou, as defined in the Federal Recovery Strategy for the Woodland Caribou, Boreal Population (Government of Canada 2012, ECCC 2019a; Map 12-5). However, habitat within the RAA contains a relatively high degree of disturbance (i.e., Town of Lynn Lake, MacLellan site, fires within 40 years) and currently provides limited suitable habitat for woodland caribou (Table 12-9; Map 12-6). The Manitoba North Range (MB9) is 67% undisturbed habitat for woodland caribou (ECCC 2019a), above the minimum target of 65% (Government of Canada 2012).

Table 12-9 Amount of Disturbed Habitat (ha) for Woodland Caribou in the LAA and RAA[1]

Disturbance Type	RAA	LAA
Forest Fire	47,054 (32%)	1,160 (9%)
Anthropogenic[2]	21,531 (14%)	8,855 (68%)
Disturbed Subtotal	**68,585 (46%)**	**10,790 (77%)**
Undisturbed	80,313 (54%)	3,075 (23%)
Total	176,379	13,090

[1] Following disturbance mapping methods outlined in the federal woodland caribou recovery strategy and excludes water (Government of Canada 2012).

[2] Including a 500 m buffer of the anthropogenic land cover class (Government of Canada 2012). Forest fire disturbance within 500 m of an anthropogenic disturbance is considered as an anthropogenic disturbance.

The results of the baseline remote camera survey provided a recent observation of several individual caribou in the RAA west of Lynn Lake in April 2019, which indicates woodland caribou may occasionally occur in the RAA. Additionally, this occurrence is consistent with Manitoba Metis Federation accounts of woodland caribou rights-based hunting activity outside the RAA near Zed Lake (SVS 2020).

Caribou in general, have been identified as an important resource for Indigenous communities and there have been numerous concerns raised about the potential Project-related environmental effects to caribou populations, by both Indigenous communities and other stakeholders (Stantec 2018; SVS 2020; Chapters 3 and 17). There are however, no recent TEK observations or accounts of rights-based hunting activity for woodland caribou in the RAA (Stantec 2018; SVS 2020).

Barren-ground caribou is a subspecies of caribou that ranges across the taiga forests and tundra north of the boreal forest (Banfield 1974). The occurrence of barren-ground caribou range in the RAA is considered historical, as the contemporary southern range extent of the Beverly-Qamanirjuaq herd terminates north of the RAA (BQCMB 2014, COSEWIC 2016b; Map 12-5). Background review indicates that it is unlikely that barren-ground caribou would traverse through the RAA except accidentally (MinGold Resources Inc. 1989, Tetra Tech 2013, pers. comm. 2015b, c, and e). TEK indicates that barren-ground caribou were hunted in the northern portion of the RAA until the early 1950s and are now harvested outside of the RAA (Stantec 2018; SVS 2020; Chapter 17). There is no indication that the species has been observed or hunted in the RAA in recent times.

Little brown and northern myotis require different habitats for overwintering hibernacula and maternal roosting sites. Overwintering hibernacula provide prolonged refuge from cold northern winters and are often in limited supply as the internal environmental conditions for hibernacula are relatively restrictive (e.g., caves; COSEWIC 2013, pers. comm. 2015g and 2015h). The existing mine shafts in the RAA that could potentially provide suitable conditions for bat hibernacula are anticipated to be unsuitable due to water infilling (pers. comm. 2015f) and the elevated water table was visible at the MacLellan site during field surveys. Additionally, there are no known natural caves in the RAA that are more typical of karst topography, like that of the northern Interlake region of Manitoba. There is no evidence to suggest that there are bat hibernacula in the LAA but the presence of bat hibernacula in the RAA is uncertain.

Maternal roosting sites that include anthropogenic structures and tree cavities are more readily available and individuals may travel hundreds of kilometers from overwintering hibernacula to these sites for the breeding season (COSEWIC 2013). During the spring, summer, and fall, little brown myotis and northern myotis forage along forest openings and over waterbodies (COSWEIC 2013). Field surveys confirmed the presence of little brown myotis foraging at the MacLellan site (Volume 4, Appendix M). Habitat for little brown myotis is not mapped due to the difficulty of identifying and quantifying specific anthropogenic structures or mature forest (i.e., land cover data does not include a stand age attribute) suitable for maternal roosting and is instead assessed qualitatively (Table 12-6).

Birds

Of the ten bird SAR and SOCC with potential to occur within the RAA, four species were observed during baseline surveys within the RAA and are expected to regularly occupy the RAA (Table 12-8; Appendix 12A, Table 12A-1; Volume 4, Appendix N). Trumpeter swan, horned grebe, yellow rail, short-eared owl, bank swallow, and evening grosbeak are not expected to regularly occur in the RAA, based on range distributions and limited breeding occurrences in this region (MB BBA 2019b) as well as a lack of suitable breeding habitat (i.e., expanses of graminoid fens, large patches of open treeless peatland, or steep river banks). The loss or alteration of habitat for sensitive species has been identified as a concern by Indigenous communities (Chapter 3).

Common nighthawk breeds and forages in forest clearings, burns, clear-cuts, rocky outcrops, peat bogs, lakeshores, and disturbed areas (COSEWIC 2007a; Map 12-7; Table 12-7) and was detected in the RAA during baseline surveys and historical surveys as well (MB BBA 2019b and eBird 2019). Analysis of baseline results suggest that common nighthawk is relatively more abundant in the LAA than the RAA and may be taking advantage of the disturbed sites within the LAA. Baseline habitat mapping (Table 12-6) indicates that there is 671 ha of habitat for common nighthawk in the PDA, 7,384 ha in the LAA, and 89,303 ha in the RAA (Table 12-10; Map 12-7).

Olive-sided flycatcher breeds in a variety of boreal forest habitat but is typically associated with edge habitats (COSEWIC 2007b; Map 12-8; Table 12-7). During field surveys, olive-sided flycatcher was common in bog, dense coniferous forest, sparse coniferous forest and shrubland. Historical records of olive-sided flycatcher are also common in the RAA (Tetra Tech 2013; MB BBA 2019b and eBird 2019). Baseline habitat mapping (Table 12-6) indicates that there is 701 ha of habitat for olive-sided flycatcher in the PDA, 8,827 ha in the LAA, and 108,490 ha in the RAA (Table 12-10; Map 12-8).

Barn swallow is limited to breeding where artificial nesting structures such as old buildings, bridges and culverts are available (COSEWIC 2011). During field studies in 2015 and 2016, barn swallows were observed nesting on the headframe structure and on the entrance ramp building at the MacLellan site. Previous studies also reported barn swallows in the LAA and RAA (Tetra Tech 2013; MB BBA 2019b; eBird

2019). Habitat for barn swallow is not mapped due to the difficulty of identifying and quantifying specific anthropogenic structures suitable for nesting and is instead assessed qualitatively (Table 12-7).

Rusty blackbird breeds in boreal wetlands, including along streams, bogs, and marshes (COSEWIC 2006; Map 12-9; Table 12-7). Rusty blackbird was not observed during baseline surveys; however, the 2012 environmental baseline study indicated a breeding pair of rusty blackbirds in the RAA (Tetra Tech 2013) and observations were recorded approximately 1 km outside the RAA boundary along PR 396 (MB BBA 2019b). Baseline habitat mapping (Table 12-6) indicates that there is 427 ha of habitat for rusty blackbird in the PDA, 6,007 ha in the LAA, and 68,691 ha in the RAA (Table 12-10; Map 12-9).

Table 12-10 Amount of Habitat (ha) Available for Bird Species at Risk

Species	RAA	LAA			PDA		
		Gordon	MacLellan	Total	Gordon	MacLellan	Total[1]
Common nighthawk	89,250	5,560	1,964	7,288	117	525	642
Olive-sided flycatcher	123,021	8,181	2,629	10,512	122	713	835
Rusty blackbird	113,177	7,690	2,472	9,867	105	622	727

[1] Total may be less than sum of Gordon and MacLellan totals due to LAA overlap.

Amphibians

Northern leopard frog breeds in a variety of semi-permanent to permanent waterbodies in early-spring and disperses later in the summer to forage in grassy meadows or forested habitats. In the fall, northern leopard frogs seek-out overwintering habitats that are waterbodies generally characterized as well-oxygenated and deep enough to avoid freezing to the bottom (COSEWIC 2009; MHA 2019). The Project is situated in the northern limit of the species' known range (COSEWIC 2009) and although none were detected, either from previous investigations or field surveys in 2015 and 2016 (Appendix 12A, Table 12A-1; Volume 4, Appendix O), local Indigenous knowledge indicates northern leopard frogs have been observed in the Town of Lynn Lake as recently as 2006 (pers. comm. 2016b).

Insects

Yellow-banded bumble bee is an ecologically important pollinator species that ranges throughout most of Canada, inhabiting a variety of open and forested habitats (COSEWIC 2015). The species remains relatively common in the northern, boreal extent of its range where potential threats are currently more limited than in southern extents (e.g., habitat conversion, pesticide use, pathogens from managed bee colonies; COSEWIC 2015). There have been no incidental observations of yellow-banded bumble bee during baseline field surveys and while background review did not result in any historical records of the species within the RAA, there are several historical records in northern Manitoba (COSEWIC 2015).

Transverse lady beetle is an ecologically important species that controls insect pests (e.g., aphids [order *Homoptera*]) that ranges throughout most of Canada and the United States, inhabiting a variety of open and forested habitats (COSEWIC 2016a). The species remains relatively common in the northern, boreal extent of its range where potential threats are currently more limited than in southern extents (e.g., non-native lady beetles; COSEWIC 2016a). There have been no incidental observations of transverse lady beetle during baseline field surveys and while background review did not result in any historical records of the species within the RAA, there are several historical records in northern Manitoba (COSEWIC 2016a).

12.2.2.3 Habitat

Wildlife habitat in the RAA is a mosaic of terrestrial and wetland habitats intersected by extensive stream and lake systems that is relatively undisturbed (Table 12-7; Map 12-2). Potential Project-related environmental effects to wildlife habitat and resultant population abundance and distribution has been raised as a concern, primarily for sensitive species and harvested species, by Indigenous communities and other stakeholders (Stantec 2018; Chapters 3 and 17).

Some wildlife species may be more sensitive to Project-related environmental effects and some species also warrant additional regulatory concern, such as SAR (Table 12-1). To facilitate the assessment of change in habitat, background and baseline field survey data were used to identify important habitat features in the RAA and were mapped for species used as quantitative measurable parameters (Table 12-2) and outlined in Table 12-6. Overall, change in habitat for wildlife SAR and SOCC was assessed using a habitat-based approach that evaluated the suitability of each land cover class to provide the necessary life requisites (i.e., food, cover) to support each species (Table 12-6).

12.2.2.4 Mortality Risk

Mortality risk in the RAA is primarily attributable to traffic-related mortality, hunting and trapping activities, and predation. These baseline sources of mortality risk are difficult to quantify, particularly for hunting, trapping, and predation, but there does exist some data on traffic-related wildlife mortality. Manitoba Infrastructure (MI) maintains an inventory of reported wildlife collisions for provincial roads, and sections of provincial roads in Manitoba, including separate sections of PR 391, which post a maximum road speed of 90 km/h. The wildlife collision rate from 2008 to 2012 along a 40-km section of PR 391 within the LAA is 0.23 per million vehicle kilometers travelled (MVKT), or 0.5 reported wildlife fatalities per year (MI 2017). This is comparable to the 0.22 MVKT for a section of PR 391 between the Hughes River (east of the Gordon site access road) and the turn off to Nelson House, MB. MI considers 1.0 per MVKT a threshold at which additional safety concern or mitigation is required (MI 2017).

The collision rates on PR 391 are assumed to primarily represent collisions with larger mammals capable of causing reportable vehicle damage (e.g., moose, black bear) and collisions with smaller wildlife species are likely unreported. Reported ratios of traffic-related mortality rates between large mammals and smaller wildlife species, not specific to Manitoba, vary greatly and range from 2-32 small mammals, 2-21 birds, and 2-74 amphibians for every large mammal-vehicle collision (Hansen 1982 in Seiler 2003, Siebert and Conover 1991, Seiler 2003, Kambourova-Ivanova 2012).

Mortality associated with increased Project-related traffic has been identified as a concern by Indigenous communities (Chapter 3). Wildlife mortality risk, primarily for migratory birds, may also increase following the construction of the electrical distribution line (i.e., electrocutions, line strikes).

12.2.2.5 Wildlife Health

Contaminants of potential concern (COPC) are identified as those Project-related chemicals that have the potential to elicit adverse human or ecological health effects (Volume 5, Appendix H). Baseline ambient air quality data and the subsequent human health and ecological risk assessment indicate that the risk of exposure to baseline criteria air contaminants (CACs; NO_2, SO_2 and $PM_{2.5}$) is negligible (Chapter 18). However, baseline concentrations of some COPC exceed established risk acceptability benchmarks for humans and include manganese, methylmercury, and thallium. Exceedances for total ingestion for methylmercury were primarily due to consumption of fish, while exceedances for manganese and thallium were primarily due to consumption of wild meat, traditional plants and/or backyard garden produce (Chapter 18). It is assumed that these COPC represent compounds that may also affect wildlife health. However, since there are , no historical tailings present at either of the mine sites, the effect pathways of historical mining activities on wildlife are anticipated to be minimal.

Primary contributors of baseline COPC in the RAA include those that affect ambient air quality (e.g., seasonal forest fires, traffic on unpaved roads and subsequent dustfall, wood stoves, open fires; Chapter 6) or surface water quality (e.g., mining; Chapter 9).

12.3 PROJECT INTERACTIONS WITH WILDLIFE AND WILDLIFE HABITAT

Anticipated interactions between Project activities and the VC environmental effects (Section 12.1.3) are identified in Table 12-11 with a check mark and are discussed in detail in Section 12.4, in the context of effects pathways, standard and Project-specific mitigation/enhancement, and residual effects. Justification for no effect (indicated by a dash) is provided following the table.

Project activities for each phase are described in detail in Chapter 2, Section 2.3 and 2.4. Project related emissions and discharges are described in Chapter 2, Section 2.8.

The potential interactions between Project activities and the environment were considered for the construction, operation, and decommissioning/closure phases of the Project. The identification of Project activities and their potential interactions was based on engagement with interested parties, the professional judgment of technical specialists involved in the assessment, and a review of existing conditions. The selection of interactions is informed by the potential effects and effects pathways for each VC as described in Section 12.1.3.

Emissions, discharges, and wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many and varied Project activities. Rather than acknowledging this by placing a check mark against each of these activities, “Emissions, Discharges and Wastes” have been consolidated as an integrated activity for efficiency with relevant detail described in the text. This category includes the emissions, discharges, and wastes generated by all project activities under each Project phase.

Project-related environmental effects can influence wildlife and wildlife habitat directly or indirectly and positively or negatively. A direct effect is characterized by an interaction that occurs at the same time and place (e.g., mortality resulting from vegetation clearing) and exhibits no intermediate effects, whereas an indirect effect is characterized by an interaction that occurs at a later time and space and with intermediary steps (e.g., altered predator-prey dynamics following clearing; Hegmann et al. 1999). Most interactions will affect wildlife and wildlife habitat adversely, but in some cases the effects are positive for certain species or Project activity (e.g., habitat succession during post-closure).

Table 12-11 Potential Project-Environment Interactions with Wildlife and Wildlife Habitat

Project Activities and Components	Environmental Effects					
	Change in Habitat		Change in Mortality Risk		Change in Wildlife Health	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
Construction						
Site Preparation at Both Sites (removal of existing buildings; removal of contaminated materials; vegetation clearing and earthworks; development of temporary construction camp at the MacLellan site)	✓	✓	✓	✓	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	–	–	✓	✓	–	–
Mine Components at Both Sites (construction of: ore pads; ore, overburden and mine rock storage areas; mill feed storage area and crushing plant, ore milling and processing plant, and tailings management facility (TMF) at the MacLellan site; water management facilities [e.g., sumps, ponds and ditches])	–	–	–	–	–	–

Table 12-11 Potential Project-Environment Interactions with Wildlife and Wildlife Habitat

Project Activities and Components	Environmental Effects					
	Change in Habitat		Change in Mortality Risk		Change in Wildlife Health	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
Utilities, Infrastructure, and Other Facilities at Both Sites (construction of: buildings and yards; access roads [i.e., upgrades at the Gordon and MacLellan site] and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at the MacLellan site; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities)	–	–	–	–	–	–
Water Development and Control at Both Sites (dewatering of existing pits at the Gordon site and underground workings at the MacLellan site; re-alignment of existing diversion channel at Gordon site; interceptor wells at the Gordon site)	✓	✓	✓	✓	–	–
Emissions, Discharges, and Wastes[1]	✓	✓	–	–	✓	✓
Employment and Expenditure[2]	–	–	–	–	–	–
Operation						
Open Pit Mining at Both Sites (drilling; blasting; removal, loading and on-site hauling of mined material [i.e., ore, overburden, and mine rock])	–	–	–	–	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA, including truck transportation of ore from the Gordon site to the MacLellan site)	–	–	✓	✓	–	–
Storage/Stockpiling of Ore, Overburden, and Mine Rock at Both Sites	✓	✓	–	–	–	–
Ore Milling and Processing at the MacLellan Site (ore crushing and conveyance; ore milling)	n/a	–	n/a	–	n/a	–

Table 12-11 Potential Project-Environment Interactions with Wildlife and Wildlife Habitat

Project Activities and Components	Environmental Effects					
	Change in Habitat		Change in Mortality Risk		Change in Wildlife Health	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
Water Management at Both Sites (mine water collection and storage; process water supply for the MacLellan site including water intake on Keewatin River at the MacLellan site; pumping fresh/fire water from Farley Lake at Gordon site; operation of interceptor wells at the Gordon site)	✓	✓	–	–	✓	✓
Tailings Management at the MacLellan Site	n/a	✓	n/a	✓	n/a	✓
Utilities, Infrastructure, and Other Facilities at Both Sites (presence and operation of: buildings and yards; access roads and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at the MacLellan site; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities; explosives storage, maintenance of access roads and bridges)	–	–	✓	✓	–	–
Emissions, Discharges, and Wastes[1]	✓	✓	–	–	✓	✓
Employment and Expenditure[2]	–	–	–	–	–	–
Decommissioning/Closure						
Decommissioning at Both Sites	✓	✓	–	–	–	–
Reclamation at Both Sites	✓	✓	–	–	–	–
Post-Closure at Both Sites (long-term monitoring)	✓	✓	✓	✓	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	–	–	✓	✓	–	–
Emissions, Discharges and Wastes[1]	✓	✓	–	–	✓	✓
Employment and Expenditure[2]	–	–	–	–	–	–

NOTES:
✓ = Potential interaction

Table 12-11 Potential Project-Environment Interactions with Wildlife and Wildlife Habitat

Project Activities and Components	Environmental Effects					
	Change in Habitat		Change in Mortality Risk		Change in Wildlife Health	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
– = No interaction						
[1] Emissions, Discharges, and Wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many Project activities. Rather than acknowledging this by placing a check mark against each of these activities, "Emissions, Discharges and Wastes" have been introduced as an additional component under each Project phase.						
[2] Project employment and expenditures are generated by most Project activities and components and are the main drivers of many socio-economic effects. Rather than acknowledging this by placing a check mark against each of these activities, "Employment and Expenditures" have been introduced as an additional component under each Project phase.						

Employment and expenditure activities are not expected to interact with change in habitat, mortality risk, or wildlife health for the lifetime of the Project as there is no pathway for these activities to affect wildlife and wildlife habitat.

Construction

Project-related transportation within the LAA, mine components, and utilities, infrastructure and other facilities are not expected to cause change in wildlife habitat during construction as there are no pathways that are not discussed in emissions, discharges, and wastes (i.e., sensory disturbances). Changes to habitat associated with these components would occur as a result of site preparation.

Mine components and utilities, infrastructure and other facilities are not expected to interact with wildlife mortality risk as these activities will be conducted after site preparation has been completed, so wildlife will no longer be present at these sites. Emissions, discharges, and wastes, are also not expected to affect wildlife mortality risk as these are not expected to have lethal effects on wildlife.

All activities and components, other than emissions, discharges, and waste, are not expected to affect wildlife health as there are no pathways for environmental contamination.

Operation

Open pit mining, Project-related transportation within the LAA, ore milling and processing, and utilities, infrastructure, and other facilities are not expected to cause change in wildlife habitat as these activities will be conducted on previously-cleared land and/or there are no pathways that are not discussed in emissions, discharges and wastes.

Open pit mining and ore milling and processing are not expected to interact with wildlife mortality risk as these activities will be conducted on previously-cleared land and there is no pathway for these activities to cause wildlife fatalities. Emissions, discharges, and wastes are also not expected to affect wildlife mortality risk as these are not expected to have lethal effects on wildlife.

All activities and components, other than emissions, discharges, and waste, are not expected to affect wildlife health as there are no pathways for environmental contamination.

Decommissioning/Closure

Project-related transportation is not expected to cause a change in wildlife habitat during decommissioning/closure, as there are no pathways that are not discussed in emissions, discharges, and wastes.

Decommissioning, reclamation, and emissions, discharges and wastes are not expected to affect wildlife mortality risk as there are no potential pathways that are not discussed under Project-related transportation in the LAA.

All activities and components, other than emissions, discharges, and waste, are not expected to affect wildlife health as there are no pathways for environmental contamination.

12.4 ASSESSMENT OF RESIDUAL ENVIRONMENTAL EFFECTS ON WILDLIFE AND WILDLIFE HABITAT

This section discusses the interaction pathways for the Project activities identified in Table 12-11 (Section 12.3) that have the potential to affect a change in habitat, mortality risk, or wildlife health, including analytical assessment techniques, mitigation, and residual effects. The assessment of potential change in habitat, mortality risk, and wildlife health, is organized by Project components (i.e., Gordon and MacLellan sites), as regulatory guidance has indicated a desire to understand pathways of effects by individual site. For wildlife and wildlife habitat, the portion of PR 391 between the Gordon and MacLellan sites is included in the assessment for Gordon site (Section 12.1.4).

12.4.1 Analytical Assessment Techniques

The general approach to assessing potential environmental effects on wildlife and wildlife habitat follows the sequence and methods outlined in Chapter 4 - Environmental Effects Assessment Scope and Methods. Analytical assessment techniques specific to each potential environmental effect are described separately in Sections 12.4.2 through 12.4.4.

12.4.1.1 Assumptions and the Conservative Approach

A conservative approach is used to address uncertainty in the environmental effects assessment, which increases confidence in the final determination of significance. Assumptions used to address uncertainty are identified as part of the description of analytical assessment techniques for each of the respective environmental effects. The prediction confidence of the assessment for wildlife and wildlife habitat incorporates these assumptions (Section 12.7).

12.4.2 Assessment of Change in Habitat

12.4.2.1 Analytical Assessment Techniques

Change in habitat was assessed by comparing direct and indirect changes in the amount of habitat available for key wildlife species (Table 12-6) and for each Project component (i.e., construction, operation, and decommissioning/closure) to baseline conditions. Direct change in habitat (i.e., habitat loss) was calculated as the loss of wildlife habitat that is no longer available to wildlife resulting from the PDA; effects do not extend into the LAA. In general, once vegetation clearing is completed during the construction component, the PDA will provide no suitable wildlife habitat, except for a few species that may take advantage of developed sites (e.g., barn swallow). Indirect change in habitat (i.e., sensory disturbance) was assessed qualitatively as the area of reduced habitat effectiveness; effects are generally confined to the LAA but may extend into the RAA. Potential effects are considered as a whole, inclusive of all seasonal requirements for wildlife (e.g., primary nesting or migration periods for birds, calving and overwintering periods for moose).

12.4.2.2 Project Pathways

Gordon Site

Construction

Vegetation clearing and dewatering will result in direct habitat loss and alteration during site preparation and during water development and control activities, respectively. Site preparation activities will require the removal of upland and wetland habitats in the PDA. During construction, the PDA will provide limited wildlife habitat, except for uncleared areas used in the expansion of storage/stockpiling of ore, overburden, and mine rock. A few species such as barn swallow, may take advantage of developed sites and anthropogenic structures. Vegetation clearing will result in the loss or structural alteration (e.g., edge effects) of riparian and terrestrial habitats for wildlife, including for migratory and non-migratory birds. Vegetation clearing will contribute to the existing unnatural transition between the cleared PDA and the adjacent wildlife habitat (i.e., edge effects). Edge effects can include changes in microclimate (e.g., Murcia 1995), vegetation structure (e.g., Harper et al. 2005), nest predation (e.g., Paton 1994), community structure (e.g., Schmiegelow et al. 1997), or behavioral responses of wildlife (e.g., Machtans 2006) and are particularly harmful to breeding songbird species. Sensory disturbances (i.e., noise) is expected to be the primary pathway for and indirect change in habitat attributed to emissions, discharges, and wastes activities.

Construction activities also have the potential to result in indirect habitat loss (i.e., sensory disturbance) due to noise and vibrations (e.g., blasting). Project-related noise from most construction activities (e.g., heavy equipment operation, infrastructure construction, increased traffic volumes) have the potential to disturb wildlife and change the use of habitat around the site or road (e.g., habitat avoidance [e.g., Bayne et al. 2008]). There are, however, species that may opportunistically exploit such altered habitats (e.g., red fox [*Vulpes vulpes*]; Volume 4, Appendix M).

Water development and control activities will include re-alignment of the existing diversion channel and dewatering of the existing pits into Gordon and Farley lakes, and subsequently Farley Creek, that will experience higher flow volumes which could result in localized changes in riparian habitats. Water development and control at the Gordon site will include pumping water from the existing pits into Farley Lake, which will then flow through Farley Creek to Swede Lake. Elevated water levels are expected on Farley Lake and Farley Creek, which may directly affect the habitat available for certain wildlife species, particularly those that nest over water or along the lake margins (e.g., waterbirds), or in riparian areas. Swede Lake and other interconnected lakes are not anticipated to be affected as they can withstand the effects of the increased flow.

Operation

Fluctuating water levels is a primary pathway for a direct change in habitat during water management activities. As the pit is excavated, the water balance of Farley Lake and Farley Creek may be affected, which can directly affect the habitat available for certain wildlife species, particularly those that nest over water or along the lake margins (e.g., waterbirds), or in riparian areas. Additionally, previously uncleared vegetation may be removed as storage/stockpiling of ore, overburden, and mine rock is expanded.

Noise is expected to be the primary pathway for an indirect change in habitat during the emissions, discharges, and wastes activities. Project-related noise (e.g., heavy equipment operation, blasting, and increased traffic levels) and light (e.g., mine buildings, light plants) sources has potential to result in habitat displacement and avoidance (i.e., reduced habitat effectiveness)

Decommissioning/Closure

The pathways that affect a direct change in habitat vary over time as the halt of intensive mine operations transitions towards habitat restoration and succession during the decommissioning/closure phase. A direct change in habitat during decommissioning activities includes the removal of mine infrastructure that may affect species such as barn swallow. Water infilling and vegetation succession of the PDA will result in increased habitat value for wildlife during active closure and post-closure activities.

Similarly, pathways that affect an indirect change in habitat vary over time from decommissioning (active closure) to post-closure. While edge effects will persist during active closure, the level of sensory disturbance will be reduced in comparison to operational components. Sensory disturbance during reclamation is expected to be greatly reduced and returned to baseline conditions during post-closure. Over time, edge effects will continue to be abated during reclamation and post-closure as succession softens the unnatural transition between the PDA and adjacent habitat.

MacLellan Site

Construction

As with the Gordon site, vegetation clearing and dewatering are the primary pathways for a direct change in habitat during site preparation and water development and control activities, respectively. The pathways for direct change in habitat are the same as described above, but also includes the removal of existing mine infrastructure (e.g., habitat for small mammals, bats, birds), indirect draw-down of East Pond, and vegetation removal for tailings management construction. Site preparation activities will require the removal of upland and wetland habitat for the PDA.

As with the Gordon site, vegetation clearing and sensory disturbances are the primary pathways for an indirect change in habitat during the site preparation and emissions, discharges, and wastes activities, respectively. The pathways for indirect change in habitat are the same as described above.

The clearing of the power distribution line right-of-way and construction of the wood pole distribution line will re-disturb land. Project clearing and construction activities at the MacLellan site will include a new 34.5 kV distribution line that will be routed along an existing disturbed right-of-way beside the existing access road to the site. The segment from PR 391 to the site will be approximately 5 km long and routed adjacent to the existing access road on a former power supply line right-of-way. The single pole distribution line will be situated on a 20 m (approx.) wide right-of-way. Clearing for the power distribution line right-of-way segment from PR 391 to the site will involve approximately 10 ha of land. An additional 3.2 km segment from a new station built by Alamos near Lynn Lake to PR 391 at the entrance to the site is required. Routing and right-of-way access are in progress. The power distribution line may require new access road(s) of 500 m (approx.) in length to be built for access to the distribution line. The distribution line will involve a crossing of the outlet of Dot Lake to the Keewatin River and a crossing of the Keewatin River at the existing bridge crossing to reach the MacLellan site.

Operation

As with the Gordon site, sensory disturbance is expected to be the primary pathway for an indirect change in habitat during the emissions, discharges, and wastes activities. The same Project-related noise and light sources described for the Gordon site will be experienced here, in addition to noise from ore processing operations.

Water development and control at the MacLellan site will involve subsurface drainage and incidental dewatering and loss of East Pond as the open pit is developed.

Decommissioning/Closure

The effect pathways for direct and indirect change in habitat are expected to operate similarly at the MacLellan site as described above for the Gordon site.

12.4.2.3 Mitigation for Change in Habitat

Project interactions leading to change in habitat are outlined in Table 12-11. The pathways by which these changes are expected to occur are outlined in Section 12.4.2.2. Mitigation for changes in habitat are not specific to individual interactions but rather the pathways by which those interactions occur.

A series of environmental management plans will be developed by Alamos to mitigate the effects of Project development on the environment. These are summarized in Chapter 23. The Wildlife Monitoring and Management Plan will be the primary plan applicable to changes in habitat. However, additional plans that may apply are the Conceptual Closure Plan, Emergency Response, Spill Response and Contingency Plan, Explosives Management Plan, and the Waste Management Plan. This section highlights the key mitigation measures to be implemented during construction, operation, and decommissioning/closure phases used to limit effects on wildlife and wildlife habitat, including to migratory birds, SAR and SOCC, and species harvested by resource users, where feasible.

The implementation of the mitigation measures and other commitments described in this section will be the responsibility of Alamos and or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Gordon Site

- Design for limitation of construction footprint (i.e., PDA) to the extent possible.
- Design for use of down-lighting, a technique of directing night lighting downward, to reduce light effects on wildlife adjacent to the PDA.
- Design for maintenance of a 30 m naturally vegetated buffer around wetlands, waterbodies, and watercourses.
- Design for restriction of unauthorized access to habitat adjacent to the PDA.
- Design for provision of low areas in the ploughed snowbanks of access and on-site roads, where practical, to facilitate wildlife movements across and out of road corridors.
- Design for scheduling vegetation clearing and site preparation activities outside the breeding period for migratory birds (Zone C7; May 7 to August 7; ECCC 2019b). If activities that could result in risk of harm cannot be avoided, Alamos will develop and implement a Project-specific Avian Monitoring Plan as a sub-plan within the Wildlife Monitoring and Management Plan that outlines how risk of harm will be managed in accordance with ECCC guidance (Chapter 23, Section 23.5.14).

- Flag environmentally sensitive areas (e.g., seeps and springs, mineral licks, dens, roosts, stick nests, hibernacula) prior to clearing and construction, and evaluation of the features for additional mitigation measures (e.g., setbacks).
- Retain actual or potential habitat trees where safe and technically feasible to do so. If removal is required, removal activities will be scheduled, to the extent practical, outside the core maternity roosting season for bats (May 1 to August 31; Fenton and Barclay 1980; Barclay 1982, 1984) and breeding season for birds (Zone C7; May 7 to August 7; ECCC 2019b). If habitat tree removal or general tree clearing is required during the maternity roosting period, a qualified biologist will review the trees to make a determination on occupancy before removal. This measure will also reduce the risk to other species that use trees for denning or shelter (e.g., American marten).
- Maintain vegetation cover along the boundaries of high activity areas (e.g., access roads) to reduce sensory (noise and visual) disturbance.
- Report the discovery of nests or other animal dwellings (e.g., lodges, dens) to Alamos, and appropriate action or follow-up will be guided by the Avian Monitoring sub-plan to the Wildlife Monitoring and Management Plan (Chapter 23, Section 23.5.14). Report to the Wildlife and Fisheries Branch of DARD for direction on follow-up actions in necessary.

MacLellan Site

Mitigation measures at the MacLellan site are the same as indicated for the Gordon site with the additional mitigation measure specific to the removal of the existing infrastructure at the MacLellan site:

- Demolish existing buildings and infrastructure outside of the nesting window for birds (Zone C7; May 7 to August 7; ECCC 2019b) and the maternity roosting period for bats (May 1 to August 31; Fenton and Barclay 1980; Barclay 1982, 1984) as per the Wildlife Monitoring and Management Plan.

12.4.2.4 Project Residual Effect for Change in Habitat

Gordon Site

Construction

Construction of the Gordon site PDA will result in the direct loss or alteration of 269 ha of habitat within the LAA, a decrease of 2% from baseline conditions within the LAA (includes expansion of the storage/stockpiling of ore, overburden, and mine rock areas during the operation phase; Tables 12-7 and 12-12). Vegetation clearing and water development and control will result in a direct loss of 119 ha (44%) of upland terrestrial habitats, 65 ha (24%) of wetland habitats, and 13 ha (5%) of open water habitats and alteration of 72 ha (27%) of developed lands. Species that occupy disturbed and rocky habitats, such as common nighthawk, are most likely to be affected by the alteration of developed lands. Wildlife and wildlife habitat important to current land and resources users for traditional purposes most likely to be affected by the loss of terrestrial and wetland habitats include migratory (e.g., olive-sided flycatcher) and non-migratory (e.g., ruffed grouse [*Bonasa umbellus*]) birds, furbearers (e.g., American marten), and moose.

Table 12-12 Residual Change in Wildlife Habitat in the LAA[1]

Landscape Type	Land Cover Class	Existing Conditions (ha)		Residual Conditions (ha / % change)	
		Gordon	MacLellan	Gordon	MacLellan
Upland[2]	Barren				
	Conifer Dense	2,312.4	692	2,290.2 (-1%)	471.7 (-31.8%)
	Conifer Open	1,153.2	468.3	1,132.8 (-1.8%)	298.5 (-36.3%)
	Conifer Sparse	895.2	295.2	866.8 (-3.2%)	196.9 (-33.3%)
	Deciduous				
	Mixedwood Dense	340.8		300.8 (-11.7%)	
	Mixedwood Open	63.6		61.1 (-4%)	
	Shrubland	615.7	28.9	609.8 (-1%)	26.9 (-6.9%)
Upland Subtotal[4]		**5,380.9**	**1,484.4**	**5,261.5 (-2.2%)**	**993.9 (-33%)**
Wetland[3]	Bog Shrubby	642.7	195.5	632 (-1.7%)	153.6 (-21.4%)
	Bog Treed	1,909.0	763.3	1,901.1 (-0.4%)	563.8 (-26.1%)
	Fen Graminoid		31.9		26.9 (-15.7%)
	Fen Pattern		15.9		10.8 (-32.1%)
	Fen Shrubby	966.2	109.2	924.6 (-4.3%)	87.6 (-19.8%)
	Fen Treed	162.5	61.6	162 (-0.3%)	46.6 (-24.4%)
	Marsh	15.5		15.5 (0.3%)	
	Swamp Shrubby	74.8	36.8	73 (-2.4%)	24.7 (-32.9%)
	Swamp Treed	745.6	342.2	743.3 (-0.3%)	271.6 (-20.6%)
Wetland Subtotal[4]		**4,516.2**	**1,556.4**	**4,451.5 (-1.4%)**	**1185.4 (-23.8%)**
Water	Water	943.2	299.6	929.9 (-1.4%)	295.4 (-1.4%)
Water Subtotal[4]		**943.2**	**299.6**	**929.9 (-1.4%)**	**295.4 (-1.4%)**
Anthropogenic	Development	381.9	143.9	579.3 (51.7%)	1,009.3 (601.4%)
Anthropogenic Subtotal[4]		**381.9**	**143.9**	**579.3 (51.7%)**	**1,009.3 (601.4%)**
Mine Site Total[4]		***11,222.2***	***3,484.3***	***11,222.2 (0.0%)***	***3,484.3 (0.0%)***
Project Grand Total[1,4]		***14,328.0***		***14,328.0 (0.0%)***	

[1] LAA for each site is a 1 km buffer of the respective Project components which results in 378 ha of overlap and is excluded in the Project Grand Total.

[2] Canadian Forest Service 2003

[3] Halsey et al. 1997, AESRD 2015

[4] represent actual totals and may differ from land cover sums due to rounding.

An indirect loss or alteration of wildlife habitat is expected through sensory disturbance, edge effects, and altered wetland function that can result in habitat avoidance and reduced habitat effectiveness for wildlife, including migratory birds, SAR and SOCC, moose, and furbearers, in areas adjacent to the PDA. Sensory disturbance (i.e., noise and artificial light) emitted during construction is expected to cease immediately following the conclusion of construction activities. Baseline noise estimates ranged from 35-41 decibels (dBA) in the RAA (Chapter 7) and noise-related effects to wildlife have the potential to occur beyond 40 dBA (Shannon et al. 2016). The distance at which the mean volume of construction activities attenuates around the site to 40 DBA is approximately 1 km (Chapter 7) and therefore contained within the wildlife and wildlife habitat LAA. Increased traffic volumes associated with the Project may increase the existing level of indirect effects to wildlife (i.e., avoidance) along PR 391 and the Gordon site access road, but effects are not expected to extend far beyond the PDA. Edge effects are anticipated to be minor because the Gordon site is an existing site with existing edge effects (albeit effects may have been lessened over time due to vegetation regrowth), but expansion of the PDA will add to this existing disturbance. Additionally, the the Project will not result in increased habitat fragmentation as core areas of large patches will not be lost. Dewatering of the existing pits will be controlled and directed into both Gordon and Farley Lakes to reduce potential effects to Farley Creek. However, an indirect change in riparian habitat may extend beyond the LAA along Farley Creek, but habitats downstream of the creek will remain unaffected (i.e., Swede Lake, Ellystan Lake; Chapter 9). Riparian habitats and terrestrial and wetlands habitats adjacent to Gordon Lake, Farley Lake, and Farley Creek are likely to be temporarily altered (i.e., flooded), which could affect the vegetation community and habitat for species such as moose, waterbirds, olive-sided flycatcher, and rusty blackbird.

Migratory Birds

Residual effects to migratory and non-migratory birds and their habitats have incorporated year-round potential effects, including during the primary nesting and migration periods for birds. Direct and indirect loss or alteration of upland and wetland habitats, described above, is most likely to affect migratory bird species commonly observed breeding in the RAA, included ruby-crowned kinglet, Tennessee warbler, and swamp sparrow. Other commonly observed, non-migratory bird species likely to be affected include spruce grouse, willow ptarmigan, common raven, and gray jay. Upland and wetland habitats are widely available throughout the RAA.

Species at Risk

Construction of the Gordon site PDA will result in the direct loss or alteration of 119 ha of upland habitat within the LAA for wolverine, a decrease of 1% from baseline conditions within the LAA (Table 12-13). Upland habitat for the species is relatively abundant in the RAA (80,589 ha), which corresponds with the relatively high number of wolverine observations from baseline field studies, particularly around the Gordon site (Section 12.2.2.2).

The existing conditions for woodland caribou in the LAA are highly disturbed by both anthropogenic (e.g., historical mine sites, PR 391) and natural (i.e., forest fires) disturbances (Table 12-9), with only 21% of the LAA undisturbed habitat (Table 12-13). The Gordon site will contribute 51 ha of additive indirect (i.e., within the 500 m disturbance buffer; Government of Canada 2012) habitat disturbance for woodland caribou (Table 12-14), an increase in disturbance in the LAA of 1.4% in the LAA and 0.01% in the KMU (Table 12-13; Map 12-10). While the Gordon site will result in additive habitat loss in the KMU that is currently below the minimum desired target of 65% undisturbed habitat (MBWCMC 2015, pers. comm. 2019c), the loss is small, indirect, in an area adjacent to existing disturbance, and there has been no evidence to suggest the contemporary range of woodland caribou includes the site. Additionally, the loss is temporary as this habitat will no longer be considered disturbed following reclamation. The Gordon site is outside the Manitoba North Range (MB9; Map 12-5) and despite PR 391 occupying a small portion of the Manitoba North Range (MB9), the Gordon site is not anticipated to result in post-construction residual effects on woodland caribou as the road is an existing landscape disturbance (Map 12-9).

Table 12-13 Residual Change in Habitat Disturbance for Woodland Caribou

Spatial Boundary	Existing Conditions		Residual Conditions		
	Area (ha)	Percent Undisturbed	Gordon Additive Disturbance (ha)	MacLellan Additive Disturbance (ha)	Total Disturbance (ha / % change)
Kamuchawie Management Unit[1]	1,812,937	56	51	154	205 (-0.01%)
Manitoba North Range (MB9)[2]	6,205,520	67	0	154	154 (-0.002%)
LAA[3]	14,328	21	51	154	205 (-1.4%)

[1] pers. comm. 2019c
[2] ECCC 2019a
[3] see Section 12.2.2.2

Table 12-14 Land Cover Classification of Additive Disturbance for Woodland Caribou

Landscape Type	Land Cover Class	Gordon (ha / percent)	MacLellan (ha / percent)
Upland[1]	Barren	-	-
	Conifer Dense	10 (20%)	25 (16%)
	Conifer Open	3 (6%)	27 (18%)
	Conifer Sparse	4 (7%)	6 (4%)
	Deciduous	-	-
	Mixedwood Dense	5 (9%)	-
	Mixedwood Open	2 (3%)	-
	Shrubland	<1 (<1%)	2 (2%)
	Upland Subtotal	***24 (45%)***	***60 (39%)***
Wetland[2]	Bog Shrubby	7 (13%)	10 (7%)
	Bog Treed	11 (22%)	51 (33%)
	Fen Graminoid	-	-
	Fen Pattern	-	-

Table 12-14 Land Cover Classification of Additive Disturbance for Woodland Caribou

Landscape Type	Land Cover Class	Gordon (ha / percent)	MacLellan (ha / percent)
	Fen Shrubby	8 (16%)	1 (1%)
	Fen Treed	-	1 (<1%)
	Marsh		
	Swamp Shrubby	<1 (<1%)	2 (1%)
	Swamp Treed	1 (3%)	25 (16%)
	Wetland Subtotal	***27 (55%)***	***94 (61%)***
	Mine Site Total	***51***	***154***
	Project Grand Total	***205***	

[1] Canadian Forest Service 2003
[2] Halsey et al. 1997, AESRD 201

Construction of the Gordon site PDA will result in the direct loss or alteration of 117 ha of habitat within the LAA for common nighthawk, a decrease of 2% from baseline conditions within the LAA (5,560 ha; Table 12-15). Analysis of habitat mapping suggests that breeding habitat for the species is relatively abundant in the RAA (89,250 ha), which corresponds with the determination in the existing conditions that the species is relatively common within the RAA (Section 12.2.2.2).

Construction of the Gordon site PDA will result in the direct loss or alteration of 122 ha of habitat within the LAA for olive-sided flycatcher, a decrease of 1% from baseline conditions within the LAA (8,181 ha; Table 12-15). Analysis of habitat mapping indicates olive-sided flycatcher breeding habitat is relatively abundant in the RAA (123,021 ha), which corresponds with the determination in the existing conditions that the species is relatively common within the RAA (Section 12.2.2.2). Habitat losses for olive-sided flycatcher are expected to be less than 248 ha because despite the species inhabiting open and edge habitats, a portion of the 122 ha is already subject to disturbance (e.g., edge effects).

Construction of the Gordon site PDA will result in the direct loss or alteration of 105 ha of habitat within the LAA for rusty blackbird, a decrease of 1% from baseline conditions within the LAA (7,690 ha; Table 12-15). Analysis of habitat mapping suggests that breeding habitat for the species is relatively abundant in the RAA (113,177 ha); however, the species is relatively uncommon within the RAA (Section 12.2.2.2). Therefore, the residual effects of direct and indirect habitat loss are expected to be minor.

The absence of anthropogenic structures and dense forest habitats at the Gordon site (Table 12-7) make it unlikely that the PDA provides maternal roosting habitat for little brown myotis and northern myotis, although suitable forested habitats may exist in the LAA. Construction of site infrastructure (e.g., buildings) may create opportunities for breeding bats. As stated in the existing conditions (Section 12.2.2.2), overwintering bat hibernacula are not known to occur, and are unlikely to occur in the LAA.

The absence of anthropogenic structures at the Gordon site precludes the possibility that barn swallow will be negatively affected by construction of the Gordon site. Additionally, baseline surveys did not detect barn swallows nesting under bridges along the existing access road and PR 391, but the bridges will remain unaffected by Project construction. Construction of site infrastructure (e.g., buildings) may create opportunities for breeding barn swallows or other bird species (e.g., cliff swallow [*Petrochelidon pyrrhonota*]).

There are no known ESSs that will be affected by construction activities at the Gordon site.

Table 12-15 Residual Change in Habitat in the LAA for Bird Species at Risk and General Wildlife Habitat

Species	Existing Conditions (ha)			Residual Conditions (ha / % change)		
	Gordon	MacLellan	Total[1]	Gordon	MacLellan	Total[1]
Common nighthawk	5,560	1,964	7,288	5,443 (-2%)	1,439 (-27%)	6,646 (-9%)
Olive-sided flycatcher	8,181	2,629	10,512	8,059 (-1%)	1,916 (-27%)	9,677 (-8%)
Rusty blackbird	7,690	2,472	9,867	7,585 (-1%)	1,850 (-25%)	9,140 (-7%)

[1] Total may be less than sum of Gordon and MacLellan totals due to LAA overlap.

Following the implementation of mitigation measures described above, residual effects for change in habitat during construction are characterized by the following:

- Direction is adverse: there will be a direct and indirect loss or alteration of wildlife habitat.
- Magnitude is low: effects will result in a <10% and <5% change in wildlife habitat and SAR and SOCC habitat in the LAA, respectively.
- Geographic extent is the RAA: indirect loss or alteration of habitat associated with noise may occasionally exceed the LAA and indirect effects associated with dewatering activities may exceed the LAA (i.e., Farley Creek).
- Timing is high sensitivity: although clearing will occur in the winter, construction will likely occur through the year, including during sensitive periods for wildlife.
- Frequency is single event: effects will occur once during the construction phase.
- Duration is short-term: indirect effects will cease following the construction period (i.e., <2 years) but direct effects will persist into the decommissioning/closure phase.
- Change is reversible: effects will cease following the construction phase.
- Ecological context is disturbed to undisturbed: the LAA is relatively disturbed or adversely affected by human activity but the RAA contains large areas of habitat unaffected by human activity.

Operation

A direct loss of wildlife habitat is expected to occur through vegetation clearing during the expansion of the storage/stockpiling of ore, overburden, and mine rock areas and anticipated effects are described above in the construction phase.

An indirect loss or alteration of wildlife habitat is expected through sensory disturbance that can result in habitat avoidance and reduced habitat effectiveness for wildlife in areas adjacent to the PDA, as described above during the construction phase. Chronic sensory disturbance from mining equipment and ore hauling and occasional blasting disturbance will terminate following completion of the operation phase (six years; Section 12.1.3). Baseline noise estimates ranged from 35-41 decibels (dBA) in the RAA (Chapter 7) and noise-related effects to wildlife have the potential to occur beyond 40 dBA (Shannon et al. 2016). The distance at which the mean volume of operational activities around the site attenuates to 40 DBA is approximately 1 km (Chapter 7) and therefore contained within the wildlife and wildlife habitat LAA. Increased traffic volumes associated with the Project may increase the existing level of indirect effects to wildlife (i.e., avoidance) along PR 391 and the Gordon site access road, but effects are not expected to extend far beyond the PDA. Some species may habituate to the chronic sensory disturbance near the site and those that inhabit the LAA adjacent to the site access road and PR 391 may be unaffected.

It is difficult to quantify the adverse effects of indirect loss or alteration of wildlife habitat, but it is unlikely that the Project will have an appreciable long-term effect, including for wolverine, woodland caribou common nighthawk, olive-sided flycatcher, rusty blackbird, barn swallow, little brown myotis, or northern myotis. The Project is predominantly situated on previously developed lands and adjacent to existing sources of anthropogenic disturbance (e.g., PR 391) that have already compromised habitat effectiveness in the LAA. Noise and light abatement measures for machinery and buildings will be used to reduce sensory disturbance to wildlife, including migratory birds, within the LAA (Volume 5, Appendix B). The effects to wildlife resulting from sensory disturbance are expected to be similar as those described above during the construction phase and wildlife occupying the LAA are already subject to some degree of altered habitat effectiveness. Sensory disturbance from the Project will temporarily increase the degree of altered habitat effectiveness and some wildlife species may avoid the portions of the LAA or relocate to inhabit other areas of the RAA with an abundance of undisturbed habitats. Other species (e.g., red fox) may become tolerant of the increased disturbance and the indirect loss or alteration of wildlife is expected to cease following the operation phase.

Following the implementation of mitigation measures described above, residual effects for change in habitat during operation are characterized by the following:

- Direction is adverse: there will be an indirect loss or alteration of wildlife habitat.
- Magnitude is low: effects will result in a <10% and <5% change in wildlife habitat and SAR and SOCC habitat in the LAA, respectively.
- Geographic extent is the RAA: effects associated with noise may occasionally exceed the LAA.

- Timing is high sensitivity: site operation will occur through the year, including during sensitive periods for wildlife.
- Frequency is continuous: effects will occur throughout during operation.
- Duration is medium-term: effects will occur during the operation period (i.e., six years).
- Change is reversible: effects will cease following operations.
- Ecological context is disturbed: the LAA is relatively disturbed or adversely affected by human activity but the RAA contains large areas of habitat unaffected by human activity.

Decommissioning/Closure

In general, potential Project-related environmental effects for a change in habitat, both direct and indirect, are positive during the decommissioning/closure phase. For example, a direct positive change in habitat will occur where water infilling and vegetation succession of the PDA provides increased habitat opportunities for wildlife. Similarly, sensory disturbances are expected to be greatly reduced and returned to baseline conditions during closure and, over time, edge effects will continue to be abated during active closure and post-closure as succession softens the unnatural transition between the PDA and adjacent habitat. Regenerating habitats in the site PDA will provide habitat opportunities for moose and migratory birds, including SAR and SOCC. Following decommissioning/closure, the site will be returned to a more suitable condition for wildlife when compared to baseline conditions and over time the habitat within the entire PDA will mature to be more consistent with habitats in the LAA.

Decommissioning/closure of the Gordon site will benefit SAR and SOCC, including wolverine, woodland caribou, common nighthawk, olive-sided flycatcher, rusty-blackbird, little brown myotis, and northern myotis. The removal of mine infrastructure, however, may adversely affect species such as barn swallow that rely on anthropogenic structures for nesting sites. Overall, reclamation and closure of the site will benefit wildlife and wildlife habitat compared to baseline conditions. Following the implementation of mitigation measures described above, residual effects for change in habitat during decommissioning/ closure are characterized by the following:

- Direction is adverse and positive: decommissioning may affect some species reliant on anthropogenic structure (e.g., barn swallow) but there will be a long-term benefit to wildlife and wildlife habitat following reclamation and closure of the Gordon site.
- Magnitude is low: effects will result in a <10% and <5% change in wildlife habitat and SAR and SOCC habitat in the LAA, respectively.
- Geographic extent is the RAA: direct and indirect effects will no longer exceed the LAA.
- Timing is high sensitivity: site decommissioning/closure will occur through the year, including during sensitive periods for wildlife, however the level of activity is unlikely to disturb wildlife.
- Frequency is continuous: effects will occur throughout the decommissioning/closure phase.

- Duration is long-term: effects will occur during the decommissioning/closure phase.
- Change is reversible: effects will cease following the decommissioning/closure phase.
- Ecological context is disturbed: the LAA is relatively disturbed or adversely affected by human activity but the RAA contains large areas of habitat unaffected by human activity.

MacLellan Site

Construction

Construction of the MacLellan site PDA will result in the loss or alteration of 938 ha of habitat within the LAA, a decrease of 11% from baseline conditions within the LAA; however, 72 ha (8%) is existing development (includes expansion of the storage/stockpiling of ore, overburden, and mine rock and TMF areas during the operation phase; Table 12-7). Vegetation clearing and water development and control will result in a direct loss of 490 ha (51%) of terrestrial habitats, 372 ha (40%) of wetland habitats, and 4 ha (<1%) of open water habitats (notably East Pond). Most of the undeveloped PDA, however, is subject to some existing indirect effects of development, primarily for mineral exploration trails and cut lines north of the historical mine site. Species that occupy disturbed and rocky habitats, such as common nighthawk, are most likely to be affected by the alteration of developed habitats, whereas migratory birds, furbearers, and moose are most likely to be affected following the loss of the terrestrial and wetland habitats.

An indirect loss or alteration of wildlife habitat is expected through sensory disturbance, edge effects, and altered wetland function that can result in habitat avoidance and reduced habitat effectiveness for wildlife, including migratory birds, SAR and SOCC, moose, and furbearers in areas adjacent to the PDA. Sensory disturbance (i.e., noise and artificial light) emitted during construction is expected to cease immediately following the conclusion of construction activities but some chronic sensory disturbance will persist into the operation phase. Baseline noise estimates ranged from 35-41 decibels (dBA) in the RAA (Chapter 7) and noise-related effects to wildlife have the potential to occur beyond 40 dBA (Shannon et al. 2016). The distance at which the mean volume of construction activities attenuates to 40 DBA is approximately 1 km (Chapter 7) and therefore contained within the wildlife and wildlife habitat LAA. Increased traffic volumes associated with the Project may increase the existing level of indirect effects to wildlife (i.e., avoidance) along the MacLellan site access road. Edge effects are anticipated to be minimal because the MacLellan site is an existing site with existing edge effects (albeit effects may have become ameliorated over time due to vegetation regrowth), but expansion of the PDA will add to this existing disturbance. Additionally, the Project will not result in increased habitat fragmentation as core areas of large patches will not be lost. Edge effects and fragmentation effects may be offset by the PDA eliminating existing effects associated with the network of existing trails in the PDA. An indirect change in habitat may occur as water levels rise in the tributary connecting East Pond and the Keewatin River, following indirect draw-down the East Pond. These effects will not extend beyond the LAA as the Keewatin River can accept the increased flow. Riparian habitats and terrestrial and wetlands habitats adjacent to the tributary are likely to be temporarily altered (i.e., flooded), which could affect the vegetation community and habitat for species such as moose.

Migratory Birds

As with the Gordon site, residual effects to migratory and non-migratory birds and their habitats have incorporated year-round potential effects, including during the primary nesting and migration periods for birds. Direct and indirect loss or alteration of upland and wetland habitats, described above, is most likely to affect migratory bird species commonly observed breeding in the RAA, including ruby-crowned kinglet, Tennessee warbler, and swamp sparrow. Other commonly observed, non-migratory bird species likely to be affected include spruce grouse, willow ptarmigan, common raven, and gray jay.

There is one known ESS, a bald eagle nest, within the MacLellan site LAA (approximately 230 m south of the PDA along the Keewatin River) that may be adversely affected by construction activities. In 2019, the nest was inactive, with the most recent breeding activity observed in 2015.

Species at Risk

Construction of the MacLellan site PDA will result in the direct loss or alteration of 490 ha of upland habitat within the LAA for wolverine, a decrease of 33% from baseline conditions within the LAA (Table 12-12). Overall, the Project will result in the direct loss or alteration of 609 ha of upland habitat within the LAA for wolverine, a decrease of 9% from baseline conditions. Upland habitat for the species is relatively abundant in the RAA (80,589 ha), which corresponds with the relatively high number of wolverine observations from baseline field studies; however, there were few observations from around the MacLellan site (Section 12.2.2.2).

As with the Gordon site, the MacLellan site is highly disturbed by both anthropogenic (e.g., mine site, PR 391) and natural (i.e., forest fires) disturbances for woodland caribou (Table 12-9). The MacLellan site will contribute 154 ha of additive indirect (i.e., within the 500 m disturbance buffer; Government of Canada 2012) habitat disturbance for woodland caribou (Table 12-14), an increase in disturbance in the LAA of 1.2% in the LAA, 0.009% in the KMU, and 0.003% in the Manitoba North Range (MB9; Table 12-14; Map 12-10). While the MacLellan site will result in additive habitat loss in both the KMU and Manitoba North Range (MB9), of which only the KMU is currently below the minimum desired target of 65% undisturbed habitat (MBWCMC 2015, pers. comm. 2019c), the loss is small, indirect, in an area adjacent to existing disturbance, and there has been no evidence to suggest the contemporary range of woodland caribou includes the site. Overall, the Project is anticipated to result in minor post-construction residual effects to woodland caribou as the contribution to habitat disturbance is minimal (207 ha; Table 12-13) and woodland caribou have not been shown to occupy the LAA. Additionally, the loss is temporary as this habitat will no longer be considered disturbed following site decommissioning/closure, which will also reclaim previously disturbed habitat for woodland caribou.

Construction of the MacLellan site PDA will result in the loss or alteration of 525 ha of habitat within the LAA for common nighthawk, a decrease of 27% from baseline conditions within the LAA (1,964). Overall, the Project will result in the loss or alteration of 644 ha of habitat within the LAA for common nighthawk, a decrease of 9% from baseline conditions (7,288 ha). Analysis of habitat mapping suggests that breeding habitat for the species is relatively abundant in the RAA (89,250 ha), which corresponds with the determination in the existing conditions that the species is relatively common within the RAA (Section

12.2.2.2). Effects resulting from direct habitat loss are expected to be offset by the Project creating disturbed sites that may become suitable for common nighthawk nests.

Construction of the MacLellan site PDA will result in the loss or alteration of 713 ha of habitat within the LAA for olive-sided flycatcher, a decrease of 27% from baseline conditions within the LAA (2,628 ha). Overall, the Project will result in the loss or alteration of 961 ha of habitat within the LAA for olive-side-flycatcher, a decrease of 8% from baseline conditions (10,512 ha). Analysis of habitat mapping suggests that breeding habitat for the species is relatively abundant in the RAA (123,021 ha), which corresponds with the determination in the existing conditions that the species is relatively common within the RAA (Section 12.2.2.2). Habitat losses for olive-sided flycatcher are expected to be less than 713 ha because despite the species inhabiting open and edge habitats, a portion of the 713 ha is already subject to disturbance (e.g., edge effects).

Construction of the MacLellan site PDA will result in the loss or alteration of 622 ha of habitat within the LAA for rusty blackbird, a decrease of 25% from baseline conditions within the LAA (2,472 ha). Overall, the Project will result in the loss or alteration of 836 ha of habitat within the LAA for rusty blackbird, a decrease of 7% from baseline conditions (9,967 ha). Analysis of habitat mapping suggests that breeding habitat for the species is relatively abundant in the RAA (113,177 ha); however, the species is relatively uncommon within the RAA (Section 12.2.2.2). Therefore, the residual effects of direct and indirect habitat loss are expected to be minor.

While there is no dense forest in MacLellan site PDA (Table 12-7), the presence of anthropogenic structures may provide maternal roosting habitat for little brown myotis and northern myotis that would be lost during the construction phase. Construction of the site infrastructure (e.g., buildings), however, may create opportunities for breeding bats. As stated in the existing conditions (Section 12.2.2.2), overwintering bat hibernacula are not known to occur, and are unlikely to occur in the LAA.

The removal of anthropogenic structures at the MacLellan site that are known to provide nesting habitat for barn swallow (Section 12.2.2.2) may adversely affect the species. However, construction of site infrastructure (e.g., buildings) may create new opportunities for breeding barn swallows or other bird species (e.g., cliff swallow).

Following the implementation of mitigation measures described above, residual effects for change in habitat during construction are characterized by the following:

- Direction is adverse: there will be a direct and indirect net loss or alteration of wildlife habitat.
- Magnitude is moderate to high: effects will result in a >10% change in wildlife habitat and >20% change in SAR and SOCC habitat.
- Geographic extent is the RAA: indirect effects associated with noise may occasionally exceed the LAA.
- Timing is high sensitivity: although clearing will occur in the winter, construction will likely occur through the year, including during sensitive periods for wildlife.
- Frequency is a single event: effects will occur once during the construction phase.

- Duration is short-term: indirect effects will cease following the construction period (i.e., <2 years) but direct effects will persist into the decommissioning/closure phase.
- Change is reversible: effects will cease following the construction phase.
- Ecological context is disturbed: the LAA is relatively disturbed or adversely affected by human activity but the RAA contains large areas of habitat unaffected by human activity.

Operation

A direct loss of wildlife habitat is expected to occur through vegetation clearing during the expansion of the storage/stockpiling of ore, overburden, and mine rock and TMF areas and anticipated effects are described above in the construction phase.

An indirect loss or alteration of wildlife habitat is expected through sensory disturbance that can result in habitat avoidance and reduced habitat effectiveness for wildlife, including migratory and non-migratory birds, in areas adjacent to the PDA, as described above for the Gordon site. Chronic sensory disturbance (i.e., noise, light) from mining equipment, ore hauling, and ore processing and occasional blasting disturbance will terminate following completion of the operation phase (13 years; Section 12.1.3). Baseline noise estimates ranged from 35-41 decibels (dBA) in the RAA (Chapter 7) and noise-related effects to wildlife have the potential to occur beyond 40 dBA (Shannon et al. 2016). The distance at which the mean volume of operational activities around the site attenuates to 40 DBA is approximately 1 km (Chapter 7) and therefore contained within the wildlife and wildlife habitat LAA. Increased traffic volumes associated with the Project may increase the existing level of indirect effects to wildlife (i.e., avoidance) along the MacLellan site access road but effects are not expected to extend far beyond the PDA. Some species may habituate to the chronic sensory disturbance near the site and those that inhabit the LAA adjacent to the site access road may be unaffected.

For the reasons described above for the Gordon site, the Project is unlikely to result in an appreciable long-term indirect loss or alteration of wildlife habitat, including for wolverine, woodland caribou, common nighthawk, olive-sided flycatcher, rusty blackbird, barn swallow, little brown myotis, or northern myotis. The MacLellan site is not anticipated to adversely affect woodland caribou during the operation phase as the effects are already assessed during the construction phase.

The bald eagle nest within the MacLellan site LAA (approximately 230 m south of the PDA along the Keewatin River) may continue to be adversely affected by operation activities. However, given several years of inactivity and following two proposed years of construction, the nest may not be used in the future and effects may be negligible.

Following the implementation of mitigation measures described above, residual effects for change in habitat during operation are characterized by the following:

- Direction is adverse: there will be an indirect loss or alteration of wildlife habitat.
- Magnitude is low: effects will result in a <10% and <5% change in general wildlife habitat and SAR and SOCC habitat in the LAA, respectively.

- Geographic extent is the RAA: indirect effects associated with noise may occasionally exceed the LAA.
- Timing is high sensitivity: site operation will occur through the year, including during sensitive periods for wildlife.
- Frequency is continuous: effects will occur throughout the operation phase.
- Duration is medium-term: effects will occur during the operation period (i.e., 13 years).
- Change is reversible: effects will cease following the operation phase.
- Ecological context is disturbed: the LAA is relatively disturbed or adversely affected by human activity but the RAA contains large areas of habitat unaffected by human activity.

Decommissioning/Closure

In general, potential Project-related environmental effects for a change in habitat, both direct and indirect, are positive during the decommissioning/closure phase. For example, a direct positive change in habitat will occur where water infilling and vegetation succession of the PDA provides increased habitat opportunities for wildlife. Similarly, sensory disturbances are expected to be greatly reduced and returned to baseline conditions during decommissioning/closure and, over time, edge effects will continue to be abated during active closure and post-closure as succession softens the unnatural transition between the PDA and adjacent habitat. Regenerating habitats in the site PDA will provide habitat opportunities for moose and migratory birds, including SAR and SOCC. Following decommissioning/closure, the existing mine development will be returned to a more suitable condition for wildlife when compared to baseline conditions and over time the habitat within the entire PDA will mature to be more consistent with habitats in the LAA.

Decommissioning/closure of the MacLellan site will benefit SAR and SOCC, including wolverine, woodland caribou, common nighthawk, olive-sided flycatcher, rusty-blackbird, little brown myotis and northern myotis. The removal of mine infrastructure, however, may adversely affect species such as barn swallow that rely on anthropogenic structures for nesting sites. Overall, decommissioning/closure of the site will benefit wildlife and wildlife habitat compared to baseline conditions. Following the implementation of mitigation measures described above, residual effects for change in habitat during decommissioning/closure are characterized by the following:

- Direction is adverse and positive: decommissioning may affect some species reliant on anthropogenic structure (e.g., barn swallow) but there will be a long-term benefit to wildlife and wildlife habitat following reclamation and closure of the MacLellan site.
- Magnitude is low: there will be an increase in habitat for wildlife over time, including for migratory birds and SOC, within the LAA.
- Geographic extent is the LAA: direct and indirect effects will no longer have the potential to exceed the LAA.

- Timing is high sensitivity: site decommissioning/closure will occur through the year, including during sensitive periods for wildlife, however the level of activity is unlikely to disturb wildlife.
- Frequency is continuous: effects will occur throughout the decommissioning/closure phase.
- Duration is long-term: effects will occur during the decommissioning/closure phase.
- Change is reversible: effects will cease following the closure phase.
- Ecological context is disturbed: the LAA is relatively disturbed or adversely affected by human activity but the RAA contains large areas of habitat unaffected by human activity.

12.4.3 Assessment of Change in Mortality Risk

12.4.3.1 Analytical Assessment Techniques

Change in mortality risk was assessed qualitatively through changes in direct and indirect sources of mortality (e.g., vehicle collisions, human-wildlife conflict). The qualitative assessment included a combination of literature review and professional judgment to predict the mortality risks to wildlife.

Direct sources of mortality risk were estimated through predictions of increases in construction activity and equipment, vehicular traffic, and human-wildlife conflict. Direct sources of mortality risk were also assessed through predictions of wildlife interactions with Project infrastructure. Direct sources of mortality were mainly associated with construction and operation phases of the Project. Indirect sources of mortality were assessed qualitatively and include predictions of changes in predator-prey interactions and harvest pressure. Indirect sources of mortality are associated with all phases of the Project.

12.4.3.2 Project Pathways

Gordon Site

Construction

Site preparation (e.g., vegetation clearing and earthworks), water development and control (e.g., dewatering) and Project-related transportation within the LAA are expected to be the primary pathways through which changes in mortality risk to wildlife, including migratory birds, will occur during construction.

Site preparation and water development and control will both involve vegetation removal and soil disturbance, which could result in mortality for less mobile wildlife species such as amphibians and rodents living in the leaf litter or burrowing/hibernating in the soil. Project-related transportation and heavy equipment also have the potential to crush or collide with wildlife.

Human-wildlife encounters or conflicts (e.g., food waste, garbage) may occur at site facilities that can lead to wildlife mortality through trapping of rodents or destroying larger problem wildlife species such as black bear or red fox.

Operation

During operation, Project-related transportation within the LAA is the primary activity with potential to cause wildlife mortality. The increase in traffic due to ore hauling to stockpile sites and the ore processing plant at the MacLellan site will result in a greater potential for wildlife/vehicle collisions and mortality along the access roads and PR 391. Animals most at risk include migratory birds such as songbirds and non-migratory birds such as owls, grouse, and ptarmigan. Furbearers such as rabbits and moose are also at risk.

The presence of utilities, site infrastructure, and facilities may lead to wildlife mortality through migratory bird or bat collisions with utility wires, poles, or buildings. Direct mortality may also occur through human-wildlife encounters at site facilities and infrastructure during Project operation, such as trapping removal of rodents and other problem wildlife.

Decommissioning/Closure

Human presence, site traffic, and equipment activity during active closure activities are expected to be similar to, or less than, that occurring during construction. Therefore, Project pathways during this period are expected to be the same as observed during construction.

During post-closure, however, there may be increased access for humans and predators. Linear features created during construction and operation will cease to have mine-related activity after closure and may become attractive and accessible to predators and hunters. This increased access may result in an indirect change to mortality risk, such as shifts in predator-prey relationships and harvest pressure on certain species (e.g., moose).

MacLellan Site

The pathways for a change in mortality risk at the MacLellan site are similar to those present at Gordon site. Traffic-related mortality risk will be lower at MacLellan site during all Project phases because PR 391 is included in the assessment for Gordon site. The MacLellan site may have greater risk of human-wildlife encounters at site facilities and infrastructure during all Project phases due to higher staffing levels at the site and the presence of the work camp. These human encounters, most likely removal of problem wildlife from food and waste storage areas, will likely result in higher mortality risk for scavenging species. The MacLellan site also has a higher risk for direct mortality during operation due to the presence of the power distribution line (i.e., electrocutions, line strikes) and the TMF. The TMF may elevate mortality risk through the ingestion and/or absorption of water with elevated concentrations of cyanide. Wildlife including large mammals, migratory birds, and bats have been reported drinking from TMFs and associated contact ponds, and amphibians may be attracted to these facilities as breeding and overwintering habitat (Eisler and Wiemeyer 2004; Donato et al. 2007; Griffiths 2013). Wildlife, such as migratory birds, may also be exposed to elevated concentrations of cyanide by ingesting aquatic flora and fauna within the TMF.

12.4.3.3 Mitigation

Project interactions leading to change in mortality risk for wildlife are outlined in Table 12-11. The pathways by which these changes are expected to occur are outlined in Section 12.4.3.2. Mitigation for changes in mortality are not specific to individual interactions but rather the pathways by which those interactions occur.

A series of environmental management plans will be developed by Alamos to mitigate the effects of Project development on the environment (Chapter 23). The Wildlife Monitoring and Management Plan will be the primary plan applicable to changes in mortality for wildlife. However additional plans that may apply are the Conceptual Closure Plan (Appendix 23B); Emergency Response, Spill Response and Contingency Plan; Explosives Management Plan; and the Waste Management Plan. This section highlights the key mitigation measures to be implemented during the construction, operation, and decommissioning/closure phases used to limit effects on wildlife and wildlife habitat, including to migratory birds, SAR and SOCC, and species harvested by resource users, where feasible.

The implementation of the mitigation measures and other commitments described in this section will be the responsibility of Alamos and or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

Mitigation measures proposed are generally considered to be industry standards and are effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Gordon Site

- Designing for scheduling vegetation clearing and site preparation activities outside the breeding period for migratory birds (Zone C7; May 7 to August 7; ECCC 2019b). If activities that could result in risk of harm cannot be avoided, Alamos will develop and implement a Project-specific Avian Monitoring Plan as a sub-plan within the Wildlife Monitoring and Management Plan that outlines how risk of harm will be managed in accordance with ECCC guidance (Chapter 23, Section 23.5.14). This plan would be developed in liaison with ECCC.
- Flagging environmentally sensitive areas (e.g., amphibian breeding ponds, dens, roosts, stick nests, hibernacula) prior to clearing and construction, and evaluating the features for additional mitigation measures (e.g., setbacks).

- Reporting the discovery of nests or other animal dwellings (e.g., lodges, dens) to Alamos, with appropriate action or follow-up guided by the Avian Monitoring sub-plan to the Wildlife Monitoring and Management Plan (Chapter 23, Section 23.5.14). Report to the Wildlife and Fisheries Branch of DARD for direction on follow-up actions in necessary.
- Retaining actual or potential habitat trees where safe and technically feasible to do so. If removal is required, removal activities will be scheduled, to the extent practical, outside the core maternity roosting season for bats (May 1 to August 31; Fenton and Barclay 1980; Barclay 1982, 1984) and breeding season for birds (Zone C7; May 7 to August 7; ECCC 2019b). If habitat tree removal or general tree clearing is required during the maternity roosting period, a qualified biologist will review the trees to make a determination on occupancy before removal. This measure will also reduce the risk to other species that use trees for denning or shelter (e.g., American marten).
- Implementing road safety measures such as speed limits and signage to reduce the chance for wildlife collisions both on site and between sites.
- Reporting wildlife encounters and problem wildlife concerns or sightings to Alamos and appropriate action or follow-up will be guided by the Wildlife Monitoring and Management Plan.
- Following best management practices for general site housekeeping to reduce wildlife attraction (e.g. food and chemical storage, prompt removal of roadkill).
- Including wildlife awareness training during site orientation to reduce the risk of human-wildlife conflict.
- Controlling site access by resource users during post-closure.

MacLellan Site

Mitigation measures at the MacLellan site are the same as indicated for the Gordon site with the following additional mitigation measure specific to the removal of the existing infrastructure at the MacLellan site:

- Demolishing existing buildings and infrastructure outside of the nesting window for birds (Zone C7; May 7 to August 7; ECCC 2019b) and the maternity roosting period for bats (May 1 to August 31; Fenton and Barclay 1980; Barclay 1982, 1984) as per the Avian Monitoring sub-plan to the Wildlife Monitoring and Management Plan (Chapter 23, Section 23.5.14).
- Using a closed circuit for cyanide use and cyanide destruction in the processing plant (via Air/SO_2 oxidation and precipitation of metals) to reduce cyanide concentrations in tailings slurry prior to release of the slurry for storage in the TMF (Chapter 2).
- Maintaining cyanide concentrations below guidelines in the TMF. Project activities will be aligned with the standards of practice set out in the International Cyanide Management Code.
- Managing vegetation around collection ponds and the TMF to deter wildlife and consider additional mitigation measures (e.g., fencing, netting, bird/bat deterrents) if monitoring identifies concerns

regarding wildlife use of these areas as per the Wildlife and Tailings Management Facility sub-Plan to the Wildlife Monitoring and Management Plans (Chapter 23, Section 23.5.14) .

- Reducing potential migratory bird mortality by avoiding power distribution line routing near high-risk collision areas (e.g., wetlands), where feasible, and enhancing line visibility, where appropriate (e.g., bird diverters).

12.4.3.4 Project Residual Effects

Gordon Site

Construction

Site preparation, including vegetation clearing and earthworks, is expected to take approximately two years to complete (Section 12.1.4.2). Site preparation and construction will implement mitigation measures that consider timing restrictions for wildlife species, including sensitive breeding periods for migratory birds, bats, and amphibians. Construction will be scheduled to begin outside the primary nesting period for migratory birds (Zone C7; May 7 to August 7; ECCC 2019b); however, if vegetation removal is required within the primary nesting period, pre-construction avian use surveys (territorial, breeding behavior) and nest searches will be completed to limit mortality risk during construction by identifying, avoiding or otherwise mitigating effects on active nests. Similarly, construction timing is expected to reduce potential effects on bats as they will have dispersed from maternity roosts prior to the start of clearing activities, including on disturbed lands.

During construction, there is potential for increased mortality risk to small mammals and amphibians due to their limited mobility (e.g., crushed by construction equipment). Overwintering amphibians and mammals (e.g., hibernating black bear) are also at greater risk as they may encounter heavy machinery during ground disturbance activities. Vehicle-related wildlife mortality has the potential to affect a wider range of species, including migratory birds, SAR and SOCC, and large mammals. Vehicles will abide by posted speed limits and multi-passenger vehicles will be used, where practical, to reduce the potential for wildlife-vehicle collisions. Proper management of wastes, including at temporary camps, will reduce the potential for wildlife to be attracted to the construction site (e.g., black bear), thus reducing the potential for mortality risk related to human-wildlife conflict.

SAR and SOCC are not uniquely susceptible to a change in mortality risk during the construction phase in comparison to other species. Implementing mitigation measures and adhering to timing restrictions and/or MB CDC (2014) activity restriction setback buffers will reduce the potential Project effects on SAR and SOCC. Common nighthawk is the species most likely to be affected as they can nest in disturbed habitats and are present within the LAA.

Mitigation measures and adherence to timing restrictions and/or activity restriction buffers for clearing and construction will reduce the potential Project effects on migratory birds breeding in the LAA.

Following the implementation of mitigation measures described above, residual effects for change in mortality risk during construction are characterized by the following:

- Direction is adverse: risks will be reduced; however, an increase in wildlife mortality risk is anticipated.
- Magnitude is low: effects will not result in a measurable change in the abundance of wildlife, including for migratory birds and SAR and SOCC, in the LAA.
- Geographic extent is the LAA: effects from site preparation and human-wildlife interaction will be confined to the PDA but traffic mortality risk will extend to the LAA (i.e., along the road).
- Timing is high sensitivity: although clearing will occur in the winter, construction will likely occur through the year, including during sensitive periods for wildlife.
- Frequency is multiple irregular events: effects will occur at no set schedule throughout the construction phase.
- Duration is short-term: effects will occur during the construction period (i.e., < two years).
- Change is reversible: effects will cease following the construction phase.
- Ecological context is disturbed: the LAA is relatively disturbed or adversely affected by human activity but the RAA contains large areas of habitat unaffected by human activity.

Operation

Mortality associated with Project-related transportation is the primary pathway for wildlife mortality to occur during operation, by transportation of ore to on-site stockpiles and to the ore processing plant at the MacLellan site (estimated at seven trucks per hour; Chapter 2, Section 2.3.1.1), and other Project-related traffic. The reported mortality risk to different wildlife groups vary (Huijser et al. 2009) but smaller herbivorous mammals (e.g., snowshoe hare), birds, and amphibians are the most at-risk species (Seiler 2003, Ford and Fahrig 2007).

Current traffic levels on PR 391 are estimated at approximately 150 vehicles per day (MI 2017). Project-related transportation will increase levels to approximately 400 vehicles per day between the sites (based on seven trucks per hour for 20 hours/day [return trip], plus passenger vehicle and material transport traffic). Using the average of 0.23 wildlife collisions per MVKT in the LAA (Section 12.2.2.3), 1.5 reportable wildlife collisions per year would be expected for large mammals during operations. Vehicle collisions with smaller species are much more difficult to predict and may be as high as 48 small mammals, 32 birds, and 111 amphibians per year on PR 391. While this estimate does not include mortality associated with the access road or on-site traffic, the risk may be reduced with the adoption of Wildlife Monitoring and Management Plan (Chapter 23, Section 23.5.15) and reduced speed limits in some sensitive areas (e.g., adjacent to wetlands). Increased mortality risk due to traffic is anticipated to be short-term as the Gordon site will only be operational for six years.

An increase in mortality risk is possible where the trapping of problem beavers at water control structures is required, and where there is the potential for bird collisions with towers and guy wires. Proper management of wastes, including at temporary camps, will reduce the potential for wildlife to be attracted to the construction site (e.g., black bear), thus reducing the potential for mortality risk related to human-wildlife conflict.

With mitigation, cyanide levels in the TMF will be maintained below guidelines and in adherence to the standard of practice to protect the environment including wildlife (e.g., migratory birds) from exposure to toxic tailings (International Cyanide Management Code; ICMI 2018). As such, mortality risk to wildlife is not expected to change as a result of the TMF.

SAR and SOCC are not uniquely susceptible to a change in mortality risk during the operation phase in comparison to other species. Following mitigation measures and adherence to timing restrictions and/or MB CDC (2014) activity restriction setback buffers will reduce the potential Project effects on SAR and SOCC.

Mitigation measures for reducing vehicle speeds will reduce the potential Project effects on migratory birds breeding in the LAA. Species most likely to be affected are species that inhabit upland and wetland habitats adjacent to roadways (e.g., mallard).

Following the implementation of mitigation measures described above, residual effects for change in mortality risk during operation are characterized by the following:

- Direction is adverse: risks will be reduced; however, a net increase in wildlife fatalities is anticipated.
- Magnitude is low: effects will not result in a measurable change in the abundance or distribution of wildlife, including for migratory birds and SAR and SOCC, in the LAA.
- Geographic extent is the LAA: traffic-related mortality risk will extend to the LAA.
- Frequency is multiple irregular events: effects will occur at no set schedule throughout operation.
- Timing is high sensitivity: operation will occur through the year, including during sensitive periods for wildlife.
- Duration is medium-term: effects will occur during the operation period (i.e., 6 years).
- Change is reversible: effects will cease following operation.
- Ecological context is disturbed: the LAA is relatively disturbed or adversely affected by human activity but the RAA contains large areas of habitat unaffected by human activity.

Decommissioning/Closure

Active closure activities are expected to have similar residual effects as those described above for the construction phase, albeit on a reduced scale. The decommissioning/closure phase and specifically the post-closure period are expected to have more enduring effects, primarily as it relates to the indirect mortality of wildlife resulting from increased access. Both predators such as wolves and humans use linear features (e.g., trails, cut lines) to increase hunting efficiency and gain access to prey species (e.g., James and Stuart-Smith 2000; Latham 2011; Dickie et al. 2016). The PDA will be a single anthropogenic disturbance but will not include a network of trails or cut lines extending into the LAA that can be used by predators and hunters to access further reaches of the LAA. Additionally, the Project will not create new access opportunities to watercourses that can then be used by hunters to access previously inaccessible portions of the LAA. As the only large-bodied prey species that regularly occupies the LAA, moose are targeted by both hunters and predators (e.g., gray wolf), and are most likely to be affected by an increase in indirect mortality risk resulting from increased hunting and predation pressure. However, given the absence of linear features resulting from the Project, they are unlikely to alter their distribution to avoid the LAA beyond existing levels of anthropogenic avoidance. SAR and SOCC are not uniquely susceptible to a change in mortality risk during the decommissioning/closure phase in comparison to other species. Following mitigation measures and adherence to timing restrictions and/or MB CDC (2014) activity restriction setback buffers will reduce the potential Project effects on SAR and SOCC. Species such as common nighthawk and olive-sided flycatcher may benefit from open habitats and edges following reclamation.

Following the implementation of mitigation measures described above, residual effects for change in mortality risk during decommissioning/closure are characterized by the following:

- Direction is adverse: there may be a net increase in wildlife fatalities.
- Magnitude is low: a measurable change in the abundance or distribution of wildlife in the LAA is unlikely given the absence of trails and cut lines with the potential to be used by predators and hunters.
- Geographic extent is the LAA: mortality risk will extend to the LAA.
- Frequency is multiple irregular events: effects will occur at no set schedule throughout the decommissioning/closure phase.
- Timing is high sensitivity: activities will occur through the year, including during sensitive periods for wildlife.
- Duration is long-term: effects will occur throughout the decommissioning/closure phase.
- Change is reversible: effects will cease following the decommissioning/closure phase.
- Ecological context is disturbed: the LAA is relatively disturbed or adversely affected by human activity but the RAA contains large areas of habitat unaffected by human activity.

MacLellan Site

While the MacLellan site has a higher amount of existing infrastructure that needs to be removed (potentially affecting bats and barn swallow) and constructed (e.g., ore processing plant), the Project pathways for change in mortality risk and proposed mitigation are similar for both sites during all Project phases. The main difference is the TMF at the MacLellan site that has the potential to increase wildlife mortality risk via drowning and the power distribution line has the potential to increase wildlife mortality risk, primarily for migratory birds, via electrocution or line strikes. These small differences will not change the characterization of effects for a change in mortality risk; the assessment of the residual effects for the Project is the same for both sites and as described above.

12.4.4 Assessment of Change in Wildlife Health

The assessment of the potential change in wildlife health is based on the ecological risk assessment (ERA), which evaluates the potential for ecological receptors (i.e., mammals, birds, amphibians) to experience adverse health effects as a result of exposure to chemical stressors (Volume 5, Appendix H). In this assessment, adverse effects refer to toxicologically induced changes in the health of ecological receptors resulting from exposure to COPC released into the environment, specifically the LAA, as a result of Project-related activities.

12.4.4.1 Analytical Assessment Techniques

Quantifying the effect of environmental contamination on wildlife health is complex and influenced by a wide array of environmental factors. Bioavailability of different contaminants, interaction between metals and chemicals, methods of transport, pathways, environmental factors, and existing baseline concentrations of COPC can influence the Project's effect on wildlife health. The framework used in the ERA follows a standard risk assessment approach that includes five stages that are summarized below (Volume 5, Appendix H):

- Problem formulation: is an information gathering and interpretation stage that includes identifying ecological receptors of concern (i.e., wildlife species and community receptors) for which a species-specific risk assessment is conducted. For wildlife, the ERA requires known species profiles (i.e., detailed physiological and biological data) for each ecological receptors of concern (Volume 5, Appendix H, Table 12A-2).
- Exposure assessment: quantifies an ecological receptor's total exposure to a COPC.
- Toxicity assessment: identifies the potential adverse effects associated with chronic exposure of ecological receptors to each COPC.
- Risk characterization: compares the quantifiable risk quotient (RQ) for ecological receptors of concern for both Baseline Case (without the Project) and Future Case (with the Project), which can be contrasted and compared to established guidelines. Future Case refers to the predicted chemical concentrations in environmental media for the Project as a whole, as determined through detailed modelling from other VC chapters (e.g., air quality, water quality) and is not assessed by Project phase (i.e., construction, operation, decommissioning/closure). Project pathways, however, are discussed below by Project phase to provide a better understanding of the potential interactions. When the change in RQ between Baseline Case and Future Case is less than 1.0, the probability of adverse health effects to ecological receptors at the populational level, as a result of the Project, is negligible because the changes in COPC concentration is less than the dose required to elicit an adverse biological response. When the RQ is greater than 1.0, there is a potential (but not a certainty) that adverse effects to the

ecological receptor as a result of the Project may exist. In these cases, additional analysis and considerations are required including a review of the conservative assumptions applied in the assessment to provide a more accurate prediction of ecological risk. If it is ultimately determined that the RQ indicates an unacceptable ecological health risk, mitigation or remediation activities may be recommended to reduce the risk to ecological receptors. This is assessed quantitatively for mammals and birds and qualitatively for amphibians as there is limited exposure and toxicity data to support the assessment of amphibians using a quantifiable RQ.

- Uncertainty assessment: provides details on the nature of the uncertainties and the conservative approach that was used in the ERA.

12.4.4.2 Project Pathways

An exposure pathway (i.e., effect pathway) must be present for there to be an increased risk to wildlife health. Exposure pathways with potential to affect wildlife health include the ingestion of soil, sediment, food, or water, and through direct contact with soil, sediments, or water (Volume 5, Appendix H). The effect pathways that may result in a change in wildlife health include:

- Deposition of rock and ore dust onto the surrounding terrestrial and aquatic environment during transport, extraction (e.g., drilling, blasting, removal of ore), milling and processing.
- Discharges and runoff from Project activities, both planned and unplanned, may release COPC into surface water and/or groundwater, affecting aquatic flora and fauna.
- TMF and water management ponds (i.e., storage and treatment of contact water) may have elevated levels of COPC and attract wildlife as a source of drinking water or foraging, breeding, and overwintering habitat.

Gordon Site

Construction

Atmospheric emissions (e.g., combustion byproducts, road dust) from Project activities may result in direct changes to wildlife health through ingestion by wildlife. Dispersal and deposition of emissions across the environment (i.e., into soil or sediment, food, or water) may elevate environmental levels of COPC, indirectly affecting wildlife health through contamination of the food chain (Sanderfoot and Holloway 2017).

Like atmospheric emissions, discharges released into the environment may elevate levels of environmental contaminants in surface water, sediments, soils, and vegetation, indirectly affecting wildlife health through contamination of the food chain. Solid and/or liquid wastes (e.g., garbage, sewage) may directly affect wildlife health during the construction phase of the Project through ingestion by wildlife.

Operation

Atmospheric emissions during operation are expected to increase during the drilling, blasting, removal, and transport of ore. Rock dust released into the atmosphere may contain heavy metals (e.g., arsenic, copper, cadmium, lead, chromium) known to be persistent in the environment and potentially toxic to wildlife. The dispersal of rock dust may have direct effects on wildlife health through inhalation and indirect effects through the contamination of surface water, sediments, soils, vegetation, and contamination of the food chain. Atmospheric emissions from combustion byproducts and/or road dust will be highest during operation. The discharges and wastes component of the Project and their associated effect pathways are expected to be the same during operation as the construction phase described above.

Water management at the Gordon site will include a collection pond that will hold mine contact water. The collection pond has the potential to affect wildlife health through the consumption of mine contaminants within the water, plants or aquatic organisms contained within the pond. Although noise and activity associated with operation activities will likely deter wildlife from using the PDA, some wildlife such as migratory birds (e.g., ducks, geese) may interact with the pond when moving through the area.

Decommissioning/Closure

The emissions, discharges, and wastes component of the Project and their associated pathways are expected to be the same during the decommissioning/closure phase of the Project as during operation. During reclamation and closure of the site, pathways will be reduced as mine activities are wound down and sources of emissions, discharges, and wastes are removed. As a result, direct and indirect effects on wildlife health, including migratory birds, are expected to decrease.

MacLellan Site

Construction

The emissions, discharges, and wastes component of the Project and their associated pathways are expected to be the same as those described above for the Gordon site during the construction, operation, and decommissioning/closure phases. However, the milling and processing of ore during operation, and the associated TMF at the MacLellan site will create additional pathways for changes in wildlife health which are described below.

Water management at the MacLellan site will include the TMF and a collection pond that will hold mine contact water. The TMF and collection pond have the potential to affect wildlife health through the consumption of mine contaminants within the water, plants or aquatic organisms contained within this infrastructure. Although noise and activity associated with operation activities will likely deter wildlife from using the PDA, some wildlife such as migratory birds (e.g., ducks, geese) may interact with the TMF and/or pond when moving through the area.

Operation

Ore milling and processing at the MacLellan site is expected to increase atmospheric emissions of rock dust during operation of the Project. Pathways for direct and indirect effects on wildlife health from rock dust are the same as those described above for the Gordon site.

The TMF may result in direct changes to wildlife health through the ingestion and/or absorption of water with elevated concentrations of cyanide or other COPC. Wildlife including large mammals, migratory birds, and bats have been reported drinking from TMFs and associated contact ponds, and amphibians may be attracted to these facilities as breeding and overwintering habitat (Eisler and Wiemeyer 2004; Donato et al. 2007; Griffiths 2013). Wildlife, such as migratory birds may also be exposed to elevated concentrations of cyanide and COPC by ingesting aquatic flora and fauna within the TMF and contact ponds.

Decommissioning/Closure

The emissions, discharges, and wastes component of the Project and their associated pathways are expected to be the same during the decommissioning/closure phase of the Project as during operation. During the reclamation and closure of the site, pathways will be reduced as mine activities are wound down and sources of emissions, discharges, and wastes are removed. As a result, direct and indirect effects on wildlife health, including migratory birds, are expected to decrease.

12.4.4.3 Mitigation

Project interactions leading to change in wildlife health are outlined in Table 12-11. The pathways by which these changes are expected to occur are outlined in Section 12.4.4.2. Mitigation for changes in wildlife health are not specific to individual interactions but rather the pathways by which those interactions occur.

A series of management plans will be developed to mitigate the effects of Project development on the environment. The Environmental Management Plan will be the primary plan applicable to changes in wildlife health. However additional plans that may apply include the Air Quality Management Plan; Conceptual Closure Plan (Appendix 23B); Emergency Response and Spill Prevention and Contingency Plan; Explosives Management Plan; Surface Water Monitoring and Management Plan; and Waste Management Plan.

Effects of the Project on wildlife health were mitigated to the extent possible in the initial planning and design phase of the Project. The Project will adhere to regulated standards for air and water emissions, storage and/or disposal of wastes, the handling and disposal of hazardous materials, and environmental risks such as unusual weather events, flooding, and erosion. This section highlights the key mitigation measures to be implemented during construction, operation, and decommissioning/closure phases used to limit effects on wildlife and wildlife habitat, including to migratory birds, SAR and SOCC, and species harvested by resource users, where feasible.

The implementation of the mitigation measures and other commitments described in this section will be the responsibility of Alamos and or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Gordon Site

- Designing Project infrastructure and facilities to avoid sensitive areas (e.g., watercourses, important habitat types) to the extent possible, within watershed boundaries, and reducing the PDA to the extent practical.
- Designing and maintaining control of fugitive dust emissions from roads, material handling, and storage areas/stockpiles and from equipment emissions (Chapter 6, Section 6.4.1.3).
- Designing for administrative controls, including a no idling policy to reduce emissions from vehicles and mobile equipment.
- Designing for adherence to applicable Transport Canada emission requirements for new mobile equipment on-site.
- Designing for use of perimeter berms and runoff and contact-water collection ditches (Chapter 9, Section 9.4.1.3 and Chapter 8, Section 8.4.3.2).
- Designing for fuel storage in approved aboveground storage tanks equipped with secondary containment systems in accordance with federal and provincial regulations and standards.
- Designing the sewage treatment plant and water management facilities (if necessary) to treat effluent to levels that will meet applicable federal and provincial guidelines of toxicity.
- Disposing and handling waste oils, fuels, and hazardous waste as recommended by the suppliers and/or manufacturers in compliance with federal, provincial, and municipal regulations.
- Managing vegetation around collection ponds and consider additional mitigation measures (e.g., fencing, netting, bird/bat deterrents) if monitoring identifies concerns regarding wildlife, including migratory bird use of these areas.

MacLellan Site

Mitigation measures at MacLellan site are the same as indicated for Gordon site with the addition of mitigation measures specific to the milling and processing of ore and the TMF:

- Designing for enclosure of mill feed storage area and use of wet scrubbers (or equivalent; Chapter 6, Section 6.4.1.3).

- Designing water management facilities to collect and treat (as required) surplus contact water and design for cyanide detoxification (Chapter 9, Section 9.4.2.3).
- Managing vegetation around collection ponds and the TMF and considering additional mitigation measures (e.g., fencing, netting, bird/bat deterrents) if monitoring identifies concerns regarding wildlife, including migratory bird use of these areas.

12.4.4.4 Project Residual Effects

Changes in calculated RQ values between the Baseline Case and the Future Cases were generally less than 1.0 for all COPC and wildlife ecological receptors of concern assessed at both the Gordon and MacLellan sites (Volume 5, Appendix H). Additionally, as was identified for all other freshwater aquatic life assessed (e.g., fish), no unacceptable risks to amphibians are expected. Furthermore, when considering the Baseline Case and the Future Case separately (i.e., not considering the changes in RQ values between the two cases), most of the calculated RQ values for COPC and ecological receptors were less than 1.0 (i.e., below the level in which adverse effects are possible). Exceptions are described below by site.

Overall, the predicted Project-related increase in the health risks between Baseline Case and Future Case for mammals, birds, and amphibians are considered adverse and negligible.

Gordon Site

RQ values higher than 1.0 were encountered for both the Baseline Case and the Future Case for copper, nickel, molybdenum, selenium, vanadium and/or zinc for several mammal and bird ecological receptors (Volume 5, Appendix H). In most of these cases, the Project-related contribution to the RQ is negligible to low (generally less than 1%). One notable increase was observed for river otter (*Lontra canadensis*) exposure to selenium, which had a RQ value of 0.74 for the Baseline Case and increased to a RQ value of 1.1 for the Future Case, slightly above the target RQ of 1.0. However, when accounting for model assumptions and conservatism an RQ value of 1.1 will likely have no material effect on the species. For example, the model assumes that the species spends 100% of the time in the area of high selenium concentration which is unlikely to be true. Therefore, Project-related increases in health risks to mammal and bird ecological receptors at the Gordon site resulting from exposure to the COPC assessed is expected to be negligible to low.

MacLellan Site

RQ values higher than 1.0 were encountered for both the Baseline Case and the Future Case for chromium, copper, nickel, selenium, vanadium and/or zinc for several mammal and bird ecological receptors (Volume 5, Appendix H). In most cases, the Project-related contribution to the RQ is negligible to low (generally less than 1%). As with the Gordon site, one notable increase was observed for river otter exposure to selenium which had a RQ value of 0.90 for the Baseline Case and increased to a RQ value of 1.1 for the Future Case, slightly above the target RQ of 1.0. As described above, Project-related increases in health risks to mammal and bird ecological receptors at the MacLellan site resulting from exposure to the COPC assessed, and in consideration of modelling conservatism, is expected to be negligible to low.

Bioaccumulation of COPC is not expected to occur as the Project is not expected to result in the emission of COPC in quantities that would bioaccumulate in the environment. For example, the predicted increase in selenium concentrations in soil at both the Gordon and MacLellan sites is 0.3%, which is a minor change and unlikely to affect vegetation or wildlife (Volume 5, Appendix H).

SAR and SOCC and migratory birds are not uniquely susceptible to a change in wildlife health during the construction, operation, and decommissioning/closure phases in comparison to other species. Therefore, SAR and SOCC can be expected to be subject to a similar level of effects as non-SAR and SOCC wildlife species.

Following the implementation of mitigation measures described above, residual effects for change in wildlife health during the construction, operation, and decommissioning/closure phases are characterized by the following:

- Direction is adverse: there will be increased exposure to COPC.
- Magnitude is negligible to low: effects will not result in a measurable change in the abundance or distribution of wildlife, including for migratory birds and SAR and SOCC, in the LAA.
- Geographic extent is the LAA: effects of emissions, discharges, and wastes will be confined to the LAA.
- Timing (i.e., seasonality and life stages) is applicable to the assessment of wildlife and wildlife habitat.
- Frequency is continuous: effects will occur throughout the construction and operation phases.
- Duration is long-term: effects will extend beyond the life of the Project but will cease following the decommissioning/closure phase.
- Change is reversible: effects will cease following the decommissioning/closure phase.
- The ecological context is disturbed: the LAA is relatively disturbed or adversely affected by human activity but the RAA contains large areas of habitat unaffected by human activity.

12.4.5 Summary of Project Residual Environmental Effects on Wildlife and Wildlife Habitat

Table 12-16 summarizes the residual environmental effects on wildlife and wildlife during the construction, and operation, and decommissioning/closure phases of the Project.

Table 12-16 Project Residual Effects on Wildlife and Wildlife Habitat

Residual Effect	Residual Effects Characterization								
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context
Gordon and MacLellan Sites									
Change in Habitat	C	A	L/M/H	RAA	ST	A	S	R	D/U
	O	A	L	RAA	MT	A	C	R	D/U
	D	A	L	RAA	LT	A	C	R	D/U
Change in Mortality Risk	C	A	L	LAA	ST	A	IR	R	D/U
	O	A	L	LAA	MT	A	IR	R	D/U
	D	A	L	LAA	LT	A	IR	R	D/U
Change in Wildlife Health	C/O/D	A	N-L	LAA	LT	A	C	R	D/U

KEY
See Table 12-3 for detailed definitions

Project Phase
C: Construction
O: Operation
D: Decommissioning

Direction:
P: Positive
A: Adverse

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term;
MT: Medium-term
LT: Long-term

N/A: Not applicable

Timing:
NA: Not Applicable
A: Applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

12.5 ASSESSMENT OF CUMULATIVE ENVIRONMENTAL EFFECTS ON WILDLIFE AND WILDLIFE HABITAT

The Project residual effects described in Section 12.4 may interact cumulatively with residual environmental effects from other physical activities (past, present, and reasonably foreseeable).

The effects of past and current projects relative to conditions prior to historical mining activities contribute to baseline conditions upon which Project effects are assessed. Conditions prior to historical mining activities are generally considered to be similar to currently undisturbed areas of the RAA.

The resulting cumulative environmental effects (future scenario with the Project) are assessed. Cumulative effects without the Project (i.e., future scenario without the Project) are also described. This is followed by an analysis of the Project contribution to cumulative effects. Future projects and activities that are reasonably foreseeable are defined as those that (a) have been publicly announced with a defined project execution period and with sufficient project details that allow for a meaningful assessment, (b) are currently undergoing an environmental assessment or (c) are in a permitting process.

The assessment of cumulative effects is initiated if:

- The Project has residual environmental effects on the VC, and
- The residual effects could act cumulatively with residual effects of other past, present, or reasonably foreseeable future physical activities.

If either condition is not met, the assessment of cumulative effects concludes with a statement that further assessment of cumulative effects is not warranted because the Project does not interact cumulatively with other projects or activities. Both conditions apply for wildlife and wildlife habitat and a cumulative effects assessment is presented below.

12.5.1 Project Residual Effects Likely to Interact Cumulatively

Table 4C-1 in Chapter 4, Environmental Effects Assessment Scope and Methods, presents the project and physical activities inclusion list, which identifies other projects and physical activities that might interact cumulatively with the Project over time and space. Where residual environmental effects from the Project act cumulatively with residual effects from other projects and physical activities (Table 12-17), a cumulative effects assessment is undertaken to determine their significance.

Environmental effects identified in Table 12-17 as not likely to interact cumulatively with residual effects of other projects and physical activities (no check mark) are not discussed further (both Ruttan Mine and Fox Mine are outside of the RAA and not anticipated to interact cumulatively with the Project). Additionally, there are no pathways for mining exploration, other resource activities, and traditional land use to interact with a change in wildlife health. The assessment of the cumulative environmental effects that are likely to result from the Project in combination with other projects and physical activities are discussed in subsequent sections.

Table 12-17 Interactions with the Potential to Contribute to Cumulative Effects

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Environmental Effects		
	Change in Habitat	Change in Mortality Risk	Change in Wildlife Health
Past and Present Physical Activities and Resource Use			
• “A” Mine	✓	✓	–
• EL Mine	✓	✓	–
• Fox Mine	–	–	–
• Farley Mine	✓	✓	–
• Ruttan Mine	–	–	–
• MacLellan Mine (Historical)	✓	✓	–
• Burnt Timber Mine	✓	✓	–
• Farley Lake Mine	✓	✓	–
• Keystone Gold Mine	✓	✓	–
• East/West Tailings Management Areas	✓	✓	–
Mineral Exploration	✓	✓	–
Water and Waste Projects (sewage plants, waste disposal grounds)	✓	✓	–
Residential and Community Development (including cottage subdivisions)	✓	✓	–
Infrastructure Development (transmission line, airport, highways, roads, rail)	✓	✓	–
Other Resource Activities (hunting, fishing, berry picking)	✓	✓	–
Future Physical Activities			
Mineral Development	✓	✓	–
Mineral Exploration	✓	✓	–
Traditional Land Use	✓	✓	–
Resource Use Activities	✓	✓	–
Recreation	✓	✓	–

NOTES:
✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with Project residual environmental effects.
– = Interactions between the residual effects of other projects and residual effects of the Project are not expected.
For a detailed description and mapped locations of Projects and Physical Activities, where applicable, see Chapter 4, Table 4D-2 and Maps 4-1 and 4-2.

12.5.2 Change in Habitat

12.5.2.1 Cumulative Effect Pathways

Residual effects arising from past, present, and reasonably foreseeable future activities have similar pathways as those arising from the Project (Section 12.4.4.2) and have the potential to result in a cumulative increase in wildlife (including migratory bird and SAR) habitat loss or alteration during the construction, operation, and decommissioning/closure phases of the Project. These pathways are the direct loss or alteration of wildlife habitat through vegetation clearing and dewatering activities, and indirect effects through sensory disturbance and edge effects generated during Project construction, operation, and decommissioning/closure of the Project.

Past and present activities and projects that contribute to cumulative effects of habitat loss in the RAA are the A mine and EL mine, east/west tailings management areas, and infrastructure development (transmission lines, highways, roads). These past and present projects affect 340 ha (2%) of land in the LAA and <1% in the RAA. The potential cumulative effects of the historic MacLellan and Farley Lake mines (144 ha) have been accounted for in the existing conditions (Section 12.2.2) and residual environmental effects (Section 12.4.2) and are not discussed further.

Reasonably foreseeable future activities and projects are mineral development and exploration, traditional land use, resource use activities, and recreation. Although additive, the residual effects from future physical activities listed in Table 12-12 are anticipated to be minimal. Mineral exploration activities can alter habitat by removing trees to create narrow (2-3 m wide) exploration lines and new mineral developments would remove wildlife habitat unless located on previously disturbed areas (e.g., decommissioned mines).

12.5.2.2 Mitigation for Cumulative Effects

Mitigation measures and regional initiatives applicable to limiting cumulative environmental effects on wildlife (including migratory birds and SAR) habitat within the RAA (including other reasonably foreseeable future projects) include, but are not limited to, the following:

- Adherence to the Project-specific Wildlife Monitoring and Management Plan (Chapter 23, Section 23.5.15).
- Implementation of the Conceptual Closure Plan (Chapter 23, Section 23.5.18).
- Continuation of the remote camera study in the RAA to monitor large mammal distributions.
- Contribute to the identification and protection of critical habitat as part of existing and future federal and provincial SAR recovery strategies (i.e., woodland caribou).

12.5.2.3 Cumulative Effects

Development of the Project PDA will result in the direct loss or alteration of 1,207 ha of wildlife habitat (including 144 ha previously developed lands) in the RAA (176,379 ha), which is a <1% reduction from existing conditions (Table 12-7). Past and present activities and projects have resulted in the direct loss or alteration of habitat in the RAA (1,596 ha), including for migratory birds, SAR and SOCC, and the Project is anticipated to contribute 1,065 ha (1%) of new developed land cover in the RAA. For the other measurable parameters that can be quantified, this is a direct loss or alteration of 609 ha (<1%) of wolverine habitat in the RAA, 644 ha (<1%) of common nighthawk habitat in the RAA (89,250), 961 ha (<1%) of olive-sided flycatcher habitat in the RAA (123,021 ha), and 836 ha (<1%) of rusty blackbird habitat in the RAA (113,177 ha). Woodland caribou habitat disturbance within the RAA will increase by <1% (207 ha).

Common nighthawk and olive-sided flycatcher have been shown to occupy disturbed and regenerating habitats and it is expected that habitat loss or alteration for these species is temporary, with existing and future developed habitats in the PDA becoming available following reclamation. Rusty blackbird has been shown to be relatively uncommon, despite an abundance of habitat within the RAA. Habitat for common nighthawk and olive-sided flycatcher is also widespread throughout the RAA. The Project and those projects and activities that may interact cumulatively are not likely to result in a reduction in the amount or composition of habitats within the RAA that would threaten the persistence or viability of these SAR and SOCC within the RAA (EC 2013).The Project is anticipated to result in the disturbance of 154 ha of habitat within the woodland caribou Manitoba North Range (MB9), or a 0.002% contribution to the current 67% undisturbed state of the range (Table 12-13; Government of Canada 2012, ECCC 2019). This incremental increase in the overall disturbance within the Manitoba North Range (MB9) will not result in the range exceeding the 65% threshold for undisturbed habitat for woodland caribou. The KMU is below the minimum target of 65% undisturbed habitat for woodland caribou and the Project will contribute 207 ha of additional disturbance, a 0.01% contribution within the management unit (Table 12-13). Although woodland caribou were detected in the southwestern edge of the RAA, past and present activities and projects (e.g., mines, highways, residential development) and surrounding natural disturbance (i.e., forest fires) to the west of the Project likely limit the likelihood that woodland caribou would encounter the LAA or interact with the Project.

As discussed in Section 12.4.4.2, a minimal amount of potential anthropogenic nesting habitat for barn swallow and maternal roosting habitat for little brown myotis and northern myotis exists within the RAA. Anthropogenic structures, and the potential for these species to use them, will remain within the RAA and it is likely that future activities will contribute more structures over time rather than fewer.

In summary, the RAA has been subject to a relatively low amount of anthropogenic disturbance and the Project and reasonably foreseeable future activities and projects will have a small contribution to the direct and indirect loss or alteration of wildlife habitat in the RAA, including for migratory birds, SAR and SOCC. There are no known projects within the reasonably foreseeable future whose scale or scope could be considered a substantive development (e.g., a new mining development) and interact cumulatively with the Project to threaten the sustainability of wildlife population and their habitats in the RAA.

12.5.3 Change in Mortality Risk

12.5.3.1 Cumulative Effect Pathways

Residual effects arising from past, present, and reasonably foreseeable future activities have similar pathways as those arising from the Project (Section 12.4.3.2) and have the potential to result in an additive increase in habitat loss or alteration and wildlife mortality risk during the construction, operation, and decommissioning/closure phases of the Project. Pathways for change in mortality risk are site preparation activities (e.g., vegetation clearing, earthworks, dewatering), traffic-related mortality, human-wildlife encounters, infrastructure-related mortality (e.g., bird strikes with transmission lines), and increased access opportunities for hunters and predators (via new roads and trails).

Past and present activities and projects that overlap the RAA, or whose residual environmental effects are likely to overlap the RAA, are the east/west tailings management areas, infrastructure development (transmission lines, highways, roads), and other resource activities (hunting). Effects of the existing MacLellan and Farley Lake mines have been accounted for in the existing conditions (Section 12.2.2) and residual environmental effects (Section 12.4.2) and are not discussed further.

Reasonably foreseeable future activities and projects are mineral development and exploration, traditional land use, resource use activities, and recreation. Mineral development and exploration activities are expected to occur throughout the RAA and may contribute additive mortality risk primarily through increased traffic levels along PR 391 and site preparation activities. It is possible that residual cumulative effects resulting from traditional land use, resource use activities, and recreation could contribute to a minor increase in wildlife mortality risk in the RAA beyond existing conditions.

12.5.3.2 Mitigation for Cumulative Effects

Mitigation measures and regional initiatives applicable to limiting cumulative environmental effects on mortality risk within the RAA include, but are not limited to, the following:

- Implementing reclamation plans that involve revegetating/decommissioning new access trails/roads.
- Using existing roads and trails where possible.
- Implementing road safety measures such as speed limits and signage to reduce the chance for wildlife collisions both on-site and between sites.
- Implementing measures to control access on access roads during the decommissioning/closure phase (e.g., gates).

12.5.3.3 Cumulative Effects

The Project and reasonably foreseeable future projects and activities are expected to contribute to existing levels of mortality risk in the RAA, particularly where new access is created and/or where traffic levels increase (e.g., PR 391). Most of the anticipated increases in traffic are associated with the Project along the Gordon and MacLellan access roads and along PR 391 during the operation of the Gordon site (i.e., 6 years). With mitigation, mortality risk associated with traffic is anticipated to be low to moderate and short-term.

Trails created during mineral exploration activities will provide temporary new access for predators and hunters. Vegetation re-growth is expected once trails are no longer needed. Species most vulnerable to cumulative effects associated with increased access are prey and/or harvested species, such as moose and furbearers.

TLRU, along with recreational hunting are activities that will continue to influence wildlife mortality risk in the RAA. While the number of resource users or recreational hunters is not anticipated to change measurably in the foreseeable future, the locations in the RAA where resource use occurs may shift in response to changes in access. Given the short-term nature of exploration trails, the Project's mitigation to reclaim the PDA during decommissioning/closure and implement road safety measures, the Project's cumulative contributions to mortality risk in the RAA are anticipated to be minor.

12.5.4 Change in Wildlife Health

12.5.4.1 Cumulative Effect Pathways

Changes in air and water quality can result in changes in the quality of food sources (e.g., plants, fish, small mammals) consumed by wildlife. However, since the cumulative effects assessments for air quality (Chapter 6, Section 6.5) and surface water (Chapter 9, Section 9.6.3.3) quality conclude that there is no potential for cumulative effects on air or surface water quality, there is no potential for cumulative effects on wildlife health. In the absence of cumulative effects pathways, wildlife health will not be further assessed.

12.5.5 Cumulative Effects Without the Project

Past and reasonably foreseeable future projects and activities (e.g., existing and historical mines, mineral exploration, infrastructure development, resource use) are expected to have small contributions to existing levels of habitat loss/alteration and mortality risk in the RAA. Future projects and activities are not expected to measurably affect wildlife health. Trails created during mineral exploration activities will alter habitat by removing trees and provide temporary new access for predators and hunters, however vegetation re-growth is expected once trails are no longer used. Species most vulnerable to cumulative effects associated with increased access are prey and/or harvested species, such as moose and furbearers.

TLRU, along with recreational hunting are activities that will continue to influence wildlife mortality risk in the RAA without the Project. While the number of resource users or recreational hunters is not anticipated to change measurably in the foreseeable future, the locations in the RAA where resource use occurs may shift in response to exploration activities and changes in access.

12.5.6 Summary of Cumulative Effects

Table 12-18 summarizes cumulative environmental effects on wildlife and wildlife habitat.

Table 12-18 Residual Cumulative Effects

Residual Cumulative Effect	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context
Residual Cumulative Change in Habitat								
Without the Project	A	L	RAA	LT	A	C	R	D/U
With the Project	A	L	RAA	LT	A	C	R	D/U
Contribution from the Project to the residual cumulative effect	The Project will result in the direct loss or alteration <1% wildlife habitat in the RAA and increase developed lands within the RAA from <1% to <2% (1,207 ha). Direct habitat loss for wolverine is expected to be <1% (609 ha) and woodland caribou habitat disturbance within the RAA will increase by <1% (207 ha). Direct habitat loss for common nighthawk, olive-sided flycatcher, and rusty-blackbird habitat is expected to be <1% each while effects to habitat for barn swallow and little brown myotis are also expected to be minor.							
Residual Cumulative Change in Mortality Risk								
Without the Project	A	L	RAA	LT	A	C	R	D/U
With the Project	A	L	RAA	LT	A	C	R	D/U
Contribution from the Project to the residual cumulative effect	The Project will require clearing and dewatering of 1,207 ha of wildlife habitat and result in a temporary increase in traffic along PR 391 and the mine access roads that could affect mammals, birds, and amphibians.							

KEY
See Table 12-3 for detailed definitions

Direction:
P: Positive
A: Adverse

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term

N/A: Not applicable

Timing:
N/A: Not Applicable
A: Applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

The Project involves redevelopment of two existing mine sites and in an area subject to disturbance from past and present activities and projects, including existing access roads and PR 391. When current and reasonably foreseeable future project effects on wildlife habitat are considered, the Project's contributions to direct change in habitat will be low in magnitude with mitigation. Indirect effects on habitat resulting from Project noise and activity are expected to be localized and medium-term.

When current and future activities and project effects on wildlife and wildlife habitat are considered, the Project's contribution to direct change in mortality risk will be low in magnitude with mitigation. To reduce mortality risk to wildlife, PDA clearing will occur outside of the sensitive periods for wildlife (e.g., migratory birds breeding season). After decommissioning/closure, the Project is not expected to provide enhanced access for predators and hunters.

12.6 EFFECTS TO FEDERAL LANDS

Federal lands within the Wildlife and Wildlife Habitat RAA is limited to the Black Sturgeon Reserve, located approximately 5 km southwest of the Gordon site and which overlaps only a small portion of the LAA near PR 391.

As most of the Black Sturgeon Reserve is located outside of the LAA, the potential effects to wildlife and wildlife habitat on federal lands are expected to be minimal, and primarily associated with changes in wildlife mortality risk resulting from increased Project-related traffic on PR 391 (e.g., haul trucks). Vehicle collision risk is anticipated to increase for wildlife such as furbearers and moose moving in and out of reserve lands near PR 391. However, with mitigation (e.g., signage, speed limits), mortality risk associated with traffic is anticipated to be low to moderate and short-term as the Gordon site will only be operational for six years.

Project-related increases in health risks to mammal and bird ecological receptors at the Gordon and MacLellan sites resulting from exposure to the COPC assessed is expected to be negligible to low. These conclusions are based on assumptions that wildlife receptors spend 100% of their time at the mine sites when in fact many are mobile and will use a much broader area throughout the year. Given that most of the Black Sturgeon Reserve is located outside of the LAA, health risks to wildlife inhabiting federal lands is expected to be similar if not less than that predicted for the mine sites.

12.7 DETERMINATION OF SIGNIFICANCE

12.7.1 Significance of Project Residual Effects

With mitigation and environmental protection measures, the residual Project effects on wildlife and wildlife habitat are predicted to be not significant. Residual effects are not expected to threaten the long-term persistence or viability of wildlife and wildlife habitat within the RAA, nor are they expected to diminish conservation efforts for the survival, management, and recovery of SAR and SOCC.

The Project will result in the loss or alteration of 1,207 ha (<1%) of wildlife habitat within the RAA, 144 ha of which are part of the historical Gordon and MacLellan mine sites. Land clearing and PDA development will result in the direct loss or alteration of 609 ha (<1%) of wolverine habitat in the RAA, 644 ha (<1%) of common nighthawk habitat in the RAA, 961 ha (<1%) of olive-sided flycatcher habitat in the RAA, 836 ha (<1%) of rusty blackbird habitat in the RAA, and minimal habitat loss for barn swallow, little brown myotis, and northern myotis. Woodland caribou habitat disturbance within the RAA will increase by 207 ha (<1%) that is attributed to indirect loss or alteration (i.e., uncleared lands within 500 m of the sites). While the indirect loss or alteration of habitat within the Manitoba North Range (MB9) and KMU may be inconsistent with the objectives of the federal and provincial woodland caribou recovery strategies (Government of

Canada 2015, MBWCMC 2015), it is unlikely that the Project will materially affect the survival and recovery of the species because the loss is small, indirect, in an area adjacent to existing disturbance, and there has been no evidence to suggest the contemporary range of woodland caribou includes the Project. The anticipated change in habitat loss or alteration in the LAA is predicted to result in a moderate magnitude Project residual effect (Table 12-3). However, when compared to habitat availability in the RAA, it is expected that the Project will have a relatively lower magnitude effect on wildlife habitat, including for migratory birds and SAR and SOCC. Indirect loss or alteration of habitat resulting from sensory disturbance and edge effects are generally expected to be minor and generally limited to the LAA. While some species may inhabit the PDA during operation of the Project (e.g., night hawk, barn swallow), it is expected that the PDA will become naturalized following the decommissioning/closure phase of the Project that will be suitable for a wide range of species.

The Project is likely to result in an increased risk of wildlife mortality within the LAA, primarily through increased Project-related traffic. Traffic-related mortality risk will be managed by implementing road safety measures such as speed limits and signage. Changes in wildlife health are predicted to be negligible to low as the Project makes incremental contributions to baseline RQ values (less than 1% change between modeled baseline and future risk levels) and most of the calculated RQ values for COPC and ecological receptors were found to be less than 1.0. Conservative modelling assumptions for an assessment of wildlife health (i.e., likely overstating potential for adverse effects) have been applied in the analysis.

12.7.2 Significance of Cumulative Environmental Effects

Cumulative effects resulting from the Project and reasonably foreseeable future activities are expected to be minor as most of the areas potentially affected are already disturbed or are adjacent to previously disturbed lands. Some upland and wetland habitat will be lost or altered, habitat for wildlife, including for birds, mammals, amphibians, and SAR and SOCC, but habitat remains abundant and widespread throughout the RAA. Future activities combined with potential Project effects (i.e., changes in habitat, mortality risk and wildlife health), are not expected to measurably affect the abundance or sustainability of wildlife in the RAA.

With mitigation, the cumulative effects from the Project and reasonably foreseeable future activities are expected to be not significant.

12.7.3 Significance of Effects on Federal Lands

The only federal land within the LAA and RAA is Black Sturgeon Reserve. Based on these results in Section 12.6, the residual environmental effects from changes to Wildlife and Wildlife habitat are predicted to be not significant.

12.8 PREDICTION CONFIDENCE

The prediction confidence in the final determination of significance is considered moderate. This level of confidence is based on:

- The quantity and quality of data available.

- A conservative approach taken to assessment (Section 12.4.1).
- Professional judgement and experience with similar projects.
- Effectiveness of mitigation measures, which reflect best industry practices.

While the prediction confidence is high for most aspects of the assessment (e.g., migratory birds, mitigation), there remains some uncertainty regarding other components (e.g., bat hibernacula, woodland caribou ranges), resulting in overall prediction confidence being moderate. Prediction confidence is expected to increase after surveying for bat hibernacula and continuing to monitor the RAA for the presence of caribou (Section 12.9).

12.9 FOLLOW-UP AND MONITORING

Follow-up and monitoring is intended to verify the accuracy of the Environmental assessment, assess the implementation and effectiveness of mitigation and the nature of the residual effects, and to manage adaptively if required. A Wildlife Monitoring and Management Plan will be developed to implement mitigation measures, manage wildlife and wildlife habitat, comply with authorizations and approvals, and monitor and evaluate the effectiveness of wildlife mitigation measures with respect to predictions in the Environmental assessment.

In the event that an unexpected deterioration of the environment is observed as part of follow-up and/or monitoring, intervention mechanisms will include the adaptive management process described in Chapter 23, Section 23.2. This may include an investigation of the cause of the deterioration and identification of existing and/or new mitigation measures to be implemented to address it.

Follow-up and Monitoring will consist of three phases: pre-construction surveys, construction monitoring, and post-construction monitoring. These activities will be designed to address each environmental effect listed in Section 12.3 and to address the uncertainty in the prediction confidence regarding the presence of woodland caribou and bat hibernacula in the RAA (Section 12.7). Woodland caribou monitoring will be incorporated into the Wildlife Mitigation and Monitoring Plan (Chapter 23, Section 23.5.14) and developed in liaison with federal and provincial regulators. Follow-up and monitoring activities listed in Table 12-19 will be conducted using methods similar to those used during baseline studies to allow for comparison of results. Follow-up and monitoring may reveal the need to implement adaptive management strategies if mitigation measures are found to be less effective than predicted.

Results of the ERA suggests that the ecological health risks related to the Project are negligible to low and further measures to mitigate potential risk specific to this ERA are not required (Volume 5, Appendix H). Future Case health risks in this ERA were calculated based on changes in COPC concentrations predicted for various media (e.g., air, soil, water). Management plans which include monitoring of various media will be developed to ascertain how the Project affects COPC concentrations in those media. The data from these monitoring programs will be used to determine if the Future Case concentrations used in ERA reflect actual concentrations and, by extension, if risk estimates are reflective of future conditions. As a result, there are no follow-up and monitoring activities for a change in wildlife health specific to the wildlife and wildlife habitat VC.

Table 12-19 Proposed Follow-up and Monitoring Activities

Wildlife Group	Effect	Concern	Phase	Task Description	Duration	Frequency
Mammals	Change in Habitat	Habitat disturbance/ SAR (little brown myotis and northern myotis)	Pre-construction	Bat hibernacula surveys	1 year	August
Mammals	Change in Habitat	Habitat disturbance/ SAR (woodland caribou)	All	Remote cameras	Until end of Project	Continual through Construction and Operation, checked every three months
Mammals	Change in Mortality	Traffic mortality	All	Self-reporting program	Until end of Project	N/A
Birds	Change in Habitat	Habitat disturbance	Pre-construction	Raptor nest inventory	1 year	June
Birds	Change in Mortality	Wildlife mortality	Pre-construction	Breeding bird and nest sweep surveys	1 year	April 1- August 31

12.10 SUMMARY OF COMMITMENTS

As described in Section 12.4.2.3, the following measures will be implemented, where feasible, to mitigate habitat loss or alteration during the construction, operation, and decommissioning/closure phases at the Gordon and MacLellan sites:

- Design for limitation of construction footprint (i.e., PDA) to the extent practical.
- Design for use of down-lighting, a technique of directing night lighting downward, to reduce light effects on wildlife adjacent to the PDA.
- Design for maintenance of a 30 m naturally vegetated buffer around wetlands, waterbodies, and watercourses.
- Design for restriction of unauthorized access to habitat adjacent to the PDA.
- Design for provision of low areas in the ploughed snowbanks of access and on-site roads, where practical, to facilitate wildlife movements across and out of road corridors.
- Design for scheduling vegetation clearing and site preparation activities outside the breeding period for migratory birds (Zone C7; May 7 to August 7; ECCC 2019b). If activities that could result in risk of harm cannot be avoided, Alamos will develop and implement a Project-specific Wildlife Monitoring and Management Plan that outlines how risk of harm will be managed in accordance with ECCC guidance (Chapter 23, Section 23.5.14).
- Flag environmentally sensitive areas (e.g., seeps and springs, mineral licks, dens, roosts, stick nests, hibernacula) prior to clearing and construction, and evaluation of the features for additional mitigation measures (e.g., setbacks).
- Retain actual or potential habitat trees where safe and technically feasible to do so. If removal is required, removal activities will be scheduled, to the extent practical, outside the core maternity roosting season for bats (May 1 to August 31; Fenton and Barclay 1980; Barclay 1982, 1984) and breeding season for birds (Zone C7; May 7 to August 7; ECCC 2019b). If habitat tree removal or general tree clearing is required during the maternity roosting period, a qualified biologist will review the trees to make a determination on occupancy before removal. This measure will also reduce the risk to other species that use trees for denning or shelter (e.g., American marten).
- Maintain vegetation cover along the boundaries of high activity areas (e.g., access roads) to reduce sensory (noise and visual) disturbance.
- Report the discovery of nests or other animal dwellings (e.g., lodges, dens) to Alamos, and appropriate action or follow-up will be guided by the Wildlife Monitoring and Management Plan (Chapter 23, Sections 23.5.16 and 23.5.15, respectively). Report to the Wildlife and Fisheries Branch of DARD for direction on follow-up actions in necessary.

- Demolish existing buildings and infrastructure outside of the nesting window for birds and the maternity roosting period for bats as per the Wildlife Monitoring and Management Plan.

As described in Section 12.4.3.3, the following mitigation measures will be implemented, where feasible, to manage and reduce wildlife mortality risk during the construction, operation, and decommissioning/closure phases at the Gordon and MacLellan sites:

- Design for scheduling vegetation clearing and site preparation activities outside the breeding period for migratory birds (Zone C7; May 7 to August 7; ECCC 2019b). If activities that could result in risk of harm cannot be avoided, Alamos will develop and implement a Project-specific Wildlife Monitoring and Management Plan that outlines how risk of harm will be managed in accordance with ECCC guidance (Chapter 23, Section 23.5.14).
- Using a closed circuit for cyanide use and cyanide destruction in the processing plant (via Air/SO_2 oxidation and precipitation of metals) to reduce cyanide concentrations in tailings slurry prior to release of the slurry for storage in the TMF (Chapter 2).
- Flag environmentally sensitive areas (e.g., amphibian breeding ponds, dens, roosts, stick nests, hibernacula) prior to clearing and construction, and evaluation of the features for additional mitigation measures (e.g., setbacks).
- Report the discovery of nests or other animal dwellings (e.g., lodges, dens) to Alamos, and appropriate action or follow-up will be guided by the Wildlife Monitoring and Management Plan. Report to the Wildlife and Fisheries Branch of DARD for direction on follow-up actions in necessary.
- Retain actual or potential habitat trees where safe and technically feasible to do so. If removal is required, removal activities will be scheduled, to the extent practical, outside the core maternity roosting season for bats (May 1 to August 31; Fenton and Barclay 1980; Barclay 1982, 1984) and breeding season for birds (Zone C7; May 7 to August 7; ECCC 2019b). If habitat tree removal or general tree clearing is required during the maternity roosting period, a qualified biologist will review the trees to make a determination on occupancy before removal. This measure will also reduce the risk to other species that use trees for denning or shelter (e.g., American marten).
- Implement road safety measures such as speed limits and signage to reduce the chance for wildlife collisions both on-site and between sites.
- Report wildlife encounters and problem wildlife concerns or sightings to Alamos and appropriate action or follow-up will be guided by the Wildlife Monitoring and Management Plan.
- Follow best management practices for general site housekeeping to reduce wildlife attraction (e.g. food and chemical storage, prompt removal of roadkill).
- Include wildlife awareness training during site orientation to reduce the risk of human-wildlife conflict.
- Control site access by resource users during post-closure.

- Demolish existing buildings and infrastructure outside of the nesting window for birds (Zone C7; May 7 to August 7; ECCC 2019b) and the maternity roosting period for bats (May 1 to August 31; Fenton and Barclay 1980; Barclay 1982, 1984) as per the Wildlife Monitoring and Management Plan.
- Maintain cyanide concentrations below guidelines for the TMF.
- Manage vegetation around collection ponds and the TMF to deter wildlife and consider additional mitigation measures (e.g., fencing, netting, bird/bat deterrents) if monitoring identifies concerns regarding wildlife use of these areas.

As described in Section 12.4.4.3, the following mitigation measures will be implemented, where feasible, to manage and reduce effects to wildlife health during the construction, operation, and decommissioning/closure phases at the Gordon and MacLellan sites:

- Project infrastructure and facilities designed to avoid sensitive areas (e.g., watercourses, important habitat types) to the extent possible, within watershed boundaries, and PDA reduced to the extent practical.
- Design for control of fugitive dust emissions from roads, material handling, and storage areas/stockpiles through measures such as: application of dust suppressants (e.g., water); use of surfactants (as a contingency); dust sweeping; gravel application; truck wheel washing stations; and enclosure of dust sources (Chapter 23, Section 23.5.7).
- Design for administrative controls, including a no idling policy to reduce emissions from vehicles and mobile equipment.
- Design for adherence to applicable Transport Canada emission requirements for new mobile equipment on-site.
- Design for use of perimeter berms and runoff and contact-water collection ditches around the overburden storage areas, ore stockpiles, and mine rock storage areas to collect overland flow and seepage, intercept groundwater flow, and divert non-contact water away from Project components.
- Design for fuel storage in approved above ground storage tanks equipped with secondary containment systems in accordance with federal and provincial regulation and standards.
- Design of sewage treatment plant and water management facilities to treat effluent to levels that will meet applicable federal and provincial guidelines of toxicity.
- Employment of dust suppressants (e.g., water) in situations that have increased potential to generate dust.
- Maintenance of on-site roads in good condition with regular inspections to monitor dust control effectiveness.
- Conducting effective and timely equipment maintenance to keep mining vehicles and equipment in good working condition.

- Disposal and handling of waste oils, fuels, and hazardous waste as recommended by the suppliers and/or manufacturers in compliance with federal, provincial, and municipal regulations.
- Design for enclosure of mill feed storage area and use of dust collection/control systems (e.g., baghouse or equivalent and protective covers) at crushing plant to reduce potential dust emissions during ore transfer and crushing activities.
- Design for use of high efficiency wet scrubbers (or equivalent) to control emissions from Project facilities, where feasible.
- Design of water management facilities to collect and treat (as required) surplus contact water such that effluent meets applicable federal and provincial regulatory requirements, including the authorized limits of deleterious substances specified in Schedule 4 of the MDMER (amended) prior to discharge into the environment (Chapter 23, Section 23.5.5).
- Using a closed circuit for cyanide use and cyanide destruction in the processing plant (via Air/SO_2 oxidation and precipitation of metals) to reduce cyanide concentrations in tailings slurry prior to release of the slurry for storage in the TMF (Chapter 2).
- Manage vegetation around collection ponds and the TMF and consider additional mitigation measures (e.g., fencing, netting, bird/bat deterrents) if monitoring identifies concerns regarding wildlife use of these areas.

Mitigation measures and regional initiatives applicable to limiting cumulative environmental effects on habitat within the RAA (including other reasonably foreseeable future projects) include, but are not limited to, the following:

- Adherence to Project-specific Wildlife Monitoring and Management Plans.
- Implementation of the Conceptual Closure Plan (Chapter 23, Section 23.5.18).
- Continuation of the remote camera study in the RAA to monitor large mammal distributions.
- Contribute to the identification and protection of critical habitat as part of existing and future federal and provincial SAR recovery strategies (i.e., woodland caribou).

Mitigation measures and regional initiatives applicable to limiting cumulative environmental effects on mortality risk within the RAA include, but are not limited to, the following:

- Implement reclamation plans that involve revegetating/decommissioning new access trails/roads.
- Use existing roads and trails where possible.
- Implement road safety measures such as speed limits and signage to reduce the chance for wildlife collisions both on-site and between sites.

- Implement measures to control access on mine access roads during decommissioning/closure phase (e.g., gates).

As described in Section 12.8, follow-up and monitoring activities will be implemented to address the uncertainty in the prediction confidence, primarily regarding the presence of woodland caribou and bat hibernacula in the RAA. These activities include pre-construction bat hibernacula surveys and continuation of the remote camera monitoring program for woodland caribou that will be incorporated into the Wildlife Mitigation and Monitoring Plan and developed in liaison with federal and provincial regulators.

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12.11.2 Personal Communications

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2015b. Regional Wildlife Manager, Manitoba Department of Agriculture and Resource Development. Conversation with Wildlife Biologist, Stantec Consulting Ltd., Winnipeg, Manitoba, March 2nd, 2015.

2015c. Local resource user and outfitter. Conversation with Wildlife Biologist, Stantec Consulting Ltd., Winnipeg, Manitoba, April 13, 2015.

2015d. Geologist. Alamos Gold. Conversation with Wildlife Biologist, Stantec Consulting Ltd., Winnipeg, Manitoba, April 12, 2015.

2015e. Marcel Colomb First Nation member and local resource user. Conversation with Wildlife Biologist, Stantec Consulting Ltd., Winnipeg, Manitoba, April 14, 2015.

2015f. Project Manager. Manitoba Department of Agriculture and Resource. Conversation with Wildlife Biologist, Stantec Consulting Ltd., Winnipeg, Manitoba, April 14, 2015.

2015g. Wildlife Biologist (retired), Manitoba Department of Agriculture and Resource Development. Conversation with Wildlife Biologist, Stantec Consulting Ltd., Winnipeg, Manitoba, June 22, 2015.

2015h. Associate Professor of Biology, University of Manitoba. Conversation with Wildlife Biologist, Stantec Consulting Ltd., Winnipeg, Manitoba, June 24, 2015.

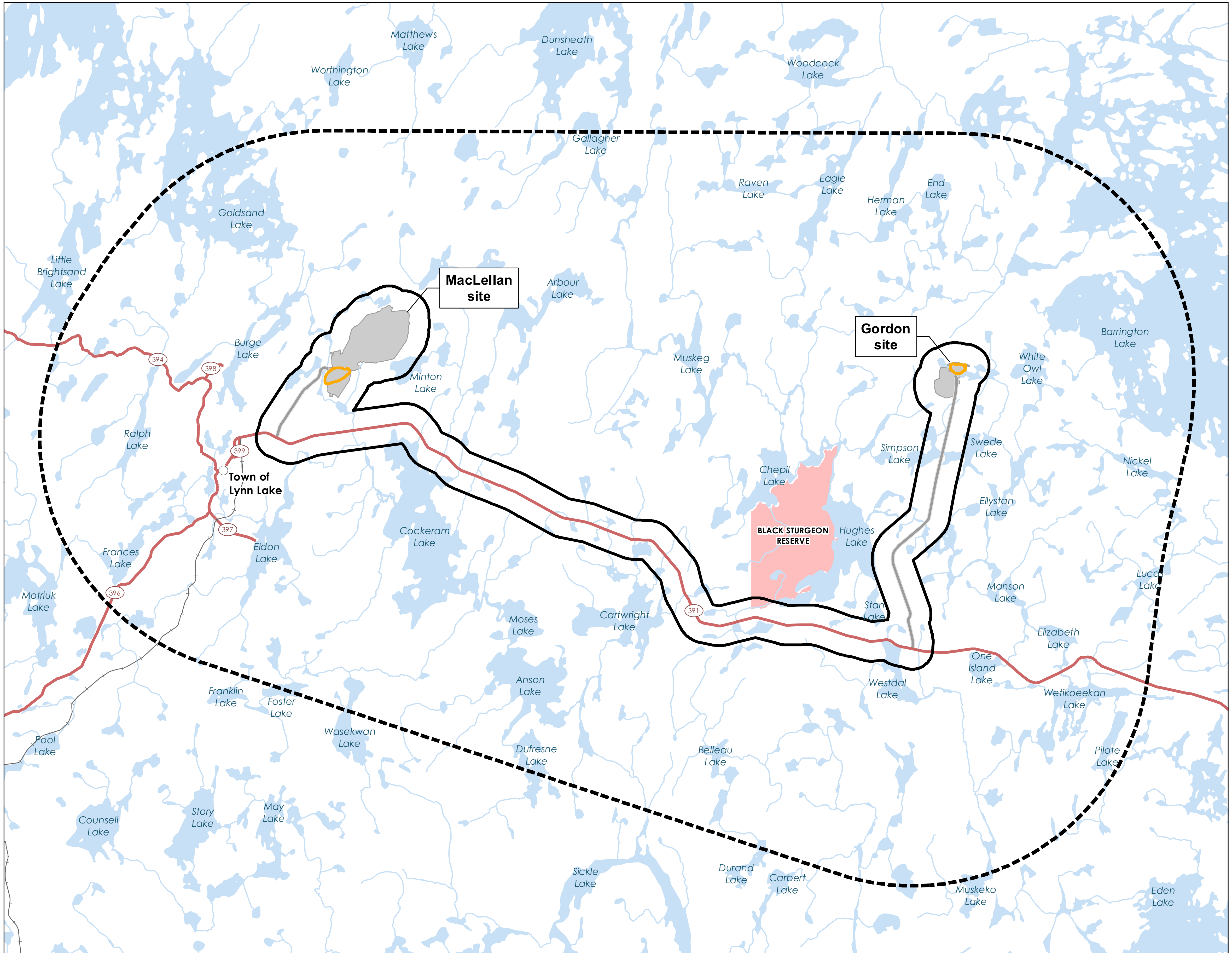
2016a. Manitoba Department of Agriculture and Resource Development, Provincial Game Bird Manager. Conversation with Wildlife Biologist, Stantec Consulting Ltd., Winnipeg, MB, January 23, 2016.

2016b. Member of the Community of Lynn Lake, Manitoba. Conversation with Wildlife Biologist, Stantec Consulting Ltd., Lynn Lake, Manitoba, May 13, 2016.

2019a. Canadian Environmental Assessment Agency, Environment and Climate Change Canada, Canadian Wildlife Service, Alamos Gold and Stantec. Alamos Gold Preliminary Caribou Assessment Teleconference, January 18, 2019.

2019b. Canadian Environmental Assessment Agency, Environment and Climate Change Canada, Canadian Wildlife Service, Manitoba Department of Agriculture and Sustainable Development, Alamos Gold and Stantec. Alamos Gold Preliminary Caribou Assessment Teleconference, December 3, 2019.

2019c. Wildlife Biologist and Assistant Wildlife Manager (Northeast), Department of Agriculture and Resource Development. Email correspondence with Wildlife Biologist, Stantec Consulting Ltd. Winnipeg, Manitoba, November 13, 2019.



Stantec

Alamos Gold Inc.

Project Infrastructure

- Proposed Open Pit
- Project Development Area

Study Area

- Wildlife and Wildlife Habitat Local Assessment Area (LAA)
- Wildlife and Wildlife Habitat Regional Assessment Area (RAA)

Landbase

- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- First Nation Reserve

N

0 2 4 Kilometres

(At original document size of 11x17)
1:200,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-03-26
Technical Review by DRouthier on 2020-03-26
Senior GIS Review by GKroupa on 2020-03-26

Client/Project 111473008

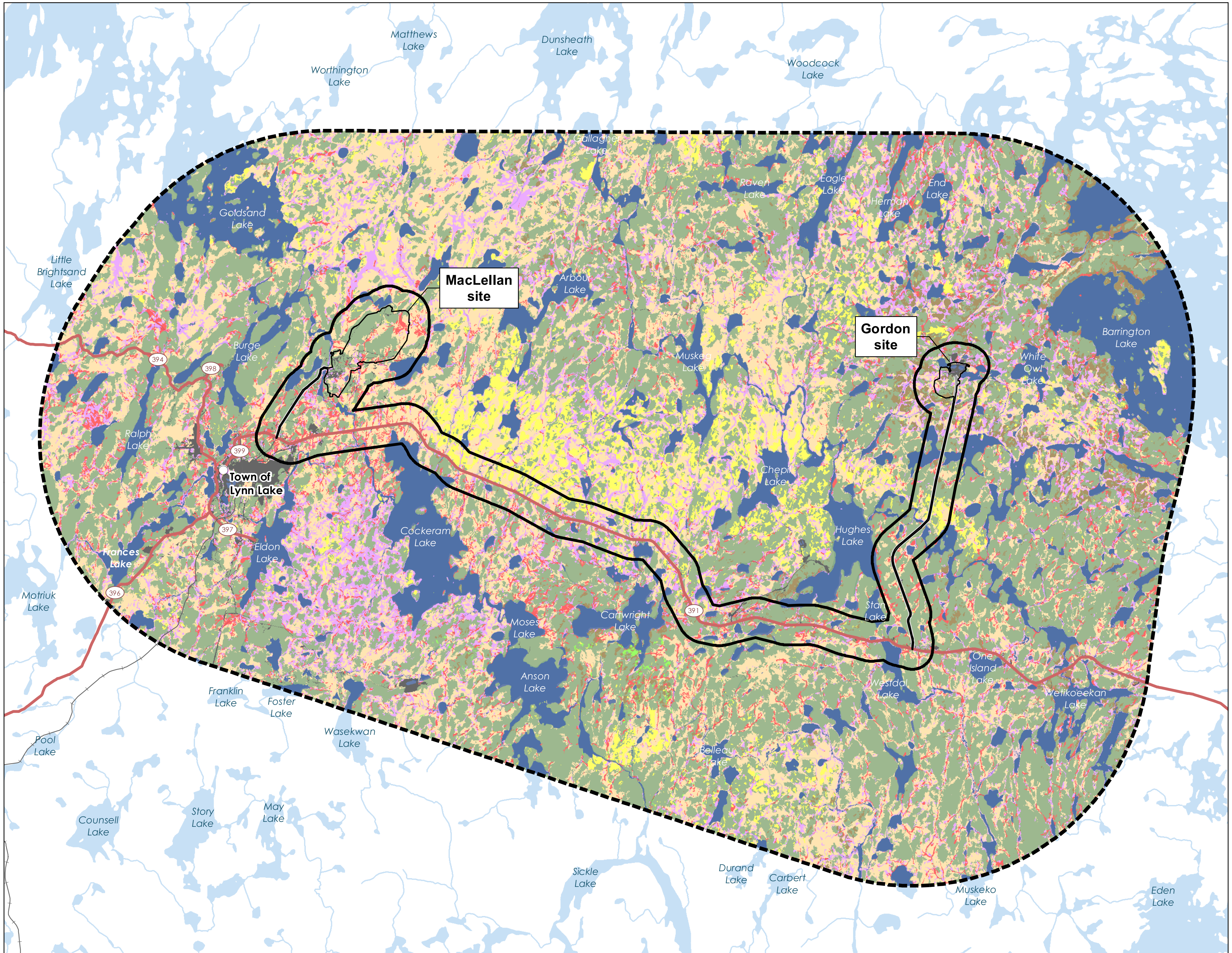
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.

12-1

Title

Project Infrastructure and Wildlife and Wildlife Habitat Assessment Areas



Stantec

Alamos Gold Inc.

Project Infrastructure

Project Development Area

Study Area

Wildlife and Wildlife Habitat Local Assessment Area (LAA)

Wildlife and Wildlife Habitat Regional Assessment Area (RAA)

Land Use/Land Cover

Upland
- Barren
- Coniferous
- Deciduous
- Mixedwood
- Shrubland

Wetland
- Bog
- Fen
- Marsh
- Swamp

Water
- Water

Anthropogenic
- Development

Landbase
- Highway
- Access Road
- Rail
- Watercourse
- Waterbody

N

0 2 4 Kilometres

(At original document size of 11x17)
1:200,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada
3. Land Use/Land Cover; Stantec 2017.

Project Location
Lynn Lake,
Manitoba

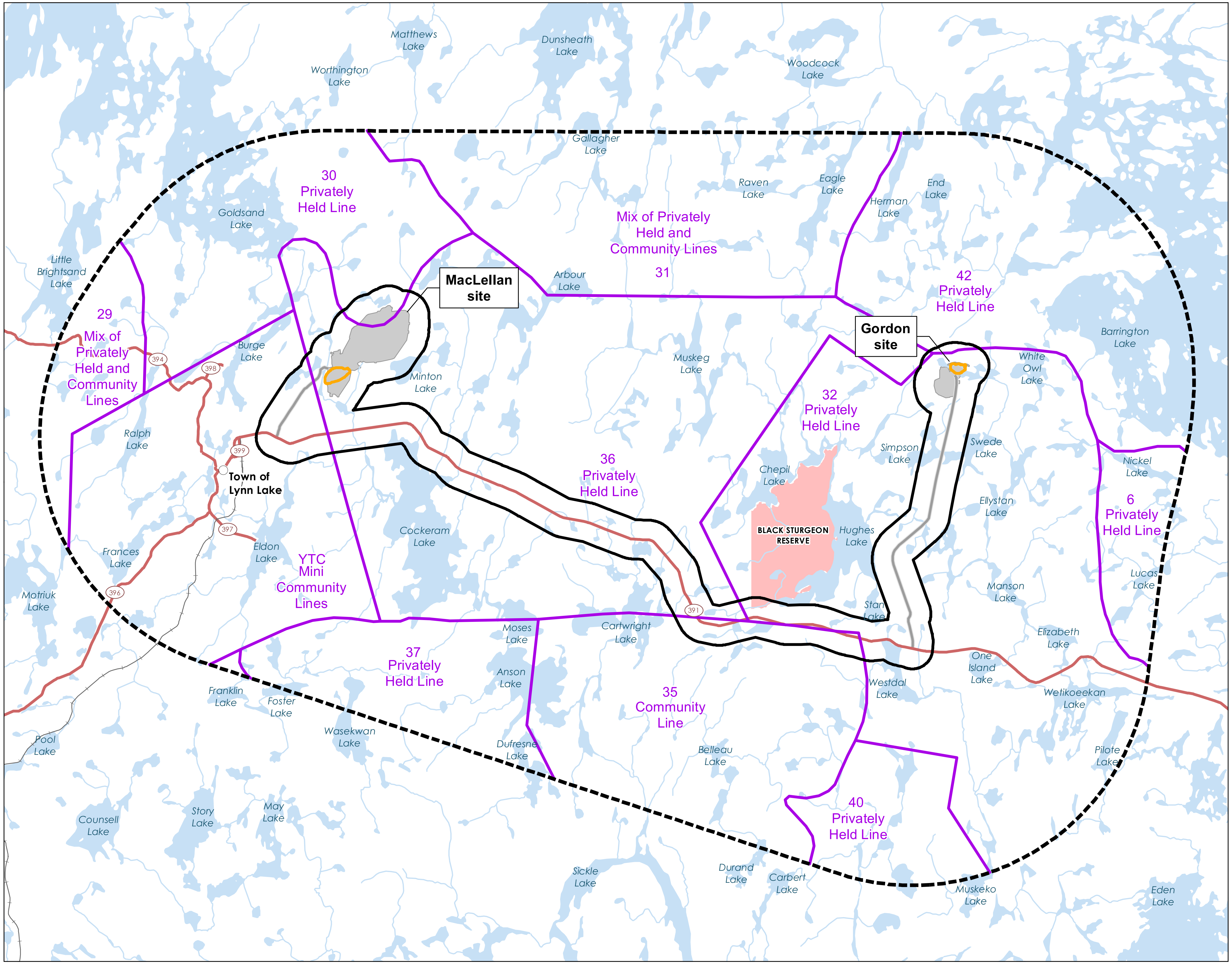
Prepared by ACampigotto on 2020-03-26
Technical Review by DRouthier on 2020-03-26
Senior GIS Review by GKroupa on 2020-03-26

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
12-2

Title
Land Cover in the Regional Assessment Area

G:_GIS_Project_Folder\111473008_LLGP_EA\figures\Ch12_Wildlife\Map12-2_WILDLIFE_HabitatLandCover_RAA_20200122.mxd Revised: 2020-04-01 By: ACampigotto



Stantec

Alamos Gold Inc.

Project Infrastructure

- Proposed Open Pit
- Project Development Area

Study Area

- Wildlife and Wildlife Habitat Local Assessment Area (LAA)
- Wildlife and Wildlife Habitat Regional Assessment Area (RAA)

Trap Lines

- Registered Traplines

Landbase

- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- First Nation Reserve

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

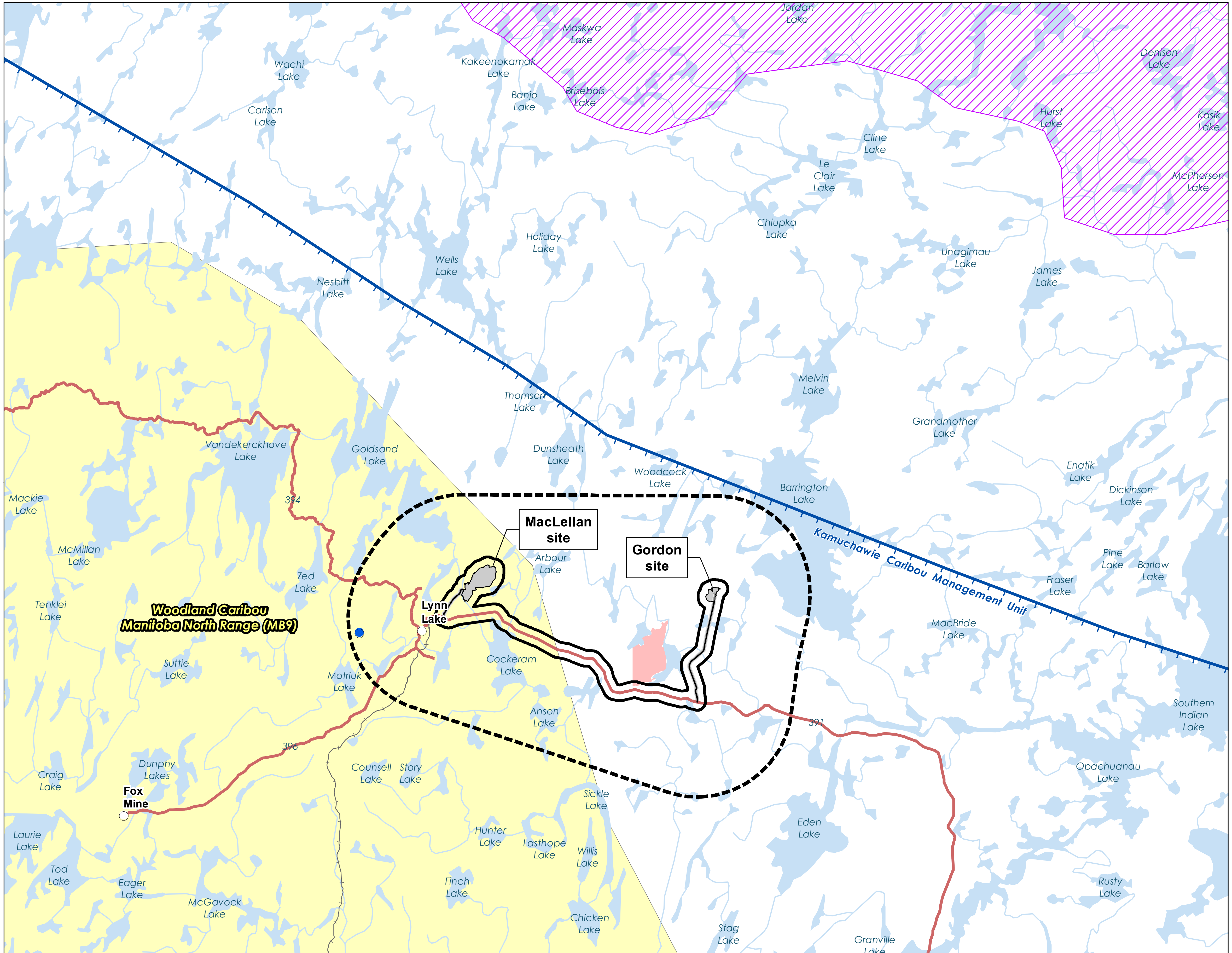
Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-03-26
Technical Review by DRouthier on 2020-03-26
Senior GIS Review by GKroupa on 2020-03-26

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
12-3

Title
Trapping Areas in the Regional Assessment Area



Stantec

Alamos Gold Inc.

Project Infrastructure and Study Area

- Project Development Area
- Wildlife and Wildlife Habitat Local Assessment Area (LAA)
- Wildlife and Wildlife Habitat Regional Assessment Area (RAA)

Caribou Ranges and Management Units

- 2019 Woodland Caribou Observation
- Kamuchawie Caribou Management Unit
- Barren-ground Caribou Range (1993-2012)
- Woodland Caribou Manitoba North Range (MB9)

Landbase

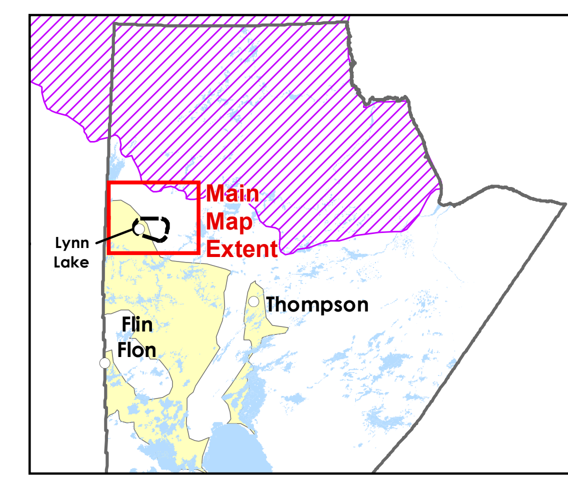
- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- First Nation Reserve

N

0 5 10 Kilometres

(At original document size of 11x17)
1:500,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Barren-ground Caribou Range Source: BQCMB (Beverly and Qamanirjuaq Caribou Management Board). 2014. Beverly and Qamanirjuaq Caribou Management plan 2013 – 2022. Beverly and Qamanirjuaq Caribou Management Board, Stonewall, MB.
4. Manitoba North Range (MB9) Source: Environment Canada. 2012. Recovery Strategy for the Woodland Caribou *(Rangifer tarandus caribou)*, Boreal population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. xi + 138pp.



Project Location
Lynn Lake,
Manitoba

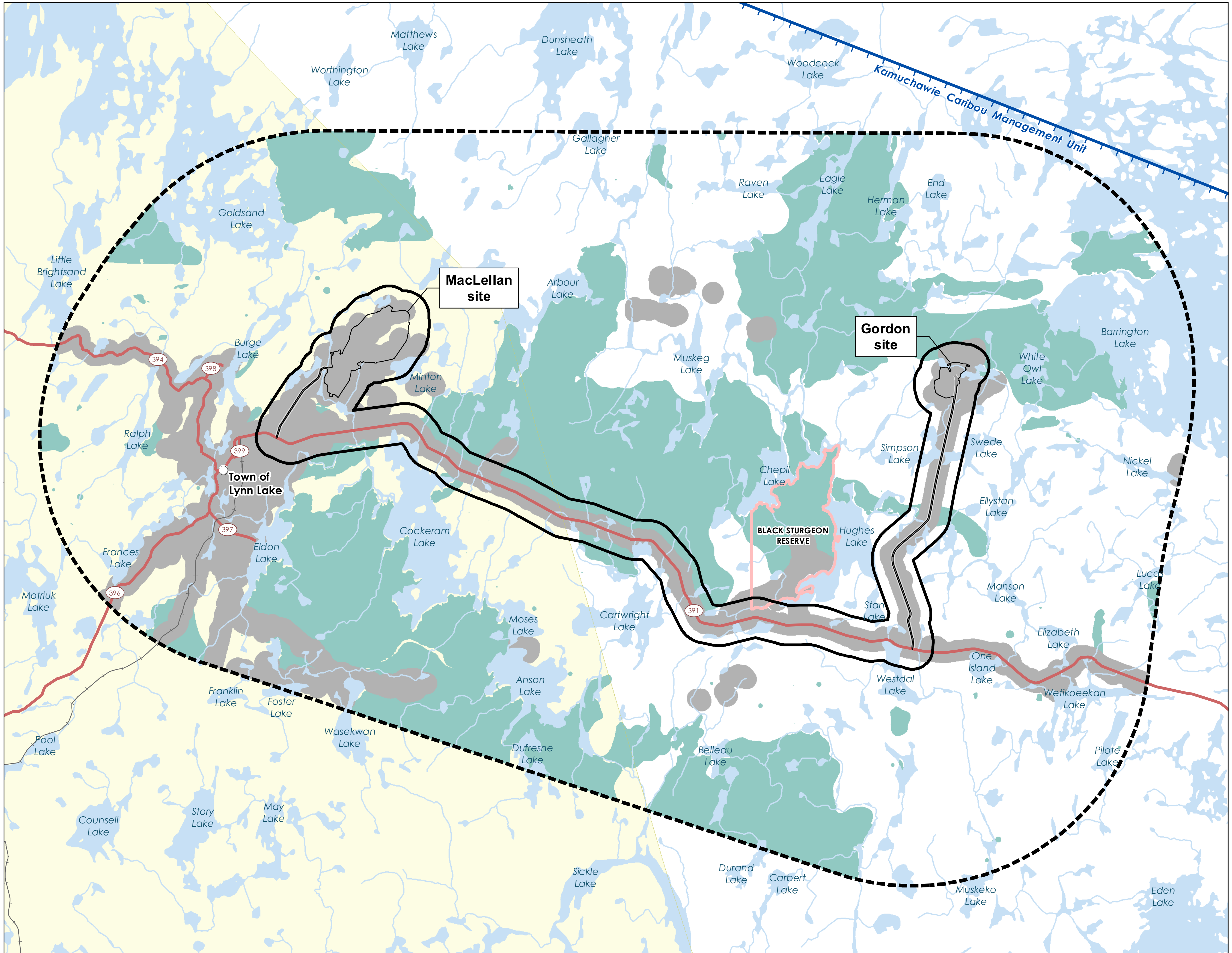
Prepared by ACampigotto on 2020-03-26
Technical Review by DRouthier on 2020-03-26
Senior GIS Review by GKroupa on 2020-03-26

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
12-4

Title
Woodland Caribou and Barren-ground Caribou Ranges



Project Infrastructure and Study Area

- Project Development Area
- Wildlife and Wildlife Habitat Local Assessment Area (LAA)
- Wildlife and Wildlife Habitat Regional Assessment Area (RAA)

Baseline Disturbance Areas

- Anthropogenic
- Fire History (1979-2019)

Caribou Range & Management Unit

- Manitoba North Range (MB9)
- Kamuchawie Caribou Management Unit

Landbase

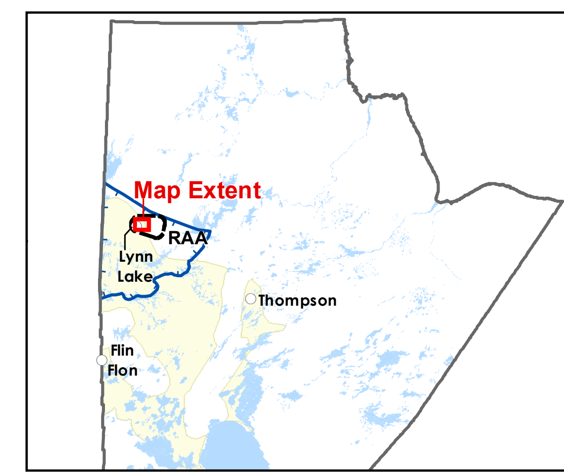
- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- First Nation Reserve

N

0 2.5 5 Kilometres

(At original document size of 11x17)
1:200,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada
3. Manitoba North Range (MB9) Source: Environment Canada, 2012.
4. Kamuchawie Caribou Mgmt Unit Source: MBWCMC (Manitoba Boreal Woodland Caribou Management Committee), 2015.



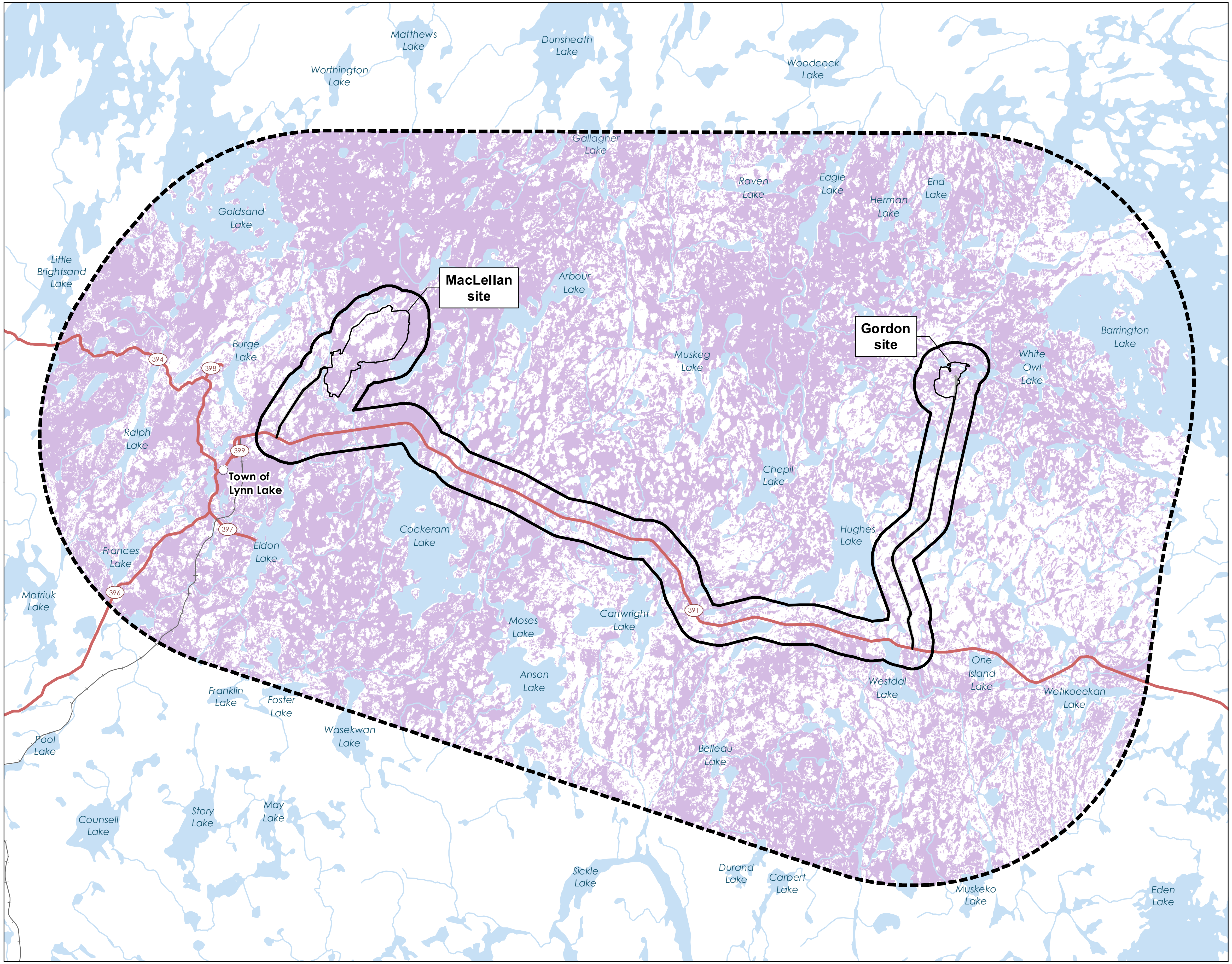
Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-03-26
Technical Review by DRouthier on 2020-03-26
Senior GIS Review by GKroupa on 2020-03-26

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
12-5

Title
Baseline Habitat Disturbance for Woodland Caribou



Stantec

Alamos Gold Inc.

Project Infrastructure

Project Development Area

Study Area

Wildlife and Wildlife Habitat Local Assessment Area (LAA)

Wildlife and Wildlife Habitat Regional Assessment Area (RAA)

Wildlife Habitat

Common Nighthawk Habitat

Landbase

Highway

Access Road

Rail

Watercourse

Waterbody

N

0 2.5 5 Kilometres

(At original document size of 11x17)
1:200,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada
3. Land Use/Land Cover; Stantec 2017.

Project Location
Lynn Lake,
Manitoba

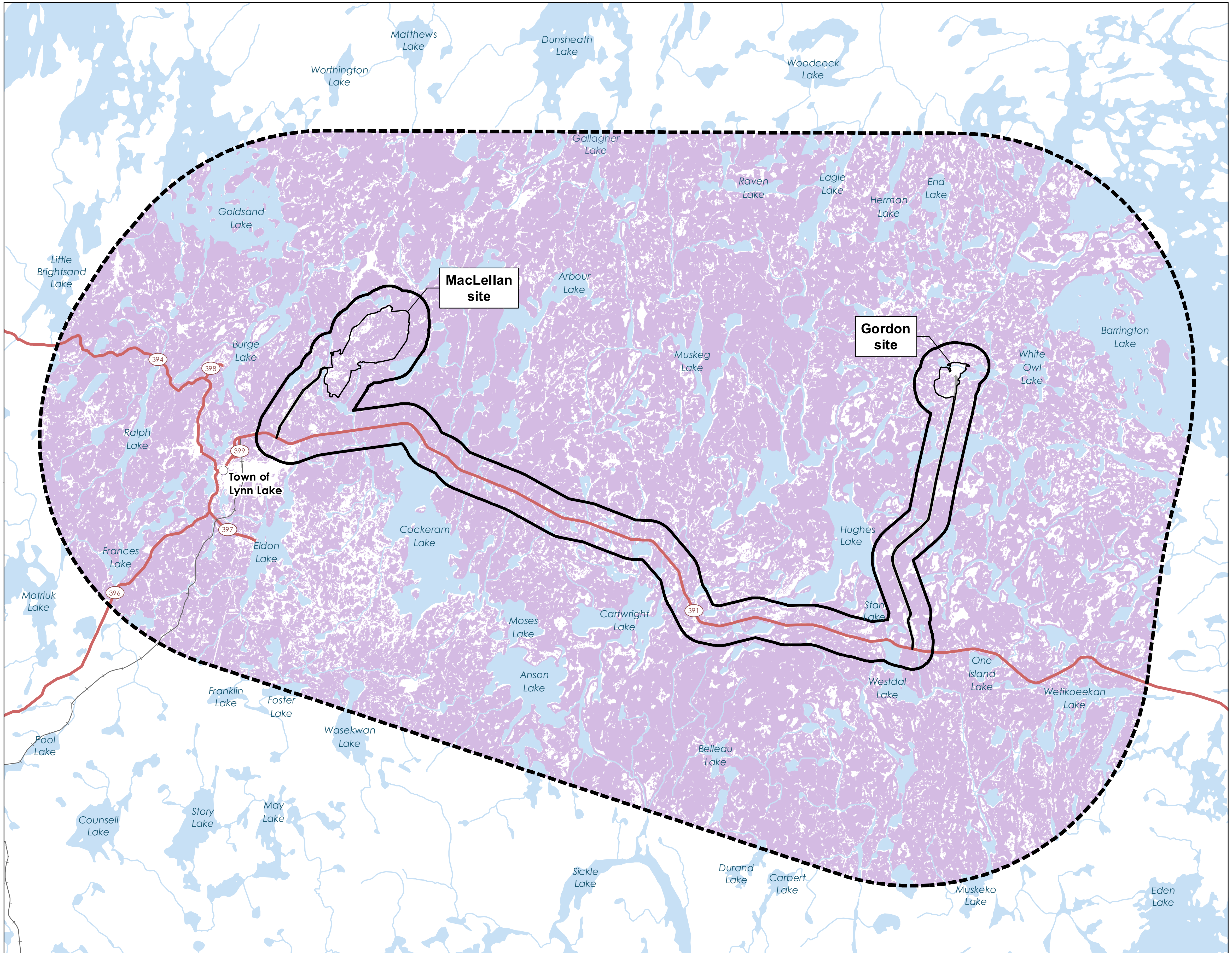
Prepared by ACampigotto on 2020-03-26
Technical Review by DRouthier on 2020-03-26
Senior GIS Review by GKroupa on 2020-03-26

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
12-6

Title
Baseline Habitat for Common Nighthawk



Stantec

ALAMOS GOLD INC.

Project Infrastructure

Project Development Area

Study Area

Wildlife and Wildlife Habitat Local Assessment Area (LAA)

Wildlife and Wildlife Habitat Regional Assessment Area (RAA)

Wildlife Habitat

Olive-sided Flycatcher Habitat

Landbase

Highway

Access Road

Rail

Watercourse

Waterbody

N

0 2.5 5 Kilometres

(At original document size of 11x17)
1:200,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada
3. Land Use/Land Cover; Stantec 2017.

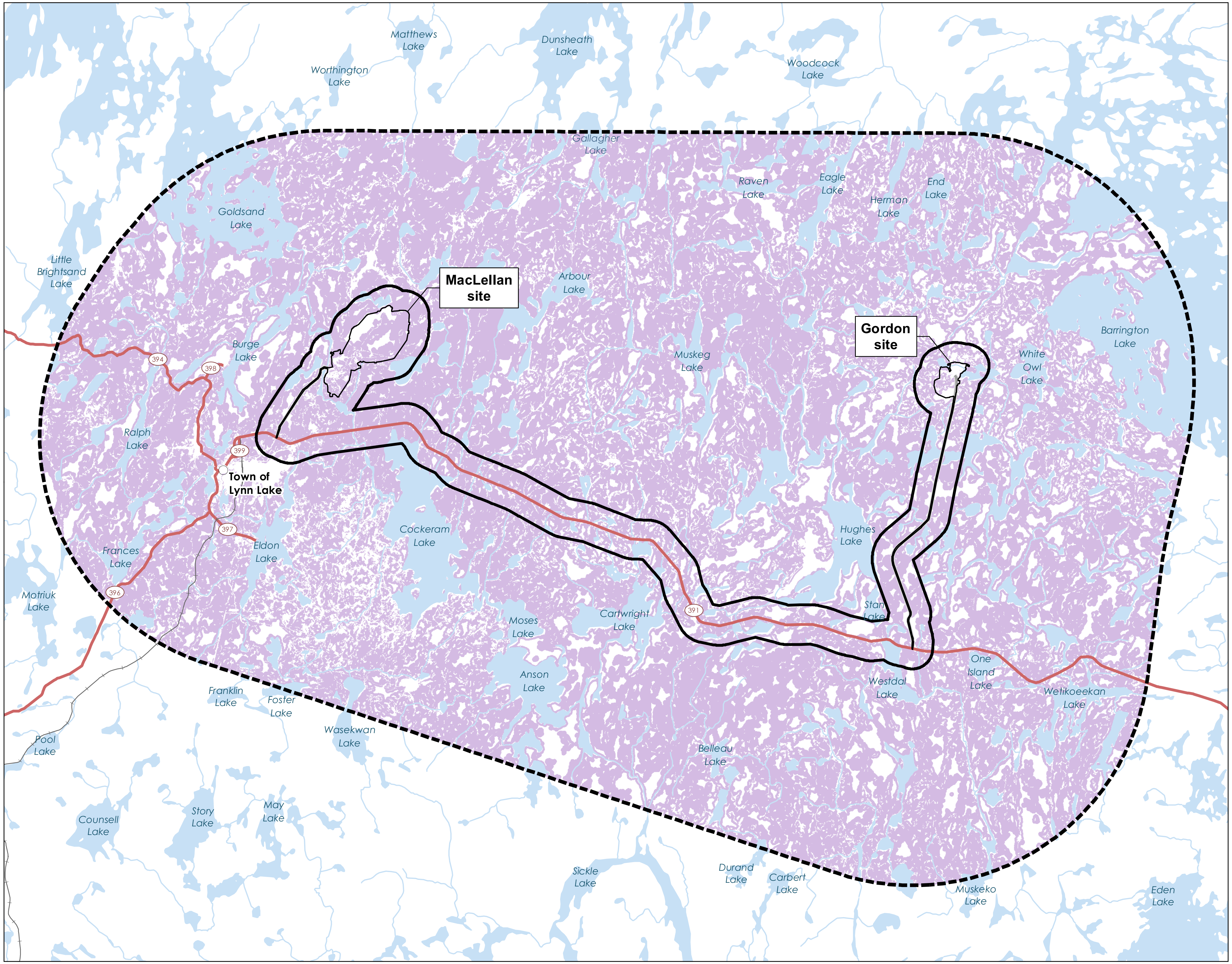
Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-03-26
Technical Review by DRouthier on 2020-03-26
Senior GIS Review by GKroupa on 2020-03-26

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
12-7

Title
Baseline Habitat for Olive-sided Flycatcher



Stantec

ALAMOS GOLD INC.

Project Infrastructure

Project Development Area

Study Area

Wildlife and Wildlife Habitat Local Assessment Area (LAA)

Wildlife and Wildlife Habitat Regional Assessment Area (RAA)

Wildlife Habitat

Rusty Blackbird Habitat

Landbase

Highway

Access Road

Rail

Watercourse

Waterbody

N

0 2.5 5 Kilometres

(At original document size of 11x17)
1:200,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada
3. Land Use/Land Cover; Stantec 2017.

Project Location
Lynn Lake,
Manitoba

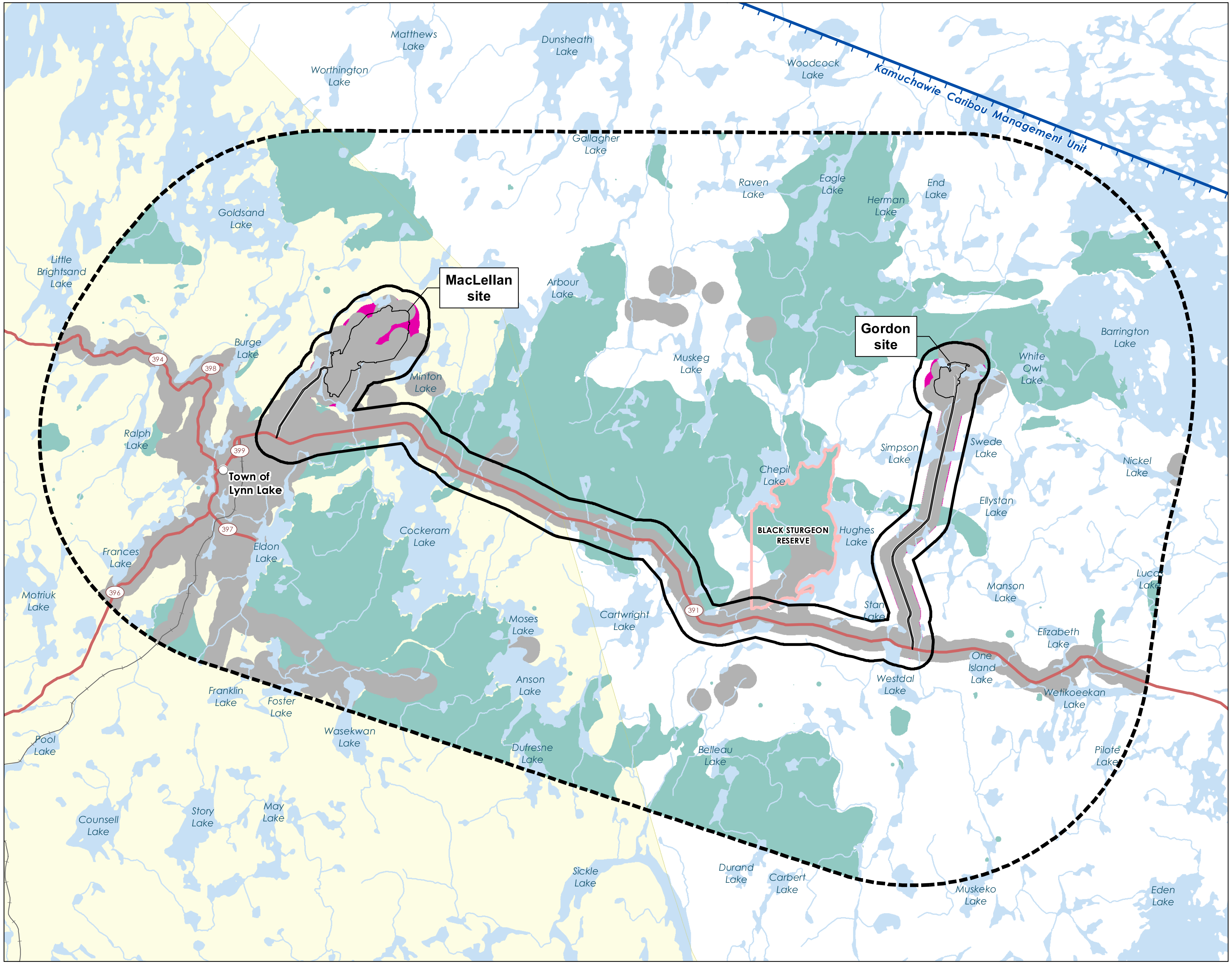
Prepared by ACampigotto on 2020-03-26
Technical Review by DRouthier on 2020-03-26
Senior GIS Review by GKroupa on 2020-03-26

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
12-8

Title
Baseline Habitat for Rusty Blackbird



Stantec

ALAMOS GOLD INC.

Project Infrastructure and Study Area

- Project Development Area
- Wildlife and Wildlife Habitat Local Assessment Area (LAA)
- Wildlife and Wildlife Habitat Regional Assessment Area (RAA)

Disturbance Areas

- Baseline Disturbance - Anthropogenic
- Baseline Disturbance - Fire History (1979-2019)
- Post-Construction Disturbance

Caribou Range & Management Unit

- Manitoba North Range (MB9)
- Kamuchawie Caribou Management Unit

Landbase

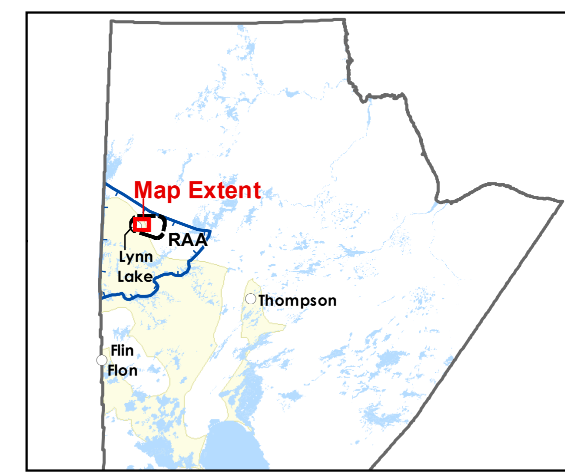
- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- First Nation Reserve

N

0 2.5 5 Kilometres

(At original document size of 11x17)
1:200,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada
3. Manitoba North Range (MB9) Source: Environment Canada, 2012.
4. Kamuchawie Caribou Mgmt Unit Source: MBWCMC (Manitoba Boreal Woodland Caribou Management Committee), 2015.



Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-03-26
Technical Review by DRouthier on 2020-03-26
Senior GIS Review by GKroupa on 2020-03-26

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
12-9

Title
Post-construction Habitat Disturbance for Woodland Caribou

Appendix 12A TABLES

Table 12A-1 Wildlife Species with the Potential to Occur in the RAA

Common Name	Latin Name	Observed in the RAA during baseline surveys
Mammals		
American red squirrel	*Tamiasciurus hudsonicus*	✓
Northern flying squirrel	*Glaucomys sabrinus*	
Woodchuck	*Marmota monax*	
Least chipmunk	*Tamias minimus*	
Beaver	*Castor canadensis*	✓
Meadow vole	*Microtus pennsylvanicus*	
Southern red-backed vole	*Myodes gapperi*	✓
Muskrat	*Ondatra zibethicus*	
Northern bog lemming	*Synaptomys borealis*	
Deer mouse	*Peromyscus maniculatus*	✓
Porcupine	*Erethizon dorsata*	
Snowshoe hare	*Lepus americanus*	✓
Eastern red bat	*Lasiurus borealis*	✓
Hoary bat	*Lasiurus cinereus*	✓
Little brown myotis	*Myotis lucifugus*	✓
Northern myotis	*Myotis septentrionalis*	
Canada lynx	*Lynx canadensis*	✓
Coyote	*Canis latrans*	
Gray wolf	*Canis lupus*	✓
Red fox	*Vulpes vulpes*	✓
Black bear	*Ursus americanus*	✓
River otter	*Lontra canadensis*	✓
Wolverine	*Gulo gulo*	✓
American marten	*Martes americana*	✓
Fisher	*Martes pennanti*	✓
Short-tailed weasel	*Mustela erminea*	✓
Least weasel	*Mustela nivalis*	
Mink	*Neovison vison*	✓

Table 12A-1 Wildlife Species with the Potential to Occur in the RAA

Common Name	Latin Name	Observed in the RAA during baseline surveys
Striped skunk	*Mephitis*	
Raccoon	*Procyon lotor*	
Moose	*Alces alces*	✓
Woodland caribou	*Rangifer tarandus caribou*	✓
Barren-ground caribou	*Rangifer tarandus groenlandicus*	
Birds[1]		
Canada goose	*Branta canadensis*	✓
Trumpeter swan*	*Cygnus buccinator*	
Unknown swan		✓
Wood duck	*Aix sponsa*	
Blue-winged teal	*Spatula discors*	✓
Northern shoveler	*Spatula clypeata*	✓
Gadwall	*Mareca strepera*	✓
American wigeon	*Mareca americana*	✓
Mallard	*Anas platyrhynchos*	✓
American black duck*†	*Anas rubripes*	
Northern pintail	*Anas acuta*	✓
Green-winged teal	*Anas crecca*	✓
Canvasback†	*Aythya valisineria*	
Redhead†	*Aythya americana*	✓
Ring-necked duck	*Aythya collaris*	✓
Greater scaup	*Aythya marila*	
Lesser scaup	*Aythya affinis*	✓
Surf scoter*†	*Melanitta perspicillata*	
White-winged scoter*	*Melanitta fusca*	✓
Bufflehead	*Bucephala albeola*	✓
Common goldeneye	*Bucephala clangula*	✓
Hooded merganser	*Lophodytes cucullatus*	✓
Common merganser	*Mergus merganser*	✓
Red-breasted merganser	*Mergus serrator*	

Table 12A-1 Wildlife Species with the Potential to Occur in the RAA

Common Name	Latin Name	Observed in the RAA during baseline surveys
Ruddy duck†	*Oxyura jamaicensis*	
Ruffed grouse	*Bonasa umbellus*	✓
Spruce grouse	*Falcipennis canadensis*	✓
Willow ptarmigan†	*Lagopus*	✓
Sharp-tailed grouse	*Tympanuchus phasianellus*	
Eared grebe†	*Podiceps nigricollis*	
Pied-billed grebe	*Podilymbus podiceps*	
Horned grebe*	*Podiceps auritus*	
Red-necked grebe	*Podiceps grisegena*	✓
Western grebe†	*Aechmophorus occidentalis*	
Rock pigeon	*Columba livia*	
Mourning dove	*Zenaida macroura*	
Black-billed cuckoo	*Coccyzus erythropthalmus*	
Common nighthawk*	*Chordeiles minor*	✓
Eastern whip-poor-will*	*Antrostomus vociferus*	
Ruby-throated hummingbird	*Archilochus colubris*	
Yellow rail*	*Coturnicops noveboracensis*	
Virginia rail	*Rallus limicola*	
Sora	*Porzana carolina*	
American coot	*Fulica americana*	✓
Sandhill crane	*Antigone canadensis*	✓
Piping plover*	*Charadrius melodus*	
Killdeer	*Charadrius vociferus*	
Marbled godwit	*Limosa fedoa*	
Least sandpiper	*Calidris minutilla*	
Short-billed dowitcher	*Limnodromus griseus*	
American woodcock	*Scolopax minor*	
Wilson’s snipe	*Gallinago delicata*	
Spotted sandpiper	*Actitis macularius*	✓
Solitary sandpiper	*Tringa solitaria*	✓

Table 12A-1 Wildlife Species with the Potential to Occur in the RAA

Common Name	Latin Name	Observed in the RAA during baseline surveys
Lesser yellowlegs*	*Tringa flavipes*	✓
Willet	*Tringa semipalmata*	
Greater yellowlegs*	*Tringa melanoleuca*	✓
Wilson's phalarope	*Phalaropus tricolor*	
Bonaparte's gull	*Chroicocephalus philadelphia*	✓
Franklin's gull	*Leucophaeus pipixcan*	
Mew gull*	*Larus canus*	
Ring-billed gull	*Larus delawarensis*	✓
California gull*	*Larus californicus*	
Herring gull	*Larus argentatus*	✓
Caspian tern	*Hydroprogne caspia*	
Black tern	*Chlidonias niger*	✓
Common tern	*Sterna hirundo*	
Forster's tern	*Sterna forsteri*	
Common loon	*Gavia immer*	✓
Double-crested cormorant	*Phalacrocorax auritus*	
American white pelican	*Pelecanus erythrorhynchos*	
American bittern	*Botaurus lentiginosus*	
Great blue heron	*Ardea herodias*	
Turkey vulture†	*Cathartes aura*	
Osprey	*Pandion haliaetus*	
Bald eagle	*Haliaeetus leucocephalus*	✓
Northern harrier	*Circus cyaneus*	✓
Sharp-shinned hawk	*Accipiter striatus*	
Northern goshawk	*Accipiter gentilis*	
Broad-winged hawk	*Buteo platypterus*	
Red-tailed hawk	*Buteo jamaicensis*	✓
Great horned owl	*Bubo virginianus*	✓
Northern hawk owl*	*Surnia ulula*	✓
Barred owl*	*Strix varia*	

Table 12A-1 Wildlife Species with the Potential to Occur in the RAA

Common Name	Latin Name	Observed in the RAA during baseline surveys
Great gray owl*	*Strix nebulosa*	✓
Long-eared owl*	*Asio otus*	
Short-eared owl*	*Asio flammeus*	
Boreal owl*	*Aegolius funereus*	✓
Northern saw-whet owl	*Aegolius acadicus*	
Belted kingfisher	*Megaceryle alcyon*	
Yellow-bellied sapsucker	*Sphyrapicus varius*	
Downy woodpecker	*Picoides pubescens*	
Hairy woodpecker	*Picoides villosus*	
American three-toed woodpecker	*Picoides dorsalis*	✓
Black-backed woodpecker	*Picoides arcticus*	✓
Northern flicker	*Colaptes auratus*	✓
Pileated woodpecker	*Dryocopus pileatus*	
American kestrel	*Falco sparverius*	
Merlin	*Falco columbarius*	
Olive-sided flycatcher*	*Contopus cooperi*	✓
Eastern wood-pewee	*Contopus virens*	
Yellow-bellied flycatcher	*Empidonax flaviventris*	✓
Alder flycatcher	*Empidonax alnorum*	✓
Least flycatcher	*Empidonax minimus*	✓
Eastern phoebe	*Sayornis phoebe*	
Eastern kingbird	*Tyrannus tyrannus*	✓
Northern shrike*	*Lanius excubitor*	
Blue-headed vireo	*Vireo solitarius*	✓
Philadelphia vireo	*Vireo philadelphicus*	
Red-eyed vireo	*Vireo olivaceus*	
Gray jay	*Perisoreus canadensis*	✓
Blue jay	*Cyanocitta cristata*	
Black-billed magpie	*Pica hudsonia*	
American crow	*Corvus brachyrhynchos*	

Table 12A-1 Wildlife Species with the Potential to Occur in the RAA

Common Name	Latin Name	Observed in the RAA during baseline surveys
Common raven	*Corvus corax*	✓
Horned lark	*Eremophila alpestris*	
Purple martin	*Progne subis*	
Tree swallow	*Tachycineta bicolor*	✓
Bank swallow	*Riparia riparia*	
Cliff swallow	*Petrochelidon pyrrhonota*	✓
Barn swallow	*Hirundo rustica*	✓
Black-capped chickadee	*Poecile atricapillus*	
Boreal chickadee	*Poecile hudsonicus*	✓
Red-breasted nuthatch	*Sitta canadensis*	
Brown creeper	*Certhia americana*	
House wren	*Troglodytes aedon*	
Winter wren	*Troglodytes hiemalis*	✓
Sedge wren	*Cistothorus platensis*	
Marsh wren	*Cistothorus palustris*	
Golden-crowned kinglet	*Regulus satrapa*	
Ruby-crowned kinglet	*Regulus calendula*	✓
Eastern bluebird	*Sialia sialis*	
Mountain bluebird	*Sialia currucoides*	
Veery	*Catharus fuscescens*	
Gray-cheeked thrush*	*Catharus minimus*	
Swainson's thrush	*Catharus ustulatus*	✓
Hermit thrush	*Catharus guttatus*	✓
American robin	*Turdus migratorius*	✓
Gray catbird	*Dumetella carolinensis*	
Brown thrasher	*Toxostoma rufum*	
European starling	*Sturnus vulgaris*	
Bohemian waxwing	*Bombycilla garrulus*	
Cedar waxwing	*Bombycilla cedrorum*	
House sparrow	*Passer domesticus*	

Table 12A-1 Wildlife Species with the Potential to Occur in the RAA

Common Name	Latin Name	Observed in the RAA during baseline surveys
Evening grosbeak	*Coccothraustes vespertinus*	
Pine grosbeak	*Pinicola enucleator*	
Purple finch	*Haemorhous purpureus*	
Common redpoll	*Acanthis flammea*	
Red crossbill*	*Loxia curvirostra*	
White-winged crossbill*	*Loxia leucoptera*	
Pine siskin	*Spinus pinus*	
American goldfinch	*Spinus tristis*	
American tree sparrow	*Spizelloides arborea*	
Chipping sparrow	*Spizella passerina*	✓
Clay-colored sparrow	*Spizella pallida*	
Vesper sparrow	*Pooecetes gramineus*	
Savannah sparrow	*Passerculus sandwichensis*	✓
Le Conte's sparrow	*Ammodramus leconteii*	✓
Nelson's sparrow	*Ammodramus nelsoni*	
Fox sparrow	*Passerella iliaca*	✓
Song sparrow	*Melospiza melodia*	
Lincoln's sparrow	*Melospiza lincolnii*	✓
Swamp sparrow	*Melospiza georgiana*	✓
White-throated sparrow	*Zonotrichia albicollis*	✓
Harris's sparrow	*Zonotrichia querula*	
White-crowned sparrow	*Zonotrichia leucophrys*	
Dark-eyed junco	*Junco hyemalis*	✓
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	
Red-winged blackbird	*Agelaius phoeniceus*	✓
Brown-headed cowbird	*Molothrus ater*	
Rusty blackbird	*Euphagus carolinus*	
Brewer's blackbird†	*Euphagus cyanocephalus*	
Common grackle	*Quiscalus quiscula*	
Ovenbird	*Seiurus aurocapilla*	

Table 12A-1 Wildlife Species with the Potential to Occur in the RAA

Common Name	Latin Name	Observed in the RAA during baseline surveys
Northern waterthrush	*Parkesia noveboracensis*	✓
Black-and-white warbler	*Mniotilta varia*	
Tennessee warbler	*Oreothlypis peregrina*	✓
Orange-crowned warbler	*Oreothlypis celata*	✓
Nashville warbler	*Oreothlypis ruficapilla*	✓
Connecticut warbler	*Oporornis agilis*	
Mourning warbler	*Geothlypis philadelphia*	
Common yellowthroat	*Geothlypis trichas*	✓
American redstart	*Setophaga ruticilla*	
Cape May warbler	*Setophaga tigrina*	
Northern parula*	*Setophaga americana*	
Magnolia warbler	*Setophaga magnolia*	✓
Bay-breasted warbler	*Setophaga castanea*	
Blackburnian warbler	*Setophaga fusca*	
Yellow warbler	*Setophaga petechia*	✓
Chestnut-sided warbler	*Setophaga pensylvanica*	
Blackpoll warbler	*Setophaga striata*	✓
Palm warbler	*Setophaga palmarum*	✓
Yellow-rumped warbler	*Setophaga coronata*	✓
Black-throated green warbler	*Setophaga virens*	
Wilson's warbler	*Cardellina pusilla*	✓
Canada warbler*	*Cardellina canadensis*	
Western tanager*	*Piranga ludoviciana*	
Rose-breasted grosbeak	*Pheucticus ludovicianus*	
Indigo bunting	*Passerina cyanea*	
Amphibians		
Wood frog	*Lithobates sylvaticus*	✓
Northern leopard frog	*Lithobates pipiens*	
Boreal chorus frog	*Pseudacris maculata*	✓
[1] – MB BBA Region 11 (Lynn Lake / Thompson; MB BBA 2019b)		

Table 12A-1 Wildlife Species with the Potential to Occur in the RAA

Common Name	Latin Name	Observed in the RAA during baseline surveys
* – Provincially rare † – Regionally rare		

Table 12A-2 Ecological Receptors Selected for the Ecological Risk Assessment[1]

Common Name of Species	Scientific Name	Feeding Guild
Mammals		
American mink	*Neovison vison*	Omnivorous mammal (semi-aquatic)
Beaver	*Castor canadensis*	Herbivorous mammal (aquatic)
Black bear	*Ursus americanus*	Omnivorous large mammal (terrestrial)
Common masked shrew	*Sorex cinereus*	Insectivorous mammal (terrestrial)
Deer mouse	*Peromyscus maniculatus*	Omnivorous small mammal (terrestrial)
Short-tailed weasel	*Mustela erminea*	Carnivorous mammal (terrestrial)
Meadow vole	*Microtus pennsylvanicus*	Herbivorous small mammal (terrestrial)
Moose	*Alces alces*	Herbivorous large mammal (terrestrial)
Muskrat	*Ondatra zibethicus*	Herbivorous mammal (aquatic)
River otter	*Lontra canadensis*	Piscivorous mammal (aquatic)
Snowshoe hare	*Lepus americanus*	Herbivorous small mammal (terrestrial)
Woodland caribou	*Rangifer tarandus caribou*	Herbivorous large mammal (terrestrial)
Birds		
American robin	*Turdus migratorius*	Omnivorous bird (terrestrial)
Barn swallow	*Hirundo rustica*	Insectivorous bird (terrestrial)
Common loon	*Gavia immer*	Piscivorous bird (aquatic)
Lesser scaup	*Aythya affinis*	Insectivorous bird (aquatic)
Mallard	*Anas platyrhynchos*	Omnivorous bird (aquatic)
Red-tailed hawk	*Buteo jamaicensis*	Carnivorous bird (terrestrial)
Spotted sandpiper	*Actitis macularius*	Omnivorous bird (aquatic)
Spruce grouse	*Falcipennis canadensis*	Herbivorous bird (terrestrial)
Herptiles		
Wood frog	*Lithobates sylvaticus*	Insectivorous amphibian (terrestrial)

[1] - from the Ecological Risk Assessment Technical Modelling Report (Volume 5, Appendix H).

Lynn Lake Gold Project Environmental Impact Statement Chapter 13 – Assessment of Potential Effects on Labour and Economy

Prepared by:

Stantec Consulting Ltd.

May 25, 2020

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Acronyms and Abbreviations

Alamos	Alamos Gold Inc.
CEGEP	Collège d'enseignement général et professionnel (in English, College of General and Vocation Education)
CSD	census subdivision
DIDO	drive-in/drive-out
EIS	Environmental Impact Statement
FIFO	fly-in/fly-out
FTE	full-time equivalent
GDP	gross domestic product
GNR	global non-response rate
INAC	Indigenous and Northern Affairs Canada
IR	Indian Reserve
IS	Indian Settlement
km	kilometre
LAA	Local Assessment Area
LICO-AT	low income cut-offs, after tax
LIM-AT	low income measure, after tax
m	metre
MFASB	Municipal Finance and Advisory Services Branch
MCC	Manitoba Conservation and Climate (formerly Manitoba Sustainable Development)
NAICS	North American Industry Classification System
NHS	national household survey

NOC	national occupational classification
PDA	Project Development Area
RAA	Regional Assessment Area
RCMP	Royal Canadian Mounted Police
TK	traditional knowledge
TLRU	traditional land and resource use
TMF	tailings management facility
VC	valued component

13.0 ASSESSMENT OF POTENTIAL EFFECTS ON LABOUR AND ECONOMY

The Labour and Economy valued component (VC) has been selected for assessment because employment and business support the economic livelihoods of residents, and provide associated social benefits related to employment and income. Economic impacts (e.g., labour, labour income, contributions to Gross Domestic Product [GDP], and government revenues) are of interest to the public, stakeholders, regulators, Indigenous communities and governments. Consideration of Project effects on humans is required per Manitoba Sustainable Development's (now Manitoba Conservation and Climate; MCC) 2018 *Environment Act* Proposal Report Guidelines. The Canadian Environmental Assessment Agency (now the Impact Assessment Agency of Canada) Final Guidelines for the Preparation of an Environmental Impact Statement (EIS), dated November 2017 (Appendix 4A) issued for the Project requires "consideration of effects on the human environment, including socio-economic conditions (encompassing a broad range of matters that affect communities in the study area in a way that recognizes interrelationships, system functions and vulnerabilities)".

The Labour and Economy VC is linked with the assessment of Community Services, Infrastructure, and Wellbeing (Chapter 14). It is also linked with the Assessment of Potential Effects to Indigenous Peoples (Chapter 19).

13.1 SCOPE OF ASSESSMENT

This section defines and describes the scope of the assessment of potential effects on labour and economy.

13.1.1 Regulatory and Policy Setting

The following regulatory, policy, and guidance documents are applicable to the assessment of labour and economy:

- MCC *Environment Act* Proposal Guidelines (2018), which require consideration of Project effects on humans and socio-economic implications resulting from environmental impact.
- Impact Assessment Agency of Canada Final EIS Guidelines (2017; Appendix 4A), which require assessment of effects on the human environment, including socio-economic conditions (encompassing a broad range of matters that affect communities in the study area in a way that recognizes interrelationships, system functions and vulnerabilities).

13.1.2 The Influence of Engagement on the Assessment

Engagement has been ongoing prior to and throughout the EIS process, and will continue with local Indigenous communities, stakeholders, the public, and government agencies through the life of the Project. More detail on the Engagement process can be found in Chapter 3.

Engagement feedback related to labour and economy has been addressed through direct responses, updates to baseline information, and in the EIS, as appropriate.

As part of the information sharing throughout the engagement process, Project-related information was provided by Indigenous communities in the form of traditional land and resource use (TLRU) studies and other forms of information sharing. Project-specific engagement was conducted with Marcel Colomb First Nation, Mathias Colomb Cree Nation, Peter Ballantyne Cree Nation, Manitoba Metis Federation, Métis Nation-Saskatchewan Eastern Region 1, Nisichawayasihk Cree Nation, O-Pipon-Na-Piwin Cree Nation, Métis Nation-Saskatchewan Northern Region 1, Barren Lands First Nation, Hatchet Lake First Nation, Northlands Denesuline First Nation and Sayisi Dene First Nation.

A Project-specific TLRU study was completed collaboratively with Marcel Colomb First Nation with a final report provided to the community on January 11, 2018 (Stantec 2018). The TLRU study included interviews with participants selected by Marcel Colomb First Nation regarding traditional land use in the Project area, including availability of traditional resources, access to traditional resources or areas, occupancy, cultural sites and areas, and experience of TLRU.

A Project-specific TLRU study was completed in collaboration with Peter Ballantyne Cree Nation but has not yet been released by community leadership for use in the environmental assessment. The TLRU study included interviews with community members in Kinoosao, Saskatchewan.

A TLRU study (Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project) was completed by an independent consultant for the Manitoba Metis Federation (SVS 2020), the results of which were received in February 2020. The study documents harvesting and land use by the Manitoba Métis Community within a 100-kilometre (km) radius of the Project.

Additionally, four open house public meetings have been held to date in Lynn Lake (in 2015, 2016, 2017 and 2020) for members of the local community including Marcel Colomb First Nation (Chapter 3). Open house attendees were invited to complete questionnaires to provide feedback on the Project, as well as identify issues, concerns or inquiries related to the Project.

Table 13-1 summarizes key information and concerns from the public, stakeholders, regulators, and Indigenous communities that influenced the scope of the assessment for the Labour and Economy VC.

Table 13-1 Summary of Key Information and Concerns that Influenced the Scope of the Assessment

Topic	Key Information and Concerns	Influence on the Assessment
Employment	Communication of labour demands and necessary skills/training is needed to increase local content.	Mitigation and management measures were developed to increase awareness of Project-related employment and required qualifications (Section 13.4.2.2).
	Skills training is needed to increase local content. Capacity funding likely needed to support Indigenous-led training opportunities	Mitigation and management measures were developed to help address education barriers to employment (Section 13.4.2.2). Alamos Gold Inc. (Alamos) will also work with local communities to develop training programs (e.g., contract opportunities) oriented to Project operational needs (Section 13.4.3.2).
	Labour drawdown is of concern (local employers loosing skilled workers to the Project).	Consideration of labour drawdown, wage inflation and increased difficulty for local employers to recruit and retain workers was added to the assessment of 'change in local and regional business' (Section 13.4.4).
	Cultural sensitivity training should be provided to Project workers and contractors.	Mitigation/management measure was developed specific to cultural sensitivity training (Section 13.4.2.2).
Business	Contracting and business opportunities are of high importance. Potential for partnership agreements with Indigenous communities has been identified.	Alamos will develop work packages that consider the capacity and capabilities of local and regional businesses and plan for working with local and Indigenous-owned businesses to enhance their potential for successfully bidding on Project contracts regarding the supply of goods and services (Section 13.4.3.2).
Economy	"Boom/bust" effects; need a plan to address adverse economic effects following closure of the mine	The assessment of Project Residual effects includes consideration of adverse effects on local and regional labour forces, businesses, and the economy (overall) as the Project transitions from operation into and through decommissioning/closure (Section 13.4).

13.1.3 Potential Effects, Pathways and Measurable Parameters

Table 13-2 lists potential Project effects on labour and economy and provides a summary of the Project effect pathways and measurable parameters and units of measurement used to assess potential effects. The selection of potential effects and measurable indicators was informed through review of previous studies, existing information, primary research, and through engagement with the public, stakeholders, regulators, and Indigenous communities.

Table 13-2 Potential Effects, Effects Pathways and Measurable Parameters for Labour and Economy

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in local and regional labour force	• Project demand for labour	• Qualified labour supply • Project employment (full-time equivalents [FTEs])
Change in local and regional business	• Project regional expenditures • Project direct employment	• Value of local and regional spending • Project employment (FTEs) • Wage levels and labour income
Change in local and regional economy	• Project regional expenditures • Project direct employment • Project property taxes	• Contributions to local and regional government GDP ($) • Municipal property tax ($)

13.1.4 Boundaries

13.1.4.1 Spatial Boundaries

The following spatial boundaries, based on Statistics Canada administrative boundaries[1], are used to assess Project effects, including residual and cumulative environmental effects, on labour and economy in the region surrounding the Gordon and MacLellan sites and access roads (Map 13-1):

The Project Development Area (PDA) encompasses the immediate area in which Project activities and components may occur at the Gordon and MacLellan sites, respectively, plus a 30-metre (m) buffer and is the anticipated area of direct physical disturbance associated with construction and operation of the Project (i.e., the Project footprint).

The Local Assessment Area (LAA) encompasses the area in which direct and indirect environmental effects from Project activities and components can be predicted or measured with a level of confidence that allows for assessment. It consists of the PDAs for both sites and adjacent areas where Project-related environmental effects are reasonably expected to occur based on available information and professional judgement. The LAA consists of the Town of Lynn Lake and Black Sturgeon Indian Reserve (IR), which represent all populated Census Subdivisions (CSDs) within 30 km of the Gordon and MacLellan sites.

The Regional Assessment Area (RAA) is the area that establishes the context for determining the significance of residual Project-related environmental effects. It is also the area within which residual environmental effects from Project activities and components may interact cumulatively with the residual environmental effects of other past, present, and future physical activities. The RAA encompasses both the

[1] These Statistics Canada administrative boundaries consist of the following standard geographical classifications: Census subdivision including towns, cities, Indian Reserves, and Indian Settlements. This nomenclature (e.g., Black Sturgeon IR) is unique to Chapters 13 and 14.

PDAs and the LAA and includes other populated CSDs within a 100-km distance of the Gordon and MacLellan sites. These are:

- Town of Leaf Rapids, Manitoba.
- Black Sturgeon IR, Manitoba, a settlement of the Marcel Colomb First Nation.
- Granville Lake Indian Settlement (IS), Manitoba, a settlement of the Mathias Colomb Cree Nation.
- South Indian Lake IS, Manitoba, a settlement of the O-Pipon-Na-Piwin Cree Nation.
- Kinoosao-Thomas Clarke 204 IR, Saskatchewan, the most northern community within the Peter Ballantyne Cree Nation.
- The City of Thompson, Manitoba, which is also included because of its role as the regional service center for northern Manitoba.

13.1.4.2 Temporal Boundaries

The temporal boundaries for the Project consist of the following phases:

- Construction – two years (scheduled to be carried out concurrently from Year -2 to Year -1 at both sites).
- Operation – 13 years (scheduled to be carried out from Year 1 to Year 6 at the Gordon site and from Year 1 to Year 13 at the MacLellan site).
- Decommissioning/closure – five to six years of active closure (scheduled to begin in Year 6 at the Gordon site and in Year 14 at the MacLellan site). Active closure will be followed by post-closure, which is the time period during which active reclamation measures are complete, but monitoring is still required. The expected duration for post-closure is approximately 10 years. Pit filling is expected to take 11 years at the Gordon site and 21 years at the MacLellan site under average conditions (Chapter 9, Section 9.4.1). Permanent closure will occur when the site is stable, and monitoring is no longer required. For Labour and Economy this will occur when Project expenditures and demand for labour have ceased. The duration and conditions for post-closure monitoring and permanent closure will be detailed in subsequent submissions of the Closure Plan to regulatory agencies as Project design and execution progresses.

13.1.5 Residual Effects Characterization

The criteria and definitions described in Table 13-3 are used to characterize the residual effects on labour and economy.

Table 13-3 Characterization of Residual Effects on Labour and Economy

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Positive –** a residual effect that moves measurable parameters in a direction beneficial to labour and economy relative to baseline. **Adverse –** a residual effect that moves measurable parameters in a direction detrimental to labour and economy relative to baseline.
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	**Negligible –** No measurable change in labour and economy from baseline conditions **Low** – A measurable change in labour and economy but residual effect cannot be distinguished from baseline conditions within normal range of variability **Moderate** – Measurable change but less than high likelihood to pose a serious risk or benefit to labour and economy **High** – Measurable change that is likely to pose a serious risk or benefit to labour and economy
Geographic Extent	The geographic area in which a residual effect occurs	**PDA –** residual effects are restricted to the PDA **LAA –** residual effects extend into the LAA **RAA –** residual effects interact with those of other projects in the RAA
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	**Not Applicable –** seasonal aspects are unlikely to affect labour and economy **Applicable –** seasonal aspects may affect labour and economy
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	**Single event** – effects occur once **Multiple irregular event** – occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	**Short-term** – residual effect restricted to no more than the duration of the construction phase (two years) **Medium-term** – residual effect extends through operation (13 years) **Long-term** – residual effect extends beyond operation (greater than 13 years)
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	**Reversible –** the residual effect is likely to be reversed after activity completion and reclamation **Irreversible –** the residual effect is unlikely to be reversed
Socio-economic Context	Existing condition and trends in the area where residual effects occur	**Resilient** – VC is able to assimilate the additional change **Not Resilient** – VC is not able to assimilate the additional change because of having little tolerance to imposed stresses due to fragility or near a threshold

13.1.6 Significance Definition

A significant adverse residual effect on economy and employment is defined as an adverse effect that is highly distinguishable from current conditions and trends and cannot be managed or mitigated through adjustments to programs, policies, plans, or through other mitigations.

The residual effects assessment considers both positive and adverse effects after mitigation and other management measures are implemented. However, significance determination is made for adverse effects only.

13.2 EXISTING CONDITIONS FOR LABOUR AND ECONOMY

Existing conditions for labour and economy for the Project are presented in detail in the Socio-Economic Baseline Technical Data Report and associated Validation Report provided in Volume 4, Appendix P. The existing conditions and the methods used to characterize baseline conditions are summarized below.

13.2.1 Methods

Information on existing conditions was collected through primary and secondary research. Information on existing conditions was also obtained from meetings with Indigenous communities and regulators. Secondary information includes publicly available data and literature, as well as primary and secondary data submitted to Alamos from Indigenous and local communities. Sources used to help characterize the existing conditions within each LAA include, but are not limited to:

- Engagement carried out by Alamos with potentially affected communities.
- Emails and direct communications with representatives from local businesses and governments.
- Government sources such as Statistics Canada (e.g., 2016 Census of the Population (Census) Community Profiles and 2011 Census and National Household Survey (NHS) Community Profiles).

To protect the identity of individuals and to address data quality issues Statistics Canada may selectively choose to not disclose survey information for a given location. For the 2016 Aboriginal Census, Community Profile information for Black Sturgeon IR, Granville Lake IS, and Kinoosao-Thomas Clark 204 IR is not publicly available. For the 2011 NHS, Community Profile information is not publicly available for Granville Lake IS, Kinoosao-Thomas Clark 204 IR, Town of Leaf Rapids, and Town of Lynn Lake). Statistics Canada also periodically updates the administrative boundary for which Community Profile information is collected and reported. Prior to the 2016 Census Black Sturgeon IR was enumerated along with Census Division 23 (i.e., 2011 NHS data specific to Black Sturgeon is not publicly available). Because Community Profile information is not available for Black Sturgeon IR (2011 or 2016), baseline conditions, as taken from the 2016 Census, are presented for Lynn Lake only. It is acknowledged that baseline conditions presented in Section 13.2.2 may not represent overall conditions within the LAA.

13.2.2 Overview

13.2.2.1 Population

In the mid-1970s, the Town of Lynn Lake reached a peak population of 3,500 residents; however, the population dropped to 830 by 1991 following partial and permanent mine closures (Lynn Lake Mayor and Council 2014). In 1994, Blackhawk Mining began operation and the population rebounded to 1,200 until 2000 (Lynn Lake Mayor and Council 2014). As Blackhawk Mining operations wound down around the year 2000, the skilled workforce began to leave the town and region (Lynn Lake Mayor and Council 2014). In 2011, the official population count was 674 residents and during the most recent Census in 2016, it had decreased by nearly 30% to 490 (Table 13-4; Statistics Canada 2012, 2017). The Indigenous[2] population of Lynn Lake accounted for 48.0% of the total population in 2016 (Statistics Canada 2017).

Part of the reason for the decrease in population is the establishment of the Black Sturgeon IR in the intervening years (pers. comm. 2015). The reserve is associated with the Marcel Colomb First Nation and was established through the Manitoba Treaty Land Entitlement Framework Agreement in 1997 (Tetra Tech 2013). At the time, members of the Marcel Colomb First Nation were part of the Mathias Colomb Cree Nation; however, Marcel Colomb First Nation became a distinct band in 1999 (Tetra Tech 2013).

Prior to the establishment of the reserve, members lived outside of and in the Town of Lynn Lake. As of September 2015, the population of Black Sturgeon IR was estimated at 200 and another 150 members live in the Town of Lynn Lake (pers. comm. 2015b). As of December 2019, the Marcel Colomb First Nation had a membership of 449 and, at that time, just over 75% lived on-reserve or on Crown land (Table 13-5; INAC 2020a).

Table 13-4 Population of Service Centres in RAA, 2011 and 2016

Location	2016 Population			2011 Population			Percent (%) Change (2011-2016)	Percent (%) Indigenous (2016)
	Total	Male	Female	Total	Male	Female		
Lynn Lake	490	235	255	674	-	-	-26.7	48.0
Leaf Rapids	580	290	290	450	205	245	16.9	62.0
Thompson	13,680	6,915	6,765	12,825	6,525	6,300	4.2	43.0
Manitoba	1,278,370	631,400	646,970	1,208,265	594,550	613,715	5.8	17.5

NOTES: - Data not available. 2011 total population counts were updated for the Town of Lynn Lake (from 480 to 674) with the 2016 Census. Updated information on males and female subpopulations were not updated.
SOURCE: Statistics Canada 2012, 2017

[2] *Indigenous* includes statistics for Aboriginal identity. Statistics Canada defines Aboriginal identity as persons who self-identify as being an Aboriginal person. This includes those who are First Nations (North American Indian), Métis or Inuk (Inuit) and/or those who are Registered or Treaty Indians (that is, registered under the *Indian Act* of Canada) and/or those who have membership in a First Nation or Indian band. Aboriginal peoples of Canada are defined in the Constitution Act, 1982, section 35 (2) as including the Indian, Inuit and Métis peoples of Canada.

The Town of Leaf Rapids was constructed during the early 1970s to meet the demands of the Ruttan Mine. The population decreased after the closure of the mine in 2002 but increased from 498 to 580 (nearly 17%) between 2011 and 2016 (Statistics 2017).

The City of Thompson was established in the late 1950s after the International Nickel Company of Canada discovered an ore body in what is now known as the Thompson Nickel Belt. The City has since evolved as a diverse urban center, functioning as a regional service hub for approximately 72,000 people (Northern Region of Manitoba), providing a range of goods and services to regional communities, including retail, education, health, and other government services. The population of Thompson decreased approximately 12% between 1991 and 2011; however, between 2011 and 2016, the City's population increased approximately 4%, from 13,123 to 13,680 (Statistics Canada 2017).

Table 13-5 Registered Population of First Nations with Reserves in the RAA, December 2019

Location	2020				
	Total Population	On Reserve or Crown land[1]		Off Reserve or Crown land[2]	
		Male	Female	Male	Female
Marcel Colomb First Nation[3]	450	176	162	64	48
Mathias Colomb Cree Nation[4]	3,909	1,326	1,160	661	762
O-Pipon-Na-Piwin Cree Nation[5]	1,713	605	521	301	286
Peter Ballantyne Cree Nation[6]	11,375	3,713	3,587	1,969	2,106

NOTES:
1) includes population counts for persons 'on own reserves', 'on other reserves', 'on own Crown land', and on 'other Band Crown land'
2) Includes 'on no Band Crown land' and 'off reserve'
3) Black Sturgeon IR is within the LSA
4) Granville Lake IS is within the RSA; other populated reserves fall outside the study area.
5) South Indian Lake IS is within the RSA; other populated reserves fall outside the study area.
6) Kinoosao-Thomas Clarke 204 IR is within the RSA; other populated reserves as part of Peter Ballantyne Cree Nation fall outside the study area.
SOURCE: INAC 2020a, 2020b, 2020c, 2020d

13.2.2.2 Economy

The economies of the main population centres in the LAA and RAA (i.e., the towns of Lynn Lake and Leaf Rapids and the City of Thompson) have historically been based on mining as the primary industry. All three population centres were built to serve mines in the mid-20th century. With the closing of the Blackhawk Mining operation in 2001, the Town of Lynn Lake experienced a large decrease in employment opportunities and the town has since been unsuccessful in developing strong secondary industries (Lynn Lake Mayor and Council 2014).

Currently, the LAA economy is heavily reliant on government funding. Most jobs are in the public sector, mainly the public school and hospital (pers. comm. 2015c). Other government funding comes in the form of special project funding and Child Tax Credits and welfare (Lynn Lake Mayor and Council 2014).

Elsewhere in the RAA, services and businesses are mainly available in the City of Thompson, the regional service center for northern Manitoba. Thompson was constructed to service the mining industry and still relies on Vale Ltd. mining operations. Thompson is the principal regional trade and service centre in northern Manitoba and many people are employed by government at the federal, provincial, and local levels. Section 13.2.2.3 provides an overview of the LAA and RAA labour force and employment by industry and occupation.

Table 13-6 provides a summary of businesses and public service providers operating within the Town of Lynn Lake (as of December 2019) by North American Industry Classification System (NAICS) code.

Table 13-6 Businesses/Public Service Providers Operating within the Town of Lynn Lake, December 2019

NAICS Code (Sectors)	Business/Public Service Providers
21 - Mining, quarrying, and oil and gas extraction	0905144 B.C. Ltd.; 5918139 Manitoba Inc.; Alamos Gold; Bishopsgate Exploration Ltd.; Copper Reef Mining Corporation; Exiro Minerals Corporation; Peter C. Dunlop; Rockcliff Copper Corp.; Strider Resources Limited; Victory Nickel Inc.; VMS Ventures Inc.
44-45 - Retail trade	Clarke’s Pharmacy; Connie’s Jewelry; Halstead Motors; Lynn Lake Esso (Lynn Lake SNC); Northern Store; Osmond’s Investments; Lynn Inn Inc. Store
48-49 - Transportation and warehousing	King of Obsolete; Mid North Hauling; Osmond’s Investments; Timber Wolf Trucking Ltd.; YYL Airport Inc.; Canada Post (Post Office)
51 - Information and cultural industries	Lynn Lake Centennial Public Library
61 - Educational services	West Lynn Heights School
62 - Health care and social assistance	Lynn Lake Friendship Centre Inc.; Lynn Lake Hospital
71 - Arts, entertainment, and recreation	Corner Pocket Billiards & Hall*; Lynn Lake Mining Town Museum
72 - Accommodation and food services	Lynn Inn Inc.; Route 391 Bar & Grill; The Bronx Motel
81 - Other services (except public administration)	Northwest Community Futures Development Corporation; St. Maria Goretti Catholic Church
91 - Public administration	Manitoba Transportation (Highways);Royal Canadian Mounted Police (RCMP); Conservation and Climate; Town of Lynn Lake

SOURCE:
Town of Lynn Lake 2019; Statistics Canada 2019a; Pers. comm 2020.
*Open by appointment or special request only

In 2015, the Economic Development Officer with the Town of Lynn Lake noted that most of the town residents who were previously employed by mining operations near Lynn Lake, and who have stayed within the community after closure of these mines, are now retired (pers. comm. 2015c). This notion is supported by the position of the Lynn Lake Mayor and Council, who in 2014, noted that the resident labour force of Lynn Lake was largely unskilled and not looking for work (Lynn Lake Mayor and Council 2014). Mayor and Council further note that when new positions become available within the community it is often difficult to fill them locally because of a lack of skilled labour and that it can be difficult to attract skilled workers from outside the community (Lynn Lake Mayor and Council 2014). In 2003, Carlisle Goldfields Limited began gold exploration in the area and brought in workers from elsewhere, housing them in a camp outside of the existing town (Lynn Lake Mayor and Council 2014).

Since the closure of the mines, the region has tried to develop its tourism industry, which is based largely around fishing and hunting. The industry generates seasonal work for local guides as well as some economic spinoffs for the Town of Lynn Lake, which is used as a staging area for visiting anglers and hunters. In 2014, the Town of Lynn Lake identified several economic development goals, including encouraging new mineral resource development, promoting tourism, and partnering with the Centre for Livelihoods and Ecology to conduct a feasibility study for the development of an essential oils enterprise (Lynn Lake Mayor and Council 2014).

In 2015, it was noted that there were no businesses on the Black Sturgeon IR; a community store had previously operated but had closed due to financial issues (pers. comm. 2015b). At the time, unemployment was estimated at 90% (pers. comm. 2015b). Members of the community were primarily employed through the Band administration and about 20 members gained seasonal employment as guides (pers. comm. 2015b). A few members of the First Nation were employed at the mines when they were in operation (pers. comm. 2015b). From 2008 to 2012, members of the First Nation were involved in the remediation of the Farley Lake Tailings Management Area (pers. comm. 2015b). The First Nation has also been active in bidding on road work with the Province (pers. comm. 2015b).

Gross Domestic Product

Gross domestic product (GDP), the total value of all goods and services produced in a given area (e.g., Manitoba, the LAA or RAA) over a given period (typically on an annual basis), provides a global measure of the performance of an economy. In 2018, Manitoba’s GDP was estimated at $67.4 billion (current dollars, market price; Statistics Canada 2020a). Manitoba’s GDP represented 3.3% of Canada’s total GDP (Statistics Canada 2020a).

While GDP estimates are not readily available at the LAA level from Statistics Canada, assuming a similar level of per-capita GDP contributions as the provincial average, 2018 GDP estimate for Lynn Lake (population counts for Black Sturgeon IR are unavailable; Section 13.2.1) is $26 million.

13.2.2.3 Labour Force

Labour Force Indicators

Labour force indicators for Lynn Lake and the RAA are summarized in Table 13-7. Labour force indicators for Manitoba are summarized in Table 13-8. In 2016, there were a total of 175 persons (62.9% female) in the Lynn Lake’s labour force and 8,290 persons (46.5% female) in the RAA labour force (Table 13-7). Participation rates were 62.5% and 73.7% respectively. Compared to the provincial average participation rate (66.1%) a lesser proportion of people within Lynn Lake and a greater proportion of people within the RAA were either employed or actively seeking employment.

The Indigenous labour force of Lynn Lake totaled 70 persons (78.6% of whom were female), representing 40.0% of the total labour force. The RAA labour force totaled 3,090 persons (48.7% female), representing 37.3% of the total labour force. Generally, participation rates among the Indigenous population were lower than total population participation rates within Lynn Lake and the RAA and greater than provincial Indigenous averages (except for Indigenous males within Lynn Lake).

In terms of unemployment, the Indigenous labour force has higher unemployment rates than the non-Indigenous labour force of Lynn Lake and the RAA (a similar discrepancy seen across the province). Unemployment rates within Lynn Lake and the RAA were generally greater than provincial averages (total and Indigenous population).

Table 13-7 Labour Force Indicators, LAA and RAA – 2016

Topic	Total Population			Indigenous Population[1]		
	Total	Male	Female	Total	Male	Female
LAA						
Population aged 15 years+	280	115	165	235	95	140
Labour force	175	65	110	70	15	55
Participation rate (%)	62.5	56.5	66.7	29.8	15.8	39.3
Employed	155	45	110	65	10	55
Unemployed	15	15	0	10	10	0
Unemployment rate (%)	8.6	23.1	-	14.3	66.7	-
RAA						
Population aged 15 years+	11,250	5,685	5,565	7,415	3,570	3,845
Labour force	8,290	4,435	3,855	3,090	1,585	1,505
Participation rate (%)	73.7	78.0	69.3	41.7	44.4	39.1
Employed	7,575	4,015	3,560	2,580	1,255	1,325
Unemployed	730	425	305	525	335	190
Unemployment rate (%)	8.8	9.6	7.9	17.0	21.1	12.6

NOTES:

- Data not available

1) Indigenous and non-Indigenous totals may not sum to equal total population counts as they are based on a 25% population sample size

Total may not sum due to rounding.

Values shown in "Total" columns are the sum of male and female CSD subsets taken from Statistics Canada's 2016 Census Profile (Census of the Population). Due to Statistics Canada rounding (Statistics Canada 2019c) totals may not exactly align with those shown on CSD Census Profiles and may not sum across tables

SOURCE:

Statistics Canada 2017, 2018

Table 13-8 Labour Force Indicators – Manitoba, 2016

Topic	Total Population			Indigenous Population[1]		
	Total	Male	Female	Total	Male	Female
Manitoba						
Population aged 15 years+	1,001,305	491,580	509,725	223,305	108,495	114,810
Labour force	662,150	347,685	314,465	87,815	44,230	43,585
Participation rate (%)	66.1	70.7	61.7	39.3	40.8	38.0
Employed	617,465	322,130	295,335	74,770	36,685	38,085
Unemployed	44,690	25,560	19,130	13,040	7,545	5,495
Unemployment rate (%)	6.7	7.4	6.1	14.8	17.1	12.6

NOTES:

1) Indigenous and non-Indigenous totals may not sum to equal total population counts as they are based on a 25% population sample size

Total may not sum due to rounding.

Values shown in "Total" columns are the sum of male and female CSD subsets taken from Statistics Canada's 2016 Census Profile (Census of the Population). Due to Statistics Canada rounding (Statistics Canada 2019c) totals may not exactly align with those shown on CSD Census Profiles and may not sum across tables

SOURCE:

Statistics Canada 2017, 2018

Employment by Industry

Industry Employment within the LAA

The following sections present labour force employment information by North American Industry Classification (NAICS). The system provides common definitions of the industrial structure of Canada, Mexico, and the United States. Information below is presented at the two-digit NAICS or sector level. Because of this not all industries comprising a sector may be applicable to the LSA or RSA (e.g., the 'agricultural industry' in the 'agriculture, forestry, fishing, and hunting' sector may not be relevant).

Total Population

In 2016, employment within Lynn Lake was greatest in educational services (29% of the labour force or 50 persons), health care and social assistance (17% or 30 persons) and transportation and warehousing (14% or 25 persons; Appendix 13B Figure 13B-1). Within educational services, females accounted for the greatest percentage of employment in each of these industries (80%, 100%, and 100%, respectively). Males accounted for 100% of employment in construction, manufacturing, wholesale trade, public administration, and industries not applicable to the North American Industry Classification System (NAICS). Employment was evenly distributed among males and females in accommodation and food services. The remaining industries had no reported employment in 2016. Compared to provincial averages employment within Lynn Lake is substantially less diversified.

Indigenous Population

Labour force employment by sector for the Indigenous population is illustrated in Appendix 13B, Figure 13B-2. Like the total population of Lynn Lake, employment was greatest in health care and social assistance (31% of the labour force or 20 persons), transportation and warehousing (31% or 20 persons) and educational services (23% or 15 persons). Employment within health care and social assistance and educational services was completely attributable to females. Employment in transportation and warehousing was evenly divided among males and females, while males accounted for the entirety of employment in agriculture, forestry, fishing, and hunting. The remaining industries had no reported employment in 2016 in the LAA. Compared to provincial Indigenous averages, employment within Lynn Lake is substantially less diversified.

Industry Employment within the RAA

Total Population

In 2016, employment within the RAA was greatest in mining, quarrying, and oil and gas extraction (16% of the labour force or 1,300 persons), health care and social assistance (15% or 1,045 persons) and educational services (11% or 695 persons; Appendix 13B, Figure 13B-3). Females accounted for the greatest percentage of employment in health care and social assistance (83%) and educational services (78%) while males accounted for the greatest percentage of employment in mining, quarrying, and oil and gas extraction (93%).

Overall, employment in the RAA across industries (total population) was similar to provincial averages, with notable differences (greater than a five-percentage point difference) limited to a greater proportion of RAA workers employment in mining, quarrying, and oil and gas extraction (16% vs. 1%). Variations in the proportion of male versus female employment are seen across most RAA industries when compared to provincial averages.

Indigenous Population

Labour force employment by industry for the Indigenous population within the RAA is illustrated in Appendix 13B, Figure 13B-4. In 2016, employment among the Indigenous population of the RAA was greatest in health care and social assistance (17% of the labour force or 525 persons), mining, quarrying, and oil and gas extraction (12% or 375 persons) and accommodation and goods and services (12% or 360 persons). Females accounted for the greatest percentage of employment in health care and social assistance (73%) and accommodation and food services (64%) whereas males accounted for the greatest percentage of employment in mining, quarrying, and oil and gas extraction (91%).

Overall, employment among the Indigenous portion of the RAA was like Indigenous provincial averages (Appendix 13B, Figure 13B-4) with notable differences (five percentage point difference) limited to the proportion of workers employed mining, quarrying, and oil and gas extraction (12% in the RAA vs. 1% for the province). Variations in the proportion of male versus female employment are seen across many RAA industries when compared to provincial averages.

Employment by Occupation

Occupational Employment within the LAA

Total Population

Occupational employment (percent of labour force) patterns for Lynn Lake are shown in Appendix 13B, Figure 13B-5. In 2016, employment was greatest in education, law and social, community and government service occupations (32% of the labour force or 50 persons), followed by business, finance and administration occupations (19% or 30 persons) and trades, transport and equipment operation (16% or 25 persons). Females accounted for the greatest percentage of employment in education, law and social, community and government occupations (80%) and businesses, finance, and administration occupations (100%). Males accounted for the entirety of employment in trades, transport, and equipment operation. There was no reported employment in management, manufacturing, and utilities occupations or in occupations not included in the National Occupational Classification (NOC) system. Compared to provincial averages employment within Lynn Lake is substantially less diversified.

Indigenous Population

Occupational employment among the Indigenous population of Lynn Lake is concentrated in businesses, finance and administration; health; education, law and social, community and government services; and sales and service occupations, each employing 21% of the labour force (or 15 persons each; Appendix 13B, Figure 13B-6). Employment in these industries was completely attributable to females. Males accounted for the entirety of employment in trades, transport, and equipment operation, which represented 14% of the total Indigenous labour force (10 persons).

Occupational Employment within the RAA

Total Population

Occupational employment (percent of labour force) patterns for the RAA are shown in Appendix 13B, Figure 13B-7. In 2016, employment was greatest in sales and service (22% of the labour force or 1,815 persons), followed by trades, transport, and equipment operation (17% or 1,385 persons) and occupations in education, law and social, community and government services (17% or 1,375 persons). Females accounted for the greatest percentage of employment in sales and service (58%) and occupations in education, law and social, community and government services (73%). Males accounted for 98% of employment within trades, transport, and equipment operation occupations.

Overall, employment in the RAA across occupations (total population) was similar to provincial averages, with notable differences (greater than a five-percentage point difference) limited to a greater proportion of RAA workers employment in natural resources, agriculture and related production occupations (9% vs. 3%). Variations in the proportion of male versus female employment are seen across most RAA industries when compared to provincial averages.

Indigenous Population

Labour force employment by occupation for the Indigenous population is illustrated in Appendix 13B, Figure 13B-8. Like the total population of the RAA, employment was greatest in sales and service (26% of the labour force or 795 persons), occupations in education, law and social, community, and government services (17% or 530 persons), and trades, transport and equipment operation (16% or 490 persons). Females accounted for 60% of employment in sales and service occupations and 77% of employment in education, law and social, community and government service occupations. Males accounted for 98% of employment in trades, transport, and equipment operation.

Overall, employment in the RAA across occupations (total Indigenous population) was similar to provincial Indigenous averages, with notable differences (greater than a five-percentage point difference) limited to a greater proportion of RAA workers employment in natural resources, agriculture and related production occupations (11% vs. 3%). Variations in the proportion of male versus female employment are seen across most RAA industries when compared to provincial averages.

13.2.2.4 Education

Educational attainment for the LAA and RAA is summarized in Table 13-9. Education attainment within Manitoba is summarized in Table13-10. As of 2016, 46.4% of the total population (aged 15 years and over) of Lynn Lake and 28.6% of the Indigenous population of Lynn Lake had completed post-secondary (i.e., greater than secondary [high school]) education. Within the RAA these percentages were 44.3% and 28.1%, respectively.

Across the population of Lynn Lake and the RAA males accounted for the greatest percentage of the persons with an apprenticeship or trades certificate or diploma, while females accounted for the greatest percentage of the population with all other forms of educational attainment. Compared to provincial averages a lower level of educational attainment is observed within Lynn Lake and the RAA.

Table 13-9 Educational Attainment, 2019 – LAA and RAA

Topic	Total Population				Indigenous Population[1]			
	Total		Male (%)	Female (%)	Total		Male (%)	Female (%)
	Number	Percent (%)			Number	Percent (%)		
Lynn Lake								
No certificate, diploma, or degree	170	35.1	38.2	61.8	60	42.9	33.3	66.7
Secondary (high) school diploma or equivalency certificate	90	18.6	38.9	61.1	40	28.6	37.5	62.5
Apprenticeship or trades certificate or diploma	75	15.5	80.0	20.0	25	17.9	60.0	40.0
College, CEGEP or other non-university certificate or diploma	85	17.5	11.8	88.2	15	10.7	0.0	100.0
University certificate or diploma below bachelor level	0	0.0	0.0	0.0	0	0.0	0.0	0.0
University certificate, diploma, or degree at bachelor level or above	65	13.4	61.5	38.5	0	0.0	0.0	0.0
Total	**485**	**100.0**			**140**	**100.0**		
RAA								
No certificate, diploma, or degree	5,360	27.6	56.6	43.4	2,160	44.6	53.7	46.3
Secondary (high) school diploma or equivalency certificate	5,460	28.1	50.1	49.9	1,320	27.3	46.2	53.8
Apprenticeship or trades certificate or diploma	1,820	9.4	79.4	20.6	325	6.7	80.0	20.0
College, CEGEP or other non-university certificate or diploma	3,155	16.3	40.3	59.7	600	12.4	30.8	69.2
University certificate or diploma below bachelor level	650	3.3	33.1	66.9	150	3.1	26.7	73.3
University certificate, diploma, or degree at bachelor level or above	2,970	15.3	38.4	61.6	285	5.9	14.0	86.0
Total	**19,415**	**100.0**			**4,840**	**100.0**		

NOTES:

[1] Indigenous and non-Indigenous totals may not sum to equal total population counts as they are based on a 25% population sample size

Total may not sum due to rounding.

Values shown in “Total” columns are the sum of male and female CSD subsets taken from Statistics Canada’s 2016 Census Profile (Census of the Population). Due to Statistics Canada rounding (Statistics Canada 2019c) totals may not exactly align with those shown on CSD Census Profiles and may not sum across tables.

Data is presented for persons aged 15 years and older (aligns with statistics on labour force status).

SOURCE

Statistics Canada 2017, 2018

Table 13-10 Educational Attainment, 2019 – Manitoba

Topic	Total Population				Indigenous Population[1]			
	Total		Male (%)	Female (%)	Total		Male (%)	Female (%)
	Number	Percent (%)			Number	Percent (%)		
No certificate, diploma, or degree	94,310	14.4	58.0	42.0	63,180	41.1	52.4	47.6
Secondary (high) school diploma or equivalency certificate	182,330	27.9	51.0	49.0	41,640	27.1	47.3	52.7
Apprenticeship or trades certificate or diploma	53,805	8.2	71.0	29.0	10,950	7.1	68.5	31.5
College, CEGEP or other non-university certificate or diploma	137,930	21.1	41.6	58.4	22,825	14.9	35.1	64.9
University certificate or diploma below bachelor level	21,215	3.2	42.4	57.6	3,410	2.2	33.1	66.9
University certificate, diploma, or degree at bachelor level or above	165,085	25.2	43.0	57.0	11,535	7.5	32.0	68.0
Total	**654,675**	**100.0**			**153,540**	**100.0**		

NOTES:

[1] Indigenous and non-Indigenous totals may not sum to equal total population counts as they are based on a 25% population sample size

Total may not sum due to rounding.

Values shown in "Total" columns are the sum of male and female CSD subsets taken from Statistics Canada's 2016 Census Profile (Census of the Population). Due to Statistics Canada rounding (Statistics Canada 2019c) totals may not exactly align with those shown on CSD Census Profiles and may not sum across tables.

Data is presented for persons aged 15 years and older (aligns with statistics on labour force status).

SOURCE

Statistics Canada 2017, 2018

13.2.2.5 Individual Income

Table 13-11 provides information on total and employment incomes for individuals within Lynn Lake, the RAA and Manitoba. Total income represents the sum of regular and recurring monetary receipts from part-time and full-time employment income, income from investment sources, income from employer and personal pension sources, other regular cash income (e.g., child support payments and spousal support payments), and income from government sources (e.g., social assistance). Employment income is the sum of wages, salaries, tips, commissions, and net income from self-employment.

In 2015, most incomes (total, employment, mean and median) within Lynn Lake and incomes within the RAA were above provincial averages. Exceptions includes lower median employment incomes among males across the total population and lower average total incomes among Indigenous females. Employment income (median and mean) for the male proportion of the Indigenous population of Lynn Lake is not publicly available; however, based on female and total Indigenous population averages employment income among indigenous males is understood to be less than provincial averages. Total incomes and employment incomes among non-Indigenous populations of Lynn Lake, the RAA and Manitoba are understood to be greater than those among the Indigenous population.

Table 13-11 Individual Income (Annual – Before Tax), 2015

Topic		Total Income			Indigenous Population[1]		
		Total	Male	Female	Total	Male	Female
Lynn Lake							
Total Income	Median	31,520	31,040	31,808	25,605	17,858	31,808
	Mean	45,169	51,292	41,042	31,372	29,408	32,213
Employment Income	Median	32,128	31,296	32,192	25,405	-	25,366
	Mean	51,381	58,782	45,707	35,443	-	34,306
RAA							
Total Income	Median	42,154	55,450	33,107	30,346	38,274	26,719
	Mean	52,755	64,749	40,572	40,645	49,721	32,717
Employment Income	Median	42,732	57,875	33,668	33,671	43,753	24,796
	Mean	54,136	66,083	40,519	43,693	53,853	33,030
Manitoba							
Total Income	Median	34,188	40,379	29,220	23,427	24,005	23,100
	Mean	43,767	51,068	36,747	31,525	34,011	29,321
Employment Income	Median	33,677	39,365	28,679	26,013	28,689	23,914
	Mean	42,551	49,417	35,168	33,732	37,702	29,776

NOTES:

[1] Indigenous and non-Indigenous totals may not sum to equal total population counts as they are based on a 25% population sample size

Total income is presented for persons aged 15 years and older and is the sum of regular and recurring monetary receipts from part-time and full-time employment income (e.g., wages, tips, and commissions), income from investment sources (e.g., dividends, guaranteed investment certificates, and mutual funds), income from employer and personal pension sources (e.g., private pensions and payments from annuities and registered retirement income funds), other regular cash income (e.g., child support payments and spousal support payments), and income from government sources (e.g., social assistance, Employment Insurance benefits, Old Age Security benefits, and Canada Pension Plan benefits and disability income).

Employment income is the sum of wages, salaries, tips, commissions, and net income from self-employment.

Values shown in “Total” columns are the sum of male and female CSD subsets taken from Statistics Canada’s 2016 Census Profile (Census of the Population). Due to Statistics Canada rounding (Statistics Canada 2019c) totals may not exactly align with those shown on CSD Census Profiles and may not sum across tables

SOURCE:
Statistics Canada 2017, 2018

13.2.2.6 Household Low Income Measure and Low-Income Cut-Offs, After Tax

Two standard measures published by Statistics Canada are used to measure economic wellbeing of households (in terms of income). These include low-income measure after tax (LIM-AT) and low-income cut-off after tax (LICO-AT). LIM-AT delineates a dollar threshold (50% of median income, adjusted for household size) below which a household is in a low-income situation (Statistics Canada 2015a). LICO-AT represent a dollar threshold (defined as the income threshold below which a household would spend 20 percentage points more than average households on basic necessities such as food, shelter and clothing in a given geography; Statistics Canada 2015b). Summary information on the percent of the LAA, RAA and provincial population falling below LIM-AT and LICO-AT thresholds is provided in Table 13-12.

Overall, when compared to provincial averages a greater percentage of Lynn Lakes population (total and Indigenous) fell below the LIM-AT threshold in 2015 but a lesser percentage below the LICO-AT threshold. This differential suggests that the prevalence of households in low income situations within Lynn Lake is more pronounced than other locations within the province but that the cost of securing basic needs such as food, shelter, and clothing account for an overall lower percentage of total income. The percentage of populations (total and Indigenous) below the LIM-AT threshold in the RAA is like that of provincial averages with fewer households below the LICO-AT threshold. Except for the percentage of Indigenous households within Lynn Lake below the LICO-AT threshold, a greater percentage of Indigenous households (Lynn Lake, RAA and province) are in low income situations (LIM-AT and LICO-AT) than non-Indigenous populations.

Table 13-12 LIM-AT and LICO-AT, 2015

Category	Total Population (%)			Indigenous Population (%)		
	Total	Male	Female	Total	Male	Female
Lynn Lake						
LIM-AT	32.2	30.4	34.0	38.9	42.1	35.7
LICO-AT	6.3	6.5	6.0	2.6	-	-
RAA						
LIM-AT	15.6	13.5	17.8	25.1	22.1	28.2
LICO-AT	6.6	5.9	7.4	8.9	8.0	9.9
Manitoba						
LIM-AT	15.4	14.6	16.1	29.7	27.8	31.7
LICO-AT	9.9	9.7	10.0	19.8	18.4	21.2

NOTES:
- Data not available

SOURCE:
Statistics Canada 2017, 2018

13.2.2.7 Average Wages by Industry

Table 13-13 provides a summary of average hourly wages (2019) for Manitoba workers in forestry, fishing, mining, quarrying and oil and gas, construction, and professional, scientific, and technical services (industries likely to provide direct labour to the Project). Average annual wages were applied to two scenarios to estimate average annual employment; results are shown in Table 13-12. As calculated, estimated annual wages under scenario one are based on full-time employment and 2,100 person hours per year (no overtime); scenario two is based on 12-hour workdays and a two-week on/two-week off work schedule (overtime after 40 hours per week); and scenario 3 is based on 10-hour workdays and a three-week on/one-week off work schedule (overtime after 40 hours per week).

Table 13-13 Average Annual Employee Wages by Industry

Industry	Average Hourly Wage (2019)	Estimate 1 - Annual Wage (based on 2,100 hrs/year)	Estimate 2 - Annual Wage (based on 12-hour 2X2 work schedule)[1]	Estimate 2 - Annual Wage (based on 10-hour 3X1 work schedule)[1]
Forestry, fishing, mining, quarrying, oil and gas	$33.92	$71,000	$93,000	$121,000
Construction	$28.23	$59,000	$77,000	$100,000
Professional, scientific, and technical services	$32.15	$67,000	$88,605	$114,000

NOTES:
[1] Assumes overtime payments beyond 40 hours per week; rounded down to nearest thousand
SOURCE:
Statistics Canada 2020b

13.2.2.8 Municipal Government Revenue

Table 13-14 provides summary information on municipal revenue for communities within the LAA. In 2016, the latest year for which municipal financial data are publicly available from the Municipal Finance and Advisory Services Branch (MFASB) of Manitoba Municipal Relations, Lynn Lake posted positive revenues of $1.4 million. 2016 revenues were up 2.9% from 2015 but represented a decrease of 6.8% over the preceding four-year average (2012-2015). This decrease is attributable to higher revenues in 2012 (almost $2.0 million) as revenues between 2013 and 2015 were all less than the 2016 figure.

Table 13-14 Municipal Revenues, 2012-2016

Revenue Line	2016	2015	2014	2013	2012
Property Taxes	625,292	634,445	632,691	632,691	506,208
Grants in Lieu of Taxation	137,249	126,288	140,189	140,189	130,517
User Fees	67,594	54,471	82,790	82,790	177,133
Permits, Licenses & Fines	7,367	1,490	2,105	2,105	2,145
Investment Income	11,910	13,015	16,365	16,365	14,965
Other Revenue	60,594	99,197	58,638	58,638	77,742
Water & Sewer	365,752	315,608	317,693	317,693	733,300
Grants Province of Manitoba	114,058	104,659	129,285	129,285	212,136
Grants Other	34,667	34,671	38,969	38,969	38,969
Total Revenue	1,424,483	1,383,844	1,418,725	1,418,725	1,893,115

SOURCE:
MFASB 2019, 2018, 2016a, 2016b, 2016c

13.3 PROJECT INTERACTIONS WITH LABOUR AND ECONOMY

Table 13-15 identifies, for each potential effect, the physical activities that might interact with the VC and result in the identified environmental effect. These interactions are indicated by a check mark and are discussed in detail in Section 13.4, in the context of effects pathways, standard and project-specific mitigation/enhancement, and residual effects. A justification for no effect is provided following the table.

Project activities for each phase are described in detail in Chapter 2, Section 2.3 and 2.4. Project related emissions and discharges are described in Chapter 2, Section 2.8.

The potential interactions between Project activities and the environment were considered for the construction, operation, and decommissioning/closure phases of the Project. The identification of Project activities and their potential interactions was based on engagement with interested parties, the professional judgment of technical specialists involved in the assessment, and a review of existing conditions. The selection of interactions is informed by the potential effects and effects pathways for each VC as described in Section 13.1.3.

Project employment and expenditures are generated by most Project activities and components and are the main drivers of many socio-economic effects. Rather than acknowledging this by placing a check mark against each of these activities, "Employment and Expenditure" have been consolidated as an integrated activity for efficiency of approach.

Table 13-15 Project-Environment Interactions with Labour and Economy

Project Activities and Components	Environmental Effects		
	Change in Regional Labour Force	Change in Regional Business	Change in Regional Economy
Construction			
Site Preparation at Both Sites (removal of existing buildings; removal of contaminated materials; vegetation clearing and earthworks; development of temporary construction camp at the MacLellan site)	–	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	–	–	–
Mine Components at Both Sites (construction of: ore pads; ore, overburden and mine rock storage areas; mill feed storage area and crushing plant, ore milling and processing plant, and tailings management facility (TMF) at the MacLellan site; water management facilities [e.g., sumps, ponds and ditches])	–	–	–

Table 13-15 Project-Environment Interactions with Labour and Economy

Project Activities and Components	Environmental Effects		
	Change in Regional Labour Force	Change in Regional Business	Change in Regional Economy
Utilities, Infrastructure, and Other Facilities at Both Sites (construction of: buildings and yards; access roads [i.e., upgrades at the Gordon and MacLellan site] and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at the MacLellan site; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities)	–	–	–
Water Development and Control at Both Sites (dewatering of existing pits at the Gordon site and underground workings at the MacLellan site; re-alignment of existing diversion channel at the Gordon site; interceptor wells at the Gordon site)	–	–	–
Emissions, Discharges, and Wastes[1]	–	–	–
Employment and Expenditure[2]	✓	✓	✓
Operation			
Open Pit Mining at Both Sites (drilling; blasting; removal, loading and on-site hauling of mined material [i.e., ore, overburden, and mine rock])	–	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA, including truck transportation of ore from the Gordon site to the Maclellan site)	–	–	–
Storage/Stockpiling of Ore, Overburden, and Mine Rock at Both Sites	–	–	–
Ore Milling and Processing at MacLellan Site (ore crushing and conveyance; ore milling)	–	–	–
Water Management at Both Sites (mine water collection and storage; process water supply for the MacLellan site including water intake on Keewatin River at the MacLellan site; pumping fresh/fire water from Farley Lake at Gordon site; operation of interceptor wells at the Gordon site)	–	–	–
Tailings Management at the MacLellan Site	–	–	–
Utilities, Infrastructure, and Other Facilities at Both Sites (presence and operation of: buildings and yards; access roads and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at the MacLellan site; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities; explosives storage, maintenance of access roads and bridges)	–	–	–

Table 13-15 Project-Environment Interactions with Labour and Economy

Project Activities and Components	Environmental Effects		
	Change in Regional Labour Force	Change in Regional Business	Change in Regional Economy
Emissions, Discharges, and Wastes[1]	–	–	–
Employment and Expenditure[2]	✓	✓	✓
Decommissioning/Closure			
Decommissioning at Both Sites	–	–	–
Reclamation at Both Sites	–	–	–
Post-Closure at Both Sites (long-term monitoring)	–	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	–	–	–
Emissions, Discharges, and Wastes[1]	–	–	–
Employment and Expenditure[2]	✓	✓	✓

NOTES:
✓ = Potential interaction
– = No interaction
[1] Emissions, Discharges, and Wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many Project activities. Rather than acknowledging this by placing a check mark against each of these activities, “Emissions, Discharges and Wastes” have been introduced as an additional component under each Project phase.
[2] Project employment and expenditures are generated by most Project activities and components and are the main drivers of many socio-economic effects. Rather than acknowledging this by placing a check mark against each of these activities, “Employment and Expenditure” have been introduced as an additional component under each Project phase.

Demand for labour and regional expenditures are the primary pathways through which the Project may affect labour and economy. Both pathways are captured through the identified interaction with “Employment and Expenditure”. Therefore, Project activities and components except for “Employment and Expenditure” are identified as having no interaction. The assessment of change in regional labour force, change in regional business, and change in regional economy is considered in the overall context of each Project phase (i.e., construction, operation, and decommissioning/closure).

13.4 ASSESSMENT OF RESIDUAL ENVIRONMENTAL EFFECTS ON LABOUR AND ECONOMY

The assessment of potential effects on labour and economy considers changes in local and regional labour supply, local and regional business, and local and regional economy. This section describes the assessment of each potential effect, applicable mitigation measures, and characterization of residual effects.

13.4.1 Analytical Assessment Techniques

Provincial and regional (i.e., Northern Region of Manitoba) estimates of direct, indirect, and induced economic impacts of Project construction, operation, and decommissioning/closure were provided by PricewaterhouseCoopers (PwC). The Northern Region of Manitoba, defined as that part of the province of Manitoba north of the 53rd parallel, includes Census Divisions 19, 21, 22 and 23. The LAA and RAA fall within Census Division 23.

PwC estimated economic impacts at the provincial level through Manitoba's Input-Output Model (IOM) and Tax Revenue Impact Assessment Model with input data (e.g., provincial allocations of operating and capital expenses) provided by Alamos (PwC 2020a, 2020b). Regional impacts were estimated by applying location quotients (i.e., a statistical measure used to determine a region's [i.e., the Northern Region of Manitoba] industrial specialization relative a larger geographical unit [Manitoba]) to each industry affected by the mine). Estimates of carbon taxes, based on projections provided by Alamos, were also provided by PwC at the provincial level (based on the federal Output-Based Pricing System). A copy of the economic impact assessment completed by PwC including explanation of analytic methods is provided as Appendix 13A.

Results of PwC's economic impact assessment are integrated into the assessment of 'change in local and regional labour force', 'change in local and regional business', and 'change in local and regional economy'. Residual Project effects at the LAA and RAA level were qualified using assumptions from Alamos regarding estimated levels of local employment and in consideration of effect pathways, mitigation and management measures, and existing conditions (Section 13.2). Where possible, residual economic effects are described in terms of direct, indirect, and induced effects, where:

- Direct effects result from labour demand from Alamos and its contractors during each Project phase and taxes paid by Alamos and its direct workforce.
- Indirect effects result from Project spending on goods and services (e.g., employment with suppliers/manufacturers of materials used during each Project phase).
- Induced effects result from spending by direct and indirect workers on consumer goods and services (e.g., restaurant servers, retail positions).

13.4.2 Change in Local and Regional Labour Force

13.4.2.1 Project Pathways

Project demand for labour has the potential to both beneficially and adversely affect local and regional labour forces. Beneficial effects include increases in local employment (direct, indirect, and induced) during construction, operation, and decommissioning/closure. Adverse effects primarily relate to decreased demand for labour as the Project transitions from operation into and through decommissioning/closure, resulting in loss of direct employment. Project pathways are the same for both the Gordon and MacLellan sites.

13.4.2.2 Mitigation

To enhance beneficial effects of the Project and mitigate adverse effects Alamos and/ or its contractors will, to the extent possible:

- Inform residents and Indigenous communities of job and procurement opportunities during all Project phases and implement a policy of local hire where priority is given to the workers from the LAA, followed by other parts of the RAA, other parts of Manitoba, and other parts of Canada.
- Post job qualifications in advance and identify available training programs and providers so that local and Indigenous residents can acquire the necessary skills and qualify for potential Project-related employment.
- Identify potential shortages of workers with specific skill requirements, and work with training and education facilities, Indigenous communities, and local communities to increase opportunities for local community members to obtain training required for Project participation.
- Require workers (not inclusive of summer students) 19 years and younger to have completed grade 12 or have an appropriate equivalency to prevent young people from leaving school prematurely.
- Workforce education to encourage healthy lifestyle choices, sensitivity training and strict enforcement of Alamos' health and safety policies.

Mitigation and management measures are the same for both the Gordon and MacLellan sites.

The implementation of the mitigation and management measures will be the responsibility of Alamos and/or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

Mitigation and management measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

13.4.2.3 Project Residual Effect

Direct Employment

Alamos estimates that an annual average direct workforce 406 full-time equivalents[3] (FTE) will be required over the two-year construction period, a 412 FTE workforce over the 13-year operational period, and an annual 90 FTE workforce during decommissioning/closure (PwC 2020a, PwC 2020b, Ausenco 2019). Annual average direct workforce estimates for Project construction and operation, by National Occupational Classification (NOC)[4], in FTEs are provided in Table 13-16. Estimates are based on Alamos' experience operating mines within North America (including the Young-Davidson and Island Gold Mines in Northern Ontario) and Project design. Estimates of annual average direct employment by NOC are not provided for decommissioning/closure due to the timing (i.e., well into the future) of this Project phase.

Table 13-16 Direct Workforce (FTEs) by NOC

NOC	Construction	Operation
Management	40	30
Business, finance, and administration	25	25
Natural and applied sciences	20	20
Sales and service	311	325
Trades, transport, and equipment operators and related	10	12
Total	406	412
SOURCE: Ausenco 2019, Statistics Canada 2019b		

Through economic modelling completed for the Project, Alamos estimates that 100% of direct employment effects will occur in the Northern Region of Manitoba; an area that includes the LAA and RAA. Compared to existing labour force conditions (Section 13.2.2.3), employment estimates for the Northern Region exceed the overall available labour force size and scope of occupations available to respond Project demands). Given baseline labour force conditions and uncertainty regarding the extent to which local works apply to work on the Project (mitigation measures identified in Section 13.4.2.3 work to increase local content), Alamos estimates that 5% of direct Project labour (construction, operation, decommissioning/

[3] Defined as the number of hours worked by one individual on a full-time basis. FTEs are used to describe the total hours worked by several part-time employees (e.g., contract, seasonal, fulltime) into the hours worked by full-time employees.

[4] "The NOC provides a systematic classification structure that categorizes the entire range of occupational activity in Canada. Its detailed occupations are identified and grouped primarily according to the work performed, as determined by the tasks, duties and responsibilities of the occupation" (Statistics Canada 2019b).

closure) may be sourced from the LAA. The remaining 95% of labour demand will be satisfied using a fly-in/fly-out (FIFO) or drive-in/drive-out (DIDO) workforce recruited from other parts of the RAA (e.g., City of Thompson), Manitoba (including other locations within the Northern Region), and Canada as well as from foreign markets.

A summary of local employment effects (FTEs and jobs) is provided in Table 13-17. Because estimates of local hires are highly variable (contingent not only the supply of qualified workers but also on the extent to which local workers seek employment with the Project) estimates of employment by NOC within the LAA are not provided. It is possible that Project employment could result in the in-migration of workers (and their families) to the LAA; however, due to workforce planning that calls for the use of a FIFO/DIDO workforce to satisfy a large percentage (i.e., 95%) of labour demand, the likelihood of this occurring is low. It is therefore assumed that most local employment (5% of total direct demand), would flow to usual (or already existing) residents of the LAA assuming local residents seek employment with the Project and are appropriately skilled. Note that the information presented in Table 13-17 is based on modelling and estimates of local employment. Actual direct employment and income may vary substantively.

Table 13-17 Estimates of Direct Employment (FTEs) and Labour Income (undiscounted), North Region

Category	Construction		Operation		Decommissioning/ Closure	
	Lynn Lake (LAA)	Northern Region	Lynn Lake (LAA)	Northern Region	Lynn Lake (LAA)	Northern Region
FTEs	20	386	20	392	5	85
Direct labour income/FTE, average ($)[1]	$95,000		$130,000		$76,000	

NOTES:

1) Labour income estimates per FTE have been rounded down to the nearest thousand. Values are undiscounted (i.e., not adjusted to incorporate the time value of money).

Estimates of economic impacts are taken from PwC 2020a and PwC 2020b.

Recognizing that the Indigenous population represents 40% of Lynn Lake's labour force and just over 37% of the RAA labour force (17.9% of Lynn Lakes Indigenous labour force (equal to 33.3% of the total labour force) hold an apprenticeship or trades certificate or diploma while 6.7% (equal to 17.9% of the total labour force) of the RAA population hold an apprenticeship or trades certificate or diploma)) and because of uncertainty regarding the degree to which Indigenous persons and women will seek employment with the Project, it is conservatively assumed that the Project will likely employ more non-Indigenous than Indigenous persons. It is also possible that the Project could employ more males than females because most jobs associated with the Project will be in trades- and construction-related occupations and industries that have disproportionately high employment among males (Section 13.4.2). To address issues of diversity and inclusion, Alamos, will implement the mitigation and management measures identified in Section 13.4.2.2. With the implementation of mitigation and management measures, and in consideration of local employment estimates, the Project is expected to result in positive, low magnitude effects on direct employment within the LAA and RAA.

Transition from Project Operation to Decommissioning/Closure

As the Project transitions into decommissioning/closure, a planned decrease in workforce that ultimately results in the loss of employment will occur. This loss of employment is known and will be anticipated by Project workers as the operational life of the Gordon site and the MacLellan site will be communicated at early stages of the Project. Mitigating the magnitude of this loss of employment is the gained labour income, skills and experience workers realize while employed with the Project. In the case of gained skills and experience, these improved qualifications will aid with securing employment on future projects within the LAA, RAA or Manitoba. Loss of employment following closure of the Project is therefore anticipated to be low in magnitude.

Summary

With the implementation of mitigation and management measures, Project residual effects on the local and regional labour force are expected to be positive in direction but low in magnitude during construction and operation. Low magnitude adverse effects are anticipated as the Project transitions from operation into and through the completion of decommissioning/closure (i.e., loss of direct employment). Positive and adverse effects are expected to extend to the RAA, although it is recognized that employment does extend to other parts of Manitoba and beyond. Effects are short-term in duration during construction and decommissioning/closure, and medium-term in duration during operation. Effects occur continuously through each Project phase and are reversible following the completion of construction and operation but irreversible (with the Project) following the completion of decommissioning/closure. Based on existing conditions, effects occur within a non-resilient socio-economic context within the LAA and a resilient context within the RAA. There are no seasonal timing considerations with respect to residual effects.

13.4.3 Change in Local and Regional Business

13.4.3.1 Project Pathways

Project spending has potential to both beneficially and adversely affect local and regional businesses. Beneficial effects include increases in business revenue, which can support capital investment and hiring, resulting in increased capacity and capabilities of local and regional businesses. Potential adverse effects of Project spending on regional businesses primarily relate to increased demand for local labour, goods, and services, which can lead to labour scarcity (i.e., labour drawdown) and increased labour costs. Project pathways are the same for both the Gordon and MacLellan sites.

13.4.3.2 Mitigation

To enhance beneficial effects of the Project Alamos and/or its contractors will, to the extent possible:

- Inform residents and Indigenous communities of job and procurement opportunities during all Project phases and implement a policy of local hire where priority is given to the workers from the LAA, followed by other parts of the RAA, other parts of Manitoba, and other parts of Canada.

- Develop work packages that consider the capacity and capabilities of local and regional businesses and plan for working with local and Indigenous-owned businesses to enhance their potential for successfully bidding on Project contracts regarding the supply of goods and services.
- Post Project purchasing requirements in advance so that local and regional businesses can position themselves to effectively compete to supply goods and services needed for Project construction and operation.
- Design for completion of timber removal in accordance with *The Forest Act* of Manitoba.
- Work with local communities to develop training programs (e.g., contract opportunities) oriented to Project operational needs.

Mitigation and management measures are the same for both the Gordon and MacLellan sites. The implementation of the mitigation and management measures will be the responsibility of Alamos and or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

13.4.3.3 Project Residual Effect

Indirect and Induced Employment

Alamos estimates that over the life of the Project $493.1 million in capital expenditure and $1.9 billion in operational spending (PwC 2020a, 2020b) will occur within Manitoba. In terms of effects, Project expenditures within the LAA and RAA represent economic potential for local and regional businesses, not limited to supply and service contracts to the Project and goods and service provision to direct and indirect workers. Table 13-18 provides a summary of indirect and induced employment estimates for the Northern Region. Indirect and induced employment effects are in addition to direct employment effects identified in Section 13.4.2.3.

Table 13-18 Annual Average Estiamtes of Indirect and Induced Employment (FTEs) and Labour Income (undiscounted), Northern Region

Category	Indirect		Induced	
	FTEs	Labour Income/FTE	FTEs	Labour Income/FTE
Construction	12	$56,000	14	$41,000
Operation	4	$57,000	21	
Decommissioning/closure	2	$62,000	3	

SOURCE:
Estimates of economic impacts are taken from PwC 2020a and PwC 2020b.

While estimates of local spending (e.g., within the LAA) on materials, goods and services have not been prepared, Alamos will implement a range of mitigation and management measures targeted at increasing the Project's local content (Section 13.4.3.2). Additional discussion of indirect and induced employment effects is provided in the following subsections.

Indirect Employment

The degree to which LAA and RAA businesses will benefit from Project contracting and supply opportunities, and therefore result in indirect employment, depends on several factors, including their size, capability and capacity to accommodate Project requirements. Specifically, indirect employment resulting from Project spending on goods and services would only be expected to result in 'net new' (i.e., creation of) indirect employment if businesses become established or expand (by increasing workforces) to meet Project demands.

In consideration of the LAA's existing labour force (Section 13.2.2.3), industrial classification of businesses within the LAA (Table 13-6), and using employment as a measure of capacity, businesses within the LAA are likely positioned to respond to small- to medium-sized service and supply contracts, particularly those related the transportation of goods and materials.

In comparison, the labour force of the RAA is substantially larger than that of the LAA and has greater capacity (measured in terms of employment) to accommodate a greater range of service and supply contracts (Sections 13.2.2.2 and 13.2.2.3). It is therefore highly likely that a greater percentage of Project expenditures on goods and services will occur within other parts of the RAA, particularly in larger centres such as the city of Thompson. Specialized labour, goods and services are likely to be sourced from other locations within Manitoba, Canada, and foreign markets.

In both cases (LAA and RAA), indirect employment effects are anticipated to be positive in direction but low in magnitude. Low magnitude effects within the LAA are largely attributable to existing conditions (the economy of the LAA is largely oriented toward education, health care, and transportation and warehousing; Section 13.2.2.3) and the type of service and supply contracts likely to be satisfied by local businesses. Given the length of construction, operation, and decommissioning/closure (Section 13.1.4.2) it is possible that local business could expand (workforce size) or new business establish (especially those seeking to fulfill operational service and supply contracts) to meet Project demands; however, given that businesses would be largely dependent on one revenue source (i.e., the Project) the degree to which this will occur is assumed to be low. Assuming all estimated indirect employment for the Northern Region (Table 13-18) were to occur in the LAA and result in 'net-new' new employment, the Project would result in a 7.7% increase (over baseline conditions) in the number of employed persons within the Lynn Lake during construction, a 2.6% increase during operation, and a 1.3% increase during decommissioning/closure. Given these increases and the low likelihood that all indirect employment effects estimated for the Northern Region will occur in the LAA and result in 'net-new' employment, residual effects within the LAA are considered low in magnitude.

Similarly, residual effects occurring within the RAA are also expected to be low in magnitude. Should 100% of estimated Northern Region indirect employment effects (Table 13-18) occur within the RAA and result in 'net-new' employment, the Project would represent less than a 0.2% increase in the number of employed persons (over baseline conditions) during construction, just over a 0.05% increase during operation, and less than a 0.03% increase during decommissioning/closure.

As the Project transitions from operation and into and through decommissioning/closure a loss of Project expenditures within the LAA and RAA could result (depending on economic conditions at the time) in adverse effects (i.e., a reduction) on indirect employment. The magnitude of this effect would align with gains in indirect employment during construction and operation (low magnitude).

Induced Employment

Because induced employment depends on consumer purchasing on the part of direct and indirect workers, the magnitude of effect within the LAA and RAA largely depends on the magnitude of Project-related direct and indirect employment. Based on induced employment estimates for the Northern Region (Table 13-18), and assuming all estimated induced employment effects for the Northern Region result in 'net-new' employment, the Project would result in a 9.0% increase (over baseline conditions) in the number of employed persons within the Lynn Lake during construction, a 13.5% increase during operation, and a 1.9% increase during decommissioning/closure. Given these increases and the low likelihood that all induced employment effects estimated for the Northern Region will occur in the LAA and result in 'net-new' employment, residual effects within the LAA are considered low in magnitude.

Similarly, residual effects occurring within the RAA are also expected to be low in magnitude. Should 100% of estimated Northern Region induced employment effects occur within the RAA and result in 'net-new' employment, the Project would represent less than a 0.2% increase in the number of employed persons (over baseline conditions) during construction, less than a 0.3% increase during operation, and a 0.04% increase during decommissioning/closure.

As the Project transitions from operation into decommissioning/closure a loss of direct and indirect Project-related employment within the LAA and RAA could result (depending on economic conditions at the time) in adverse effects (i.e., a reduction in) on induced employment. The magnitude of this effect would align with gains in direct and indirect employment during construction and operation (low magnitude).

Labour Scarcity and Increased Labour Costs

Potential adverse effects of Project spending and increased economic activity include labour scarcity and increased labour costs. Table 13-19 provides a comparison between existing employment income in Lynn Lake and projected Project-case wages and salaries.

Table 13-19 Baseline Employment Income and Projected Project-related Wages and Salaries (undiscounted), Lynn Lake and RAA

Category	Existing Mean Employment Income ($)[1]		Projected Project-Case Direct Wages/Salaries, mean ($)
	Lynn Lake	RAA	
Construction	$51,381	$54,136	$95,000
Operation			$130,00
Decommissioning/closure			$76,000

NOTES:
[1] Mean employment income is presented for the total population (aggregate of Indigenous and non-Indigenous labour force)
SOURCE:
Estimates of economic impacts are taken from PwC 2020a and PwC 2020b. Baseline wage information is taken from Table 13-10.

Wages paid to the Project's direct workforce show a measurable variance from existing conditions in Lynn Lake (an 85% increase from existing conditions during construction, 153% increase during operation, and 48% increase during decommissioning/closure) and RAA (an 85% increase from existing conditions during construction, 153% increase during operation, and 48% increase during decommissioning/closure) but closely align with average annual wages paid to Manitoba mining industry workers employed fulltime on 10-hour, 3:1 (three weeks on and one week off) rotations (Table 13-13). However, due to differentials between all forms of Project-related employment (i.e., direct, indirect, and induced), the Project has the potential to contribute to upward pressure on wages though increased competition for labour within the LAA and RAA. Combined with the potential for Project-related employment to be perceived as being more desirable than other forms of employment within the LAA and RAA the Project could also result in increased difficulty for local businesses to recruit or retain qualified workers.

To manage the Project's contribution to upward pressure on wages Alamos will pay its direct workforce wages that are consistent with Manitoba's mining industry. Combined with the anticipated size of the Project's local direct workforce, adverse effects on local and regional businesses in terms of upward pressure on wages and associated increased difficultly to recruit or retain workers is expected to be low in magnitude.

Summary

With the implementation of mitigation and management measures, Project residual effects on local and regional businesses are expected to be mixed (positive and adverse). Positive effects relate to Project spending on goods and service contracts and indirect and induced employment effects. Adverse effects result from anticipated upward pressure on wages and increased difficulty of local employers to recruit or retain workers who may be qualified for employment with the Project.

In both cases (positive and adverse), effects are expected to extend to the RAA, although it is recognized that employment does extend to other parts of Manitoba and beyond. Effects are short-term in duration during construction and decommissioning/closure, and medium-term in duration during operation. Effects occur continuously through each Project phase and are reversible following the completion of construction and operation but irreversible (with the Project) following the completion of decommissioning/closure. Based on existing conditions, effects occur within a non-resilient socio-economic context within the LAA and a resilient context within the RAA. There are no seasonality considerations with respect to residual effects (timing – not applicable).

13.4.4 Change in Local and Regional Economy

13.4.4.1 Project Pathways

Project spending will result in overall increased economic activity (i.e., GDP) in the LAA and RAA. The Project will also pay property taxes to the municipality of Lynn Lake and contribute to provincial and federal government revenues through taxation on labour, goods and services. Project pathways are the same for both the Gordon and MacLellan sites

13.4.4.2 Mitigation

Beneficial effects of the Project on the regional economy are enhanced by increasing regional employment and contracting with the Project. Mitigation and management measures identified in Sections 13.4.2.2 and 13.4.3.2 also apply to the assessment of 'change in local and regional economy'. Mitigation and management measures are not reproduced in this section. Mitigation and management measures are the same for both the Gordon and MacLellan sites.

13.4.4.3 Project Residual Effect

Contributions to Local and Regional Gross Domestic Product

Alamos estimates that direct Project contributions to Provincial GDP will total a net present value (5% discount rate) of $664 million over the life of the Project, comprised of $637 million in direct effects (100% of which is estimated to occur in the Northern Region), $6 million in indirect effects (8.3% of which is estimated to occur in the Northern Region) and $21 million in induced effects (8.3% of which is estimated to occur in the Northern Region). GDP Estimates for the Northern Region are presented in Table 13-21Overall, 68.8% of GDP effects are anticipated to occur in the Northern Region.

Table 13-20 Estimated GDP Contributions (thousands, discounted) – Northern Region

Effect	Construction	Operation	Decommissioning/Closure	Total
Direct	93,460	537,367	$5,800	636,627
Indirect	2,094	4,106	$86	6,286
Induced	3,171	17,570	$136	20,877
Total	98,725	559,043	$6,022	663,789
SOURCE: Estimates of economic impacts are taken from PwC 2020a and PwC 2020b.				

While estimates of GDP contributions to the LAA and RAA have not been prepared, the Project is inherently beneficial to the local and regional economy. Because GDP is a measure of overall economic activity, the magnitude of effect is represented through the additive effect of Project-related changes in the local and regional labour force and businesses. The Project is expected to have a moderate magnitude positive effect on the GDP of the LAA and RAA.

As the Project transitions from operation and into and through decommissioning/closure Project contributions to the GDP of the LAA and RAA will cease. The magnitude of this effect would align with the magnitude of Project GDP contributions to the LAA and RAA during construction and operation (moderate magnitude).

Municipal Property Tax

At the time of writing estimates of municipal taxes payable by the Project were not available. Property taxes payable by the Project are inherently beneficial to the municipal government of Lynn Lake. The Project is therefore expected to result in a positive residual effect on municipal government revenues. Because quantitative estimates of changes in municipal government revenues have not been calculated, effects are conservatively characterized as being low in magnitude. Because it is unclear when property tax payments will cease following the completion of decommissioning/closure a residual effect characterization of this aspect of the Project is not made.

Summary

With the implementation of mitigation and management measures, Project residual effects are predicted to be positive in direction during construction, operation, and decommissioning/closure. Given the value of baseline GDP and in consideration of nature of the Project (i.e., resumption of mining operation within the LAA), Project GDP contributions (direct, indirect, and induced) are expected to be positive in direction but moderate in magnitude. Contributions to municipal government revenues are conservatory characterized as being low in magnitude. Effects are expected to primarily extend to the RAA, although it is recognized that Project expenditures, and therefore contributions to GDP also occur in other parts of Manitoba, Canada, and foreign markets. Effects are short-term in duration during construction and decommissioning/ closure and medium-term in duration during operation. Effects occur continuously through each Project phase and are reversible following the completion of construction and operation but irreversible (with the Project) following the completion of decommissioning/closure. Because Project effects on GDP and municipal government revenues are purely beneficial, the socio-economic context in which effects occur is characterized as being resilient. There are no seasonality considerations with respect to residual effects (timing – not applicable).

13.4.5 Summary of Project Residual Environmental Effects on Labour and Economy

A summary of Project residual effects on labour and economy is provided in Table 13-22.

Overall, the Project is expected to result in both positive and adverse effects. Low magnitude positive effects on labour and economy are associated with increased direct, indirect, and induced employment and contributions to municipal government revenues (through taxation). Moderate magnitude positive effects are anticipated through Project contributions to GDP. Positive effects on local and regional labour forces and businesses occur within a non-resilient socio-economic context in the LAA and a resilient context in the RAA. Effects on the local and regional economy occur within a resilient context (LAA and RAA). Effects occur continuously over the short-term during construction and medium-term during operation. Positive effects are reversable following the completion of each Project phase. There are no seasonal timing considerations to positive effects on labour and economy.

Adverse effects are anticipated as follows:

Change in local and regional labour force

- Low magnitude loss of direct employment within the LAA and RAA as the Project transitions from operation into and through decommissioning/closure.

Change in local and regional business

- Low magnitude contribution to increased competition for labour and upward pressure on wages during Project construction and operation.
- Low magnitude loss of Project spending on goods and services within the LAA and RAA, and associated indirect and induced employment, as the Project transitions from operation into and through decommissioning/closure.

Change in local and regional economy

- Moderate magnitude loss of Project GDP contributions to the economy of the LAA and RAA as the Project transitions from operation into and through decommissioning/closure.
- Because it is unclear when property tax payments will cease following the completion of decommissioning/closure, a residual effect characterization of this aspect of the Project is not made.

Adverse effects occur within the LAA and RAA. Adverse effects on local and regional business (i.e., increased competition for labour and contributions to wage inflation) occur continuously over the short-term during construction and medium-term during operation. Adverse effects associated with losses in employment and contributions to GDP occur continuously over the short-term during decommissioning/closure. Adverse effects on local and regional labour forces and businesses occur within a non-resilient socio-economic context in the LAA and a resilient context in the RAA. Effects on the local and regional economy occur within a resilient context (LAA and RAA). Construction and operational adverse effects on local and regional businesses (i.e., contributions to increased competition for labour and wage inflation) are reversible following the completion of each Project phase. Other adverse effects are irreversible (i.e., they only occur finitely within the context of the Project and end when the Project ends). There are no seasonal timing considerations to adverse effects on labour and economy.

Table 13-21 Project Residual Effects on Labour and Economy

Residual Effect	Residual Effects Characterization								
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context
Change in regional labour force	C	P	L	LAA/RAA	ST	N/A	C	R	NR/R
	O	P	L	LAA/RAA	MT	N/A	C	R	NR/R
	D	A	L	LAA/RAA	ST	N/A	C	I	NR/R
Change in regional business	C	P	L	LAA/RAA	ST	N/A	C	R	NR/R
	O	P	L	LAA/RAA	MT	N/A	C	R	NR/R
	D	A	L	LAA/RAA	ST	N/A	C	I	NR/R
Change in regional economy	C	P	L-M	LAA/RAA	ST	N/A	C	R	R
	O	P	L-M	LAA/RAA	MT	N/A	C	R	R
	D	A	M	LAA/RAA	ST	N/A	C	I	R

KEY
See Table 13-3 for detailed definitions

Project Phase
C: Construction
O: Operation
D: Decommissioning

Direction:
P: Positive
A: Adverse

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term;
MT: Medium-term
LT: Long-term

N/A: Not applicable

Timing:
N/A: Not Applicable
A: Applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Socio-Economic Context:
R: Resilient
NR: Not Resilient

13.5 ASSESSMENT OF CUMULATIVE ENVIRONMENTAL EFFECTS ON LABOUR AND ECONOMY

The Project residual effects described in Section 13.4 are likely to interact cumulatively with residual environmental effects from other physical activities (past, present, and reasonably foreseeable).

The effects of past and current projects relative to conditions prior to historical mining activities contribute to baseline conditions upon which Project effects are assessed.

The resulting cumulative environmental effects (future scenario with Project) are assessed. Cumulative environmental effects (the future scenario without the Project) are also described. This is followed by an analysis of the Project contribution to cumulative effects. Future projects and activities that are reasonably foreseeable are defined as those that (a) have been publicly announced with a defined project execution period and with sufficient project details that allow for a meaningful assessment, (b) are currently undergoing an environmental assessment or (c) are in a permitting process.

The assessment of cumulative effects is initiated with a determination of whether two conditions exist:

- The Project is assessed as having adverse residual environmental effects on a VC, and
- The adverse residual effects from the Project overlap spatially and temporally with residual effects of other physical activities on a VC.

If either is not met, the assessment of cumulative effects concludes with a statement that further assessment of cumulative effects is not warranted because the Project does not interact cumulatively with other projects or activities.

13.5.1 Project Residual Effects Likely to Interact Cumulatively

Table 4C-1 in Chapter 4, Environmental Effects Assessment Scope and Methods, presents the Project and physical activities inclusion list, which identifies other projects and physical activities that might act cumulatively with the Project. Where residual environmental effects from the Project act cumulatively with residual effects from other projects and physical activities (Table 13-22), a cumulative effects assessment is undertaken. The environmental effects identified in Table 13-22 marked as not likely to interact cumulatively with residual effects of other projects and physical activities (no check mark) are not discussed further.

Table 13-22 Interactions with the Potential to Contribute to Cumulative Effects

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Environmental Effects		
	Change in Local and Regional Labour Force	Change in Local and Regional Business	Change in Local and Regional Economy
Past and Present Physical Activities and Resource Use			
• “A” Mine	✓	✓	✓
• EL Mine	✓	✓	✓
• Fox Mine	✓	✓	✓
• Farley Mine	✓	✓	✓
• Ruttan Mine	✓	✓	✓
• MacLellan Mine (Historical)	✓	✓	✓
• Burnt Timber Mine	✓	✓	✓
• Farley Lake Mine	✓	✓	✓
• Keystone Gold Mine	✓	✓	✓
• East/West Tailings Management Areas	✓	✓	✓
Mineral Exploration	✓	✓	✓
Water and Waste Projects (sewage plants, waste disposal grounds)	✓	✓	✓
Residential and Community Development (including cottage subdivisions)	✓	✓	✓
Infrastructure Development (transmission line, airport, highways, roads, rail)	✓	✓	✓
Other Resource Activities (hunting, fishing, berry picking)	✓	✓	✓
Future Physical Activities			
Mineral Development	✓	✓	✓
Mineral Exploration	✓	✓	✓
Traditional Land Use	–	–	–
Resource Use Activities	–	–	–
Recreation	–	–	–

NOTES:
✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with Project residual environmental effects.
– = Interactions between the residual effects of other projects and residual effects of the Project are not expected.
For a detailed description and mapped locations of Projects and Physical Activities, where applicable, see Chapter 4, Table 4D-2 and Maps 4-3 and 4-4.

Regarding the two conditions (both pertaining to adverse effects only) that must be met to initiate a cumulative effects assessment the Project is assessed as having the following adverse effects:

Change in Local and Regional Labour Force

- Low magnitude loss of direct employment within the LAA and RAA as the Project transitions from operation into and through decommissioning/closure.

Change in Local and Regional Business

- Low magnitude contribution to increased competition for labour and upward pressure on wages during Project construction and operation.
- Low magnitude loss of Project spending on goods and services within the LAA and RAA, and associated indirect and induced employment, as the Project transitions from operation into and through decommissioning/closure.

Change in Local and Regional Economy

- Moderate magnitude loss of Project GDP contributions to the economy of the LAA and RAA as the Project transitions from operation into and through decommissioning/closure.
- Because it is unclear when property tax payments (or grants in lieu) will cease following the completion of decommissioning/closure, a residual effect characterization of this aspect of the Project is not made.

The residual effects of other past and present projects and activities have contributed to condition of the existing environment (i.e., existing economy and labour force) in which the Project will be located. As such, the cumulative effects of these past and present projects have been considered in the assessment of Project residual effects (Section 13.4).

Future mineral development and exploration within the RAA will likely result in increased labour demand and stimulate indirect and induced economic activity (both of which contribute to positive effects on GDP, and depending on location, municipal government revenues). Potential therefore exists for the adverse effects of the Project to act cumulatively with contributions to increased competition for labour and upward pressure on wages from future mineral development and exploration. It is also possible that should future mineral development and exploration occur within the RAA and transition into completion phases or decommissioning/closure at the same time as the Project (13 years from the beginning of construction), that cumulative adverse effects could occur.

13.5.2 Change in Local and Regional Labour Force

13.5.2.1 Cumulative Effect Pathways

Should future mineral development and exploration occur within the RAA and transition into completion or decommissioning/closure phases at the same time as the Project (13 years from the beginning of Project construction), it is possible that cumulative losses of direct employment could occur. This pathway is the same for the Gordon site and MacLellan site.

13.5.2.2 Mitigation for Cumulative Effects

Mitigation for changes to local and regional labour force are proposed in Section 13.4.2.2. No additional mitigation measures are required for cumulative effects.

13.5.2.3 Cumulative Effects

Given the size of the current RAA labour force (Section 13.2.2.3), should future mineral development and exploration within the RAA transition into completion or decommissioning/closure phases at the same time as the Project, cumulative loss of direct employment is anticipated to result in low magnitude adverse effects. The Project's contribution to cumulative effects, mitigated through measures identified in Section 13.5.2.2, is expected to be that of a low magnitude short-term loss of direct employment. Cumulative effects occur within the RAA on a continual basis over the long-term (due to uncertainty regarding the timing of other projects and activities over the operational life of the Project). Effects occur within a resilient socio-economic context in the RAA and are reversible assuming future employment is created within the RAA. There are no seasonal timing considerations to cumulative effects.

13.5.3 Change in Local and Regional Business

13.5.3.1 Cumulative Effect Pathways

Should labour demand from future mineral development and exploration temporally overlap with periods of increased demand from the Project (i.e., during construction and operation) cumulative increased demand for labour and upward pressure on wages could occur.

It is also possible that should future mineral development and exploration occur within the RAA and transition into completion decommissioning/closure phases at the same time as the Project (13 years from the begging of Project construction), loss of Project and mineral development and exploration spending on goods and services, and associated losses of indirect and induced employment, could result in cumulative effects. These pathways are the same for the Gordon site and MacLellan site.

13.5.3.2 Mitigation for Cumulative Effects

Mitigation for changes to local and regional businesses in Section 13.4.3.2. No additional mitigation measures are required for cumulative effects.

13.5.3.3 Cumulative Effects

It is likely that increased competition for labour and upward pressure on wages from future mineral development and exploration and the Project could result in cumulative adverse effects should periods of increased labour demand overlap temporally and spatially. The Project's contribution to cumulative effects, mitigated through measures identified in Section 13.5.3.2, is expected to be that of low magnitude medium-term contributions to increased competition for labour and upward pressure on wages. Given the size of the RAA labour force (Section 13.2.2.3), cumulative effects, inclusive of the Project's contribution, are anticipated to be low in magnitude.

Given the size of the current RAA labour force and existing levels of industry and occupational employment (Section 13.2.2.3), should future mineral development and exploration within the RAA transition into completion or decommissioning/closure phases at the same time as the Project, cumulative loss of spending on goods and services, and associated indirect and induced employment, is anticipated to result in low magnitude adverse effects. The Project's contribution to cumulative effects, mitigated through measures identified in Section 13.5.3.2, is expected to be that of low magnitude short-term losses of indirect and induced employment.

Overall, cumulative effects (i.e., losses in indirect and induced employment) are adverse in direction and low in magnitude. Effects related to increased competition for labour and upward pressure on wages occur over the medium term while losses of indirect and induced labour occur over the long-term due to uncertainty regarding the timing of other projects and activities over the operational life of the Project). Cumulative effects occur within the RAA on a continual basis. Effects occur within a resilient socio-economic context in the RAA and are reversible assuming future capital spending and demand for goods, services, and labour within the RAA. There are no seasonal timing considerations to cumulative effects.

13.5.4 Change in Local and Regional Economy

13.5.4.1 Cumulative Effect Pathways

Should future mineral development and exploration occur within the RAA and transition into completion or decommissioning/closure phases at the same time as the Project (13 years from the beginning of Project construction), it is possible that cumulative losses in GDP contributions to the economy of the RAA could occur. This pathway is the same for the Gordon site and MacLellan site.

13.5.4.2 Mitigation for Cumulative Effects

Mitigation for changes to local and regional economy Section 13.4.4.2. No additional mitigation measures are required for cumulative effects.

13.5.4.3 Cumulative Effects

Given cumulative losses of employment (direct, indirect, and induced) and capital spending on goods and services (Sections 13.4.2 and 13.4.3), should future mineral development and exploration within the RAA transition into completion or decommissioning/closure phases at the same time as the Project, cumulative loss of GDP contributions to the economy on the RAA are anticipated to be low in magnitude. The Project's contribution to cumulative effects, mitigated through measures identified in Section 13.5.4.2, is expected to be that of a low magnitude short-term loss of GDP (direct, indirect, and induced) contributions to the economy of the RAA. Cumulative effects occur within the RAA on a continual basis over the long-term (due to uncertainty regarding the timing of other projects and activities over the operational life of the Project). Effects occur within a resilient socio-economic context in the RAA and are reversible assuming future employment is created within the RAA. There are no seasonal timing considerations to cumulative effects.

13.5.5 Cumulative Effects Without the Project

Without the Project, the RAA would not experience Project-related changes in employment, business, or economy. Therefore, the RAA would not have beneficial effects of the Project including employment (and associated wages), contributions to GDP, or municipal government revenues (taxation). Alternatively, without the Project, adverse effects on regional businesses such as increased competition for labour and upward pressure on wages as a direct result of the Project's demand for labour would not occur. However, future mineral exploration and development projects would likely require large workforces (compensated with wages greater than RAA averages and therefore contribute to increased competition for labour and upward pressure on wages) and would contribute to regional GDP and municipal government revenues.

Since the contribution of the Project to residual effects is expected to be low, it is likely that the future of the RAA (in terms of regional employment, business and economy) would be similar with or without the Project – adverse, long-term in duration, continuous, reversible, and occur within a resilient socio-economic context. It is also expected that current and reasonably foreseeable future projects and physical activities will be required to apply standard mitigation and other management measures to avoid or reduce their effect on labour and economy.

13.5.6 Summary of Cumulative Effects

While the cumulative effects assessment only considers adverse effects, it is highly likely that should other projects and physical activities overlap temporally and spatially with the Project that cumulative positive effects on local and regional labour forces, businesses and economy would occur. Table 13-23 summarizes cumulative adverse environmental effects on labour and economy. Because only adverse effects are considered in the cumulative effects assessment positive effects are not characterized.

Table 13-23 Residual Cumulative Effects

Residual Cumulative Effect	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context
Residual Cumulative Change in Local and Regional Labour Force								
Without the Project	A	L	RAA	LT	N/A	C	R	R
With the Project	A	L	RAA	LT	N/A	C	R	R
Contribution from the Project to the residual cumulative effect	The Project's contribution to cumulative effects, mitigated through measures identified in Section 13.5.2.1, is expected to be that of a low magnitude short-term loss of direct employment.							
Residual Cumulative Change in Local and Regional Business								
Without the Project	A	L	RAA	LT	N/A	C	R	R
With the Project	A	L	RAA	LT	N/A	C	R	R
Contribution from the Project to the residual cumulative effect	The Project's contribution to cumulative effects, mitigated through measures identified in Section 13.5.3.2, is expected to be that of low magnitude medium-term increased competition for labour and upward pressure on wages as well as low magnitude short-term losses of indirect and induced employment.							
Residual Cumulative Change in Local and Regional Economy								
Without the Project	A	L	RAA	LT	N/A	C	R	R
With the Project	A	L	RAA	LT	N/A	C	R	R
Contribution from the Project to the residual cumulative effect	The Project's contribution to cumulative effects, mitigated through measures identified in Section 13.5.4.2, is expected to be that of a low magnitude short-term loss of GDP (direct, indirect, and induced) contributions to the economy of the RAA.							

KEY

See Table 13-4 for detailed definitions

Direction:
P: Positive
A: Adverse

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term;
MT: Medium-term
LT: Long-term

N/A: Not applicable

Timing:
N/A: Not Applicable
A: Applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

13.6 EFFECTS TO FEDERAL LANDS

Federal lands within the LAA and RAA for Labour and Economy consist of Black Sturgeon IR (a settlement of the Marcel Colomb First Nation, which falls within the LAA), and Granville Lake IS (a settlement of the Mathias Colomb Cree Nation), South Indian Lake IS (a settlement of the O-Pipon-Na-Piwin Cree Nation), and Kinoosao-Thomas Clarke 204 IR, Saskatchewan (the most northern community within the Peter Ballantyne Cree Nation), which fall within the RAA. Effects on Federal lands, in consideration of disproportionate effects on Indigenous groups and women, are anticipated to be similar to other areas in the LAA and RAA as described in Sections 13.4 and 13.5.

13.7 DETERMINATION OF SIGNIFICANCE

13.7.1 Significance of Project Residual Effects

A significant effect on labour and economy is defined as one that results in a highly distinguishable change from current conditions and trends and cannot be managed or mitigated through adjustments to programs, policies, plans, or through other mitigation measures. A significance determination is only made for adverse effects. Because residual adverse effects on labour and economy are anticipated to be low in magnitude, and therefore are not highly distinguishable from current conditions within the RAA, with the implementation of mitigation and management measures, residual adverse effects on labour and economy are predicted to be not significant.

13.7.2 Significance of Cumulative Effects

Because cumulative adverse effects on labour and economy are anticipated to be low in magnitude, and therefore are not highly distinguishable from current conditions in the RAA, with the implementation of mitigation and management measures, cumulative adverse effects on labour and economy are predicted to be not significant.

13.7.3 Significance of Effects on Federal Lands

Federal lands within the LAA and RAA include Black Sturgeon Reserve which falls within the LAA, and Suwannee Lake Indian Reserve, Nihkik Ohnikapihs Indian Reserve, and O-Pipon-Na-Piwin Cree Nation which fall within the RAA. Based on the results in Section 13.6, the residual environmental effects on federal lands from changes to Labour and Economy are predicted to be not significant.

13.7.3.1 Project Contribution to Cumulative Effects

The Project's contribution to cumulative effects include short-term, low magnitude losses of direct employment, capital spending on goods and services (and associated losses of indirect and induced labour), and GDP contributions to the economy of the RAA as well as medium-term, low-magnitude increased demand for labour and upward pressure on wages. Effects occur as the Project transitions from operation into and through decommissioning/closure. The Project's contribution to cumulative adverse effects are mitigated through measures identified in Section 13.5.2.2, 13.5.3.2, and 13.5.4.2.

13.8 PREDICTION CONFIDENCE

There is a moderate degree of confidence in the assessment of effects on labour and economy because of baseline data limitations (e.g., suppression of Census Profile information, limited 'current' [2020] baseline data), pre-frontend engineering and design cost estimates, and uncertainty about future economic conditions in the LAA and RAA. The extent of employment of local and regional workers will also depend on finalized Project workforce planning, while the extent to which regional businesses are affected depends on how they choose to respond to the opportunities presented by Project spending. Known margins of error in economic modelling completed for the Project (Appendix 13A) also affect prediction confidence.

13.9 FOLLOW-UP AND MONITORING

During construction and operation, the Project is expected to primarily result in positive effects on the local and regional labour force, businesses, and economy. Alamos will implement mitigation and management measures to increase local and regional content (i.e., positive effects); however, the extent to which workers and business participate in Project-related opportunities is largely external to Alamos (e.g., the extent to which local workers seek employment with the Project and local business participate in procurement opportunities). No follow-up and monitoring programs are proposed.

Project contributions to increased competition for labour and upward pressure on wages are anticipated to result in adverse effects on local businesses. To attract qualified labour for the Project Alamos will compensate workers in accordance with Manitoba mining industry averages. Given this macroeconomic consideration (i.e., largely external to Alamos) and that adverse effects are anticipated to be low in magnitude no follow-up and monitoring programs are proposed.

Following the completion of decommissioning and closure Project expenditures and demand for labour will cease resulting in adverse effects on the local regional labour force, businesses, and economy (relative to the Project's operational case). This phased reduction in expenditure and demand for labour will be known and anticipated by workers and business. Qualifications (e.g., skills and experience) gained by workers while employed with the Project will aid in securing employment on future projects within the LAA, RAA or Manitoba. For businesses, experience gained providing goods and services to the Project will prove beneficial in securing future contracts with projects in the LAA, RAA or Manitoba. For these reasons and because Project activities will have ceased, no follow-up and monitoring programs are proposed.

13.10 SUMMARY OF COMMITMENTS

To enhance beneficial effects of the Project and mitigate adverse effects Alamos will:

- Inform residents and Indigenous communities of job and procurement opportunities during all Project phases and implement a policy of local hire where priority is given to the workers from the LAA, followed by other parts of the RAA, other parts of Manitoba, and other parts of Canada.

- Post job qualifications in advance and identify available training programs and providers so that local and Indigenous residents can acquire the necessary skills and qualify for potential Project-related employment.
- Identify potential shortages of workers with specific skill requirements, and work with training and education facilities, Indigenous and local communities to increase opportunities for local community members to obtain training required for Project participation.
- Require workers (not inclusive of summer students) 19 years and younger to have completed grade 12 or have an appropriate equivalency to prevent young people from leaving school prematurely.
- Workforce education to encourage healthy lifestyle choices, sensitivity training and strict enforcement of Alamos' health and safety policies.
- Develop work packages that consider the capacity and capabilities of local and regional businesses and plan for working with local and Indigenous-owned businesses to enhance their potential for successfully bidding on Project contracts regarding the supply of goods and services.
- Post Project purchasing requirements in advance so that local and regional businesses can position themselves to effectively compete to supply goods and services needed for Project construction and operation.
- Design for completion of timber removal in accordance with *The Forest Act* of Manitoba.
- Work with local communities to develop training programs (e.g., contract opportunities) oriented to Project operational needs.

Mitigation and management measures are the same for both the Gordon and MacLellan sites.

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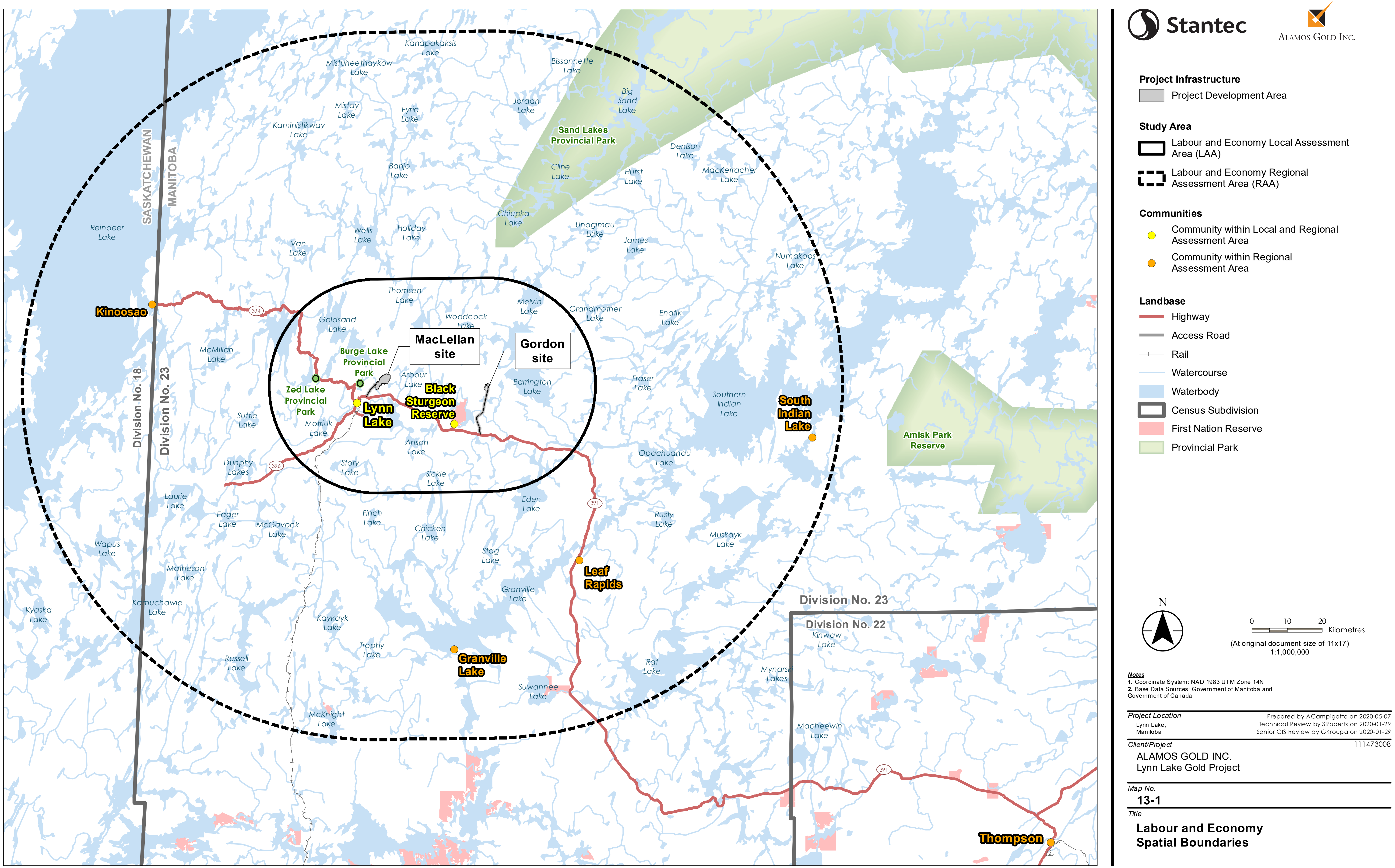

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-05-07
Technical Review by SRoberts on 2020-01-29
Senior GIS Review by GKroupa on 2020-01-29

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.

13-1

Title

Labour and Economy Spatial Boundaries

Appendix 13A LYNN LAKE PROJECT – ECONOMIC IMPACT ASSESSMENT (PWC 2020)

www.pwc.com/ca

Lynn Lake Project Economic impact assessment

April 2020

pwc

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Executive summary

Alamos Gold is considering advancing an open-pit gold mining project near Lynn Lake, Manitoba ("Lynn Lake Project"). In this context, Alamos Gold has retained PricewaterhouseCoopers, LLP ("PwC" or "we") to provide a review of the state of the mining industry in Manitoba and assess the potential economic impacts of the Lynn Lake Project for Canada, Manitoba and the Northern Region of Manitoba.

The Lynn Lake Project is a prospective gold camp consisting of four near surface deposits with some existing infrastructure and a history of past production. The Lynn Lake Project consists of two primary deposits: the MacLellan Mine and the Gordon Mine, which were the subject of a Feasibility Study published in December 2017.

Economic impact of the Lynn Lake Project

PwC assessed the economic footprint of the Lynn Lake Project for both the mine development phase and ongoing mine operations. The following table shows the total economic impacts that would be created in Manitoba over the life of the mine, including two years of development and eleven years of ongoing operations. A discount rate of 5% was applied to calculate the total present value of the economic impacts below, except for person years of employment. Including indirect (supply chain) and induced (employee spending) impacts, the total economic footprint of the project is $965 million in GDP, $684 million in labour income, 11,030 person year jobs and $358 million in total taxes, of which $163 million are provincial taxes.

Table 1: Economic impacts in Manitoba, CAD (000s) except for employment

Impact types	GDP	Labour income	Employment in person years	Total tax footprint
Direct	636,627	534,035	6,258	
Indirect	75,994	41,788	1,001	
Induced	252,409	108,196	3,772	
Total	**965,030**	**684,020**	**11,030**	**357,921**

Economic impacts in the North

The Northern region of Manitoba represents 4.8% of overall employment in the province and 41.6% of employment in forestry, fishing, mining, quarrying, oil and gas. The Lynn Lake Project would generate economic activity in Manitoba's Northern region through direct employment, purchases of inputs such as machinery, and spending by employees in the region. Of the economic impact generated by the Lynn Lake Project in Manitoba, 69% would occur in the Northern region. That is equivalent to $664 million in GDP, $546 million in labour income, and 6,652 jobs in person years.

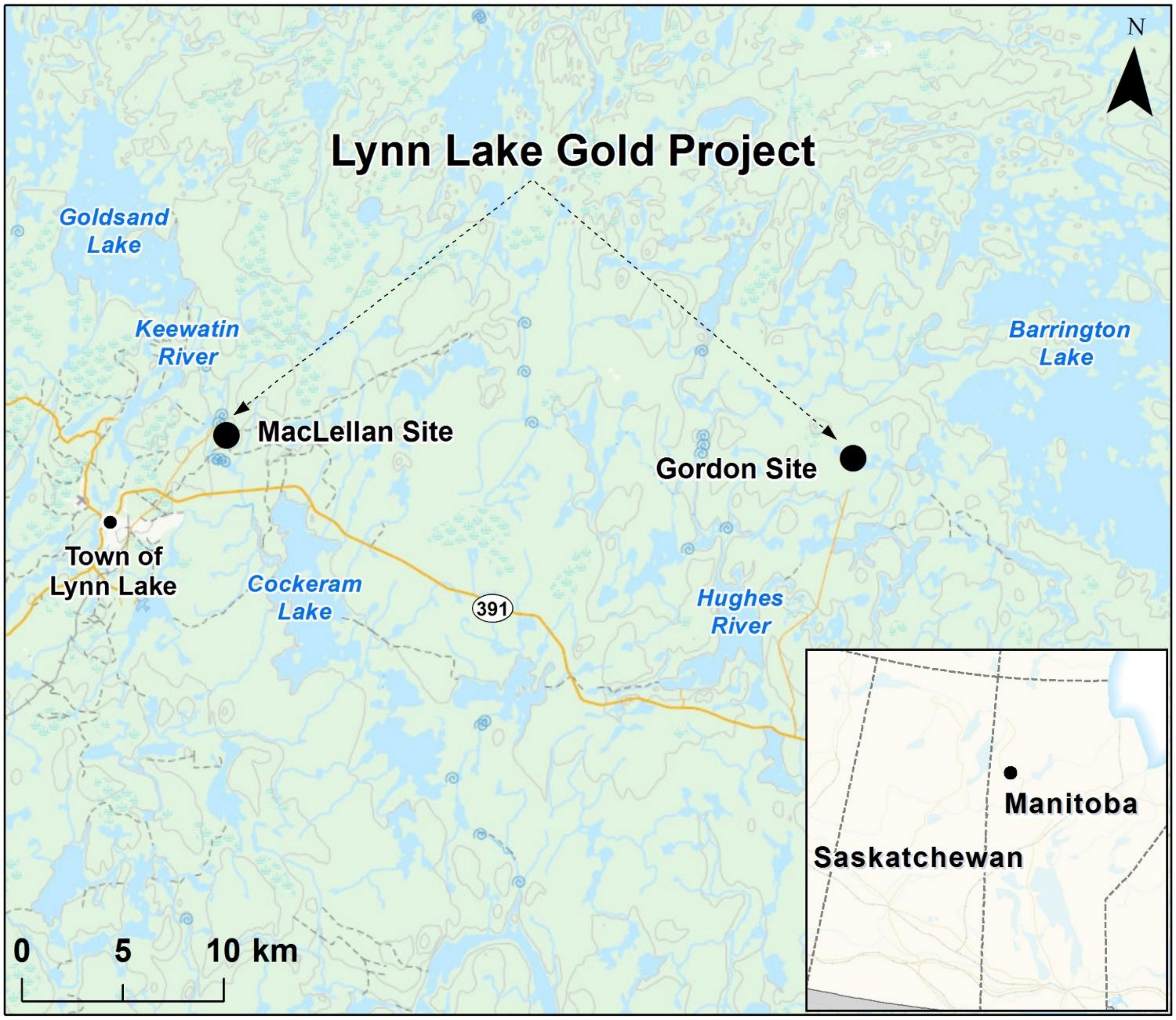
The mining industry in Manitoba

Mining is an important industry for Canada, and mining activity in Manitoba has been decreasing over the past two decades. The mining sector directly contributed $26.3 billion to the Canadian gross domestic product ("GDP") in 2017. In that year, mining activity in Manitoba accounted for 2% of Canada's mining GDP. Over the past 20 years, Manitoba's mining GDP has been on a downward trend, decreasing from $2.8 billion at its peak in 2000 to $2.0 billion in 2018. Over the same period, employment in the mining sector in Manitoba declined from 2,295 to 1,865, whereas mining employment in Ontario, Quebec and British Columbia increased. Development of the Lynn Lake project would represent a significant boost to the Manitoba mining sector as a share of total mining activity in the province.

Introduction

Alamos Gold is considering developing an open pit gold mining project at Lynn Lake, Manitoba ("the Lynn Lake Project"). Alamos consolidated full ownership of Lynn Lake through its acquisition of Carlisle Goldfields in January 2016. The Lynn Lake Project is one of the highest-grade open pit gold deposits in Canada with significant exploration potential. Moreover, some infrastructure in Lynn Lake is already in place. Alamos expects to develop the site over two years, and operate it for 13 years. Annual production levels are expected to be 170,000 ounces for the first six years of mine life and 143,000 ounces for the remaining years.

The map below shows the anticipated site location.[1]



[1] Source: Canadian Environmental Assessment Agency https://www.acee-ceaa.gc.ca/050/evaluations/proj/80140?culture=en-CA

In assessing the economic impact of the Lynn Lake Project, we have estimated the contribution of the project on GDP, employment, labour income, and taxes during development and on annual basis for steady state ongoing operations. The results of our analysis are measures of commonly considered economic variables and the total contribution to each variable of the industry's activities.

This study is an update of a 2018 study that estimated the economic footprint of the Lynn Lake Project. Since the previous study, Alamos has made additional discoveries that allowed them to extend the operating life of the mine from eleven to thirteen years. This change has led to increased anticipated spending in Manitoba, along with increased direct employment.

Unless otherwise specified, the figures in this report are expressed in 2019 Canadian dollars.

The following PwC staff contributed to this study:

- Michael Dobner – Partner, Leader of PwC Canada's Economics Practice
- Gemma Stanton-Hagan – Manager, Economics Practice

Scope of review

To prepare this assessment, we have reviewed and, where appropriate, relied upon various documents and sources of information. By general classification, these sources include the following:

- Data provided by Alamos Gold on planned expenditures during development and ongoing operations
- Manitoba Bureau of Statistics Economic Impact Assessment Model and Tax Revenue Impact Assessment Model
- Secondary sources including Statistics Canada and Natural Resources Canada

A complete list of the documents and sources we reviewed is available in Appendix B.

Limitations

Data limitations: PwC has relied on the information provided by Alamos regarding the provincial allocations of operating and capital expenses of Alamos' business operations in Canada. PwC has relied upon the completeness, accuracy, and fair presentation of all information and data obtained from Alamos and the various sources set out in our report, which were not audited or otherwise verified. The findings in this report are conditional upon such completeness, accuracy, and fair presentation, which have not been verified independently by PwC. Accordingly, we provide no opinion, attestation or other form of assurance with respect to the results of this study.

Where the information or data provided is not sufficient to conduct the analysis that has been requested, we have made assumptions, as noted throughout the report.

Receipt of new data or facts: PwC reserves the right at its discretion to withdraw or revise this report should we receive additional data or be made aware of facts existing at the date of the report that were not known to us when we prepared this report. The findings are as of April 2020 and PwC is under no obligation to advise any person of any change or matter brought to its attention after such date, which would affect our findings.

Input-output analysis: Input-output analysis (a model used to estimate Gross Domestic Product ("GDP") and employment impact) does not address whether the inputs have been used in the most productive manner or whether the use of these inputs in this industry promotes economic growth by more than their use in another industry or economic activity. Nor does input-output analysis evaluate whether these inputs might be employed elsewhere in the economy if they were not employed in this industry at the time of the analysis. Input-output analysis calculates the direct, indirect and induced economic impacts that can reasonably be expected to affect the economy based on historical relationships within the economy. This analysis does not take into account fundamental shifts in the relationships within the economy that may have taken place since the last estimation of multipliers by Statistics Canada, nor shifts that may take place in the future.

Use limitations: This report has been prepared solely for the use and benefit of, and pursuant to a client relationship exclusively with Alamos. We understand that Alamos may share our report with third parties. Alamos can release this report to third parties only in its entirety and any commentary or interpretation in relation to this report that Alamos intends to release to the public either requires PwC's written consent or has to be clearly identified as Alamos's own interpretation of the report or Alamos is required to add a link to the full report. PwC accepts no duty of care, obligation or liability, if any, suffered by Alamos or any third party as a result of an interpretation made by Alamos of this report.

Further, no other person or entity shall place any reliance upon the accuracy or completeness of the statements made herein. In no event shall PwC have any liability for damages, costs or losses suffered by reason of any reliance upon the contents of this report by any person other than Alamos.

This report and related analysis must be considered as a whole: Selecting only portions of the analysis or the factors considered by us, without considering all factors and analysis together, could create a misleading view of our findings. The preparation of our analysis is a complex process and is not necessarily susceptible to partial analysis or summary description. Any attempt to do so could lead to undue emphasis on any particular factor or analysis.

We note that significant deviations from the above listed major assumptions may result in a significant change to our analysis.

Overview of the mining industry in Canada

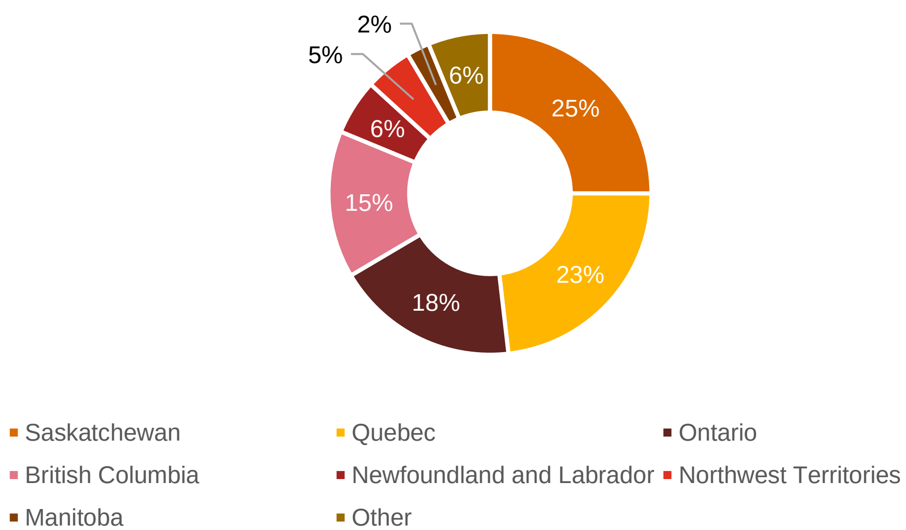
This section provides an overview of mining industries across Canada and presents general trends of the industry regarding GDP, employment, and investment, comparing Manitoba with other provinces.

Mining GDP

Mining activity in Canada generates significant economic activity at the local, provincial, and national level. It provides economic and social benefits through job creation, local purchases, and tax revenue. Mining is particularly important to Northern and remote regions in Canada.

In 2018, direct mining GDP in Canada was $35.2 billion, or 1.8% of Canada's total GDP. As shown in Figure 1, the provinces that accounted for the largest shares of Canada's mining GDP in 2018 were Saskatchewan (25%), Quebec (23%), Ontario (18%), and British Columbia (15%). Manitoba accounted for 2% of Canada's mining GDP.

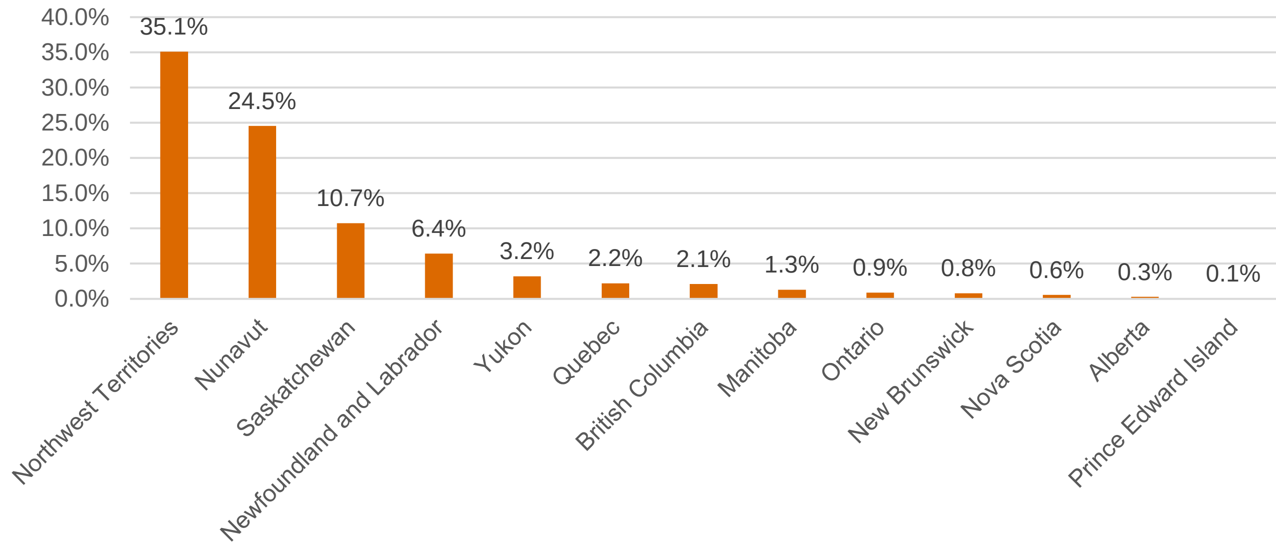
Figure 1: Provincial Share of Canadian mining GDP, 2018[2]



Within Manitoba, mining accounted for 2.65% of provincial GDP in 2018. The jurisdictions with the highest mining shares of GDP were the Northwest Territories, Nunavut and Saskatchewan, while Manitoba's share was slightly higher than that of the major mining provinces of Quebec, British Columbia, and Ontario.

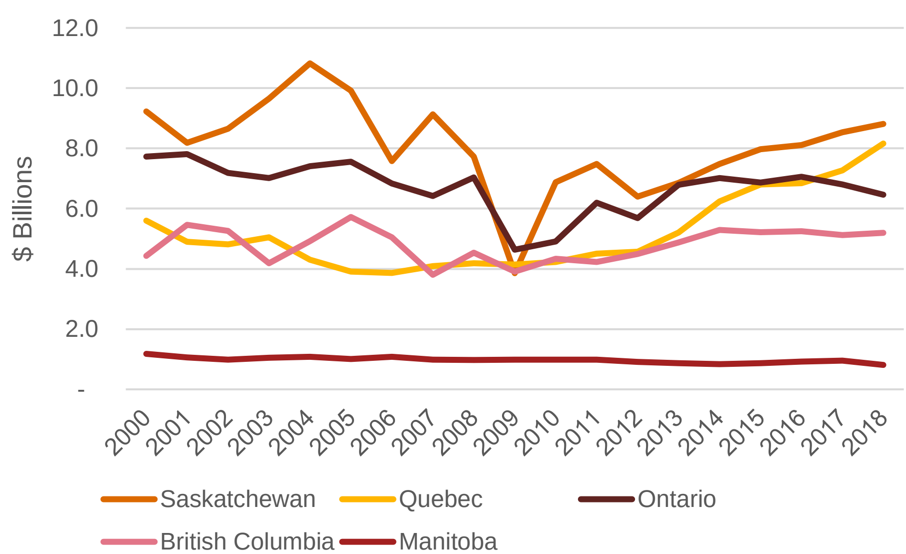
[22] Statistics Canada CANSIM Table 36-10-0402-01, Gross domestic product (GDP) at basic prices, by sector and industry, provincial and territorial (x 1,000,000)

Figure 2: Mining Industry Share of Provincial GDP by Province, 2018[3]



Over the past several years, mining GDP in Manitoba held steady around $900 million in chained 2012 dollars. In 2018 it dropped slightly to $811 million. This was in contrast to stronger growth seen in Quebec and Saskatchewan during the same period. Two Manitoba mines closed in 2017 (Vale's Birchtree mine in Thompson and Hudbay's Reed Mine near Flin Flon). If the Lynn Lake site is developed, annual direct GDP contribution during operation would be approximately $63 million, or 8% of Manitoba's 2018 mining GDP.

Figure 3: Mining GDP by province, chained 2012 dollars[4]



The majority of mining activity in Manitoba is for copper, nickel, lead and zinc ore. In 2018, gold and silver ore mining accounted for 7% of Manitoba's mining GDP.

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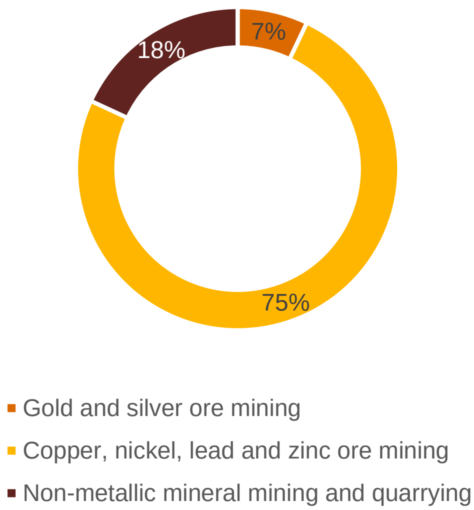
3 Ibid
4 Ibid

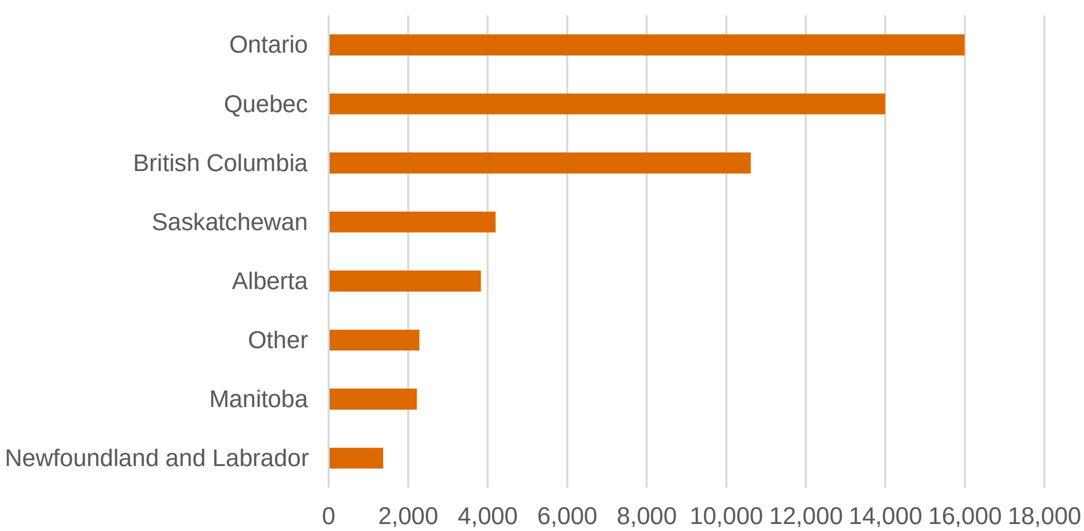
Figure 4: Manitoba mining GDP by commodity, 2018[5]



Mining employment

In 2018, mining accounted for 73,360 direct jobs in Canada, of which over half were in Ontario (26%) and Quebec (22%). In Manitoba, there were just over 2,200 jobs in the mining sector.

Figure 5: Mining employment by province, 2018[6]

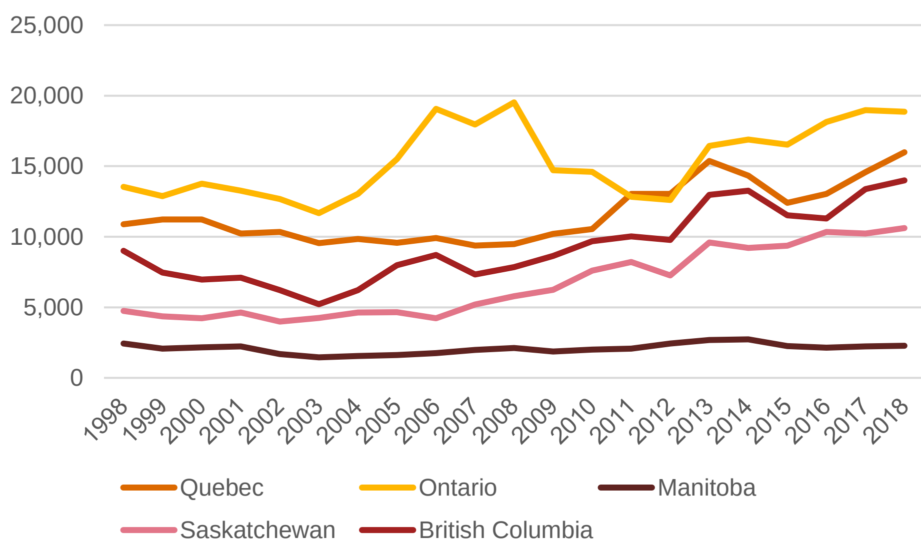


Among the provinces with the highest mining employment (Ontario, Quebec, British Columbia, and Saskatchewan), employment has been on an upward rend since 2015. In Manitoba, however, employment has been

5 Ibid
6 Statistics Canada Table 36-10-0489-01, Labour statistics consistent with the System of National Accounts (SNA), by job category and industry

steady at just over 2,000 jobs. If the Lynn Lake site is developed, the project will directly employ approximately 400 people on an annual basis over the life of the mine, which would represent a significant share of Manitoba's mining employment (18% of 2018 employment, for example).

Figure 6: Mining employment by province[7]

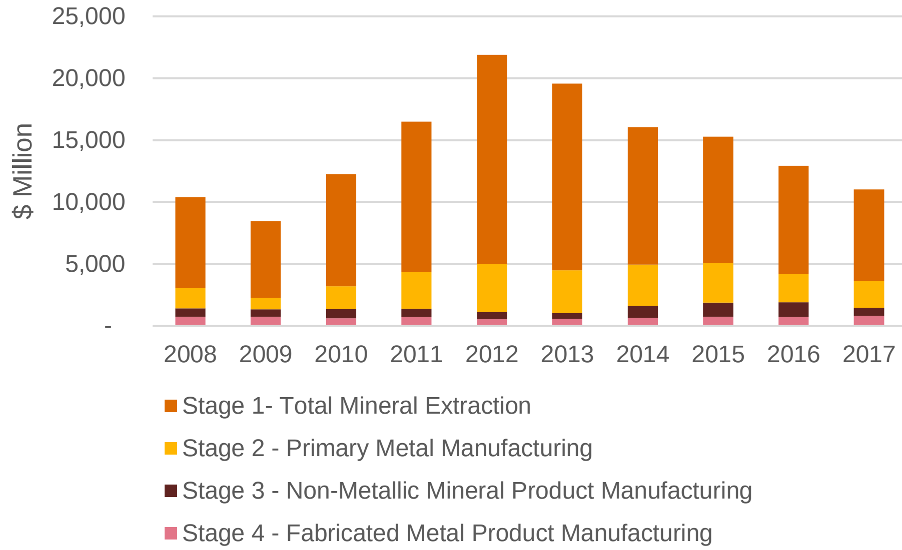


Investment in the mining sector

Capital spending enables new mine construction, increases existing mine capacity, sustains mine operations, and improves efficiency. It is an indicator of investors' confidence in future market conditions and the business environment in a particular jurisdiction. In 2017, the mining industry accounted for 4.4% of total capital spending in Canada of $11.7 billion. As shown in Figure 7, most mining-related capital expenditure is spent on extraction. Total capital investment in the Canadian mining sector declined each year between 2012 and 2017, which poses a challenge for sustaining ongoing mining activity in the future.

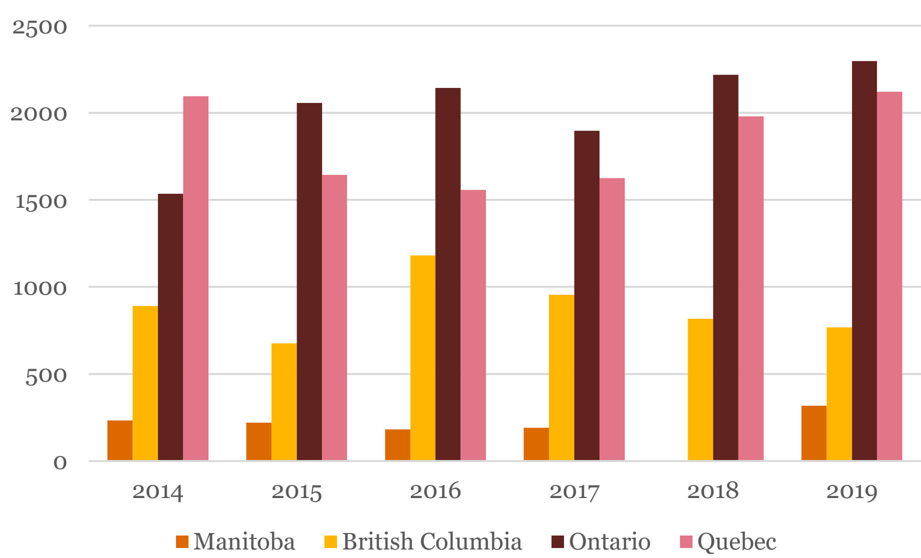
[7] Statistics Canada Table 36-10-0489-01, Labour statistics consistent with the System of National Accounts (SNA), by job category and industry

Figure 7: Mining related capital expenditures in Canada[8]



As illustrated by Figure 8, capital expenditures in the mining sector vary by province. Since 2016, mining capital expenditure has been increasing in Ontario and Quebec, and stagnant or decreasing in most other regions in Canada. Mining capital expenditure in Manitoba in 2019 is estimated at $318.0 million, its highest recorded level since 2013. 2018 data was not available due to poor data quality, which suggests that it was closer to zero. Therefore, it is too early to say whether the increase seen in 2019 is an enduring trend.

Figure 8: Mining related capital expenditures by province[9]

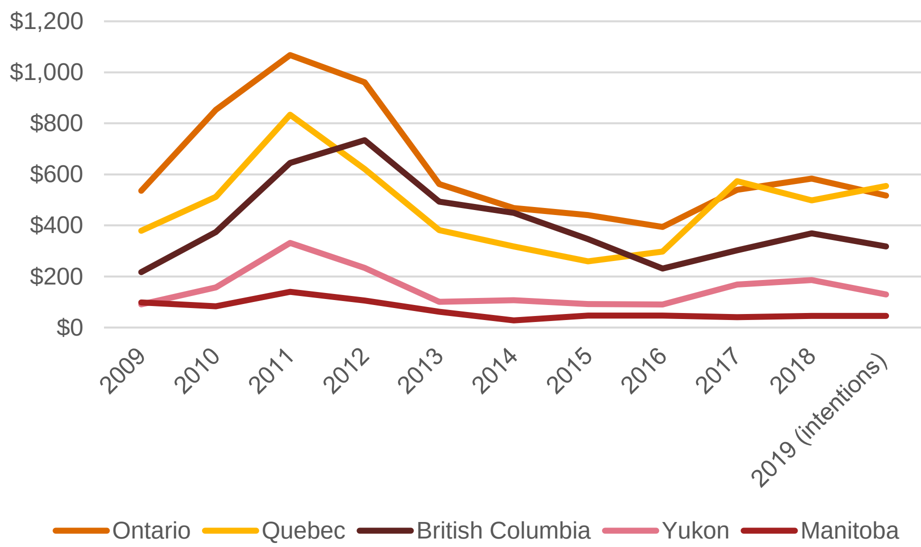


Exploration spending is another indicator of upcoming investment. It represents the geological potential in a jurisdiction, as well as perceptions about commodity prices and the policy and regulatory environment. As shown in Figure 9, overall trends are similar to capital spending, with increases in Ontario, Quebec, and British Columbia.

[8] Mining Association of Canada Facts and Figures
[9] Fraser Institute, 2019

Exploration spending in Manitoba increased slightly in 2018 to $45.5 million, up from $41.1 million in 2017. 2019 spending intentions are similar, at $46.0.

Figure 9: Mining exploration and deposit appraisal spending by province[10]

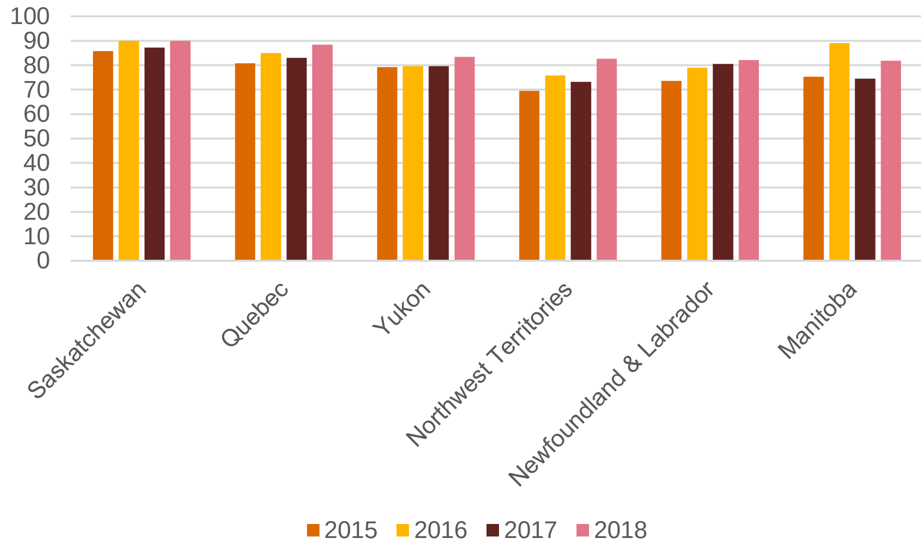


Attractiveness to mining investment

The Fraser Institute annually assesses the investment attractiveness of mining jurisdictions around the world through its Annual Survey of Mining Companies. Although this study may be subject to response bias, it is valuable as a measure of investor sentiment. The Survey's Investment Attractiveness Index takes into account both policy perception and investor confidence. Figure 10 shows the attractiveness index for the top provinces in 2018. The three most attractive jurisdictions in Canada were Saskatchewan, Quebec, and the Yukon. Manitoba's Investment Attractiveness Index increased from 74.5 in 2018 to 81.78 in 2018 and maintained its rank as the sixth-most attractive jurisdiction in Canada. Compared to other jurisdictions, Manitoba is cited as having less favourable permitting times, taxation regime, socioeconomic agreements, and community development conditions.

[10] Natural Resources Canada, 2019

Figure 10: Fraser Institute Investment Attractiveness Index for top rated Canadian provinces



Lynn Lake Project economic footprint assessment

We have estimated the economic footprint of the proposed Lynn Lake Project over the life of the mine, which includes an anticipated two years of construction, thirteen years of operation, and a closure period. Over the mine life, Alamos anticipates $493.1 million in capital expenditure and $1.9 billion in operational spending.

This study is an update of a 2018 study that estimated the economic footprint of the Lynn Lake project. Since the previous study, Alamos has made additional discoveries that allowed them to extend the operating life of the mine from eleven to thirteen years. This change has led to increased anticipated spending in Manitoba, by $42 million in capex and $405 million in operating expenditure, along with increased direct employment. Additional exploration at the site has the potential to further increase the operating life, along with associated spending and employment.[11]

Provincial impacts

The following table shows the net present value of the economic impacts in Manitoba over the life of mine i.e. the number of years for mine development and operation.[12] We have applied a discount rate of 5% to estimate the net present value of the project. Employment is expressed in full-time equivalent person years. In total over the life of mine, the economic footprint of the project would be $965 million in GDP, $684 million in labour income, 11,030 person year jobs and $358 million in total taxes, of which $163 million are provincial taxes.

Table 2: Economic impacts in Manitoba, CAD (000s) except for employment

Impact types	GDP	Labour income	Employment in person years
Direct	636,627	534,035	6,258
Indirect	75,994	41,788	1,001
Induced	252,409	108,196	3,772
Total	**965,030**	**684,020**	**11,030**

[11] The previous study used the Statistics Canada Input Output Model, whereas this study uses the Manitoba Bureau of Statistics Economic Impact Assessment Model and Tax Revenue Impact Assessment Model, meaning that multipliers may have changed slightly, so the results are not directly comparable.
[12] For the purpose of our analysis, reclamation and closure activity was included in the last year of operating life.

Table 3: Total tax impact, CAD (000s)

Type of taxes	Total impact
Provincial taxes	162,691
Personal income tax	46,564
Corporate income tax	7,498
Other direct taxes	82,962
Indirect taxes	18,329
Carbon tax	7,337
Local taxes	34,434
Federal taxes	160,796
Total taxes	**357,921**

Regional impacts

The following table shows the net present value of the economic impacts in the Northern region of Manitoba over the life of the mine. Overall, 69% of the total economic impact takes place in the Northern region. Note that tax impacts were not estimated for the Northern region specifically, because of the uncertainty around the types and value of taxes collected at the regional level.

Table 4: Economic impacts in Manitoba's Northern region, CAD (000s) except for employment

Impact types	GDP	Labour income	Employment in person years
Direct	636,627	534,035	6,258
Indirect	6,286	3,456	83
Induced	20,877	8,949	312
Total	**663,789**	**546,441**	**6,652**

Appendix A: Methodology

Input-output

The fundamental philosophy behind economic impact analysis is that spending on goods and services has attendant impacts throughout the economy. For instance, mining will generate demand for the inputs to this process (such as tools and labour) that in turn generates additional demand that extends beyond the initial spending. Our analysis permits the estimation of this cascading effect by using the input-output model of the Manitoba economy.

The input-output model used for the purpose of this report estimates the relationship between economic activity for a given good or service and the resulting impacts throughout the economy (including demand for other goods and services and tax revenues). For the purpose of this report, economic impacts were estimated for the following measures of economic activity:

- **Value added or GDP** – the value added to the economy, or the output valued at basic prices less intermediate consumption[13] valued at purchasers' prices. GDP includes only final goods to avoid double counting of products sold during a certain accounting period.
- **Employment** – the number of FTE jobs created or supported.
- **Labour income** – the amount earned by the employment expected to be generated from existing operations.
- **Government revenue** – the amount of revenue collected by the provincial, local and federal government. It includes personal and corporate income taxes collected on a provincial level and territorial, as well as other direct and indirect taxes.

Economic impacts are typically estimated at the direct, indirect and induced levels:

- **Direct impacts** are those that result directly from the company's expenditures on labour and capital as well as gross operating profits.
- **Indirect impacts** arise from the activities of the firms providing inputs to the company's suppliers (in other words, the suppliers of its suppliers).
- **Induced impacts** are the result of consumer spending by employees of the businesses stimulated by direct and indirect expenditures.

The input-output model for Manitoba, used for the purpose of this assessment, was developed based on Statistic Canada's model and is maintained by the Government of Manitoba.

[13] Defined as the value of goods and services used or transformed as inputs by a process of production.

Regional impacts

In addition to the province-wide impacts, we have estimated the economic impacts associated with the Lynn Lake Project at a sub-provincial level. The regional impacts were estimated for the Northern region of Manitoba, which consists of the following four Manitoba census divisions: 19, 21, 22 and 23. Refer to Statistics Canada 2016 Census for exact definition of the census divisions used.

In order to allocate the above impacts to the four census divisions of Manitoba, we applied a location quotient to each industry affected by the project. A location quotient is an analytical statistic that measures a region's (in this case, the four census divisions considered) industrial specialization relative to a larger geographic unit (Manitoba). We compute the location quotient as an industry's share of a regional total for employment by economic area divided by the industry's share of the provincial total for employment in each industry affected.

Note that direct impacts, by definition, occur at the project site, which is located within the four census divisions. Indirect and induced impacts were allocated to each region based on the methodology described above.

Carbon tax

Carbon tax payments were estimated based on projections provided by Alamos, who expects to participate in the Output-Based Pricing System. This analysis has assumed that the price of carbon will stay at $50 from 2022 to the end of the mine life. To the extent that the price increases, actual carbon tax paid may be higher than these estimates. The projected carbon tax payments do not account for any offsets that may be applied against the tax value, which may reduce the value of carbon tax paid.

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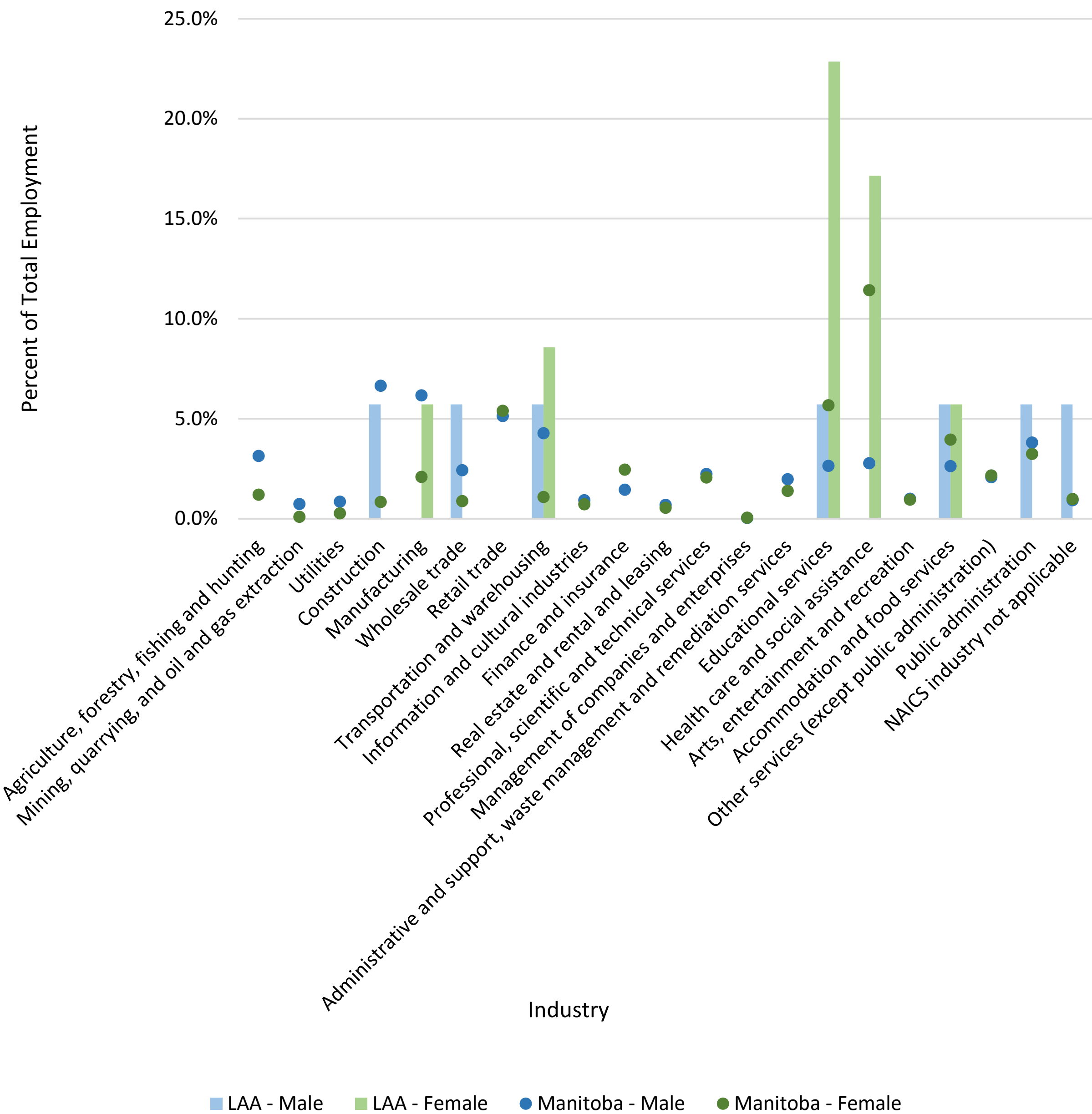
Statistics Canada CANSIM Table 36-10-0402-01, Gross domestic product (GDP) at basic prices, by sector and industry, provincial and territorial (x 1,000,000)

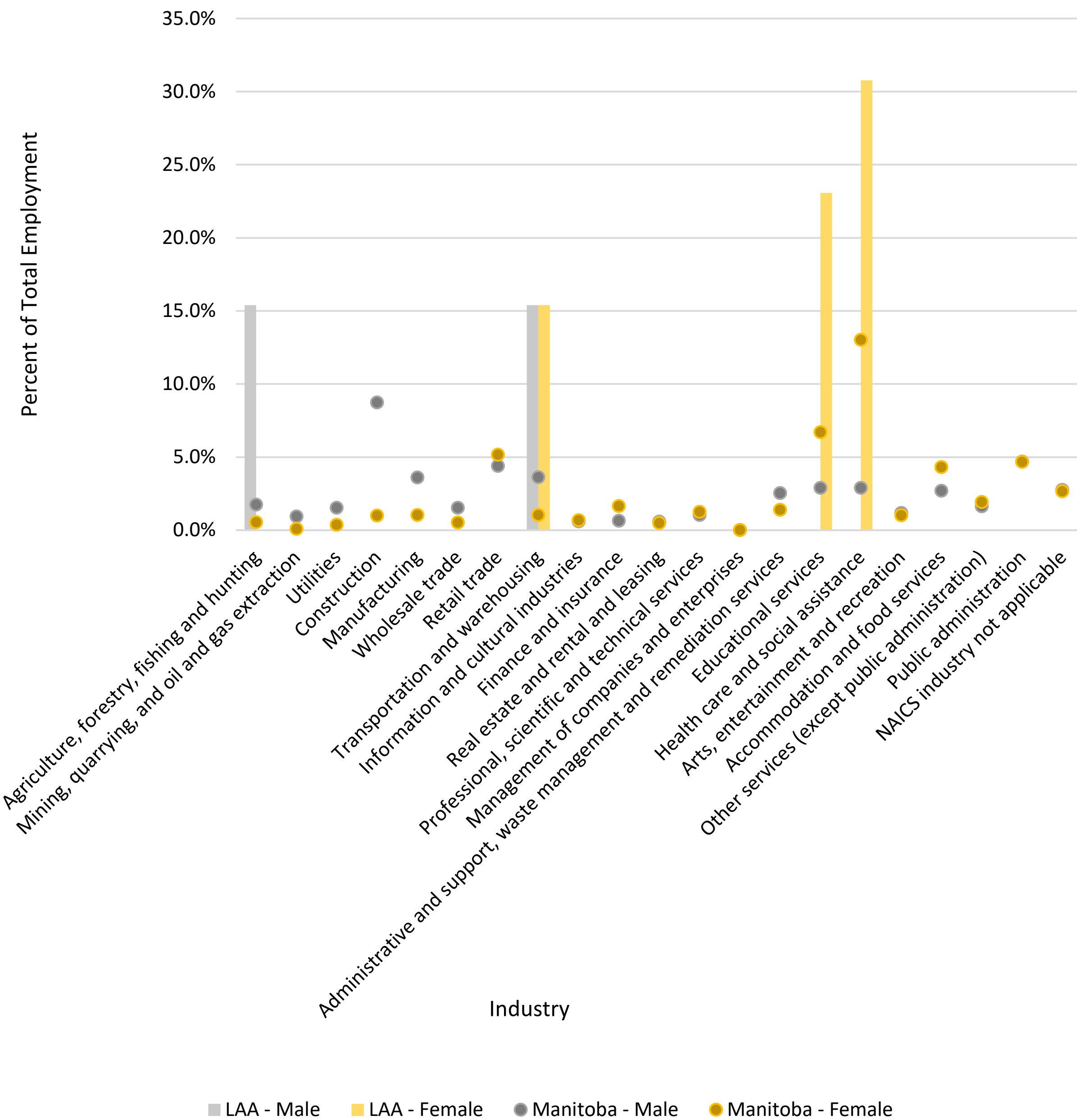
Statistics Canada Table 36-10-0489-01, Labour statistics consistent with the System of National Accounts (SNA), by job category and industry

Appendix 13B FIGURES



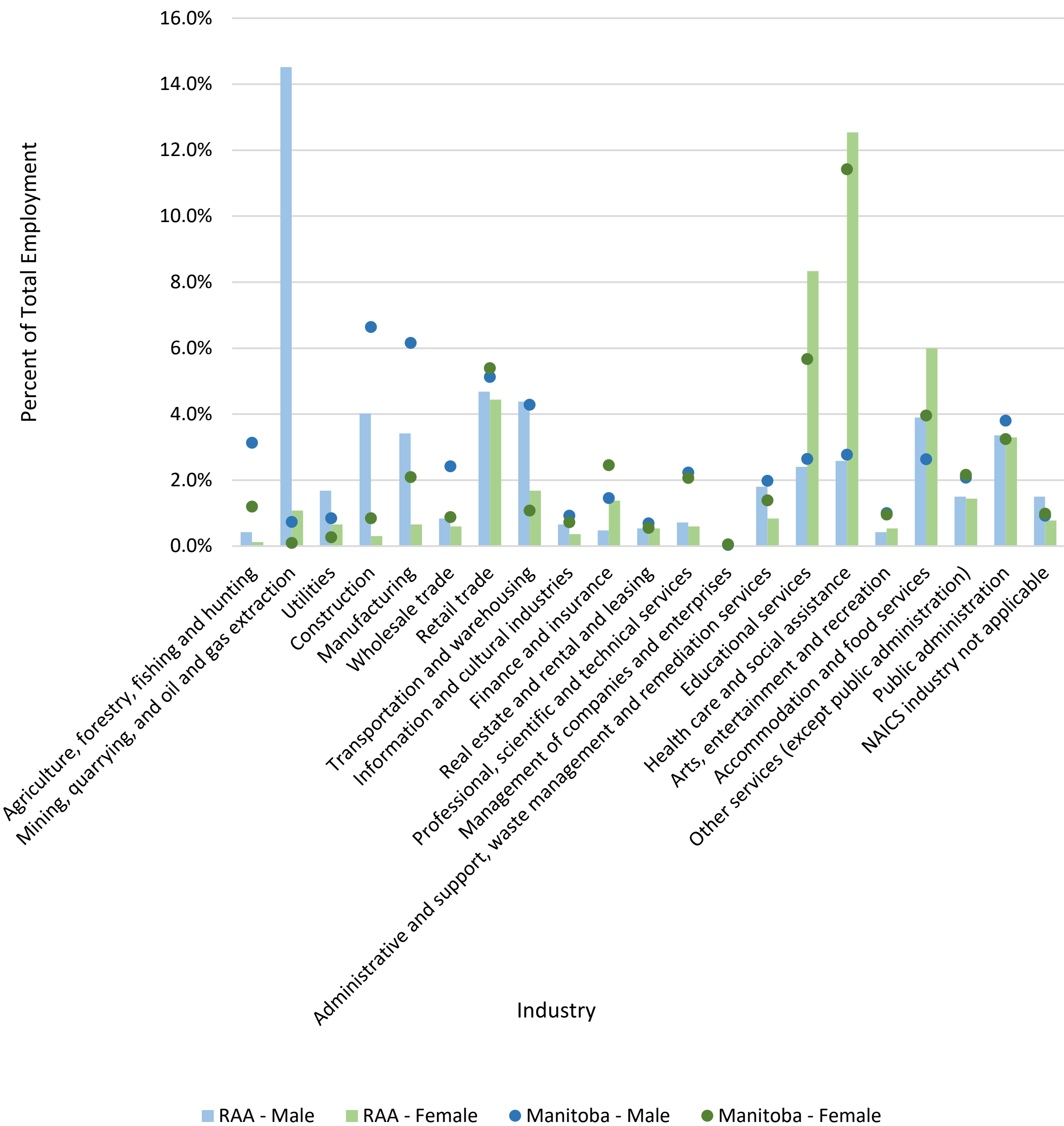
SOURCE: Statistics Canada 2017

Figure 13B-1 Industry Employment 2016, by Sex, Total Population – Lynn Lake



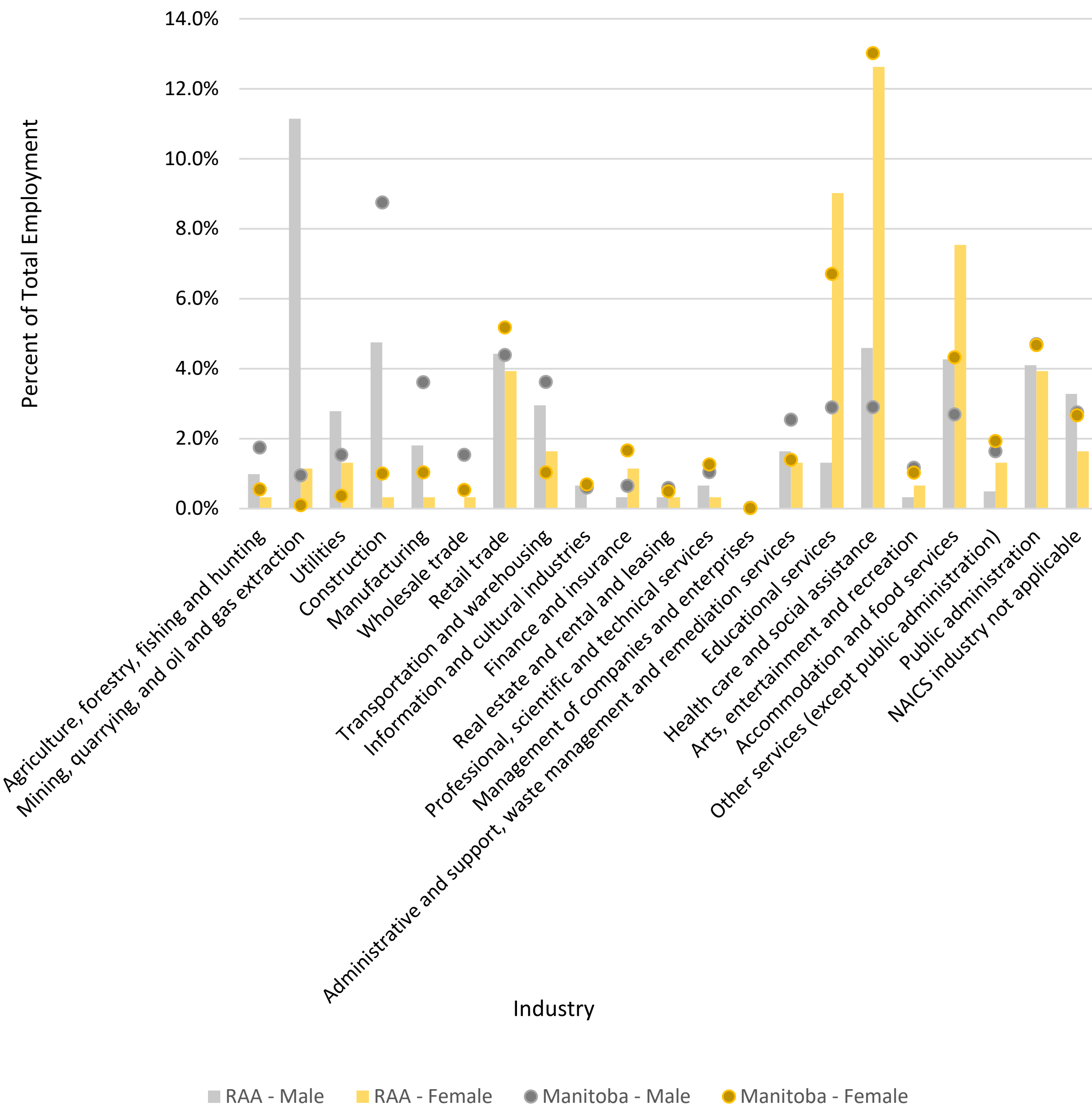
SOURCE: Statistics Canada 2018

Figure 13B-2 Industry Employment 2016, by Sex, Indigenous Population – Lynn Lake



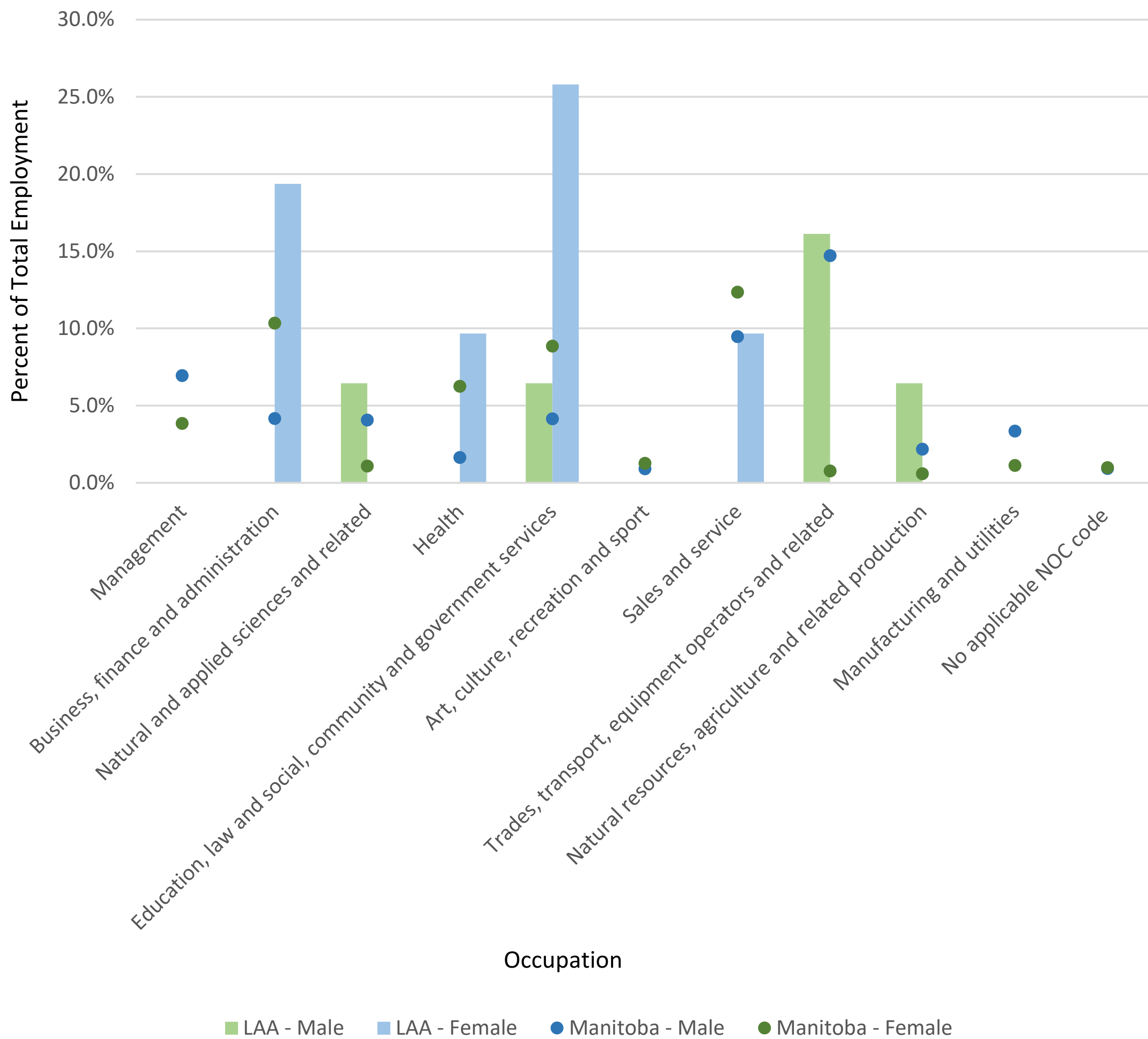
SOURCE: Statistics Canada 2017

Figure 13B-3 Industry Employment 2016, by Sex, Total Population – RAA



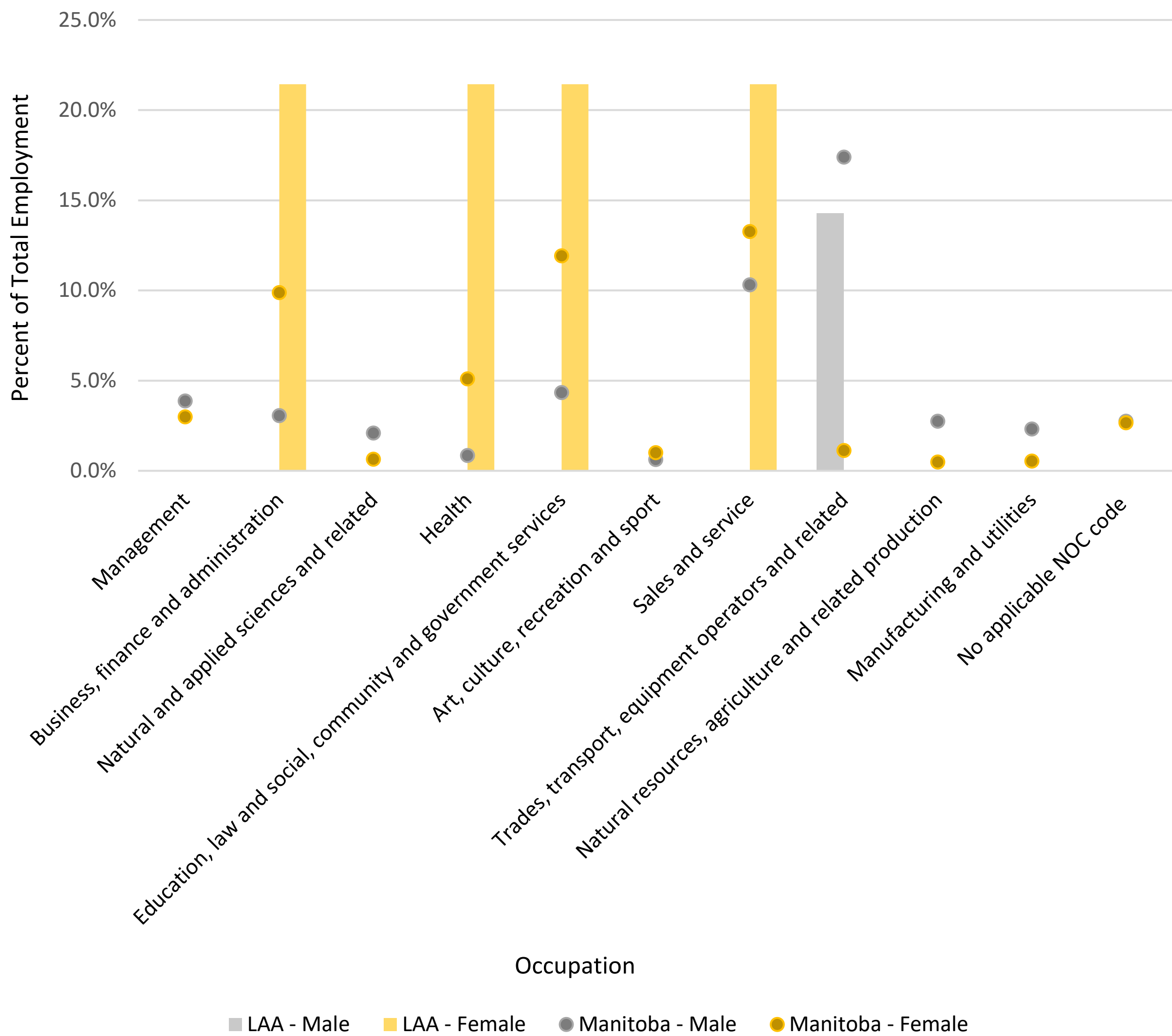
SOURCE: Statistics Canada 2018

Figure 13B-4 Industry Employment 2016, by Sex, Indigenous Population – RAA



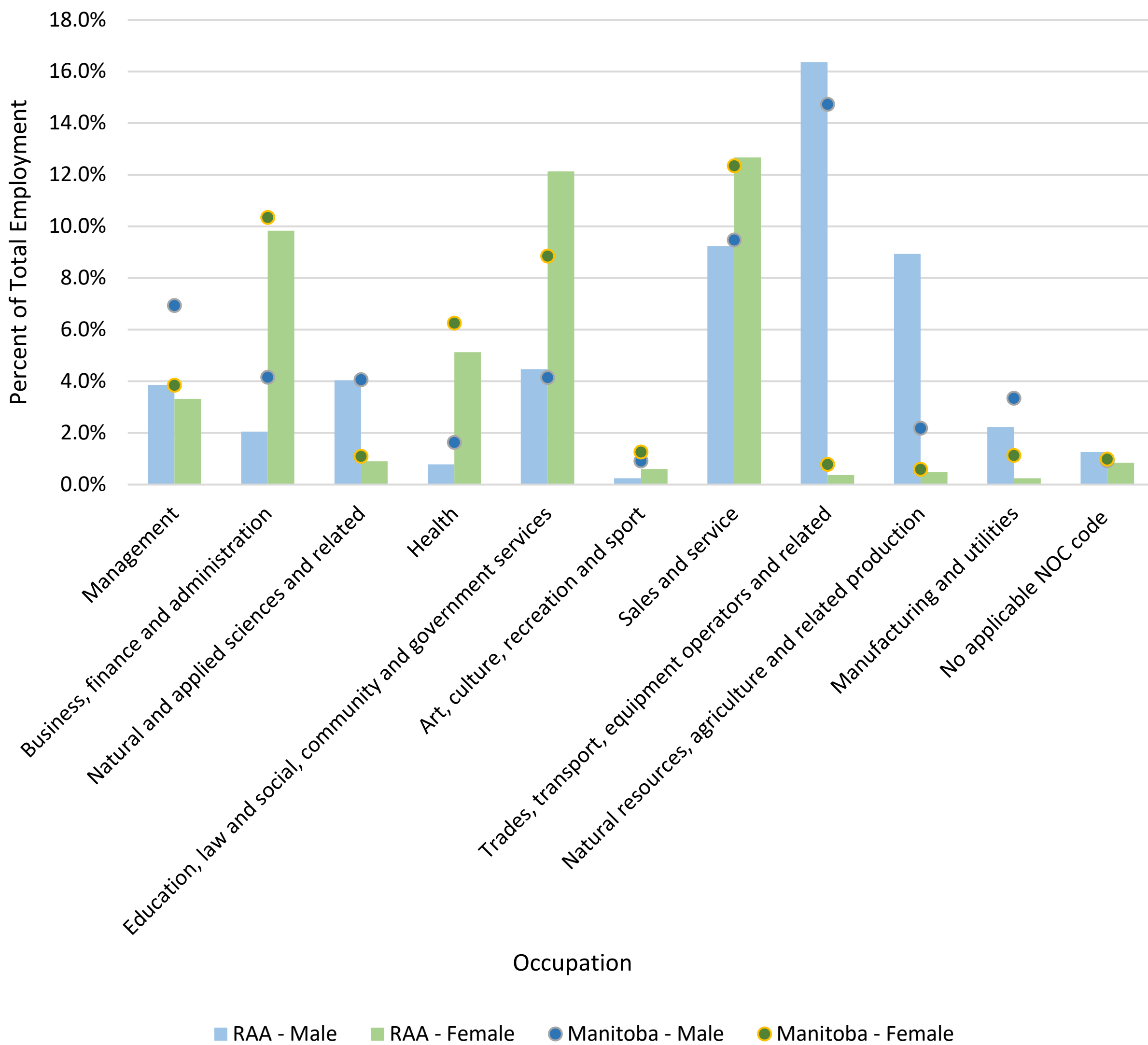
SOURCE: Statistics Canada 2017

Figure 13B-5 Occupational Employment 2016, by Sex, Total Population – Lynn Lake



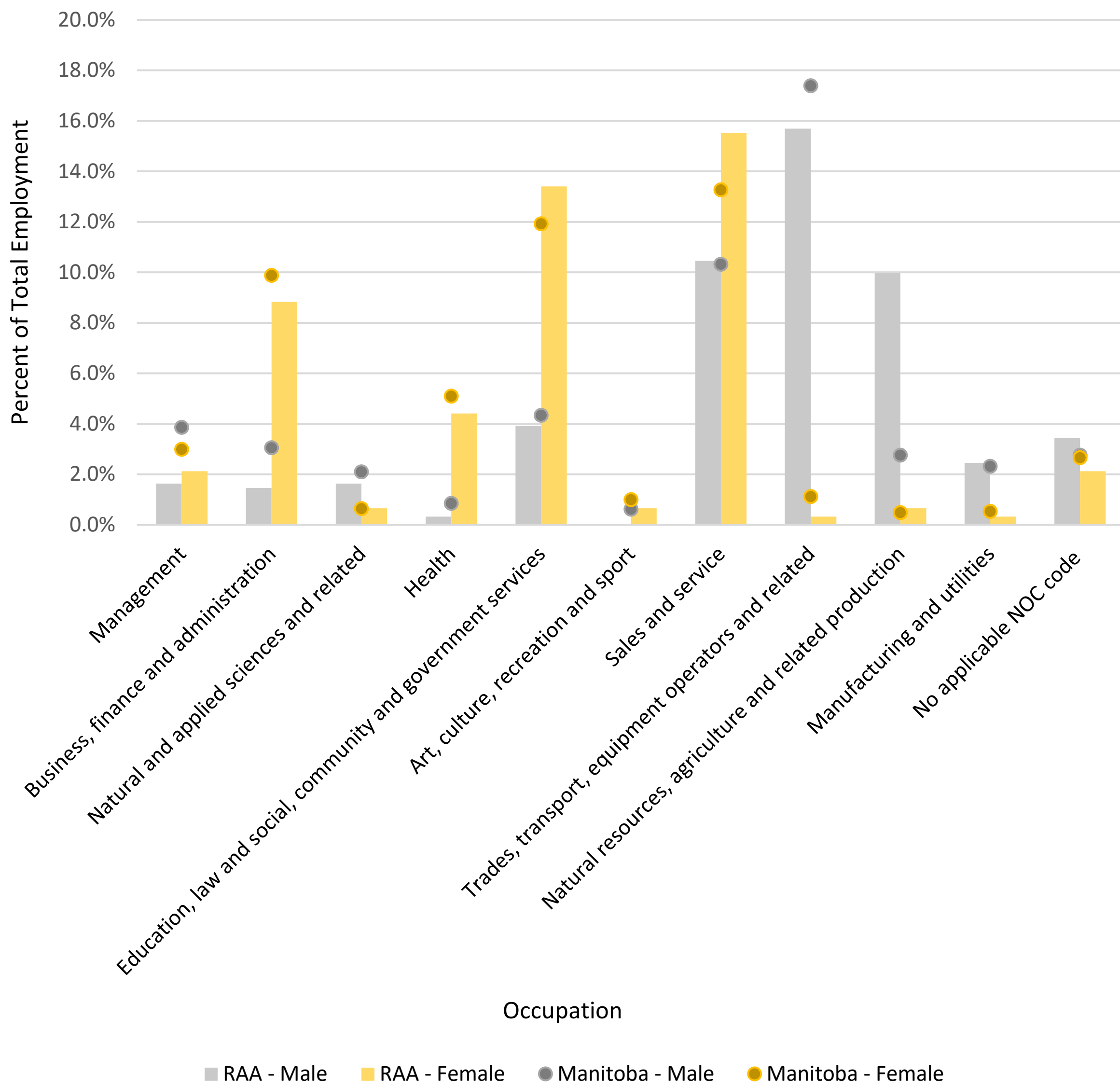
SOURCE: Statistics Canada 2018

Figure 13B-6 Occupational Employment 2016, by Sex, Indigenous Population – Lynn Lake



SOURCE: Statistics Canada 2017

Figure 13B-7 Occupational Employment 2016, by Sex, Total Population – RAA



SOURCE: Statistics Canada 2018

Figure 13B-8 Occupational Employment 2016, by Sex, Indigenous Population – RAA

ALAMOS GOLD INC.

Lynn Lake Gold Project Environmental Impact Statement Chapter 14 – Assessment of Potential Effects on Community Services, Infrastructure, and Wellbeing

Stantec

Prepared by:

Stantec Consulting Ltd.

May 25, 2020

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Acronyms and Abbreviations

Alamos	Alamos Gold Inc.
ATV	all-terrain vehicle
CMHC	Canadian Mortgage and Housing Corporation
DIDO	drive-in-drive-out
EIS	Environmental Impact Statement
EMS	emergency medical services
EPCM	Engineering, Procurement, and Construction Management
FIFO	fly-in-fly-out
FTE	full-time equivalent
kg	kilogram
KHA	Keewatin Housing Authority
km	kilometre
LAA	Local Assessment Area
LGD	Local Government District
LLFD	Lynn Lake Fire Department
m	metres
MCC	Manitoba Conservation and Climate (formerly Manitoba Sustainable Development)
MHSAL	Manitoba Health Seniors and Active Living
MH	Manitoba Housing
mm	millimeter
NRHA	Northern Regional Health Authority
PDA	Project Development Area

PR	provincial road
RAA	Regional Assessment Area
RCMP	Royal Canadian Mounted Police
TMF	tailings management facility
VC	valued component
WDG	waste disposal grounds

14.0 ASSESSMENT OF POTENTIAL EFFECTS ON COMMUNITY SERVICES, INFRASTRUCTURE, AND WELLBEING

Community services, infrastructure, and wellbeing was selected as a valued component (VC) because construction, operation, and decommissioning/closure of the Project could increase demand for community services and infrastructure and affect (beneficially or adversely) community wellbeing. The Project also has the potential to result in positive effects through upgrades to existing infrastructure to address increased demand caused by the Project.

Community services and infrastructure include housing and temporary accommodations, transportation, and local services and infrastructure (water, sewer, power, solid waste, education, recreation, safety, and health care). Community wellbeing refers to socio-economic determinants of health (i.e., socio-economic conditions, health behaviours, and personal resources). Community wellbeing is indicated by levels of perceived health, stress, sense of community belonging, life satisfaction, rates of obesity, smoking and heavy drinking compared with provincial averages.

Community services in the Local Assessment Area (LAA; Section 14.1.4.1) have declined because of population loss as a result of mine closures. There is available capacity for some community infrastructure, specifically those related to education, recreation, and health care. However, most facilities are 40 years old and in need of repair, upgrading or replacement. The water and waste-water systems are either unable to meet demand or close to reaching their physical capacity, and available housing is in a state of disrepair.

In the absence of workplace readiness measures, the available labour force in the LAA is insufficient to meet the Project's requirements for skilled and unskilled labour. It is anticipated that most Project labour will come from outside the LAA, mainly from Thompson, Flin Flon, and Winnipeg, Manitoba. Minor levels of in-migration are anticipated.

An assessment of potential Project-related effects on the human environment requires an understanding of potentially-affected aspects of community services, infrastructure, and wellbeing, both locally and regionally. Project aspects that could affect socio-economic baseline conditions include Project labour requirements and expenditures, demand on housing and accommodations, the transportation of goods and equipment, on-site water and wastewater management demand, and the generation of solid waste.

This assessment is linked to other VC assessments and is informed by the conclusions of the effects assessment of the following VCs:

- Labour and Economy (Chapter 13) – estimates of Project employment inform the assessment of effects on community services and infrastructure, while baseline labour force and income information, as well as estimates of Project employment and labour income, inform the assessment of community wellbeing.

Other sections that are supported by components of this assessment include Chapter 19 (Indigenous Peoples).

14.1 SCOPE OF ASSESSMENT

This section defines and describes the scope of the assessment of potential effects on community services, infrastructure, and wellbeing.

14.1.1 Regulatory and Policy Setting

Several federal and provincial regulatory requirements may apply to this VC, including environmental assessment and other environmental permitting obligations. The following regulatory, policy, and guidance documents are applicable to the assessment of community services, infrastructure, and wellbeing:

- Manitoba Sustainable Development's (now Manitoba Conservation and Climate; MCC) 2018 *Environment Act* Proposal Report Guidelines, which require consideration of Project effects on humans and socio-economic implications resulting from environmental effects. Project-specific guidelines were not issued by MCC for this Project.

- Manitoba Health Seniors and Active Living's (MHSAL, formerly Manitoba Health and Healthy Living) 'Community Health Assessment Guidelines' (MHHL 2009a, 2009b), which provide a framework from which provincial health authorities develop region-specific Community Health Assessments. This framework, in the absence of specific federal and provincial guidance regarding the treatment of social determinants of health within environmental assessment, informed the assessment of community wellbeing.

- The Canadian Environmental Assessment Agency (now the Impact Assessment Agency of Canada) Final Guidelines for the Preparation of an Environmental Impact Statement (EIS), dated November 2017 (Appendix 4A) issued for the Project, which require assessment of effects on the human environment, including socio-economic conditions (encompassing a broad range of matters that affect communities in the study area in a way that recognizes interrelationships, system functions and vulnerabilities).

14.1.2 The Influence of Engagement on the Assessment

Engagement has been ongoing prior to and throughout the EIS process, and will continue with local Indigenous communities, stakeholders, the public, and government agencies through the life of the Project. More detail on the Engagement process can be found in Chapter 3.

Engagement feedback related to community services, infrastructure, and wellbeing has been addressed through direct responses, updates to baseline information, and in the EIS, as appropriate.

As part of the information sharing throughout the engagement process, Project-related information was provided by Indigenous communities in the form of traditional land and resource use (TLRU) studies and other forms of information sharing. Project-specific engagement was conducted with Marcel Colomb First Nation, Mathias Colomb Cree Nation, Peter Ballantyne Cree Nation, Manitoba Metis Federation, Métis Nation-Saskatchewan Eastern Region 1, Nisichawayasihk Cree Nation, O-Pipon-Na-Piwin Cree Nation, Métis Nation-Saskatchewan Northern Region 1, Barren Lands First Nation, Hatchet Lake First Nation, Northlands Denesuline First Nation and Sayisi Dene First Nation.

A Project-specific TLRU study was completed collaboratively with Marcel Colomb First Nation with a final report provided to the community on January 11, 2018 (Stantec 2018). The TLRU study included interviews with participants selected by Marcel Colomb First Nation regarding traditional land use in the Project area, including availability of traditional resources, access to traditional resources or areas, occupancy, cultural sites and areas, and experience of TLRU.

A Project-specific TLRU study was completed in collaboration with Peter Ballantyne Cree Nation but has not yet been released by community leadership for use in the environmental assessment. The TLRU study included interviews with community members in Kinoosao, Saskatchewan.

A TLRU study (Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project) was completed by an independent consultant for the Manitoba Metis Federation (SVS 2020), the results of which were received in February 2020. The study documents harvesting and land use by the Manitoba Métis Community within a 100-kilometre (km) radius of the Project.

Additionally, four open house public meetings have been held to date in Lynn Lake (in 2015, 2016, 2017 and 2020) for members of the local community including Marcel Colomb First Nation (Chapter 3). Open house attendees were invited to complete questionnaires to provide feedback on the Project, as well as identify issues, concerns or inquiries related to the Project.

In general, the questions, comments and concerns regarding community services, infrastructure, and wellbeing that were identified during engagement and through Project surveys (and then influenced the scope of the assessment) pertained to:

- Opportunities for improved housing or other benefits, specifically for local Indigenous communities.
- Project infrastructure.
- Increased traffic.
- Housing shortages.
- Demand on local landfills, water, and wastewater systems.
- Adverse population-related effects (i.e., in-migration of workers and presence of temporary workers) on local communities.
- Increased reliance on negative coping skills (e.g., alcohol misuse, substance abuse) resulting from gained employment and increased incomes.

14.1.3 Potential Effects, Pathways and Measurable Parameters

Table 14-1 summarizes the potential environmental effects of the Project on community services, infrastructure, and wellbeing, the measurable parameters, and the rationale for their selection. These potential environmental effects and measurable parameters were selected based on the review of regulatory, policy, and guidance documents, professional judgment, recent environmental assessments for mining projects in Manitoba and other parts of Canada, and comments provided during engagement.

Table 14-1 Potential Effects, Effects Pathways and Measurable Parameters for Community Services, Infrastructure, and Wellbeing

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Community services and infrastructure		
Change in housing and temporary accommodations	• Demand on housing and temporary accommodations may be affected by Project activities and Project-related population growth.	• Availability of accommodations (vacancy rates, inventory levels) • Cost of accommodation ($) • Shelter-to-income ratio
Change in local services and infrastructure	• Demand on local services and infrastructure may be affected by Project activities and Project-related population growth.	• construction and operation labour force • Number of hospital beds • Police officers/100,000 population • Physicians/100,000 population • Teacher:Student ratio
Change in transportation services and infrastructure	• Demand on transportation services and infrastructure may be affected by Project activities and Project-related population growth.	• Road volume (vehicles/day) • Capacity of air transportation infrastructure
Community wellbeing		
Change in community wellbeing	• Project-related employment has the potential to increase individual and household income, increase disposable income, and reduce financial barriers to beneficial health practices or negative coping mechanisms. • Project-related population growth has potential to change the demographics of nearby communities and result in changes to community cohesion • The Project has the potential to change (increase or decrease) the amount of time individuals and households have to participate in recreational, subsistence, and family-related activities through gained employment	• Community Wellbeing (CWB) Index score • Social cohesion • Local Project employment and wages • Disposable income • Number of in-migrating and transient workers • Shift schedule (days on/off)

14.1.4 Boundaries

14.1.4.1 Spatial Boundaries

The following spatial boundaries, based on Statistics Canada administrative boundaries[1], are used to assess Project effects, including residual and cumulative environmental effects, on community services, infrastructure, and wellbeing in the region surrounding the Gordon and MacLellan sites and access roads (Map 14-1):

- Project Development Area (PDA): encompasses the immediate area in which Project activities and components may occur at each site, plus a 30-metre (m) buffer, and is the anticipated area of direct physical disturbance associated with construction and operation of the Project (i.e., the Project footprint).
- Local Assessment Area (LAA): consists of the Town of Lynn Lake and Black Sturgeon Indian Reserve (IR), which represent the populated census subdivisions within 30 km of the Gordon and MacLellan sites. Given their proximity to these properties, these are the communities most likely to experience Project effects related to demands on community services and infrastructure and changes in community wellbeing.
- Regional Assessment Area (RAA): includes the LAA, as well as the other populated census subdivisions within a 100-km distance of the Gordon and MacLellan sites. These are:
  - Town of Leaf Rapids, Manitoba.
  - Black Sturgeon IR, Manitoba, a settlement of the Marcel Colomb First Nation.
  - Granville Lake Indian Settlement (IS), Manitoba, a settlement of the Mathias Colomb Cree Nation.
  - South Indian Lake IS, Manitoba, a settlement of the O-Pipon-Na-Piwin Cree Nation.
  - Kinoosao-Thomas Clarke 204 IR, Saskatchewan, the most northern community within the Peter Ballantyne Cree Nation territory.
  - The City of Thompson, Manitoba, which is approximately 200 km from the Gordon site, is also included in the RAA due to its role as the regional service center for northern Manitoba.

14.1.4.2 Temporal Boundaries

The temporal boundaries for the Project consist of the following phases:

- Construction – two years (scheduled to be carried out concurrently from Year -2 to Year -1 at both sites).

[1] These Statistics Canada administrative boundaries consist of the following standard geographical classifications: Census subdivision including towns, cities, Indian Reserves, and Indian Settlements. This nomenclature (e.g., Black Sturgeon IR) is unique to Chapters 13 and 14.

- Operation – 13 years (scheduled to be carried out from Year 1 to Year 6 at the Gordon site and from Year 1 to Year 13 at the MacLellan site).
- Decommissioning/closure – five to six years of active closure (scheduled to begin in Year 6 at the Gordon site and in Year 14 at the MacLellan site). Active closure will be followed by post-closure, which is the time period during which active reclamation measures are complete, but monitoring is still required. The expected duration for post-closure is approximately 10 years. Pit filling is expected to take 11 years at the Gordon site and 21 years at the MacLellan site under average conditions (Chapter 9, Section 9.4.1). Permanent closure will occur when the site is stable, and monitoring is no longer required. For Community Services, Infrastructure, and Wellbeing this will occur when active closure is complete and demand on community services and infrastructure to support the Project is no longer required. The duration and conditions for post-closure monitoring and permanent closure will be detailed in subsequent submissions of the Closure Plan to regulatory agencies as Project design and execution progresses.

14.1.5 Residual Effects Characterization

Table 14-2 summarizes how residual environmental effects are characterized in terms of direction, magnitude, geographic extent, timing, frequency, duration, reversibility and in ecological/socio-economic context. Quantitative measures or definitions for qualitative categories are provided.

Table 14-2 Definitions of Criteria used to Characterize Residual Effects on Community Services, Infrastructure, and Wellbeing

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Positive –** a residual effect that moves measurable parameters in a direction beneficial to community services, infrastructure, and wellbeing relative to baseline. **Adverse –** a residual effect that moves measurable parameters in a direction detrimental to community services, infrastructure, and wellbeing relative to baseline.
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	<u>**Community services and infrastructure:**</u> **Negligible –** no measurable change. **Low —** capacity of community services and infrastructure will be at or near to baseline conditions. **Moderate —** demand for community services and infrastructure approaches current capacity, standard or threshold but will not result in a reduction in standards of service. **High —** demand for community services and infrastructure exceeds current capacity, standard or thresholds that result in a reduction in standards of service.

Table 14-2 Definitions of Criteria used to Characterize Residual Effects on Community Services, Infrastructure, and Wellbeing

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	<u>**Community wellbeing:**</u> **Negligible –** no measurable change. **Low —** the Project will have a measurable effect on community wellbeing, but within the range of normal variation in baseline conditions **Moderate —** the Project will have a measurable effect on community wellbeing that exceeds the normal variation in baseline conditions, but which can be managed using existing resources **High —** the Project will have a measurable effect on community wellbeing which will exceed the management capacity of existing resources
Geographic Extent	The geographic area in which a residual effect occurs	**PDA –** residual effects are restricted to the PDA **LAA –** residual effects extend into the LAA **RAA –** residual effects interact with those of other projects in the RAA
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	**Not Applicable –** seasonal aspects are unlikely to affect community services, infrastructure and wellbeing **Applicable –** seasonal aspects may affect community services, infrastructure, and wellbeing
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	**Single event** **Multiple irregular event –** occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Duration	The time required until the measurable parameter or the VC returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	**Short-term –** residual effect restricted to construction **Medium-term –** residual effect extends through the operating life of the project **Long-term –** residual effect extends beyond the life of the project
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	**Reversible –** the residual effect is likely to be reversed after activity completion and reclamation **Irreversible –** the residual effect is unlikely to be reversed

Table 14-2 Definitions of Criteria used to Characterize Residual Effects on Community Services, Infrastructure, and Wellbeing

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Ecological and Socio-economic Context	Existing condition and trends in the area where residual effects occur	**Community services and infrastructure:** **Resilient** – community services and infrastructure have capacity to accommodate increased demand. **Not Resilient** – community services and infrastructure have limited capacity to accommodate increased demand. **Community wellbeing:** **Resilient** – community has a moderate to high capacity to recover from a perturbation, with consideration of the existing level of disturbance. **Not Resilient** – community has a low capacity to recover from a perturbation, with consideration of the existing level of disturbance.

14.1.6 Significance Definition

A significant adverse residual effect is defined as follows:

- Community services and infrastructure: effect results in an exceedance of available capacity, or a substantial decrease in the quality of a service provided, on a persistent and ongoing basis, which cannot be mitigated with current or anticipated programs, policies, or mitigation measures.
- Community wellbeing: effect is highly distinguishable from current conditions and trends and cannot be managed or mitigated through adjustments to programs, policies, plans, or other mitigation.

14.2 EXISTING CONDITIONS FOR COMMUNITY SERVICES, INFRASTRUCTURE, AND WELLBEING

Existing conditions for community services, infrastructure, and wellbeing for the Project are presented in detail in the Socio-Economic Baseline Technical Data Report and associated Validation Report provided in Volume 4, Appendix P. The existing conditions and the methods used to characterize baseline conditions are summarized below.

14.2.1 Methods

The purpose of the VC is to provide an analysis of the effects that the Project is anticipated to have on community services, infrastructure, and wellbeing within the LAA and RAA. The EIS describes technically and economically feasible measures to manage effects on community services, infrastructure, and wellbeing throughout the Project lifecycle, as well as predicted adverse residual effects and their significance. Baseline information (Volume 4, Appendix P) for this analysis was collected for the following:

- Population change and age cohorts.

- Housing and temporary accommodations (including campgrounds).
- Education.
- Recreation.
- Heath care, social, and emergency services.
- Transportation.
- Utilities (water, wastewater, power, waste).
- Community Wellbeing (CWB) Index scores.
- Self-reported health characteristics.

In addition to personal communications and online sources, such as websites for municipalities, provincial agencies, boards and commissions, planning boards and boards of trade, and school and health boards, the following key sources were used to inform the description of baseline conditions:

- Statistics Canada's 2016 Census of the Population (Census).
- Manitoba Northern Regional Health Authorities' 2014 Community Health Assessment (NHRA 2015).
- Statistics Canada, the Canadian Institute for Health Information's (CIHI) and Health Canada's Canadian Community Health Survey (Statistics Canada 2019a).
- Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)'s CWB Index (ICS 2019a).

With respect to data availability, while LAA and RAA communities fall within the Northern Region Health Authority (NRHA) area, data presented in the latest (2014) NRHA Community Health Assessment cannot be used as proxy for baseline conditions within the LAA and RAA. This is due to the outdated nature of the data and because of the small proportion of the LAA and RAA population living within the NRHA area and RAA (0.7% and 21.7% [of which 87.0% is attributable to the city of Thompson], respectively). Because the LAA and RAA population represent such a small percentage of the NRHA area, data presented in the report are likely skewed in favor of larger population centres within the region (e.g., the City of Thompson, which accounts for 18.9% of the NRHA area's population).

14.2.2 Overview

14.2.2.1 Housing and Temporary Accommodations

Housing

Table 14-3 shows the number of occupied dwellings and private dwellings occupied by usual residents in Lynn Lake, Leaf Rapids, and Thompson (i.e., the communities in the RAA most likely to provide services and infrastructure) in 2016.

Table 14-3 Dwellings, Lynn Lake, Leaf Rapids and Thompson, 2016

	Total Private Dwellings	Private Dwellings Occupied by Usual Residents
Lynn Lake	263	176
Leaf Rapids	272	183
Thompson	5,482	4,910

Source: Statistics Canada 2017a

Note: Private dwelling' refers to a separate set of living quarters with a private entrance either from outside the building or from a common hall, lobby, vestibule or stairway inside the building. The entrance to the dwelling must be one that can be used without passing through the living quarters of some other person or group of persons.

Private dwelling occupied by usual residents refers to a private dwelling in which a person or a group of persons is permanently residing.

In 2016, Lynn Lake had 263 private dwellings of which 176 were occupied by usual residents (a private dwelling in which a person or a group of persons is permanently residing; Statistics Canada 2017a). The Town of Lynn Lake has a mix of ownership and rental units. Most housing is at least forty years old and in poor condition or unlivable in 2016; the average value of a home in Lynn Lake was $56,390 and average monthly rent was $560 (Statistics Canada 2017a). Encouraging long-term residency is a goal of the Town; but with the loss of population, the condition of the Town's housing has deteriorated at the same time that there is a shortage of housing. The appearance of the Town (abandoned buildings, boarded up windows, litter) is an impediment to attracting and retaining residents, businesses, and employees (Town of Lynn Lake 2016).

As of 2013, there were more than 230 abandoned lots in Lynn Lake, 50 with vacant homes that need to be dismantled (ERM 2017). In 2014, Manitoba Housing (MH) built 10 new housing units, which are fully occupied. Some tourists have purchased Lynn Lake homes for seasonal use, attracted by the town's proximity to good hunting and fishing areas and low housing prices (Lynn Lake Mayor and Council 2014).

There is some cottage development at subdivisions at Burge Lake and Eden Lake. As of 2012, there were 20 cottages on Burge Lake. The two subdivisions are part of the First Come First Served Cottage Lot Program managed by MCC. Some residents of the Town of Lynn Lake are building permanent homes at the Burge Lake subdivision. An expansion to Burge Lake Provincial Park on the west shore of Burge Lake, about 10 km from Lynn Lake, has been proposed that would include 15 cottage lots (Graham 2018).

In 2016, there were 272 private dwellings in Leaf Rapids, 67% of them occupied by usual residents (Statistics Canada 2017a). With the closure of the mine in Leaf Rapids, many residents of that community walked away from homes or sold them for as little as $15,000. At that time, Canadian Mortgage and Housing Corporation (CMHC) took over ownership on numerous properties within the community. The majority of homes in Leaf Rapids were built before 1980. In 2016, the average value of a home in Leaf Rapids was $33,088 and average monthly rent was $709 (Statistics Canada 2017a).

The Black Sturgeon IR has 14 housing units. Overcrowding is an issue on the Reserve, with an average occupancy of 14 people per unit. Construction on an additional 14 and 8 housing units began in 2018 and 2019, respectively, but has not yet been completed (Manager pers. comm. 2019b).

New housing construction in Thompson has been limited in the past two decades. More than 65% of dwellings were constructed between 1961 and 1980, making most homes more than 25 years old. In 2016, the average value of dwellings in Thompson was $218,597 (Statistics Canada 2017a).

The overall apartment vacancy rate in Manitoba's urban centres was 2.8% in October 2016, compared to 2.9% a year earlier (CMHC 2016). Thompson's vacancy rate declined from 2.0% in October 2015 to 1.1% in October 2016. The average rent in Thompson, however, decreased from $854 in 2015 to $842 in 2016. In October 2018, the vacancy rate in Thompson increased to 7.6%, up from 1.6% the previous year, as newly renovated units came on the market. Average rent was $886 in October 2018 (CMHC 2018a).

Many property managers in Thompson keep waiting lists or applications on file for three months, which may include anywhere from 10 to 100 potential new tenants (Graham 2013). There is also a high demand for housing with three bedrooms or more, with over 200 families on waiting lists for such accommodations; it is estimated that it would take seven or eight years for all of these families to become tenants of such units, given current turnover rates. In 2013, 28 new townhouses were added to the Thompson rental market, in the form of MH units managed by the Keewatin Housing Authority (KHA), but they were immediately filled with applicants from the KHA's seven-year long waiting list (Graham 2013).

In 2016, 5.0% of owner households in the RAA and 22.9% of tenant households spent more than 30.0% of before tax income on shelter costs (a measure of housing unaffordability; Statistics Canada 2017a) compared to the provincial averages (11.4% and 36.9%, respectively). Based on this measure, housing in the RAA is more affordable than the provincial average. Data for LAA communities are unavailable.

In 2016, 61.5% of tenant households were in subsidized housing in the LAA (Statistics Canada 2017a). This is notably greater than the RAA average of 15.9% and the provincial average of 19.4% (Statistics Canada 2017a). At the time of writing additional information on marginally housed individuals and households within the LAA was not available. MH provides affordable non-market housing in Thompson and other regional centres. Non-market housing is also provided in Thompson by the KHA and University College of the North (UCN), as well as by respective First Nations governments in Indigenous communities, including in partnership with CMHC. MH administers 65 units in Thompson and, in combination with KHA, 144 units of affordable nonmarket housing are provided to Keewatin Tribal Council members residing in Thompson (TEDWG 2012).

Thompson Lions Senior Manor Non-Profit Housing Co-operative Inc. is a volunteer board that formed to promote the development of affordable seniors' housing in Thompson. It has partnered with the Manitoba government to develop plans for a new affordable housing complex for seniors. In 2016, the Manitoba government approved $2.25 million to fund construction of the 32,553 ft^2 two-storey, 30-unit wood-frame building, with a mix of one- and two-bedroom units and shared common amenity space. Construction of the facility began in 2017 and is scheduled for completion in 2019 but is not complete as of November 2019 (Antoszewski 2016; Darbyson 2018).

Temporary and Tourism Accommodations

The LAA is part of Manitoba's Northern Tourism Region, which has 57 temporary accommodations, 26 parks (including campgrounds and RV parks), and 38 lodges/outfitters (Travel Manitoba 2016).

Lynn Lake has two hotels, the Bronx Motel and the Lynn Inn. The Bronx Motel offers 11 rooms that can accommodate up to 25 people (Town of Lynn Lake 2019). Types of rooms include studio, one bedroom and two-bedroom suites ranging from one, two and three beds per room (Bronx Motel 2015). The Lynn Inn has 23 rooms and has variable vacancy rates. Rooms are available on a long-term basis (Travel in Manitoba 2020).

In Leaf Rapids, there are two sources of temporary accommodations: Dream Catcher Bed & Breakfast and Churchill River Lodge for long-term accommodations (Travel in Manitoba 2020).

Thompson has 15 hotels, motels and bed-and-breakfasts with more than 600 rooms (City of Thompson 2018; Travel in Manitoba 2020).

Several hunting and fishing lodges operate in the RAA, including:

- Grey Owl Outfitters Lodge, which is located 5 km from the Town of Lynn Lake on Eldon Lake. The lodge can accommodate up to 14 people (Grey Owl Outfitters 2019).
- Grand Slam Lodge, which is on Reindeer Lake near Kinoosao, Saskatchewan, and has five furnished cabins accommodating up to 20 people (Grand Slam Lodge 2015).
- Wolverine Lodge, although not currently operating, which is on Vandekerckhove Lake about 45 km southwest of the Town of Lynn Lake (Wolverine Lodge 2012).
- Churchill River Lodge, which is 10 km from the Town of Leaf Rapids, has three winterized cabins that can accommodate up to 18 people (Churchill River Lodge 2015).
- Thompson Lodge and Ecotourism Centre, which is located a short distance from downtown Thompson and has three units that can accommodate 12 people.

Several outfitters run fly-in lodges or camps out of the Town of Lynn Lake, including Laurie River Lodge, Lynn Lake Fly-In Outpost Camps, Golden Eagle Lodge/Great White North Wilderness Resorts, Wilderness Gardens Outfitters, Cat Train Tours, Gloewen Enterprises, and Northern Lights Lodge (Town of Lynn Lake 2019).

Campgrounds

Burge Lake and Zed Lake are provincial parks with campgrounds located within 20 km of the Town of Lynn Lake. The minimally serviced campgrounds have 18 campsites, some of which can accommodate large motor homes (Government of Manitoba n.d.). Churchill River Lodge and Outfitters is located about 10 km from the Town of Leaf Rapids and has serviced campsites and seasonal sites for motor homes (Travel in Manitoba 2020).

McCreedy Campground in Thompson has 51 sites and a boat launching facility on the nearby Burntwood River. The Paint Lake Campground is located 32 km south of Thompson and has 30 sites.

14.2.2.2 Education

Education services within the LAA and RAA, except for Thompson, are provided through Frontier School Division, Area 1, which provides both in-class teaching services and distance education for senior years and career programs (Frontier School Division n.d.). West Lynn Heights School, in Lynn Lake, serves the Lynn Lake and Black Sturgeon IR.

West Lynn Heights School has nine classrooms, three of which are not in use. In 2017, 187 students were enrolled between kindergarten and Grade 12 and in September 2018, this number had dropped to 179. There were 13 teachers at West Lynn Heights School in 2018 (Manitoba Education and Training 2018, 2019). Other programs that use the school include a breakfast program, an adult education program, and a Head Start Program (pre-kindergarten) While teaching outcomes at the school are above regional standards, there is high absenteeism, particularly beyond the eighth grade, and student performance falls below provincial standards (Town of Lynn Lake 2019).

Education services in the Town of Leaf Rapids are also delivered through the Leaf Rapids Education Centre, which teaches kindergarten to Grade 12 and had a total enrolment of 175 in 2018, up from 169 in 2017. The number of teachers at the school was 11 in 2018 (Manitoba Education and Training 2018, 2019). The Adult Learning Center in Leaf Rapids provides training related to academic upgrading, high school courses, and employment preparation (Frontier School Division n.d.).

In September 2018, Oscar Blackburn school in the community of South Indian Lake had 261 students and 17 teachers (Manitoba Education and Training 2018, 2019).

The Mystery Lake School Division provides education services to Thompson. There are seven schools in the City and in the 2017-18 school year they had a total enrolment of 3,163 students and 235 teachers. Between 2017 and 2018, the Mystery Lake School Division saw the total number of students increase by 2.1% (Manitoba Education and Training 2018, 2019).

The University College of the North, located in Thompson, is the only college in the RAA and it has over 500 students annually (City of Thompson 2018.). The closest universities to the RAA are in Winnipeg and Brandon, Manitoba (Town of Lynn Lake n.d.). The University of Manitoba Faculty of Social Work offers a four-year full-time university degree program in Thompson. The curriculum is designed to meet the specific needs of northern social work students. It includes on site instructors and field placements with local agencies, organizations, and in northern communities (Town of Lynn Lake n.d.).

14.2.2.3 Recreation

Municipal recreation facilities in the Town of Lynn Lake include the Jim MacLellan Arena, which is used for curling, skating, and hockey in the winter, and basketball, volleyball, floor-hockey, roller-skating, and badminton during other months. A fitness centre opened at the arena in November 2019 (Marcel Colomb First Nation Members 2019). There is also an unsupervised beach, a public library and a mining museum which is open by appointment. The facilities service the residents of the Town of Lynn Lake and Black Sturgeon IR and are also open to visitors. The former Royal Canadian Legion Hall in the Town of Lynn Lake is privately owned and used as a gathering place.

Recreation facilities in the Town of Leaf Rapids consist of a museum, public library, gymnasium, theatre, nine-hole golf course, baseball diamond, track and field facilities, football and soccer fields, tennis courts, and a youth center (Manitoba Regional Travel Network 2015).

The City of Thompson has a range of municipal recreational facilities and trails, as well as facilities serving the broader region, such as the Vale Regional Community Centre, which has a gym, indoor track, two ice skating rinks, and fitness center, as well as the Norplex Pool, a 25-m, six-lane swimming pool. It also has an 18-hole golf course at the Thompson Golf Club (City of Thompson 2020).

The community of South Indian Lake has a ball field, a 4,500 ft^2 community hall, an indoor rink, a youth centre, and outdoor playgrounds.

Outdoor recreation activities are popular with both local residents and visitors to the region. Sportfishing and boating are popular. There are two provincial parks within 20 km of the Town of Lynn Lake: Burge Lake and Zed Lake. Sand Lakes Provincial Park is approximately 40 km north of the Gordon site and only accessible by float plane (Chapter 15). Outdoor recreation opportunities near the Town of Lynn Lake include sportfishing, hunting, boating, swimming, camping, cross-country skiing, and snowmobiling. Outdoor recreation sites near the Town of Leaf Rapids include the Churchill River for sportfishing and Turnbull Lake for recreational boating and ice fishing. The town also has hiking, cross-country skiing, and snowmobiling trails (Manitoba Regional Travel Network 2015). Refer to Chapter 15 for further information on outdoor recreation.

14.2.2.4 Health Care, Social and Emergency Services

Health Care

The LAA is located within the service delivery area for the NRHA. It operates five hospitals and several personal care homes and health centres. In addition, there are nursing stations run by the federal and provincial governments. Access to primary care providers has been identified as an area of concern for the NRHA; while it is fully staffed with primary care physicians, they are generally working at capacity and there is a need for more providers (Northern Health Region 2016).

In 2017, the total number of physicians to 100,000 population in Manitoba was 210, up from 204 in 2015. In Canada, there were 234 physicians to 100,000 population in 2017. Between 2013 and 2017, the number of physicians in the NRHA area increased 16.5%, from 85 to 99, and the ratio of physicians to 100,000 population was 130 (CIHI 2017).

The Lynn Lake Hospital is the only hospital in the LAA. It is a 19-bed (including eight long-term care beds) facility with a 24-hour emergency room, a lab and X-ray. It is staffed by two nurses on each shift, health care aids during the day, and a physician who is available daily during regular business hours and on-call after-hours. The hospital shares a public health nurse, mental health care nurse, and foot care nurse with the Leaf Rapids Health Centre. Several other services are available on a rotating basis from Thompson. The hospital does not provide surgeries or CT scans (Town of Lynn Lake 2019).

Leaf Rapids Health Centre runs a physician-staffed clinic that is open on weekdays and a nurse-run emergency room. The centre, which has no in-patient beds, is located in the Town Centre building (Northern Health Region 2019). In 2016, the Leaf Rapids Health Centre Diagnostic Imaging Suite received upgrades with the installation of new equipment (Northern Health Region 2017).

Thompson General Hospital is the largest hospital in northern Manitoba and provides 71 acute care beds, including a 10-inpatient bed, acute-care adult psychiatric unit. In 2017, a new chemotherapy unit opened at the Thompson General Hospital and in 2019, plans were announced to install a new roof at the hospital among other renovation, such as new courtyard concrete and upgrades to pharmacy security, the nurse call system and lighting (Thompson Citizen 2019). In addition to the hospital, there are three clinics in Thompson, including a women's clinic.

Neither Marcel Colomb First Nation (on Black Sturgeon IR) nor Peter Ballantyne Cree Nation (on Kinoosao) have nursing stations. Residents of these communities travel to Lynn Lake for medical attention. The community of South Indian Lake has a federally-run nursing station with five beds (Northern Health Region 2019). The most frequent reasons for visits to the Lynn Lake Hospital and Leaf Rapids Health Centre are minor traumas, diabetes complications, mental health issues, infectious diseases, and alcohol-related emergencies.

One of the main challenges related to health care services in the LAA is recruiting nurses and doctors to move to small communities like Lynn Lake and Leaf Rapids, although there have been improvements in that area: in 2016, 10 new physicians moved into the NRHA area (Northern Health Region 2016). Accessing medical treatment is another challenge of the health care system (Northern Health Region 2016).

Social Services

In Lynn Lake, some social services programs are run out of West Lynn Heights School, including a hostel, employment counseling; parenting skills training, childcare, youth drop-in center, and social development programs (Lynn Lake Mayor and Council 2014). Indigenous social services in the LAA are provided through the Lynn Lake Friendship Center, which serves Indigenous members from the Town of Lynn Lake, Black Sturgeon IR, and elsewhere in the NRHA area.

Social services in the Town of Leaf Rapids include a healthy baby program, public health education and youth support, provided through the Leaf Rapids Education Center, Leaf Rapids Health Centre and Youth Centre (Safer Choices Northern Network n.d.).

Addictions services, including counselling, healthy lifestyle promotion and prevention, are not available in the LAA, but can be accessed through the Marcel Colomb First Nation office on the Black Sturgeon IR. The closest addictions treatment facility is in Nelson House (Northern Health Region 2019).

More extensive social services are available in the City of Thompson. In 2017, the Hope North Recovery Centre opened to provide mental health and addictions services for area youth in crisis (Darbyson 2017). The facility includes:

- A four-bed crisis stabilization unit, which will provide a secure place for youth experiencing a mental health crisis, including youth at risk for suicide, for up to one week.
- A two-bed youth addictions stabilization unit for youth who are severely and persistently abusing drugs and/or alcohol, with involuntary admissions guided by the Youth Drug Stabilization (Support for Parents) Act.
- A base for mobile crisis and outreach services, which provide in-person intervention and assessment for youth in crisis in Thompson and within a 110-km radius in addition to Telehealth and telephone-based consultation throughout the region (Manitoba 2015).

Police

Policing in Manitoba is provided by 12 police services. The Royal Canadian Mounted Police (RCMP) is Manitoba's provincial police service, while Winnipeg, Brandon, and a number of other municipalities have their own police services. Some communities also have Community Safety Officers, First Nation Safety Officers and Cadets. Over the past several years, the Canadian Crime Severity Index (CSI), which measures the severity of police-reported crime, has shown that Manitoba has one of the highest violent crime rates in Canada, including high rates for robbery, homicide, sexual violations against children, sexual assaults and major assaults (Manitoba Government 2019). In 2018, the CSI for Manitoba was 125.76, up from 118.98 in 2017. The CSI for Canada in 2018 was 75.01 (Statistics Canada 2019b). The Lynn Lake RCMP detachment provides police services to the Town of Lynn Lake and Black Sturgeon IR. The Town of Leaf Rapids and the community of South Indian Lake have their own RCMP detachments.

The Lynn Lake RCMP detachment service delivery area covers a large rural area characterized by few roads, dense forest, and several remote fishing camps that are accessible only by airplane or helicopter. There is a service agreement in place to provide occasional response to the community of Kinoosao in Saskatchewan in cases where the Southend, Saskatchewan RCMP detachment is unable to respond. To respond to emergencies in more remote areas, the detachment keeps boats, snowmobiles and all-terrain vehicles (ATVs) at its disposal, and, when necessary, charters equipment, such as planes. In 2015, staff consisted of three members.

The detachment facilities were built in the early 1980s to accommodate a larger police force than is currently required. Police equipment is a bit older than ideal, but in good condition. Given the remoteness of the community, it can be difficult to have equipment repaired.

The Leaf Rapids RCMP detachment provides policing services to the Town of Leaf Rapids and the community of South Indian Lake. There are also two community constables in the community of South Indian Lake who respond to calls in that community.

The RCMP also has a detachment in Thompson. Between 2016 and 2018, the CSI in Thompson increased from 298.46 to 365.89 (Statistics Canada 2018). In 2016, Thompson hired eight Community Safety Officers (CSOs) as part of a pilot program to enhance public safety in the community. In 2019, Thompson hired only two CSOs (City of Thompson n.d.; Darbyson 2019).

Black Sturgeon IR relies on the Town of Lynn Lake RCMP detachment for police services. Due to federal cutbacks, there is no longer a band constable program; however, a First Nations Safety Officer Program is now meant to address the service gap on reserves (Assiniboine Community College 2016).

Search and Rescue

The RCMP is responsible for initial search and rescue at the outset of an emergency, with a specialized search and rescue team deployed to follow up. Search and rescue services are provided through mutual aid system, with the Manitoba Volunteer Search and Rescue Network composed of 29 trained and mobile volunteer teams. Lynn Lake, Leaf Rapids, Thompson, the community of South Indian Lake, Nelson House, and Cross Lake all have such teams (Manitoba Office of the Fire Commissioner n.d.).

Fire Services

The Lynn Lake Fire Department (LLFD) is a volunteer service that serves both the Town of Lynn Lake and Black Sturgeon IR. Much of the Fire Department's equipment is dated beyond its recommended service life (Town of Lynn Lake 2016). LLFD members are voluntarily on call 24 hours a day, seven days a week and paid when responding to emergencies or undergoing training. In 2018, the LLFD received a more modern firetruck to replace two older trucks, which will enhance the department's capacity (Graham 2018b). The department also has a converted ambulance to serve as a rescue van with storage for additional equipment.

Fire services in the Town of Leaf Rapids are provided by a volunteer fire department.

Thompson Fire & Emergency Services (TFES) provides fire protection and emergency medical service to the city and surrounding area. It has a complement of 24 career Fire Medics and five Emergency Medical dispatchers. One Senior Communication Officer dispatches calls for service (City of Thompson 2019). TFES operates 24 hours a day, seven days a week providing fire protection and emergency medical service to the City and surrounding area. MCC provides wildfire detection and suppression services.

Ambulance Services

Both Lynn Lake and Leaf Rapids have 24-hour emergency medical services with one ambulance in each community. Services provide patient transport to the Thompson General Hospital. Ambulance services in Lynn Lake and Leaf Rapids are contracted to affiliate agencies, which employ paramedics who rotate in from Winnipeg. Construction of a new emergency medical services (EMS) building next to the hospital in Lynn Lake was completed in 2019. The Province of Manitoba is in the process of upgrading emergency medical services to station full-time paramedics in each community. Medical transport services for residents of the Town of Lynn Lake and Black Sturgeon IR are provided by the Marcel Colomb First Nation.

14.2.2.5 Transportation

Roads and Highways

The MacLellan site is connected to the Town of Lynn Lake by Provincial Road (PR) 391 and the MacLellan site access road, an all-weather gravel road. The Gordon site is also accessible from the Town of Lynn Lake by way of PR 391 and an all-weather road (Tetra Tech 2013).

Provincial roads are maintained by Manitoba Infrastructure Region 5. The Town of Lynn Lake is accessible only by PR 391, which connects the Town of Lynn Lake and Black Sturgeon IR with the Town of Leaf Rapids and City of Thompson.

PR 391 is identified by Manitoba Infrastructure as ‘Secondary Arterial’ with a traffic volume capacity of up to 6,000 vehicles per day, depending on the shoulder width (Stantec 2017). A transportation assessment of PR 391 from the Gordon site access road to the MacLellan site access road (just east of the Town of Lynn Lake) rates the existing surface conditions of the road as fair to poor. During a key informant interview, it was reported that PR 391 is in poor condition and in need of repairs (pers. comm. 2015). However, existing traffic volumes are very low at 150 vehicles per day and the road has capacity to accommodate additional truck traffic (Stantec 2017).

The Gordon site access road has a gravel surface and is generally in fair condition, (albeit with several sections appearing to be in poor condition) with loose gravel and rutting observed. Manitoba Infrastructure, in collaboration with the University of Manitoba, publishes an annual traffic report on Manitoba roads. These reports include traffic count data for traffic count station locations on provincial roads in the LAA and RAA. Average annual daily traffic between 2012 and 2017 ranged between 100 and 190 vehicles on PR 391 entering the towns of Lynn Lake and Leaf Rapids (Manitoba Infrastructure Traffic and Engineering Branch 2018).

Rail

There is currently no rail service to the Town of Lynn Lake. Although the Sherridon rail line previously connected the Town of Lynn Lake with The Pas, passenger and freight service now only runs as far north as Pukatawagan (Keewatin Railway Company 2019).

There is a train station in Thompson through which VIA Rail provides freight and passenger service to and from Churchill, The Pas, Winnipeg and points in between (City of Thompson 2019). Major upgrades are currently underway to provide safe and reliable rail line service (City of Thompson 2018).

Airports

The Lynn Lake Airport has a 1,500-m paved runway and a turf runway measuring 835 m (Town of Lynn Lake n.d.). The airport was serviced by scheduled flights until 2013, but presently there is no regular air service into Lynn Lake (Ausenco Engineering Canada Inc. [Ausenco] 2018)

The only air service at Lynn Lake Airport is through chartered flights. The main users are fishing charters in summer, RCMP, and health services (Ausenco 2018). In 2013, under the threat that it would be closed, the Town of Lynn Lake began leasing it to YYL Airport Inc., a locally owned company.

There is also an airport with a 3,500-m runway in the community of South Indian Lake. Annual aircraft movements at this airport decreased from 618 to 556 between 2010 and 2018 (Manitoba Infrastructure n.d.).

Regional air service is available from Thompson Airport, located six miles northwest of Thompson. It was originally developed by the International Nickel Company in 1961 to support mining operations. The Airport was transferred to Transport Canada in 1963 and was operated by the Local Government District (LGD) of Mystery Lake. In March of 2000, ownership was taken over by the Thompson Regional Airport Authority. The Thompson Airport is the second busiest in the Province, after Winnipeg with more than 30,000 movements a year. It is recognized as a vital air transport hub for many northern communities offering regular flights to Winnipeg, along with scheduled and/or chartered flights to 58 northern Manitoba communities. It also plays a critical role in delivering cargo (City of Thompson 2018).

The airport is served by Calm Air International and Perimeter Aviation with flights to and from Winnipeg. There are also bases for Custom Helicopters, Missinippi Airways, RCMP Air Division, and Manitoba Government Air. A radar site was constructed in 1989 and became operational in 1995, and a high-intensity lighting system was completed in 1992 (Thompson Airport n.d.).

14.2.2.6 Municipal Services and Infrastructure

Solid Waste Management Services

The Town of Lynn Lake provides solid waste services with curbside pick-up for residents and businesses. Waste from the Town of Lynn Lake and Black Sturgeon IR, which operates its own garbage pickup, is disposed of at the Lynn Lake Waste Disposal Site. The current layout of the landfill has approximately three to five years of space left; however, the landfill site sits on over 100 acres of land and could accommodate additional cells, which would provide another 20 years of capacity (pers. comm. 2019a). The Town of Lynn Lake charges a tipping fee for disposal at the landfill, with different rates depending on the type of waste and the size and type of vehicle used to dispose of waste. Rates are double for non-residents.

The City of Thompson took ownership of the Thompson waste disposal ground (WDG) from the LGD of Mystery Lake in 2015. Expansion and upgrade of the WDG is in progress, including construction of new active cells, leachate evaporation and leachate collection piping. The City plans to develop a “one-stop shop” that will include a drop-off of e-electronic waste, household hazardous waste and used oil.

The Thompson WDG services the City of Thompson, the LGD of Mystery Lake, the Wuskwatim Generating Station, the Keeyask Generating Station, and the Paint Lake Provincial Park. The average per capita waste deposited at the WDG is 2.0 kg/person/day and it is expected to have capacity until 2041 (JR Cousin Consultants Ltd. 2016).

Water and Wastewater Services

Water in the Town of Lynn Lake comes from West Lynn Lake. The water treatment plant (Level 3) and distribution network (Level 1) are operated by the Town. Water and wastewater services are generally exclusive to the community. The water distribution and wastewater collection infrastructure was built more than 50 years ago and both systems require substantial investment. Both systems were put in place to serve a much larger population, approximately four to six times the current population. While a reduced demand allows operation to continue, the fact that so few people are paying for the rate to operate these systems is impairing the ability to renew the systems (PUB 2018).

Operational problems with the water plant have led to quantity and quality issues (pers. comm. 2019a). To meet local demand, the Town tops up the volume of potable water produced with chlorinated unfiltered lake water. Potable water quality is an ongoing issue in northern Manitoba. Since 2012, a Boil Water Advisory has been in effect in the towns of Lynn Lake and Leaf Rapids. A study has determined that the water treatment plant requires major upgrades costing approximately $3,000,000; the Town Council has plans to discuss how to move forward on this issue (pers. comm.2019a). As of December 2019, residents of the Town are facing a potential increase in the quarterly water rate to triple the rates of other northern Manitoba towns, including Thompson (Froese 2019).

Wastewater facilities consist of a gravity-fed collection system (Level 1) with three lift stations and a lagoon (Level 1). The lagoon was built for a much larger population and it, along with the lift stations, has exceeded its design capacity. Plans for repairs to the wastewater system have been included in the Town's 2020 budget (pers. comm.2019a).

Marcel Colomb First Nation operates its own water treatment plant and sewage lagoon on the Black Sturgeon IR. Both were built recently and are in good condition. The community services homes using a water truck and septic tank truck, although new infrastructure is being built with lines for water and sewer (pers. comm. 2019b).

The City of Thompson operates two wastewater treatment facilities which function independently of each other. A mechanical wastewater treatment plant provides only primary treatment and handles approximately two-thirds of the City's total wastewater flows. The second facility is a single cell continuous discharge aerated lagoon, which provides secondary treatment and treats the remaining one-third of the wastewater flow from the south and south-western catchment of the City. To address the current state of the wastewater treatment infrastructure and the need to meet the current regulations, the City initiated a plan to upgrade/expand its wastewater treatment facilities (Stantec 2014).

In 2015, the City of Thompson received more than $24 million for a new wastewater treatment plant. The proposed development consists of the construction of a greenfield centralized wastewater treatment plant facility adjacent to the existing plant for a projected population of 15,000 people. The proposed plant will be designed for secondary treatment including nutrient removal and will handle the domestic wastewater generated from the City's service area. Treated effluent will be discharged via a new 600 mm outfall to the Burntwood River. The City plans to decommission the existing aerated lagoon and divert the wastewater to the proposed centralized wastewater treatment plant. The estimated completion date of the new facility was spring 2019 but it was not yet complete at the time of writing (JCNS 2019; Lindert-Wentzell 2016).

14.2.2.7 Community Wellbeing Index

The CIRNAC CWB Index measures socio-economic wellbeing for individual communities across Canada and is the only published index that provides comparability across all census subdivisions (CSDs, a spatial geography used in Statistics Canada's Census) for which data are available. The Index is comprised of four equally weighted components, widely accepted as being important to wellbeing: education, labour force activity, income and housing (CIRNAC 2019a, 2019b). The four component topics are combined to create a single well-being score that ranges from a low of 0 to a high of 100. In addition to comparability across the temporal scope of the Index (values are available for the Census reporting years 1981, 1991, 1996, 2001, 2006, 2011, and 2016), further utility is realized through the ability to identify changes in wellbeing (and component measures) over the 35 year temporal horizon of the Index. Table 14-4 provides a summary of the methods used to calculate each component included in the Index.

The CWB Index focuses on education, labour force activity, income, and housing and, does not include consideration of physical or mental health conditions (Section 14.2.2.8). As such, the CWB Index score should be viewed as one of many possible measures used to describe levels of community wellbeing within a given area.

Table 14-4 CWB Index – Component Descriptions and Weighting

Indicator	Description	Weighting (%)
Education		
High school plus	Proportion of a community's population, 20 years and over, that has obtained at least a high school certificate	75
University	Proportion of a community's population, 25 years and over, that has obtained a university degree at the bachelor's level.	25
Labour force activity		
Participation rate	Proportion of a community's population, aged 20 to 64, that was involved in the labour force during the week preceding census day, that is census reference week	50
Employment	Percentage of a community's labour force participants, aged 20 to 64, that were employed during census reference week	50
Income		
Income score	Defined in terms of total income per capita, as follows: $$Income\ Score = \left(\frac{\log(income\ per\ capita) - \log(\$2{,}650)}{\log(\$75{,}000) - \log(\$2{,}650)}\right) X\ 100$$	100
Housing		
Quantity	Proportion of a community's population living in dwelling that are not crowded as measured by having no more than one person per room	50
Quality	Proportion of a community's population living in a dwelling that is not in need of major repairs	50
SOURCE: Indigenous Services Canada, 2019a		

Within the LAA, CWB Index scores are only available for the Town of Lynn Lake. This is due to 2016 Census data suppression (because of either poor response rates or the community's small population) of Black Sturgeon IR's Community Profile and because enumeration of Black Sturgeon IR residents was included in the CSD 'Division No. 23, Unorganized' prior to 2016. Within the RAA CWB Index, scores are available for the Town of Lynn Lake, the Town of Leaf Rapids, South Indian Lake IS (excluding the Census year 1981), and the City of Thompson. Census information specific to Granville Lake IS and Kinoosao-Thomas Clark 204 IR are suppressed (and in the case of Kinoosao-Thomas Clark 204 IR included in 'Division No. 18 Unorganized' CSD enumerations prior to 2006).

CWB Index scores for the Town of Lynn Lake, Town of Leaf Rapids, South Indian Lake, and City of Thompson between 1981 and 2016 are shown in Appendix 14A (Figures 14A-1, 14A-2, 14A-3 and 14A-4, respectively). Between 1981 and 2016 the Town's CWB Index score remained relatively constant increasing with minor fluctuations four points from 70 to 74. During the 35-year period, a low CWB Index score of 63 was seen in 2001 which was primarily attributable to combined reductions in labour force activity and housing subcomponent scores. While having increased 12 points between 1981 and 2016 (from 38 to 50), the Town of Lynn Lake's education score is the primary subcomponent negatively affecting the communities overall CWB Index score.

In terms of benchmarking, the highest 2016 CWB Index score in Manitoba was 89 (15 points higher than the Lynn Lake's CWB score), seen in Headingley. The 2016 CWB Index score for the City of Winnipeg was 81 (seven points greater than the Town of Lynn Lake's score), which was an increase of nine points from a score of 72 in 1981 (similar to the Town of Lynn Lake's CWB score in 1981 of 70).

2016 CWB Index scores for the Town of Leaf Rapids (68) and the community of South Indian Lake (44) are less than that of the Town of Lynn Lake, notably more so with respect to the community of South Indian Lake (a difference of 30 points). The City of Thompson's CWB Index score was slightly greater (two points; 76 vs. 74) than the Town of Lynn Lake's. Low education and income scores are common to all three RAA communities. As noted above, CWB Index scores for all remaining RAA communities are unavailable.

14.2.2.8 Self-Reported Health Characteristics

Published annually, the Canadian Community Health Survey (CCHS) provides estimates of various health characteristics at the national, provincial, census metropolitan area and population center geographical level. Publicly-available information at the community or CSD level is not available. However, information specific to rural areas and small population centres of Manitoba, as well as information at the NRHA area, is available. Taken together, this information can be used as proxy for the likely range of existing health characteristics in the LAA and RAA. With respect to CCHS data, rural areas refer to (among others) small towns, villages and other populated places with less than 1,000 population. Small population centres refer to areas with populations between 1,000 and 29,999 (Statistics Canada 2017a, 2017b). Information is collected for the portion of the population aged 12 years and older.

While this information is applied as proxy, it is possible that conditions within the LAA and RAA could be better or worse that those reflected in regional and rural community statistics. Like all voluntary surveys, the CCHS is subject to a number of quality and reliability issues such as sample size and sampling error, survey bias[2], and proxy reporting (when another member of a household answers for the intended respondent).

Perceived Health

Table 14-5 provides a summary of self-reported perceived health within rural areas of Manitoba, small population centres of Manitoba, and the NRHA area. Response rates across all three geographies are statistically similar to provincial averages, with the exception of:

Rural Areas of Manitoba

- Statistically greater percentage of females reporting very good or excellent levels of perceived health and perceived mental health.
- Statistically lower percentage of females reporting fair or poor levels of perceived mental health.
- Statistically lower percentage of males reporting very good or excellent levels of perceived mental health.

NRHA Area

- Statistically greater percentage of females reporting very good or excellent levels of perceived mental health.
- Statistically greater percentage of males reporting fair or poor levels of perceived health.
- Statistically lower percentage of males reporting very good or excellent levels of perceived health.
- Attributable to statistical differences noted in the preceding two bullets, a statistically lower percentage of the total population reports very good or excellent levels of perceived health.

Applied as proxy for LAA communities, population response rates for rural areas of Manitoba and the NRHA area show that, relative to provincial averages, males are less likely and females more likely to perceive very good or excellent levels of physical and mental health. This corresponds with a lower percentage of females perceiving their health (physical and mental) as fair or poor and a greater percentage of males perceiving their physical heath as fair or poor (relative to provincial averages).

Applied as proxy for the RAA, response rates for small population centres of Manitoba and the NRHA area suggest that within larger centers (i.e., City of Thompson) the percentage of the population that perceives their health (physical and mental) to be very good or excellent is similar to overall rates within the NRHA area. This also applies to rates of self-reported fair or poor health (physical and mental). As such, males within larger centres of the RAA are understood to be have lower levels of very good or excellent perceived

[2] Including social desirability (when asked questions of a sensitive nature respondents may provide an answer they believe is socially acceptable), response bias (differences between those who respond to the survey and those who don't) and recall bias (respondents are unable to recall information of the line of questioning to answer accurately)

health (corresponding with higher levels of fair or poor perceived health) than the provincial average. For females, a greater percentage of the population report levels of very good or excellent perceived mental health than the provincial average.

Table 14-5 Perceived Health, Two-Year Period Estimates (2017/2018)

Indicator	Very good or excellent (% of population)			Fair or poor (% of population)		
	Total	Male	Female	Total	Male	Female
Rural Areas of Manitoba						
Perceived health	60.5	56.8	64.4 [b]	10.6	11.5	9.7
Perceived mental health	70.1	66.7 [a]	73.6 [b]	5.9	5.5	6.4 [a]
Small Population Centres of Manitoba						
Perceived health	56.7	56.9	56.6	12.4	13.0	11.8
Perceived mental health	66.0	70.8	61.6	8.5	4.3	12.2
NRHA Area						
Perceived health	54.0 [a]	51.1[a]	57.0	14.1	18.8[b]	9.3
Perceived mental health	71.6	71.5	71.7 [b]	7.7	7.2	8.2

NOTES:
a) Statistically lower percentage of the population than the provincial average
b) Statistically greater percentage of the population than the provincial average
SOURCE:
Statistics Canada 2019d

Life Satisfaction, Stress and Sense of Community Belonging

Table 14-6 provides a summary of self-reported levels of life satisfaction, stress and sense of community belonging for populations of rural areas of Manitoba, small population centres of Manitoba, and the NRHA area. Response rates across all three geographies are statistically similar to provincial averages, with the exception of:

Rural Areas of Manitoba

- Statistically greater percentage of females reporting that they are satisfied or very satisfied with life. This contributes to a statistically greater percentage of the total population reporting that they are satisfied or very satisfied with life.
- Statistically lower percentage of females reporting that they are quite or extremely stressed most days.

Applied as a proxy for the LAA, population response rates for rural areas of Manitoba and the NRHA area indicate that females, relative to provincial averages, are more satisfied (or very satisfied) with life and are less stressed and have similar levels of sense of community belonging. For males, rates of life satisfaction, stress and sense of community belonging are similar to the provincial average. Applied as proxy for the

RAA, response rates for small population centres of Manitoba and the NRHA area suggest that within larger centers (i.e., City of Thompson) the life satisfaction, stress, and sense of community belonging among males and females are similar to provincial averages.

Table 14-6 Life Satisfaction, Stress and Sense of Community Belonging, Two-Year Period Estimates (2017/2018)

Indicator	Percent of Population (%)		
	Total	Male	Female
Rural Areas of Manitoba			
Life satisfaction (satisfied or very satisfied)	95.2[b]	95.9	94.5[b]
Perceived life stress (most days quite a bit or extremely stressful)	16.4	17.1	15.6[a]
Sense of belonging to local community (somewhat strong or very strong)	76.7	77.0	76.3
Small Population Centres of Manitoba			
Life satisfaction (satisfied or very satisfied)	94.0	94.8	93.3
Perceived life stress (most days quite a bit or extremely stressful)	19.4	18.2	20.6
Sense of belonging to local community (somewhat strong or very strong)	76.4	77.7	75.2
NRHA Area			
Life satisfaction (satisfied or very satisfied)	91.7	91.2	92.3
Perceived life stress (most days quite a bit or extremely stressful)	19.2	18.6	19.8
Sense of belonging to local community (somewhat strong or very strong)	74.8	73.1	76.5

NOTES:
a) Statistically lower percentage of the population than the provincial average
b) Statistically greater percentage of the population than the provincial average
SOURCE:
Statistics Canada 2019d

Body Mass Index and Health Behaviours

Table 14-7 provides a summary of body mass index (BMI) and health behaviours for populations of rural areas of Manitoba, small population centres of Manitoba, and the NRHA area. All three geographies show statistically different response rates from provincial averages for most health indicators. Differences include:

Rural Areas of Manitoba

- Statistically greater percentage of the population (males and females) with an obese BMI. Statistically greater percentage of the male population reporting that they engage in heavy drinking. This contributes to a statistically greater percentage of the total population reporting that they engage in heavy drinking.

Small Population Centres of Manitoba

- Statistically greater percentage of the population (males and females) with an obese BMI.

- Statistically greater percentage of the total population (attribution to males or females is unclear) who are daily smokers.

NRHA Area

- Statistically greater percentage of males with an obese BMI. This contributes to a statistically greater percentage of the total population with obese BMIs.
- Statistically greater percentage of the total population (males and females) who are occasional or daily smokers.
- Statistically greater percentage of the total population (males and females) who engage in heavy drinking.

Applied as proxy for the LAA, population response rates for rural areas of Manitoba and the NRHA area show that, relative to provincial averages, a greater percentage of the population are obese, smoke, and engage in heavy drinking. Similar trends are seen in the RAA (based on small population centres and the NRHA area as proxy). Rates of self-reported physical activity within the LAA and RAA are understood to be similar to the provincial average.

Table 14-7 Body Mass Index and Health Behaviours, Two-Year Period Estimates (2017/2018)

Indicator	Percent of Population (%)		
	Total	Male	Female
Rural Areas of Manitoba			
Body mass index (adults 18 years of age and older) - overweight	34.6	37.5	31.3
Body mass index (adults 18 years of age and older) - obese	35.7 [b]	39.4 [b]	31.7[b]
Self-reported physical activity (150 minutes per week; adults 18 years of age and older)	53.8	59.4	47.8
Current smoker (daily or occasional)	15.6	18.3	12.7
Current smoker (daily)	10.6	10.7	10.5
Heavy drinking	19.8 [b]	27.0 [b]	12.3
Small Population Centres of Manitoba			
Body mass index (adults 18 years of age and older) - overweight	31.4	35.9	27.1
Body mass index (adults 18 years of age and older) - obese	38.1[b]	41.9[b]	34.3[b]
Self-reported physical activity (150 minutes per week; adults 18 years of age and older)	51.6	57.0	46.6
Current smoker (daily or occasional)	20.6	20.7	20.5
Current smoker (daily)	14.7[b]	15.8	13.8
Heavy drinking	19.8	24.3	15.6
NRHA Area			
Body mass index (adults 18 years of age and older) - overweight	33.2	35.3	30.9
Body mass index (adults 18 years of age and older) - obese	39.3[b]	42.7[b]	35.6

Table 14-7 Body Mass Index and Health Behaviours, Two-Year Period Estimates (2017/2018)

Indicator	Percent of Population (%)		
	Total	Male	Female
Self-reported physical activity (150 minutes per week; adults 18 years of age and older)	58.3	58.6	57.9
Current smoker (daily or occasional)	28.8[b]	26.9[b]	30.9[b]
Current smoker (daily)	21.9[b]	20.5[b]	23.2[b]
Heavy drinking	25.3[b]	28.7[b]	21.8[b]

NOTES:
a) Statistically lower percentage of the population than the provincial average
b) Statistically greater percentage of the population than the provincial average
SOURCE:
Statistics Canada 2019d

14.3 PROJECT INTERACTIONS WITH COMMUNITY SERVICES, INFRASTRUCTURE, AND WELLBEING

Table 14-8 identifies, for each potential effect, the physical activities that might interact with the VC and result in the identified environmental effect. These interactions are indicated by check marks and are discussed in detail in Section 14.4, in the context of effects pathways, standard and project-specific mitigation/enhancement, and residual effects. A justification for "no interaction" is provided following the table.

Project activities for each phase are described in detail in Chapter 2, Section 2.3 and 2.4. Project related emissions and discharges are described in Chapter 2, Section 2.8.

The potential interactions between Project activities and the environment were considered for the construction, operation, and decommissioning/closure phases of the Project. The identification of Project activities and their potential interactions was based on engagement with interested parties, the professional judgment of technical specialists involved in the assessment, and a review of existing conditions. The selection of interactions is also informed by the potential effects and effects pathways for each VC as described in Section 14.1.3.

Project employment and expenditures are generated by most Project activities and components and are the main drivers of many socio-economic effects. Rather than acknowledging this by placing a check mark against each of these activities, "Employment and Expenditure" have been consolidated as integrated activity for efficiency of approach.

Table 14-8 Potential Project-Environment Interactions with Community Services, Infrastructure, and Wellbeing

Project Activities and Components	Environmental Effects			
	Change in Housing and Temporary Accommodations	Change in Local Services and Infrastructure	Change in Transportation Services and Infrastructure	Change in Community Wellbeing
Construction				
Site Preparation at Both Sites (removal of existing buildings; removal of contaminated materials; vegetation clearing and earthworks; development of temporary construction camp at the MacLellan site)	–	–	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	–	–	✓	–
Mine Components at Both Sites (construction of ore pads; ore, overburden and mine rock storage areas; mill feed storage area and crushing plant, ore milling and processing plant, and TMF at the MacLellan site; water management facilities [e.g., sumps, ponds and ditches])	–	–	–	–
Utilities, Infrastructure, and Other Facilities at Both Sites (construction of: buildings and yards; access roads [i.e., upgrades at the Gordon and MacLellan sites] and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at the MacLellan site; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities)	–	✓	✓	–
Water Development and Control at Both Sites (dewatering of existing pits at the Gordon site and underground workings at the MacLellan site; re-alignment of existing diversion channel at Gordon site; interceptor wells at Gordon site)	–	–	–	–
Emissions, Discharges, and Wastes[1]	–	✓	–	–
Employment and Expenditure[2]	✓	✓	✓	✓
Operation				
Open Pit Mining at Both Sites (drilling; blasting; removal, loading and on-site hauling of mined material [i.e., ore, overburden, and mine rock])	–	–	–	–

Table 14-8 Potential Project-Environment Interactions with Community Services, Infrastructure, and Wellbeing

Project Activities and Components	Environmental Effects			
	Change in Housing and Temporary Accommodations	Change in Local Services and Infrastructure	Change in Transportation Services and Infrastructure	Change in Community Wellbeing
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA, including truck transportation of ore from the Gordon site to the MacLellan site)	–	–	✓	–
Storage/Stockpiling of Ore, Overburden, and Mine Rock at both sites	–	–	–	–
Ore Milling and Processing at the MacLellan Site (ore crushing and conveyance; ore milling)	–	–	–	–
Water Management at Both Sites (mine water collection and storage; process water supply for the MacLellan site including water intake on Keewatin River at the MacLellan site; pumping fresh/fire water from Gordon Lake at Gordon site; operation of interceptor wells at the Gordon site)	–	–	–	–
Tailings Management at the MacLellan Site	–	–	–	–
Utilities, Infrastructure, and Other Facilities at Both Sites (presence and operation of: buildings and yards; access roads and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at the MacLellan; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities; explosives storage, maintenance of access roads and bridges)	–	✓	✓	–
Emissions, Discharges, and Wastes[1]	–	✓	–	–
Employment and Expenditure[2]	✓	✓	✓	✓
Decommissioning/Closure				
Decommissioning at Both Sites	–	–	–	–
Reclamation at Both Sites	–	–	–	–
Post-Closure at Both Sites (long-term monitoring)	–	–	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	–	–	✓	–

Table 14-8 Potential Project-Environment Interactions with Community Services, Infrastructure, and Wellbeing

Project Activities and Components	Environmental Effects			
	Change in Housing and Temporary Accommodations	Change in Local Services and Infrastructure	Change in Transportation Services and Infrastructure	Change in Community Wellbeing
Emissions, Discharges, and Wastes[1]	–	✓	–	–
Employment and Expenditure[2]	✓	✓	✓	✓

NOTES:
✓ = Potential interaction
– = No interaction
[1] Emissions, Discharges, and Wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many Project activities. Rather than acknowledging this by placing a check mark against each of these activities, “Emissions, Discharges and Wastes” have been introduced as an additional component under each Project phase.
[2] Project employment and expenditures are generated by most Project activities and components and are the main drivers of many socio-economic effects. Rather than acknowledging this by placing a check mark against each of these activities, “Employment and Expenditures” have been introduced as an additional component under each Project phase.

Community Services and Infrastructure

Potential changes to community services and infrastructure will result from an in-migration of Project workers to the LAA as a result of the Project, therefore increasing demand. It is assumed that workers’ families will not relocate to Lynn Lake due to its remoteness and lack of amenities. It has therefore been assumed that most workers will operate on a fly-in-fly-out (FIFO) or drive-in-drive-out (DIDO) rotation. These workers will likely be based in Thompson, or possibly further abroad in Winnipeg. They will commute to site and will not bring their families. During construction and operation, workers will be accommodated at a work camp at the MacLellan site. While activities for each Project phase will have labour requirements causing an increase in the local population which could affect community services and infrastructure, it is not possible to isolate the effects of individual activities and so these effects are addressed collectively as part of an “employment and expenditure” activity.

Most of the physical Project activities, with the exception of wastes and emissions, movement of trucks, equipment, supplies and personnel within the LAA, and utilities, infrastructure and other facilities at both sites, will not affect community services and infrastructure. Production of Project waste will place additional demands on the local landfill. Movement of trucks, equipment, supplies and personnel within the LAA will place additional demands on local roads and airports. The Project and the work camp will operate completely independent of the Town of Lynn Lake (e.g. power, water and wastewater systems will not rely on the Town's resources). Therefore, the operation of utilities, infrastructure and other facilities will not place additional demands on existing community services and infrastructure, particularly utilities.

During decommissioning/closure, there will be a reduction in environmental effects on community services and infrastructure as a result of a reduction in demand on them as workers move away from the LAA due to diminishing employment. Additional demands that have been placed on community services and infrastructure during operation will have been addressed prior to decommissioning/closure. Therefore, the effects of the Project on community services and infrastructure during decommissioning/closure are not assessed further.

Community Wellbeing

Community wellbeing can be affected through these pathways: change in employment and income and change in population. An interaction between the Project and community wellbeing is only identified where a physical activity or component relates to one or more of these pathways.

While all Project activities and components have an associated labour (and wage) subcomponent, and therefore could affect levels of disposable income and influence positive and negative health practices, a disaggregated assessment is impractical. Instead, an interaction with the physical activity 'employment and expenditure' has been identified. As such, effects stemming from changes in employment and income that could affect community wellbeing within the LAA are assessed jointly for each Project phase (i.e., construction, operation, and decommissioning/closure). Similarly, because Project-related employment and income is the stimulus for changes in population (i.e., the in-migration of workers and their families to the LAA as well as for the presence of FIFO/DIDO workers) an interaction with 'employment and expenditure' is identified (Table 14-8), rather than identifying an interaction with every physical activity or component that could result in changes in population. Information on the population of the LAA and RAA, as well as employment estimates, are provided in Chapter 13 (Labour and Economy).

14.4 ASSESSMENT OF RESIDUAL ENVIRONMENTAL EFFECTS ON COMMUNITY SERVICES, INFRASTRUCTURE, AND WELLBEING

14.4.1 Analytical Assessment Techniques

Analytical methods differ for the assessment of community services and infrastructure and community wellbeing so they are discussed here in separate sections.

14.4.1.1 Community Services and Infrastructure

Potential environmental effects on community services and infrastructure (i.e., change in housing and temporary accommodations, change in local services and infrastructure, and change in transportation services and infrastructure) are qualitatively assessed by comparing anticipated Project demand with existing capacity, as established through baseline research. As noted in the previous subsections, there is some spare capacity as a result of recent population declines in the LAA. There may also be potential to expand existing capacity through advance planning and investment to accommodate a new development.

Characterization criteria presented in Section 14.1.5 are applied to residual environmental effects that remain after proposed mitigation and enhancements have been implemented. The significance of these environmental effects is determined by considering thresholds and methods, as outlined in Section 14.1.6. Limitations of information, data analyses and interpretation are compensated for by taking a conservative approach in this assessment (i.e., overstating rather than understating risk).

14.4.1.2 Community Wellbeing

The assessment of change in community wellbeing examines adverse effects on baseline conditions using quantitative and qualitative methods. Quantitative methods are used to estimate Project-related changes in CWB Index scores, to compare Project-related employment and wages to existing conditions, and to quantify changes in population. Qualitative methods are used to explore effect pathways drawing on academic and government literature to establish cause-and-effect reasoning to determine the plausibility of effects, both positive and adverse. Because assessing potential changes across all social determinants of health (SDoH; i.e., those factors outside of biological conditions that influence health) is impractical, two indicators are used to measure Project-related changes in community wellbeing: CIRNAC's CWB Index (quantitative analysis) and a working definition of 'social cohesion' (mostly a qualitative assessment).

CIRNAC's CWB Index (Section 14.2.2.7), is considered to be an appropriate tool to measure changes in community wellbeing because it is the only published index that provides comparability across all Canadian CSDs for which data are available, and it is comprised of four components that are widely accepted as important to wellbeing (i.e., education, labour force activity, income and housing).

Social cohesion is defined as "the ongoing process of developing a community of shared values, shared challenges and equal opportunity within Canada, based on a sense of trust, hope and reciprocity among all Canadians" (Health Canada 2003). Social cohesion is generally considered an important SDoH (Health Canada 2003, WHO 2007, Toronto Public Health 2009; Canadian Council on Social Determinants of Health 2015) of which a growing body of literature is showing accounts for numerous socio-economic, environmental, political, cultural and physical aspects of health.

Where changes in CIRNAC's CWB Index illustrates beneficial effects of Project spending on community wellbeing through increased employment and income, the qualitative assessment of social cohesion facilitates the examination of both positive and adverse effects of the Project.

Central to the assessment of change in community wellbeing is the potential for the Project to result in disproportionate or unequitable effects on vulnerable populations. Specifically, for the purpose of this assessment it is understood that the active labour force portion of vulnerable populations (based on existing conditions; Chapter 13, Section 13.3, and Section 14.2) are less likely to realize benefits of Project-related employment and income. It is also understood that various subpopulation groups may be more vulnerable to adverse changes in housing affordability and availability. As such, for the purpose of this assessment, vulnerable populations include:

> Youth, women, seniors, Indigenous persons, individuals and households below the low-income cut-off (as by Statistics Canada Statistics Canada [2019e]), marginally-housed individuals (includes individuals or households in core housing need as defined by CMHC [2018b]; similar to at-risk homelessness as defined by the Canadian Observatory on Homelessness [2018]), and individuals classified as homeless (includes individuals whom are absolutely homeless [unsheltered],

individuals staying in overnight shelters [emergency sheltered] and individuals whose accommodation is temporary or lacks security of tenure [provisionally accommodated] [Canadian Observatory on Homelessness 2018]).

Where applicable, the assessment of change in community wellbeing differentiates effects on these populations from the overall population of the LAA.

14.4.2 Change in Housing and Temporary Accommodations

14.4.2.1 Project Pathways

A temporary increase in population in the LAA is expected as a result of the Project, which has potential to place additional demands on local availability of housing, accommodations. Details and assumptions regarding the Project workforce and Project accommodations strategy are summarized as follows:

- Due to a declining population in Lynn Lake and the low level of unemployment, there might be difficulty filling Project positions with local workers (Chapter 13). Therefore, it is assumed that 95% of workers will be recruited from outside of Lynn Lake, coming mainly from Thompson, Flin Flon, and Winnipeg.
- As explained in Section 14.2, accommodations will therefore be planned, designed and costed for single workers, rather than for families.
- Non-local construction and operation workers will be housed at a work camp at the MacLellan site. The camp will be supplied, erected, and operated (including catering, housekeeping and recreation) by a third party for the life of mine.
- Camp infrastructure will be independent of existing Town facilities – Power for the MacLellan site will be supplied by Manitoba Hydro; potable water from the Keewatin River will be treated on-site; and there will be on site wastewater treatment.
- The Gordon site will be powered by on-site diesel generators.
- The camp will consist of a 300-bed purchased camp plus 100-bed leased camp (400 total beds) for the two-year pre-production period (construction and commissioning). The camp bed count was determined by the peak FIFO/DIDO workforce size in pre-production and operations. It was assumed that 5% of the total workforce will be sourced locally, thus not requiring accommodation. The total labour force, as well as full-time equivalents (FTE) expected on site at a given time (accounting for FIFO/DIDO rotations) is summarized below:
  - Pre-production peak – 541 total labour force with 555 FTE on site (92 spare beds)
  - Operation peak – 519 total labour force with 547 FTE on site (47 spare beds)
  - Operation Tailings Management Facility (TMF) lift – 531 total labour force with 266 FTE on site (34 spare beds)

  - Short-term workforce spikes associated with TMF construction/lifting are in line with the peak operation workforce.

- During the construction phase, it is expected that most workers will be on 3:1 (three weeks on and one week off) rotations.

- During operation, workers are assumed to be on 2:2 (two weeks on and two weeks off) or 4:4 (four weeks on and four weeks off) rotations.

14.4.2.2 Mitigation

The primary mitigation for change in housing and temporary accommodations will be the implementation of a worker housing strategy, which has been outlined above. An accommodation camp will be in place for pre-production (construction and commissioning) and operation. No additional mitigation is required for housing. This implementation of this strategy will be the responsibility of Alamos.

This mitigation measure has been considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

14.4.2.3 Project Residual Effect

With a declining population in the LAA, the condition of much of the available housing has deteriorated and many units are not habitable (Town of Lynn Lake 2016). There are some options for temporary accommodations in the LAA, including hotel, motels, inns, campgrounds, and lodges (Travel Manitoba 2016). However, the use of a work camp during construction and operation, which will house the non-local workforce, will satisfy requirements for worker accommodation.

Therefore, with the implementation of a Project accommodations strategy residual effects on housing and temporary accommodation during construction and operation are expected to be adverse but negligible and will occur in the LAA. Effects will be continuous, medium-term, reversible, and occur in a socio-economic context that is not resilient.

14.4.3 Change in Local Services and Infrastructure

14.4.3.1 Project Pathways

Effects on local services and infrastructure can result from a Project-related population increase placing additional demands on existing services and infrastructure, including health, emergency, education, recreation, and utilities. In the LAA, the population has been decreasing due to mine closures and, as a result, community services and infrastructure have been scaled back. There is available capacity for some community infrastructure, specifically those related to education, recreation, and health care. However, most facilities are at least 40 years old and in need of repair, upgrading or replacement. The water and waste-water systems are either unable to meet current demand or are close to reaching their physical capacity.

Policing services can be affected by interactions between Project workers and residents and by increased disposable income. Demands on local policing and other social service providers may increase if Project-related income is spent on illicit activities (further assessed in Section 14.4.5.3), or if it increases income differentials and hence tensions among community residents.

Health care and emergency services may be required by temporary Project workers, and/or related to accidents or malfunctions at the Project, increasing the potential need for First Responder and fire department services.

14.4.3.2 Mitigation

The implementation of the mitigation measures will be the responsibility of Alamos and/or its contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Mitigation measures for local services and infrastructure include:

- Work camp at the MacLellan site to accommodate workers during construction and operation.

- During construction, first aid facilities will be supplied by the Engineering, Procurement, and Construction Management (EPCM) contractor. First-aid personnel will provide transport to Lynn Lake hospital when required. During operation, first aid facilities will be supplied by a dedicated first aid/mine rescue office in each of the site administration offices. Site security personnel will be trained as EMS first responders, and when required, provide transfer to Lynn Lake hospital.
- Power, water, and wastewater treatment will be provided by Alamos and will not rely on resources within the Town of Lynn Lake.
- Development of a Waste Management Plan (Chapter 23, Section 23.5.6). Because there will be a Project demand for landfill capacity for construction and non-hazardous domestic solid waste during operation, Alamos will liaise with planners in Lynn Lake regarding these needs and potential requirements for landfill expansion.
- Mandatory safety orientations for new employees.
- Control of access to the PDAs using a security gate and guard house, and by employing on-site security staff.
- Site security services to help limit demands on the local police system.
- Careful control of flammable material (such as fuels and explosives) on-site.
- Training of Project personnel in fuel handling, equipment maintenance, and fire prevention and response measures.
- Scheduling of alternating work shifts so that all workers do not arrive in and leave the area at the same time will limit Project-related demands on both traffic and air services and infrastructure.
- Liaise with local emergency providers so that roles and responsibilities are understood, and that the necessary resources required to respond are in place.
- Maintenance of fire prevention and suppression systems on site, including water supplies, sprinklers, fire extinguishers and other firefighting equipment.
- Workforce education to encourage healthy lifestyle choices, sensitivity training and strict enforcement of Alamos' health and safety policies. For example, sensitivity training would raise the level of awareness about the potential effects that workers can have on the community and their families through drug and alcohol use or other social concerns.
- Access to Employee Assistance Program for Project personnel, and requirement for pre-employment physicals.
- Development of cooperative protocols with responsible agencies to deal with access of Project personnel to emergency and other medical services.

- Development and implementation of Project-specific environmental management plans and monitoring programs, including a Waste Management Plan that sets out procedures for reducing Project-related waste and limiting demands on local landfills.
- Development and implementation of Project-specific Emergency Response and Spill Prevention and Contingency Plans will reduce the likelihood and severity of accidents and potential fires.

14.4.3.3 Project Residual Effect

The presence of non-local workers during construction and operation, together with Project activities, will not place additional demands on power, water, and wastewater services and infrastructure. Power for the MacLellan site will be supplied by Manitoba Hydro via infrastructure built by Alamos, including two transformers, a substation, and a pole line. Diesel generators will also be used to supply power to the Gordon site. Potable water will be provided by treating filtered fresh water through a vendor-supplied potable water treatment plant. The sewage from the MacLellan site buildings will be collected via a network of buried PVC piping and manholes and conveyed by gravity to a 60 m^3/d sewage treatment plant located at the MacLellan site. For the Gordon site, sewage will be conveyed by gravity to two septic tanks at the truck shop and administration building. It will then be trucked to the MacLellan site for processing at the MacLellan sewage treatment plant.

Waste disposal will follow a Waste Management Plan for the Project (Chapters 22 and 23), which will be developed in accordance with applicable regulations (e.g., *The Waste Reduction and Prevention Act* of Manitoba and the provincial Collection and Disposal of Wastes Regulation under *The Public Health Act*) and best practices. Solid waste will be collected and recycled to the extent practical. Where feasible, paper and cardboard will be recycled, waste steel will be sold as scrap, and wood and plastic will be salvaged and recycled. Non-hazardous domestic solid waste will be deposited at the landfill in Lynn Lake. Waste oils, fuels, and hazardous wastes (if any) will be safely handled and transported as recommended by the suppliers and/or manufacturers and in compliance with applicable federal, provincial, or municipal regulations.

Since power, water, and wastewater systems for the Project will be independent of the Town of Lynn Lake, there will be no additional demands on that infrastructure within the Town. Because domestic and construction waste from the Project will be taken to the local landfill, there may be some adverse effect on that infrastructure. The Lynn Lake waste disposal site is nearing capacity but has space available for expansion, which would provide another 20 years of capacity at current rates of use.

There are RCMP detachments in Lynn Lake, Leaf Rapids and Thompson. The Lynn Lake detachment facilities are old but in good condition and there have been staffing issues in the past leading to less than a full complement of officers. Alamos will be responsible for overall site security. The individual contractors will provide site security for their own respective assets during construction. First response firefighting activities will be conducted by the mine rescue team using on-site water trucks and emergency medical services equipment. Alamos will provide emergency response services sufficient in size and capability to respond to emergency situations at the mine.

During construction, first aid facilities will be supplied by the Engineering, Procurement, Construction Management (EPCM) contractor. First-aid personnel will provide transport to Lynn Lake hospital when required. During operation, first aid facilities will be supplied by a dedicated first aid/mine rescue office in each of the site administration offices. Site security personnel will be trained as EMS first responders, and when required, provide transfer to Lynn Lake hospital. The LAA is located within the NRHA service delivery area where access to primary care providers has been identified as an area of concern; while it is fully staffed with primary care physicians, they are generally working at capacity and there remains a need for more providers. The Lynn Lake Hospital, however, is in good condition and, while the NRHA is working at capacity, the hospital has seen an increase in the number of physicians between 2011 and 2015.

To reduce demands on health care and emergency services and infrastructure, Project workers will see health care providers in their hometown during their off time. Project planning and management strategies, including in-design mitigation measures and environmental protection measures (e.g., development and implementation of Project-specific Emergency Response and Spill Prevention and Contingency Plans; Chapters 22 and 23) will reduce the likelihood of accidents and potential fires to as low a level as is reasonably practical. Project personnel will also be trained in fuel handling, equipment maintenance, and fire prevention and response measures.

There is spare capacity for recreation and education in the LAA; however, Project workers will have access to recreation at the accommodation camp and since it is unlikely that families will be accompanying Project employees, Project-related demands on education and recreation will be minimal, if any.

In addition to the mitigation and management measures listed in Section 14.4.3.2 and described above, Alamos will continue to communicate with local communities and service providers with respect to scheduling so they may prepare for potential increased demands on local services and infrastructure, particularly with respect to potential demands on the municipal landfill.

With the application of mitigation and management measures, the residual adverse effects on the capacity of local services and infrastructure during all Project phases are predicted to be low in magnitude, and continuous throughout construction, operation and decommissioning/closure. They are predicted to occur in a socio-economic context that is resilient, and effects are likely to be reversed following decommissioning/closure.

14.4.4 Change in Transportation Services and Infrastructure

14.4.4.1 Project Pathways

Project construction and operation activities will affect transportation services and infrastructure. The Project workforce will also create additional traffic, since it is assumed that most Project workers will come from Thompson, Flin Flon, and Winnipeg. The commute to the Project site at the beginning and end of rotations will also generate additional traffic between Thompson and Lynn Lake. PR 391 between Thompson and Lynn Lake is expected to see an increase of approximately one to two truckloads per day as a result of the Project.

Access to the Gordon and MacLellan sites will be via the existing all-weather PR 391, which is under the authority of Manitoba Infrastructure. PR 391 is an all-weather road connecting Thompson, Manitoba, and Lynn Lake. PR 391 will be used by personnel, material deliveries, and haulage trucks transporting material to the ore milling and processing plant. The potential need for upgrades to PR 391 and/or weight exception requirements to support the Project is currently being discussed with the highway authority (i.e., Manitoba Infrastructure). Based on an assumed haulage rate of 4,100 t/d, the Project is estimated to require seven truckloads per hour between the Gordon and MacLellan sites during the first six years of mining operation. Project-related truck traffic between the Gordon and MacLellan sites is included in the scope of the Project to be assessed.

14.4.4.2 Mitigation

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Mitigation measures for effects on transportation services and infrastructure include:

- Scheduling of alternating work shifts so that workers do not arrive in and leave the area at the same time will limit Project-related demands on both traffic and air services and infrastructure.
- Upgrading and resurfacing the existing access roads to the MacLellan and Gordon sites.
- Implement standard construction procedures, including traffic control, to reduce traffic delays during construction. The procedures will be developed during ongoing planning and engineering design to address traffic staging to reduce delays.
- Providing bussing services between the temporary camp and Gordon site.
- Encouraging carpooling among locally resident construction and operation workers.
- Scheduling arrivals/departures of employee traffic to occur earlier than the existing observed a.m. peak hour for local traffic and later than the existing observed p.m. peak hour if needed.

14.4.4.3 Project Residual Effect

A transportation assessment of PR 391 from the Gordon site access road (located near Westdal Lake) to the MacLellan site access road (located just east of the Town of Lynn Lake) rates the existing surface conditions of the road as fair to poor and in need of repairs (Stantec 2017). However, existing traffic volumes are very low (150 vehicles per day). The transportation study indicates there is sufficient capacity on PR 391 to accommodate the anticipated haul of 4,100 tonnes per day and higher volumes (Stantec 2017). The existing road surface of the Gordon site access road will require increased maintenance activity, and at least one 6-km section of PR 391 will likely require resurfacing to accommodate anticipated traffic and loading before hauling operation start (Stantec 2017).

The existing 15-km site access road from PR 391 to the Gordon site will be upgraded and resurfaced. The existing 4.6-km MacLellan site access road will be used for construction and operational vehicle access once upgraded. There is an existing single-lane concrete bridge over Keewatin River on the existing MacLellan site access road which will have downgraded posted capacity. A new prefabricated single lane steel bridge will be constructed as part of the Project alongside the existing bridge to accommodate increased traffic in and out of site.

The Gordon site access road is gravel surfaced and in fair condition (albeit with several sections appearing to be in poor condition), with loose gravel and rutting observed. The existing road surface of the Gordon site access road will require increased maintenance activity and at least one 6-km section of PR 391 will likely require resurfacing to accommodate anticipated traffic and loading before hauling operation start (Stantec 2017).

While PR 391 needs upgrades, which are being considered with Manitoba Infrastructure, a transportation study has indicated that there is sufficient capacity on PR 391 to accommodate the anticipated haul of 4,100 t/d and higher volumes (Stantec 2017). Some roads in the PDAs will also be resurfaced prior to operation.

Construction workers will be bussed from the temporary camp to the Gordon site during construction and operation. This will reduce the additional road traffic generated by the Project. Because the workforce will be FIFO or DIDO, workers will not create additional traffic within Lynn Lake during their off time as they will return to their home communities. However, it is assumed that most Project workers will come from Thompson, Flin Flon, and Winnipeg and the commute to the Project site at the beginning and end of rotations will generate additional traffic between Thompson and Lynn Lake. The average annual daily traffic ranges between 80 and 200 vehicles on roads entering the towns of Lynn Lake and Leaf Rapids. Scheduling of alternating work shifts so that all workers do not arrive in and leave the area at the same time will help reduce Project-related demands on roads. This will also reduce demands on local airports if some workers are coming from further abroad than Thompson and require air transportation to Lynn Lake.

Non-local construction and operation workers will be housed at the temporary camp and bussed to and from the Gordon site. Bussing non-local employees between the temporary camp and the site and encouraging carpooling among locally resident construction and operation workers, as well as scheduling work shifts to reduce traffic congestion during peak local traffic times will limit daily traffic volumes.

Standard construction procedures, including traffic management and control, will be implemented to reduce traffic delays during construction. The Traffic Management Plan procedures will be developed during ongoing planning and engineering design to address traffic staging to reduce delays. In addition, as with other community services and infrastructure, Alamos will continue to communicate with local communities and service providers with respect to scheduling so they may prepare for potential increased demands related to transportation.

The residual adverse effect of the Project of a change in transportation services and infrastructure is therefore predicted to be low in magnitude and continuous throughout construction and operation of the Project. Effects will occur in the LAA in a resilient socio-economic context and are likely to be reversed following active closure.

14.4.5 Change in Community Wellbeing

14.4.5.1 Project Pathways

The Project has the potential to affect (beneficially or adversely) community wellbeing through changes in employment and income and changes in population. Combined, changes in these pathways can affect numerous factors or SDoH (PHAC 2013, WHO 2007, Toronto Public Health 2009, CPHI 2004, Federal Provincial and Territorial Advisory Committee on Population Health 1999), contributing to positive or adverse changes in the existing characterization of community wellbeing within the LAA. Additional information on these pathways (drawn from review of the previously referenced publications) is provided below.

Change in Employment and Income

Depending on an individual's pre-employment situation, securing employment with the Project could result in positive or adverse effects. Through gained employment and increased income individuals could realize an increase in the amount of time, and in some cases the financial ability, that they, or members of their household have to participate in recreational, subsistence, and family-related activities and physical exercise. Where changes in income result in increased levels of disposable income, Project-related employment could decrease financial barriers to accessing healthy market foods. In other cases, increased disposable income could decrease financial barriers to negative coping mechanisms such as overeating, smoking, heavy drinking and illicit drug use. Combined, these changes can affect social cohesion.

Change in Population

Project-related population growth, either through the in-migration of workers and their families to the LAA or through the presence of a FIFO/DIDO workforce, has the potential to alter the demographic composition of the LAA and affect social cohesion. In addition, adverse interactions (e.g., physical conflicts) between FIFO/DIDO workers and residents have the potential to disrupt existing social environments (e.g., result in changes in perceived safety) and adversely affect social cohesion.

14.4.5.2 Mitigation

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Mitigation measures for community wellbeing include:

- Work camp at the MacLellan site to accommodate workers during construction and operation.
- Workforce education to encourage healthy lifestyle choices, sensitivity training and strict enforcement of Alamos' health and safety policies. For example, sensitivity training would raise the level of awareness about the potential effects that workers can have on the community and their families through drug and alcohol use or other social concerns.
- Access to Employee Assistance Program for Project personnel, and requirement for pre-employment physicals.

14.4.5.3 Project Residual Effect

CWB Index Score

Given the LAA's declining population and low level of unemployment, it is assumed that 95% of direct labour will be recruited from outside the LAA. Labour sourced from outside the LAA is expected to mainly be recruited from other RAA communities (namely the City of Thompson) and other parts of Manitoba (e.g., City of Flin Flon, City of Winnipeg). In addition to the direct workforce, it is estimated that 92% of indirect and induced employment will occur outside the LAA and RAA (Chapter 13). Table 14-9 provides a summary of estimated local employment and labour income.

Table 14-9 Estimated Local Employment (FTEs) and Labour Income/FTE (undiscounted)

<table>
<tr><th rowspan="3">Project Phase</th><th colspan="2">LAA</th><th colspan="4">Northern Region[1]</th></tr>
<tr><th colspan="2">Direct Labour</th><th colspan="2">Indirect Labour</th><th colspan="2">Induced Labour</th></tr>
<tr><th>FTEs</th><th>Labour Income/FTE[2]</th><th>FTEs</th><th>Labour Income/FTE[2]</th><th>FTEs</th><th>Labour Income/FTE[2]</th></tr>
<tr><td>Construction</td><td>20</td><td>$95,000</td><td>12</td><td>$56,000</td><td>14</td><td rowspan="3">$41,000</td></tr>
<tr><td>Operation</td><td>20</td><td>$130,000</td><td>4</td><td>$57,000</td><td>21</td></tr>
<tr><td>Decommissioning/Closure</td><td>5</td><td>$76,000</td><td>2</td><td>$62,000</td><td>3</td></tr>
<tr><td colspan="7">NOTES:
1) Estimates of local indirect and induced employment are not provided. Estimates are provided at the Northern Region, as modelled by PwC, for context.
2) Estimates of labour income/FTE have been rounded down to the nearest thousand.
SOURCE: PwC 2020a, 2020b; Alamos Project cost and FTE (local and total) estimates.</td></tr>
</table>

Because Project employment will have beneficial effects on participation and employment rates within the LAA, and because Project wages (i.e., Labour Income/FTE) are greater than existing conditions (mean employment income of $51,381 for males and $58,782 for females, total population), it is expected that the labour force and income subcomponents of Lynn Lake's CWB score will increase. While existing CWB Index scores are not available for Black Sturgeon IR (Section 14.2.2.7), given that employment and income effects are expected to occur throughout the LAA (Chapter 13), upward, or positive, changes in labour force and income variables of the CWB index (i.e., income per capita and participation and employment rates) are expected. Therefore, based on the assessment of 'change in local and regional labour force' (Chapter 13), low magnitude positive effects on community wellbeing are anticipated through positive changes in existing labour force and income conditions.

However, as noted in Chapter 13, despite the implementation of mitigation and management measures, employment and income effects may not be equitably realized by all members of the LAA population (e.g., Non-Indigenous males employed in construction and mining with trades training may realize a disparate share of total local employment). It is therefore acknowledged that Project employment and related beneficial effects on individual and household income may not be equitably realized by active labour force participants within the LAA's 'vulnerable population' classification (defined in Section 14.4.1.2).

Given results of the assessment of 'change in housing and temporary accommodations' (i.e., adverse but negligible effects during Project phases; Section 14.4.2), the Project is not anticipated to result in changes to the housing subcomponent of Lynn Lake's CWB Index score or related variables (i.e., housing quality or quantity) within Black Sturgeon IR. Because changes in demand for housing are assessed as negligible, disproportionate effects on subpopulation groups within the LAA's 'vulnerable population' classification (e.g., persons on fixed incomes and marginally-housed persons; Section 14.4.1.2) are not anticipated. As such, the Project is anticipated to result in negligible changes in existing conditions related to housing and community wellbeing are anticipated.

While Alamos will work with Indigenous communities and local communities to address educational and skills shortages that may arise as barriers to employment, and that employment policies will be in place that encourage workers to complete grade 12 (or equivalent), the Project is not anticipated to have a measurable positive or adverse effect on the proportion of the current LAA population with high school (or greater) or university educational attainment (education variables included in CIRNAC's CWB Index). As such, the Project is expected to result in negligible changes in existing conditions related to education and wellbeing.

Project residual effects on wellbeing within the LAA (as measured through variables included in CIRNAC's CWB Index) are predicted to be positive; however, there is a low to moderate degree of uncertainty with respect to estimates of local employment, in-migration and the extent to which Project wages will be realized by local residents. Due to these uncertainties, positive effects are conservatively characterized as low in magnitude during construction and operation. It is likely that positive effects on wellbeing through gained employment and income will be inequitably distributed across the population of the LAA with vulnerable populations less likely to realize these effects. Due to linkages with Project employment, residual effects occur on a continual basis over the operational life of the Project (i.e., medium term). Effects are limited to the LAA and are reversible following the completion of decommissioning/closure with the cessation of Project-related employment. There are no seasonal timing considerations to residual effects. Effects occur within a non-resilient socio-economic context, largely based on existing labour force conditions and the sizable portion of the population that, for the purpose of this assessment, are included in the definition of a vulnerable population.

Residual effects during decommissioning/closure are considered to be negligible in magnitude. No further consideration of these effects is provided.

Social Cohesion

Population Change (and the Presence of Non-Local Workers)

Given peak construction and operational employment estimates (average of 406 FTEs and 412 FTEs, respectively) and the assumed division of local versus FIFO/DIDO hire (5% and 95% respectively), in-migrating workers and their families could result in a 10% increase in the LAA's population. This estimate has conservatively assumed that the 5% local hire estimate would not be satisfied by current residents and thus could be an overestimate of immigrants (it also assumes an average Manitoba household size of 2.5 persons; Statistics Canada 2017a). Should the demographic profile of this population differ from that of the LAA (which is characterized as being roughly evenly comprised of Indigenous and non-Indigenous persons and males and females), in-migrating workers (and their families) could result in changes to the demographic profile of the LAA.

Construction and mining workers from Manitoba tend to be primarily non-Indigenous males (73% each) and between the ages of 25-54 (60% and 63% respectively; Statistics Canada 2018). Because this demographic profile differs from that of the LAA, FIFO/DIDO workers (to the extent they are present in the LAA) are expected to change the demographic profile of the LAA.

Changes in population and the demographic profile of the LAA have the potential to result in adverse changes in 'sense of community belonging'. In the extreme, demographic change associated with non-local workers could lead to adverse interactions between usual residents and workers (e.g., physical altercations), increased crime and reliance on negative coping mechanisms (e.g., drug and alcohol use) within LAA communities. The mere presence of a large FIFO/DIDO workforce near LAA communities could also adversely affect baseline levels of ‘sense of community belonging”.

While total (inclusive of FIFO/DIDO workers) estimated changes in population are substantial, due to the Project’s use of an accommodation camp, workforce sensitivity training (expected to reduce the likelihood of adverse interactions with local residents), and because of the relatively short period of time workers will spend in LAA communities (due to work schedules and because FIFO/DIDO workers will return to their home communities following the completion of shift rotations), the likelihood that residents will perceive overall population effects is moderate. The exception to this would be when workers are required to complete job-related tasks in LAA communities or during shift changes when the Projects workforce may be temporarily present in the LAA prior to returning to their home communities (e.g., to purchase goods).

Given the above, and in consideration of mitigation measures, population-related residual effects on social cohesion are conservatively assumed to be adverse in direction (as community perceptions regarding changes in population are unknown) and moderate (accounting for shift changes) in magnitude during construction and operation. Largely tied to the Project’s FIFO/DIDO workforce, adverse effects occur on a continual basis over the operating life of the Project (i.e., medium term). Effects occur within the LAA and are reversible following the completion of decommissioning/closure (corresponding with the cessation of Project employment). There are no seasonal timing considerations to residual effects.

Residual effects during decommissioning/closure are considered to be negligible in magnitude with respect to social cohesion. No further characterization is provided.

Personal Health Practices and Coping Mechanisms

Compared to average incomes within the LAA (mean employment income of $51,381 among males and $58,782 among females, total population), direct Project wages (Table 14-9) represent a measurable increase from existing conditions. However, given estimates of local hire (5% of total labour demand), changes in individual and household income within the LAA are expected to be low in magnitude.

Depending on an individual’s pre-employment situation, increased disposable income through gained employment could decrease financial barriers to engaging in recreational, subsistence, and family-related activities and healthy eating, or could increase access to negative coping mechanisms such as smoking, heavy drinking, and illicit drug use. Changes in stress either through changes in employment, failed attempts at securing employment with the Project, or due to changes in “sense of community belonging” could also result in increased reliance on negative coping mechanism.

Because Project workers will work a variety of shift rotations (e.g., three weeks on and one week off), workers who secure employment with the Project could realize an increase, or decrease, in the amount of time they have available to engage in recreational, subsistence, and family-related activities. The direction of effect being dependent on an individual’s pre-employment circumstances (e.g., unemployed, working multiple jobs). Workers who secure indirect or induced employment may also realize changes in the amount of time they have available to engage in activities other than work. For FIFO/DIDO workers, changes in the amount of time spent away from home communities and family members could result in increased stress, strained family dynamics, and increase reliance on negative coping mechanisms.

Because, relative to provincial averages, LAA residents (males and females) have higher rates of obesity and greater reliance on negative coping mechanisms (i.e., smoking and heavy drinking), the LAA is considered to be non-resilient (socio-economic context) with respect to changes in personal health practices. It is also recognized that, as noted in Section 14.4.5.3 and in Chapter 13, because employment and income effects may not be equitably realized by all members of the LAA population active labour force member of vulnerable populations are less likely to release Project effects on personal health practices (positive and adverse) related to changes in employment and income.

In consideration of the socio-economic context in which effects occur, workforce education targeted at encouraging healthy lifestyle choices, access to an Employee Assistance Program by Project personnel, changes to Lynn Lake's CWB Index score, and Project wages, adverse residual effects are characterized as being moderate in magnitude during construction and operation. Adverse effects are conservatively assumed to occur over the long-term (i.e., beyond Project decommissioning/closure) and are reversible. There are no seasonal timing considerations to residual effects.

Positive effects, when combined with the above considerations are characterized as being low in magnitude during construction and operation (aligns with the CWB Index score magnitude characterization and characterizations). Linked to employment and income, residual effects occur on a continual basis. Effects are limited to the LAA. Positive effects occur over the operational life of the Project (i.e., medium term) but are reversable following completion of decommissioning/closure. There are no seasonal timing considerations to residual effects.

Residual effects during decommissioning/closure are considered to be negligible in magnitude. No further characterization is provided.

Summary Characterization

Based on the assessment and characterization of Project residual effects on the indicators 'CWB Index Score' and 'Social Cohesion', a mixture of positive and adverse residual effects on community wellbeing are anticipated. Positive effects result from low magnitude, Project-related employment and income and related beneficial changes to individual and household disposable income resulting in increased available time (depending on pre-employment conditions) and reduced financial barriers to engage in subsistence, and family-related activities and healthy eating. Positive effects are characterized as being low in magnitude during construction and operation, occur within the LAA on a continual basis over the medium-term, and are reversable following the completion of decommissioning/closure. Effects occur within a non-resilient socio-economic context, largely based on existing labour force conditions and the sizable proportion of the population that, for the purpose of this assessment, are included in the definition of a vulnerable population.

Adverse residual effects on community wellbeing result from moderate Project-related changes in the size and demographic composition of the LAA and subsequent changes in perceived levels of "sense of community belonging". Residual effects also result from low magnitude, Project-related changes in employment and income, which subsequently can increase time spent away from home communities and families (contributing to increases in stress) and contribute to increased reliance on negative coping skills. Adverse effects are conservatively characterized as being moderate in magnitude during construction and operation, occur within the LAA on a continual basis over the long-term, and are reversable following the completion of decommissioning/closure. Effects occur within a non-resilient socio-economic context.

Residual effects during decommissioning/closure are considered to be negligible in magnitude. No further characterization is provided.

14.4.6 Summary of Project Residual Environmental Effects on Community Services, Infrastructure, and Wellbeing

A summary of residual environmental effects on community services, infrastructure, and wellbeing as a result of the Project are summarized in Table 14-10.

With the implementation of Project mitigation and management measures, residual effects on community services and infrastructure are expected to be of negligible to low magnitude, will occur in the LAA, be continuous for the medium-term, and reversible. They will generally occur in a socio-economic context that is resilient, with the exception of housing and temporary accommodations, which has a socio-economic context that is not resilient.

With the implementation of Project mitigation and management measures, positive effects on community wellbeing are characterized as being low in magnitude during construction and operation, occur within the LAA on a continual basis over the medium-term, and are reversible following the completion of decommissioning/closure. Positive effects of Project-related employment and income are likely to be inequitably distributed across the LAA population with vulnerable population less likely to realize benefits. Effects occur within a non-resilient socio-economic context. Adverse effects are characterized as being moderate in magnitude during construction and operation, occur within the LAA on a continual basis over the long-term, and are reversible following the completion of decommissioning/closure. Effects occur within a non-resilient socio-economic context. Residual effects on community wellbeing are considered to be negligible in magnitude during decommissioning/closure.

Table 14-10 Project Residual Effects on Community Services, Infrastructure, and Wellbeing

Residual Effect	Residual Effects Characterization								
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context
Gordon and MacLellan Sites									
Change in housing and temporary accommodations	C, O	A	N	LAA	MT	N/A	C	R	NR
Change in local services and infrastructure	C, O	A	L	LAA	MT	N/A	C	R	R
Change in transportation services and infrastructure	C, O	A	L	LAA	MT	N/A	C	R	R
Change in community wellbeing	C, O	P/A	L/M	LAA	MT/LT	N/A	C	R	NR

KEY
See Table 14-2 for detailed definitions

Project Phase
C: Construction
O: Operation
D: Decommissioning

Direction:
P: Positive
A: Adverse

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term;
MT: Medium-term
LT: Long-term

N/A: Not applicable

Timing:
N/A: Not Applicable
A: Applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
R: Resilient
NR: Not Resilient

14.5 ASSESSMENT OF CUMULATIVE ENVIRONMENTAL EFFECTS ON COMMUNITY SERVICES, INFRASTRUCTURE, AND WELLBEING

Project effects on community services, infrastructure, and wellbeing could potentially overlap with other planned projects and activities to cause cumulative adverse effects if the temporary addition of non-local workers places pressure on existing services or if changes in employment and income or changes in population interact in a cumulative manner to adversely affect community wellbeing.

Project residual effects described in Section 14.4 are likely to interact cumulatively with residual environmental effects from other physical activities (past, present, and reasonably foreseeable).

The effects of past and current projects relative to conditions prior to historical mining activities contribute to baseline conditions upon which Project effects are assessed.

The resulting cumulative environmental effects (future scenario with the Project) are assessed. Cumulative environmental effects (the future scenario without the Project) are also described. This is followed by an analysis of the Project contribution to cumulative effects. Future projects and activities that are reasonably foreseeable are defined as those that (a) have been publicly announced with a defined project execution period and with sufficient project details that allow for a meaningful assessment, (b) are currently undergoing an environmental assessment or (c) are in a permitting process.

The assessment of cumulative effects is initiated with a determination of whether two conditions exist:

- The Project is assessed as having adverse residual environmental effects on a VC, and
- The adverse residual effects from the Project overlap spatially and temporally with residual effects of other physical activities on a VC.

If either is not met, the assessment of cumulative effects concludes with a statement that further assessment of cumulative effects is not warranted because the Project does not interact cumulatively with other projects or activities.

14.5.1 Project Residual Effects Likely to Interact Cumulatively

Table 4C-1 in Chapter 4, Environmental Assessment Methods, presents the project and physical activities inclusion list, which identifies other projects and physical activities that might act cumulatively with the Project. Where residual environmental effects from the Project act cumulatively with residual effects from other projects and physical activities (Table 14-11), a cumulative effects assessment is undertaken to determine their significance.

Table 14-11 Interactions with Potential to Contribute to Cumulative Effects

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Environmental Effects			
	Change in Housing and Temporary Accommodations	Change in Local Services and Infrastructure	Change in Transportation Services and Infrastructure	Change in Community Wellbeing
Past and Present Physical Activities and Resource Use				
Mineral Development				
• "A" Mine	–	–	–	–
• EL Mine	–	–	–	–
• Fox Mine	–	–	–	–
• Farley Mine	–	–	–	–
• Ruttan Mine	–	–	–	–
• MacLellan Mine (Historical)	–	–	–	–
• Burnt Timber Mine	–	–	–	–
• Farley Lake Mine	–	–	–	–
• Keystone Gold Mine	–	–	–	–
• East/West Tailings Management Areas	–	–	–	–
Mineral Exploration	–	–	–	–
Water and Waste Projects (sewage plants, waste disposal grounds)	–	✓	–	–
Residential and Community Development (including cottage subdivisions)	✓	✓	✓	✓
Infrastructure Development (transmission line, airport, highways, roads, rail)	✓	✓	✓	✓
Other Resource Activities (hunting, fishing, berry picking)	–	–	–	–
Future Physical Activities				
Mineral Development	✓	✓	✓	✓
Mineral Exploration	✓	✓	✓	✓
Traditional Land Use	–	–	–	–
Resource Use Activities	–	–	–	–
Recreation	–	–	–	–

Table 14-11 Interactions with Potential to Contribute to Cumulative Effects

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Environmental Effects			
	Change in Housing and Temporary Accommodations	Change in Local Services and Infrastructure	Change in Transportation Services and Infrastructure	Change in Community Wellbeing

NOTES:
✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with Project residual environmental effects.
– = Interactions between the residual effects of other projects and residual effects of the Project are not expected.
For a detailed description and mapped locations of Projects and Physical Activities, where applicable, see Chapter 4, Table 4D-2 and Maps 4-3 and 4-4.

Environmental effects identified in Table 14-11 as not likely to interact cumulatively with residual effects of other projects and physical activities (no check mark) are not discussed further. The assessment of the cumulative environmental effects that are likely to result from the Project in combination with other projects and physical activities are discussed in subsequent sections.

14.5.2 Change in Housing and Temporary Accommodations

14.5.2.1 Cumulative Effect Pathways

Other projects and physical activities will act cumulatively with the Project to affect housing and temporary accommodations if they occur at the same time as the Project and require the temporary presence of a workforce in the RAA communities. Workers from other projects may place additional demands on housing and temporary accommodations, possibly beyond their capacity.

It is likely that workforces associated with residential and community development and infrastructure development will be local and relatively small so effects on housing and temporary accommodations will be negligible. Also, residential development will add to the housing supply of the RAA and create additional capacity for future projects. Future mineral exploration and development may have large workforces requiring temporary accommodations; however, they will only act cumulatively with the Project if they overlap temporally. Additionally, the Project work camp will accommodate the entire Project workforce with spare capacity, so the Project is not likely to compete with other projects for housing and temporary accommodations.

14.5.2.2 Mitigation for Cumulative Effects

The primary mitigation for change in housing and temporary accommodations will be the implementation of a Project worker housing strategy, which has been outlined in Chapter 13, Section 13.5.2.1. An accommodation camp will be in place for pre-production (construction and commissioning) and operation. No additional mitigation is required for housing.

It is also expected that current and reasonably foreseeable future projects and physical activities will be required to apply standard mitigation and other management measures to avoid or reduce their effect on housing and temporary accommodations and comply with applicable regulatory requirements.

14.5.2.3 Cumulative Effects

With the implementation of mitigation measures, residual cumulative effects housing and temporary accommodations in the RAA are likely to be adverse, negligible, medium-term in duration, continuous, reversible, and occur within a non-resilient socio-economic context.

14.5.3 Change in Local Services and Infrastructure

14.5.3.1 Cumulative Effect Pathways

Projects that are most likely to act cumulatively with local services and infrastructure are water and waste projects, residential and community development (including cottage subdivisions), and infrastructure development. The labour forces for these projects may increase the population of the area placing additional demands on local services and infrastructure in the RAA. However, the workforces associated with such projects are likely to be local and relatively small. Where community service and infrastructure improvements, such as power and transportation upgrades, are made, projects and users generally benefit as these projects will increase capacity of local services and infrastructure.

Future mineral exploration and development may have large workforces that may place additional demands on local services and infrastructure; however, they will only act cumulatively with the Project if they overlap temporally. The Project accommodations camp will provide some services, including catering and opportunities for recreation, which will reduce the need for Project workers to go into RAA communities. Also, the Project is not expected to compete with other projects for services and infrastructure since power, water, and wastewater infrastructure for the Project will be built by Alamos.

Alamos will provide site security and will provide emergency response services capable to respond to emergency situations at the mine. First-aid facilities and personnel will be available on site during construction and operation. These measures will reduce the likelihood of cumulative effects on local health, safety, and emergency services and infrastructure.

It is also expected that current and reasonably foreseeable future projects and physical activities will be required to apply standard mitigation and other management measures to avoid or reduce their effect on infrastructure and services (e.g., emergency response plans) and comply with applicable regulatory requirements.

In addition, Alamos will continue to communicate with local communities and service providers with respect to scheduling so they may prepare for potential increased demands local services and infrastructure, such as the local landfill due to the addition of Project-related domestic and construction waste.

14.5.3.2 Mitigation for Cumulative Effects

Mitigation for changes to local services and infrastructure are described in Section 14.4.3.2. No additional mitigation measures are required for cumulative effects.

14.5.3.3 Cumulative Effects

With application of mitigation measures, cumulative effects on local services and infrastructure are expected to be adverse, low in magnitude, medium-term, continuous, and reversible and occur in a resilient socio-economic context.

14.5.4 Change in Transportation Services and Infrastructure

14.5.4.1 Cumulative Effect Pathways

Activities associated with residential and infrastructure development, as well as future mineral development and exploration, may act cumulatively with the Project to affect transportation services and infrastructure of they overlap temporally. However, where community services and infrastructure improvements, such as road upgrades, are made, projects and users generally benefit. The occurrence of current and future road development in the RAA will most likely have positive effects on transportation services and infrastructure, because they would increase the capacity of local roads and might reduce localized traffic congestion in the RAA.

Other project labour forces may travel on local roads periodically during their off-time. However, since the Project accommodations camp will have services available, including catering and opportunities for recreation, Project workers are unlikely to travel into RAA communities. Project workers will also be bussed from the camp to the mine site during construction and operation. These measures will reduce Project contributions to cumulative effects on transportation services and infrastructure (e.g., traffic congestion).

It is also expected that current and reasonably foreseeable future projects and physical activities will be required to apply standard mitigation and other management measures to avoid or reduce their effect on infrastructure and services (e.g., traffic management plans) and comply with applicable regulatory requirements.

In addition, Alamos will continue to communicate with local communities and service providers with respect to scheduling so they may prepare for potential increased demands local services and infrastructure.

14.5.4.2 Mitigation for Cumulative Effects

Mitigation for changes to transportation services and infrastructure are described in Section 14.4.4.2. No additional mitigation measures are required for cumulative effects.

14.5.4.3 Cumulative Effects

With application of mitigation measures, cumulative effects on transportation services and infrastructure are expected to be adverse, low in magnitude, medium-term, continuous, and reversible and occur in a resilient socio-economic context.

14.5.5 Change in Community Wellbeing

14.5.5.1 Cumulative Effect Pathways

Other projects and physical activities will act cumulatively with the Project affecting community wellbeing if they occur at the same time as the Project and result in changes in employment and income within RAA communities or result in changes to the populations of RAA communities. Combined, changes in these pathways could result in changes to numerous SDoH.

14.5.5.2 Mitigation for Cumulative Effects

Mitigation for changes to community wellbeing, such as the use of a work camp to house Project workers, workforce education to encourage healthy lifestyle choices, sensitivity training, and access to an Employee Assistance Program by Project personnel, are described in Section 14.4.5.2. No additional mitigation measures are required for cumulative effects.

14.5.5.3 Cumulative Effects

It is likely that workforces associated with residential, community, and infrastructure development will be local and relatively small and will compensate workers with wages consistent with existing RAA conditions. Future mineral exploration and development may have large workforces (which may or may not be completely recruited from the RAA) and will likely compensate workers with wages greater than current income levels. Should these physical activities and projects temporally overlap with the Project, low magnitude cumulative increases in the RAA's population (should in-migrating labour satisfy labour demand for future mineral development and exploration projects) and individual and household income could occur. As such, cumulative effects on community wellbeing are anticipated to be low in magnitude.

With the implementation of mitigation and management measures, the Project's contribution to cumulative effects is that of negligible magnitude changes in population and individual and household income within the RAA. This is largely because a FIFO/DIDO workforce, which will be lodged in an accommodation camp and will return to home communities following completion of work rotations, is expected to satisfy most of the Project's demand for direct labour (95%). This characterization also considers that should FIFO/DIDO workers be recruited from the City of Thompson (i.e., the largest population centre within the RAA), changes in individual income and household income, given the size of the City of Thompson's population and labour force (Chapter 13) would result in negligible changes from existing conditions.

Overall, with the application of mitigation and management measures, adverse cumulative effects on community wellbeing are assumed to be low in magnitude. Effects extend throughout the RAA, are continuous, and reversible. Adverse effects are long-term in duration and occur within a non-resilient socio-economic context. There are no seasonal timing considerations.

14.5.6 Cumulative Effects Without the Project

Without the Project, the RAA would not experience a Project-related temporary increase in the local population or changes in employment and income. Therefore, the RAA would not be faced with potential decreases in capacity of existing infrastructure and services or changes in community wellbeing (from the Project). However, future mineral exploration and development projects would have workforces (likely compensated with wages greater than RAA averages) requiring temporary accommodations and which will place demands on other infrastructure and services. Workers associated with future mineral exploration and development projects will also likely be paid wages greater than regional averages, and when combined with population and demographic changes non-resident workers would have on RAA communities, changes in SDOH and community wellbeing would occur.

Without the Project, it is likely that the future of the RAA would be similar to existing conditions. It is expected that current and reasonably foreseeable future projects and physical activities will be required to apply standard mitigation and other management measures to avoid or reduce their effect on community services, infrastructure, and wellbeing.

14.5.7 Summary of Cumulative Effects

Table 14-12 summarizes cumulative environmental effects on community services, infrastructure, and wellbeing.

Table 14-12 Residual Cumulative Effects

Residual Cumulative Effect	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context
Residual Cumulative Change in Housing and Temporary Accommodations								
Without the Project	A	N	RAA	MT	N/A	C	R	NR
With the Project	A	N	RAA	MT	N/A	C	R	NR
Contribution from the Project to the residual cumulative effect	*The Project's contribution to these cumulative effects is negligible in magnitude because of the use of a work camp to house Project workers.*							
Residual Cumulative Change in Local Services and Infrastructure								
Without the Project	A	L	RAA	MT	N/A	C	R	R
With the Project	A	L	RAA	MT	N/A	C	R	R

Table 14-12 Residual Cumulative Effects

Residual Cumulative Effect	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context
Contribution from the Project to the residual cumulative effect	*The Project's contribution to these cumulative effects is low in magnitude because Project infrastructure will be built by Alamos to provide water, power, and sewer. Also, services, such as health, safety and emergency, will be provided by Alamos reducing need to rely on services and infrastructure in the RAA.*							
Residual Cumulative Change in Transportation Services and Infrastructure								
Without the Project	A	L	RAA	MT	N/A	C	R	R
With the Project	A	L	RAA	MT	N/A	C	R	R
Contribution from the Project to the residual cumulative effect	*The Project's contribution to these cumulative effects low in magnitude due to the capacity of local transportation infrastructure and because Alamos will implement a Traffic Management Plan and bus workers to the mine site.*							
Residual Cumulative Change in Community Wellbeing								
Without the Project	A	L	RAA	LT	N/A	C	R	NR
With the Project	A	L	RAA	LT	N/A	C	R	NR
Contribution from the Project to the residual cumulative effect	*The Project's contribution to these cumulative effects is negligible in magnitude because of the use of a work camp to house project workers, workforce education to encourage healthy lifestyle choices, sensitivity training, and access to an Employee Assistance Program by Project personnel.*							

KEY

See Table 14-2 for detailed definitions

Direction:
P: Positive
A: Adverse

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term;
MT: Medium-term
LT: Long-term

N/A: Not applicable

Timing:
N/A: Not Applicable
A: Applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
R: Resilient
NR: Non-Resilient

14.6 EFFECTS TO FEDERAL LANDS

Federal lands within the LAA and RAA for Community Services, Infrastructure and Wellbeing consist of Black Sturgeon IR a settlement of the Marcel Colomb First Nation, which falls within the LAA, and Granville Lake Indian Settlement (IS), a settlement of the Mathias Colomb Cree Nation, South Indian Lake IS, a settlement of the O-Pipon-Na-Piwin Cree Nation, and Kinoosao-Thomas Clarke 204 IR, Saskatchewan, the most northern community within the Peter Ballantyne Cree Nation territory, which fall within the RAA.

Potential effects of the Project on services and infrastructure Black Sturgeon Reserve, as part of the LAA, are assessed in Section 14.4 and determined to be adverse and negligible to low in magnitude. Positive effects on community wellbeing are characterized as being low in magnitude and adverse effects are predicted to be moderate in magnitude during construction and operation. Residual effects are restricted to the LAA and, therefore, not expected to occur in Federal lands in the RAA.

14.7 DETERMINATION OF SIGNIFICANCE

14.7.1 Significance of Project Residual Effects

14.7.1.1 Community Services and Infrastructure

A significant effect on community services and infrastructure is defined as one that results in demands on services or infrastructure above and beyond current capacity, such that standards of service are routinely and persistently reduced below current levels for an extended period such that they are unlikely to recover to existing conditions.

Because residual adverse effects on community services and infrastructure do not result in demands on services or infrastructure above and beyond current capacity such that standards of service are routinely and persistently reduced below current levels for an extended period, they are considered to be not significant for all phases of the Project.

With mitigation and management measures, the residual environmental effects on community services and infrastructure are predicted to be not significant.

14.7.1.2 Community Wellbeing

A significant effect on community wellbeing is defined as one that results in a highly distinguishable change from current conditions and trends and cannot be managed or mitigated through adjustments to programs, policies, plans, or through other mitigation measures. A significance determination is only made for adverse effects. Because residual adverse effects on community wellbeing are anticipated to be low to moderate in magnitude, and therefore are not highly distinguishable from current conditions, with the implementation of mitigation and management measures, residual adverse effects on community wellbeing are predicted to be not significant.

14.7.2 Significance of Cumulative Effects

With mitigation and environmental protection measures implemented by Alamos and operators of other current and reasonably foreseeable future projects and physical activities, the residual cumulative environmental effects on community services, infrastructure, and wellbeing are predicted to be not significant.

14.7.2.1 Project Contribution to Cumulative Effects

Project contributions to cumulative effects primary occur within the LAA. Based on the description of existing conditions, the socio-economic context in which effects occur is considered non-resilient. For community services and infrastructure this characterization is based on capacity constraints that limit the ability of LAA communities to respond to increased demand. For community wellbeing this characterization is largely based on existing labour force conditions and the sizable portion of the population that, for the purpose of this assessment, are included in the definition of a vulnerable population. It is also based on higher rates of negative personal health practices (e.g., heavy drinking) that are understood to occur int the LAA versus the provincial average.

Given the socio-economic context of the LAA, the Project's contribution to cumulative effects (within the RAA) is characterized as being low in magnitude. This is partially due to the use of an accommodation camp which will house workers during construction and operation and because Project infrastructure will be built by Alamos to provide water, power, and sewer and health, safety and emergency services will be provided on-site. Also, standard construction procedures and a Traffic Management Plan will be implemented to reduce traffic delays during construction and workers will be bussed to the mine site from the camp. These measures will reduce Project demands on community services and infrastructure.

With the implementation of mitigation and management measures, and in consideration of the socio-economic context in which effects occur, the Project's contribution to cumulative effects within the RAA is that of negligible magnitude changes in population and individual and household income. This is largely because a FIFO/DIDO workforce, of which will be lodged in an accommodation camp and will return to home communities following completion of work rotations, is expected to satisfy most of the Project's demand for direct labour (95%). This characterization also considers that should FIFO/DIDO workers be recruited from the City of Thompson (i.e., the largest population centre within the RAA), changes in individual income and household income, given the size of the City of Thompson's population and labour force (Chapter 13) would result in negligible changes from existing conditions.

14.7.3 Significance of Effects on Federal Lands

Federal lands within the LAA and RAA include of Black Sturgeon Reserve which falls within the LAA, and Suwannee Lake Indian Reserve, Nihkik Ohnikapihs Indian Reserve, and O-Pipon-Na-Piwin Cree Nation which fall within the RAA. Based on the results in Section 14.6, the residual environmental effects on federal lands from changes to Community Services, Infrastructure, and Wellbeing are predicted to be not significant.

14.8 PREDICTION CONFIDENCE

With the proposed management and mitigation measures, including implementation of normal planning procedures by the relevant authorities, and liaison between Alamos and those local authorities, the residual environmental effect of a change in capacity of community services infrastructure has been determined with a high level of confidence. Due to the nature of social interactions, and differences in individual actions, behaviours, and influences, as well uncertainty regarding the extent to which Project employment will be realized by local residents, that are outside the control of the Project, prediction confidence with respect to changes in community wellbeing is moderate.

14.9 FOLLOW-UP AND MONITORING

Government departments, public agencies, and private-sector companies that deliver community services and infrastructure will monitor the ongoing demand for community services as part of their normal planning practices. No follow-up and monitoring program is required. Similarly, community wellbeing is monitored by MHSAL and the NRHA as part of their service delivery and regular assessment of community wellbeing. For this reason and because the management of population health falls under the provincial government responsibility, no follow-up and monitoring program is required.

14.10 SUMMARY OF COMMITMENTS

The following summarizes proposed measures to mitigate Project adverse residual effects for community, services, infrastructure, and wellbeing:

- Work camp at the MacLellan site to accommodate workers during construction and operation.
- During construction, first aid facilities will be supplied by the EPCM contractor. First-aid personnel will provide transport to Lynn Lake hospital when required. During operation, first aid facilities will be supplied by a dedicated first aid/mine rescue office in each of the site administration offices. Site security personnel will be trained as EMS first responders, and when required, provide transfer to Lynn Lake hospital.
- Power, water, and wastewater treatment will be provided by Alamos and will not rely on resources within the Town of Lynn Lake.
- Development of a Waste Management Plan (Chapter 23, Section 23.5.6). Because there will be a Project demand for landfill capacity for construction and non-hazardous domestic solid waste during operation, Alamos will liaise with planners in Lynn Lake regarding these needs and potential requirements for landfill expansion.
- Mandatory safety orientations for all new employees.
- Control of access to the PDAs using a security gate and guard house, and by employing on-site security staff.

- Site security services to help limit demands on the local police system.
- Careful control of flammable material (such as fuels and explosives) on-site.
- Training of Project personnel in fuel handling, equipment maintenance, and fire prevention and response measures.
- Implementation of work schedules for Project workers (e.g., 12 hours per day, seven days per week) that deter FIFO/DIDO workers from spending time off shift in local communities and accessing community recreation services and facilities outside of working hours.
- Scheduling of alternating work shifts so that all workers do not arrive in and leave the area at the same time will limit Project-related demands on both traffic and air services and infrastructure.
- Liaise with local emergency providers so that roles and responsibilities are understood, and that the necessary resources required to respond are in place.
- Maintenance of fire prevention and suppression systems on site, including water supplies, sprinklers, fire extinguishers and other firefighting equipment.
- Workforce education to encourage healthy lifestyle choices, sensitivity training and strict enforcement of Alamos' health and safety policies. For example, sensitivity training would raise the level of awareness about the potential effects that workers can have on the community and their families through drug and alcohol use or other social concerns.
- Access to Employee Assistance Program for Project personnel, and requirement for pre-employment physicals.
- Development of cooperative protocols with responsible agencies to deal with access of Project personnel to emergency and other medical services.
- Development and implementation of Project-specific environmental management plans and monitoring programs (Chapter 23), including a Waste Management Plan that sets out procedures for reducing Project-related waste and limiting demands on local landfills.
- Upgrading and resurfacing the existing access roads to the MacLellan and Gordon sites.
- Implement standard construction procedures and a Traffic Management Plan (Chapter 23) to reduce traffic delays during construction. The Traffic Management Plan will be developed during ongoing planning and engineering design to address traffic staging to reduce delays.
- Provide bussing services between the temporary camp and Gordon site.
- Encourage carpooling among locally resident construction and operation workers.
- Schedule arrivals/departures of employee traffic to occur earlier than the existing observed a.m. peak hour for local traffic and later than the existing observed p.m. peak hour if needed.

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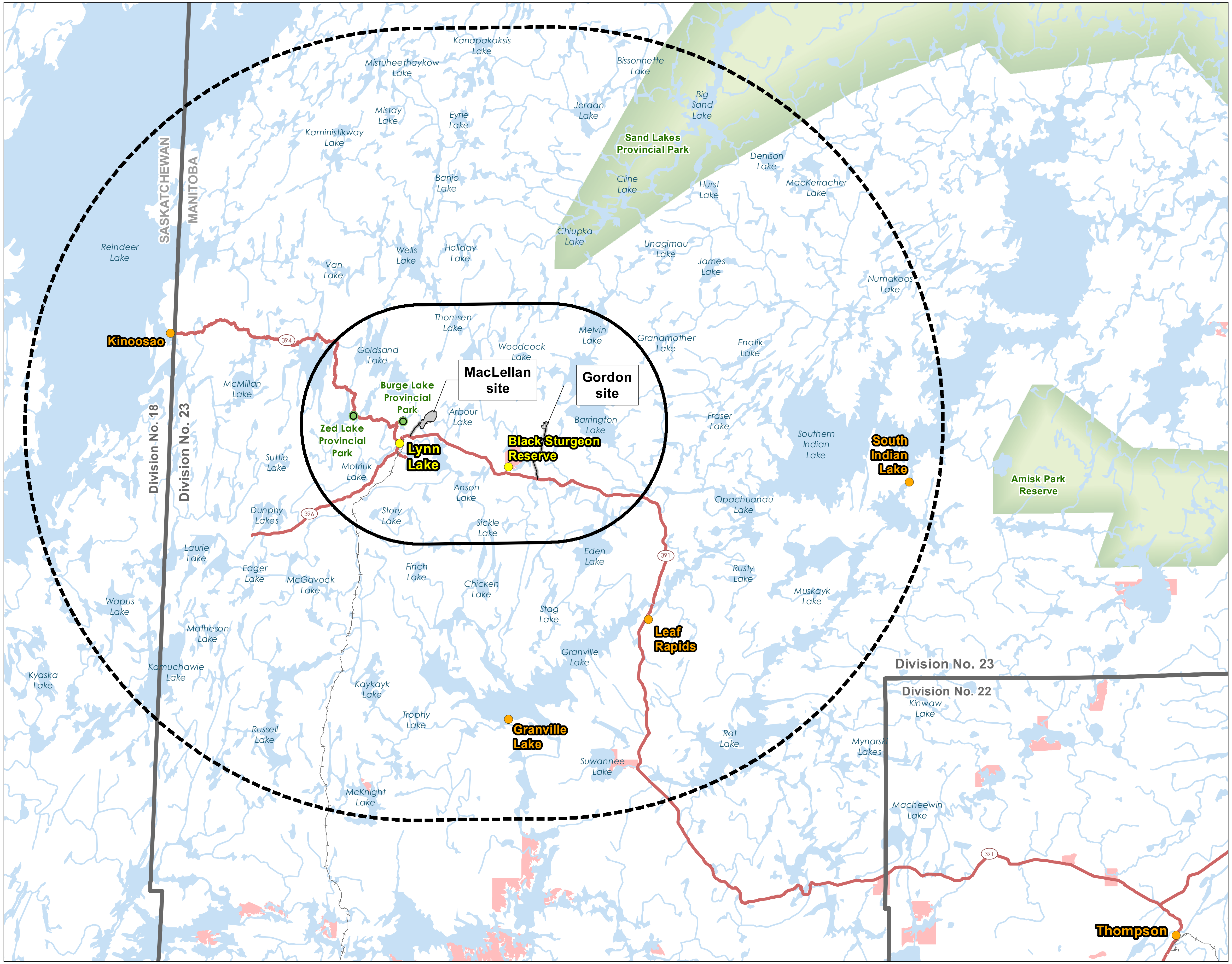


Stantec

Alamos Gold Inc.

Project Infrastructure

- Project Development Area

Study Area

- Community Services, Infrastructure, and Wellbeing Local Assessment Area (LAA)
- Community Services, Infrastructure, and Wellbeing Regional Assessment Area (RAA)

Communities

- Community within Local and Regional Assessment Area
- Community within Regional Assessment Area

Landbase

- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- Census Subdivision
- First Nation Reserve
- Provincial Park

N

0 10 20 Kilometres

(At original document size of 11x17)
1:1,000,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-05-06
Technical Review by HJanes on 2020-05-06
Senior GIS Review by GKroupa on 2020-05-06

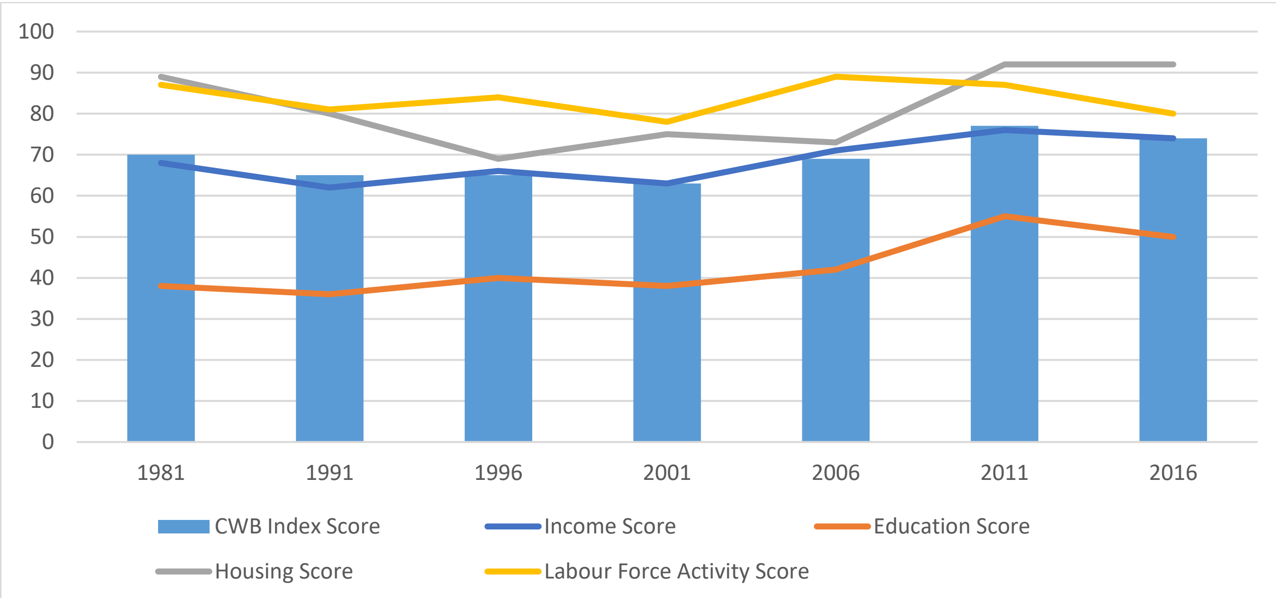
Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
14-1

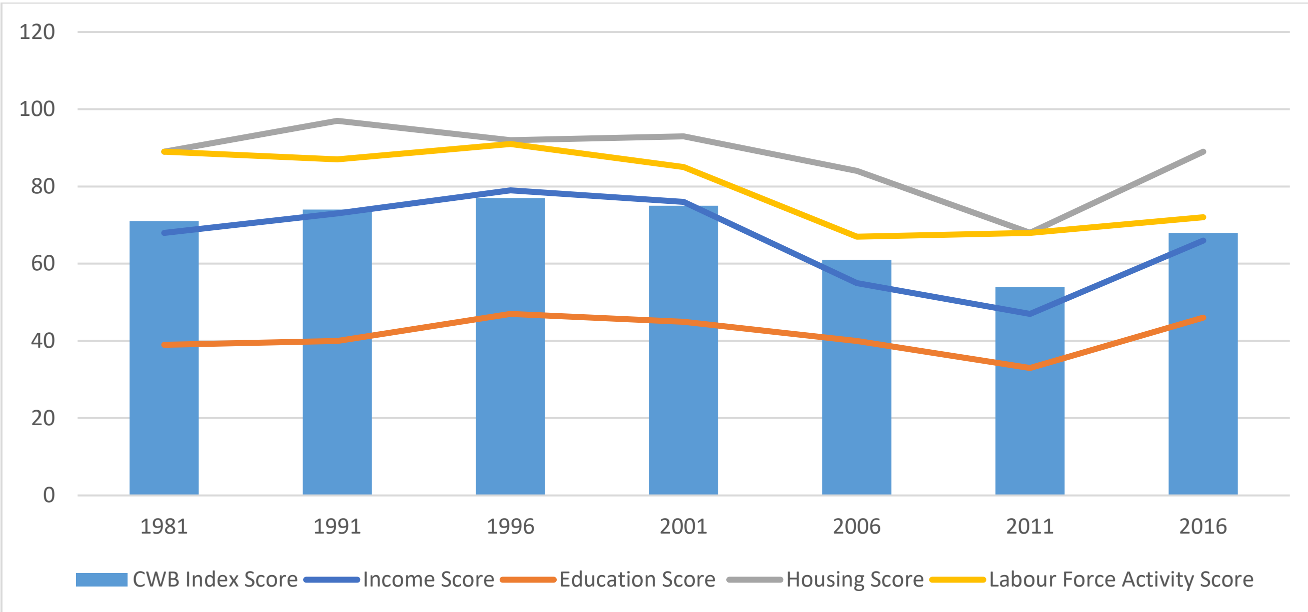
Title
Community Services, Infrastructure, and Wellbeing Spatial Boundaries

Appendix 14A FIGURES



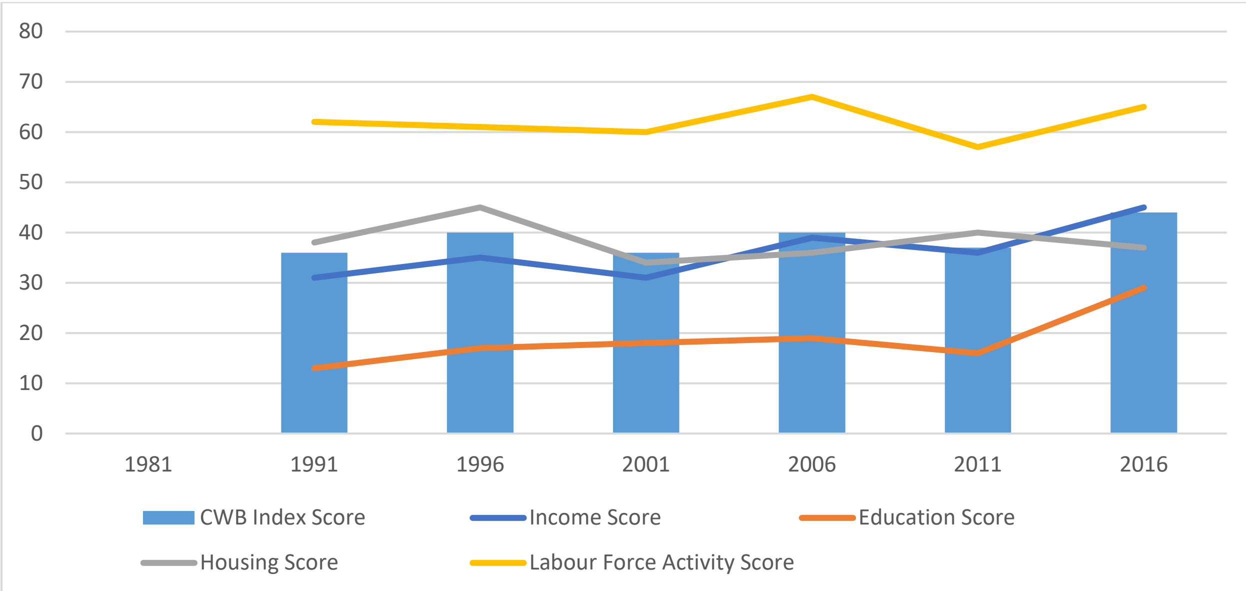
SOURCE: CIRNAC 2019c

Figure 14A-1 WB Index Score – Town of Lynn Lake, Time Series



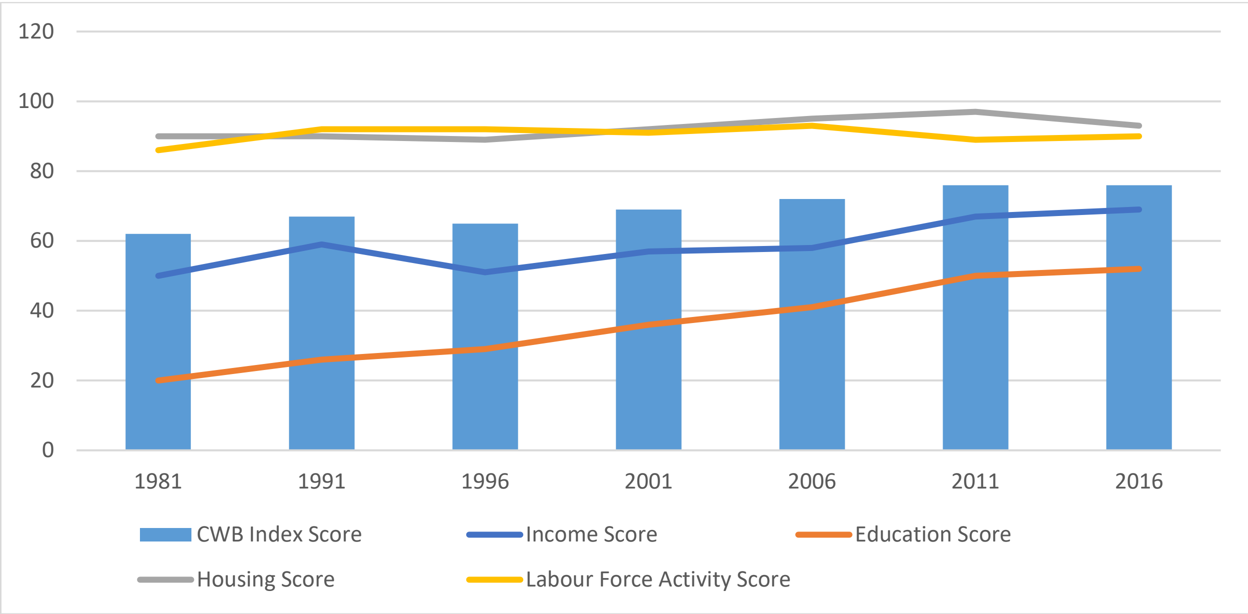
SOURCE: CIRNAC 2019c

Figure 14A-2 CWB Index Score – Town of Leaf Rapids, Time Series



SOURCE: CIRNAC 2019c

Figure 14A-3 CWB Index Score – South Indian Lake, Time Series



SOURCE: CIRNAC 2019c

Figure 14A-4 CWB Index Score – City of Thompson, Time Series

ALAMOS GOLD INC.

Lynn Lake Gold Project Environmental Impact Statement Chapter 15 – Assessment of Potential Effects on Land and Resource Use

Stantec

Prepared by:

Stantec Consulting Ltd.

May 25, 2020

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Acronyms and Abbreviations

AAC	annual allowable cut
Alamos	Alamos Gold Inc.
ASI	Area of Special Interest
ATV	all-terrain vehicle
CIZ	Community Interest Zone
CRA	commercial, recreational, Aboriginal
dBA	a-weighted decibel sound level
dBL	linear (unweighted) decibel sound level
EIS	environmental impact statement
FDAV	forest damage appraisal and valuation
FLI	forest land inventory
FMU	forest management unit
FRI	forest resource inventory
GBHZ	game bird hunting zone
GHA	game hunting area
GIS	geographic information system
ha	hectare(s)
km	kilometre(s)
km^2	square kilometre(s)
LAA	Local Assessment Area
LD	Limited Development District
LGD	Local Government District
LLGP/the Project	Lynn Lake Gold Project

m	metre(s)
m^3	cubic metre(s)
MCC	Manitoba Conservation and Climate
mm/s	millimetres per second
MRSA	mine rock storage area
MSD	Manitoba Sustainable Development (now MCC)
OAA	outfitter allocation area
PDA	Project Development Area
PLUP	Provincial Land Use Policies
PR	provincial road
RAA	Regional Assessment Area
ROW	right-of-way
TLE	treaty land entitlement
TLRU	traditional land and resource use
VC	valued component
WMA	wildlife management area
YTC	community youth trapline

15.0 ASSESSMENT OF POTENTIAL EFFECTS ON LAND AND RESOURCE USE

Land and resource use, as a valued component (VC), includes activities and associated infrastructure related to the use of land and resources, including waterways for recreational, commercial, and navigational purposes within and adjacent to the Project Development Areas (PDAs; Section 15.1.4.1). It was selected as a VC because of the potential interactions between the Project and the use of lands and resources within and adjacent to the PDAs, as well as its importance to communities, including its contribution to livelihoods and the quality of life for local stakeholders.

The Project is located on former mine sites in an area that is sparsely populated and primarily surrounded by forested provincial Crown land. The Lynn Lake area supports various outdoor recreational activities such as fishing, hunting, outfitting, and snowmobiling.

This assessment is informed by the conclusions of the effect assessments of the following VCs:

- Atmospheric environment and noise and vibration (Chapters 6 and 7) – given that Project-related activities may result in an increase in dust, lighting, sound, and vibration levels that may cause a disturbance to land and resources and the users.
- Surface water (Chapter 9) – given the importance of water quantity to navigation and water-based activities and water quality to human health.
- Fish and fish habitat (Chapter 10) – given the link with recreational fishing.
- Vegetation and wetlands (Chapter 11) – given the removal or alteration of vegetation communities supporting vegetation-based resource activities (i.e., gathering of firewood).
- Wildlife and wildlife habitat (Chapter 12) – given the link with hunting, trapping and guide outfitting.
- Current use of lands for traditional purposes (Chapter 17) – given shared use of land.
- Human health (Chapter 18) – given the link with human health through direct consumption of vegetation, fish and wildlife gathered, hunted, or caught during recreational or commercially-based land and resource use.

15.1 SCOPE OF ASSESSMENT

The scope of the assessment of potential effects to the Land and Resource Use VC was guided by the federal Environmental Impact Statement (EIS) Guidelines (Appendix 4A), the Manitoba Sustainable Development (MSD; now Manitoba Conservation and Climate [MCC]) *Environment Act* Proposal Report Guidelines, as well as the relevant federal and provincial laws, regulations, and guidelines protecting land and resource use in Canada and Manitoba.

In addition to regulations, policies, and guidelines, this section describes how engagement with the public and local Indigenous communities has influenced the scope of the assessment; the understanding of potential effects and pathways between the Project and land and resource use during all phases of the Project; measurable parameters to be used to quantify potential effects of the Project on land and resource use; spatial and temporal boundaries of the assessment; and the approach for characterizing and determining the significance of residual effects.

15.1.1 Regulatory and Policy Setting

15.1.1.1 Federal

In addition to being prepared in accordance with the requirements outlined in the Final Guidelines for the Preparation of an EIS (Appendix 4A) issued for the Project, the *Canadian Navigable Waters Act* (CNWA) was reviewed with respect to navigation and the List of Scheduled Waters.

There are no watercourses or waterbodies in the vicinity of the Gordon and MacLellan sites (including the Keewatin River) that are listed on the amended Schedule Navigable Waters, Part 2 Rivers (August 16, 2019) as specified under the Act. The CNWA also provides protection for non-scheduled waters (i.e., the right to use navigable waters) where navigation is possible (e.g., by canoe/kayak). The Minor Works Order allows for works to be built on navigable waters if they meet the criteria for applicable classes of work, as well as specific terms and conditions of construction. Works meeting the assessment criteria of the Minor Works Order are classed as “designated works” under the CNWA. Classes of works that are considered for their effect on navigation as established by the Order include Aerial Cables – Power and Telecommunication and Outfalls and Water Intakes. These classes of work can proceed without a Notice to the Minister if they comply with legal requirements (Transport Canada 2019). Major works are those classes established in the Major Works Order which are designated as likely to substantially interfere with navigation. Bridges are identified as a major work. This type of work can proceed if the proposed construction and placement of the work (i.e., bridge) would not interfere with navigation. In that case a proponent may proceed if public notification is undertaken. Should a major work on any navigable water potentially interfere with navigation the proponent would be required to apply to the Minister for approval (Transport Canada 2019).

Permanent non-scheduled waterbody bridge crossings where navigation is possible (e.g., by canoe/kayak) include the Keewatin River and Hughes River.

15.1.1.2 Provincial

In addition to MCC’s Environment Act Proposal Report Guidelines, relevant provincial legislation, regulation, policy, and guidance considered in the assessment of environmental effects for land and resource use include:

- *The Mines and Minerals Act* – a Mineral Lease is required under the Mineral Disposition and Mineral Lease Regulation, 1992, and permitting is required under the Mine Closure Regulation.
- *The Crown Lands Act* – work permits are required for work conducted on provincial Crown lands.

- *The Dangerous Goods Handling and Transportation Act* – licenses or permits are required for the transportation of hazardous wastes, construction of a petroleum storage tank system.
- *The Fisheries Act* – regulations govern the use and allocation of fish in provincial Crown waters (i.e., licensing, seasons, quotas, gear types).
- *The Forest Act* – a permit is required for the cutting or removal of timber on provincial Crown land, and a Forest Damage Appraisal and Valuation (FDAV) is required.
- *The Planning Act* – establishes the mandate for municipalities to adopt development plans and zoning by-laws to guide land use decisions and reduce land use conflicts within their boundaries.
  - *Provincial Planning Regulation* enacts Provincial Land Use Policies (PLUPs) that direct land use planning. PLUPs apply to lands located outside development plan areas, including provincial Crown lands, which includes the Gordon site. Policy Area 8: Mineral Resources (the policy) expresses the provincial interest in mineral resources development.
- *The Water Rights Act* – licenses are required to construct water control works for carrying or conducting water and for the diversion and use of surface water or groundwater for industrial or other purposes.
- *The Wildlife Act* – regulations govern designation of hunting lands (e.g., hunting zones), hunting seasons and bag limits, use of vehicles and equipment for hunting, and activities that can be undertaken on designated wildlife lands.

15.1.1.3 Municipal

Development controls in the Town of Lynn Lake consist of:

- Development Plan By-law No. 1329-2009.
- Zoning By-law No. 675.

Under the Town's development plan, mineral exploration and development is encouraged to co-exist with the community's vision and employ the principles of sustainability (Town of Lynn Lake 2009).

15.1.2 The Influence of Engagement on the Assessment

Engagement has been ongoing prior to and throughout the EIS process, and will continue with local Indigenous communities, stakeholders, the public, and government agencies through the life of the Project. More detail on the Engagement process can be found in Chapter 3.

Engagement feedback related to land and resource use has been addressed through direct responses, updates to baseline information, and in the EIS, as appropriate. Key feedback that influenced the land and resource use effects assessment is provided below.

15.1.2.1 Indigenous Community Engagement

As part of the information sharing throughout the engagement process, Project-related information was provided by Indigenous communities in the form of traditional land and resource use (TLRU) studies and other forms of information sharing.

A Project-specific TLRU study was completed collaboratively with Marcel Colomb First Nation with a final report provided to the community on January 11, 2018 (Stantec 2018). The TLRU study included interviews with participants selected by Marcel Colomb First Nation regarding traditional land use in the Project area, including availability of traditional resources, access to traditional resources or areas, occupancy, cultural sites and areas, and experience of TLRU.

A Project-specific TLRU study was completed in collaboration with Peter Ballantyne Cree Nation but has not yet been released by community leadership for use in the environmental assessment. The TLRU study included interviews with community members in Kinoosao, Saskatchewan.

A TLRU study (Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project) was completed by an independent consultant for the Manitoba Metis Federation (SVS 2020), the results of which were received in February 2020. The study documents harvesting and land use by the Manitoba Métis Community within a 100-kilometre (km) radius of the Project.

A review of issues and concerns with respect to the Project identified during engagement with Indigenous communities is provided in Chapter 3, and in Chapter 17 with respect to current use of lands for traditional purposes. The following interests and concerns with respect to land and resource use were identified:

- Environment in general.
- Requirement for environmental baseline studies.
- Air quality/atmospheric environment.
- Indigenous and treaty rights, Aboriginal Agreements and Protocols.
- Fisheries/aquatic environment, water resources, terrestrial environment.
- Traditional ecological knowledge/traditional knowledge and TLRUs.
- Compensation for effects on traditional activities.
- Potential Project-related environmental effects on water quality and terrestrial habitat, and potential implications for hunting and fishing in the area.

Indigenous community engagement contributed to the understanding of existing land and resource uses in the area, informed baseline conditions and supported the scope of issues assessed (e.g., air and water quality, effects on land and animals, hunting and fisheries, loss of land use for trapline holders, stake claim activity precluding selection of Treaty Land Entitlement [TLE] land, proximity to TLE land).

In terms of Indigenous harvesting or land use activities, a review of the TLRU information from Marcel Colomb First Nation confirmed that members engage, or have engaged, in the following (Chapters 3 and 17):

- Hunting for moose, caribou, bear, grouse, duck, goose, ptarmigan, and rabbit.
- Trapping for lynx, otter, muskrat, mink, weasel, fox, rabbit, beaver, martin, wolf, and wolverine.
- Fishing, including commercial fishing, for lake sturgeon, trout, goldeye, whitefish, suckers, walleye, and northern pike.
- Gathering activities for plants/medicine (e.g., mint, saps, spruce gum, Seneca root, rat root, herbs, and birch fungus), berries (e.g., saskatoon, strawberries, blueberries, raspberries, chokecherries, cranberries, and moss berries) and firewood.
- Seasonal habitations in cabins and camps throughout the region, including at Barrington, Cartwright, Cockeram, Eden, Goldsand, Hughes and Swede lakes, and along the Hughes and Keewatin rivers.
- Travel routes via boat and snowmobiles for traditional land and resource use activities throughout the area (e.g., Keewatin River, Hughes River). Several good fishing lakes (e.g., Hughes Lake, Cartwright Lake) and good hunting lakes (e.g., Cockeram Lake, Hughes Lake to Eden Lake along the Hughes River) were noted in the area. Springs in the area were used as traditional water sources (e.g., near Eden Lake, Hughes Lake).

Concerns expressed by the Mathias Colomb Cree Nation (interviewed as part of the Marcel Colomb First Nation TLRU study) related to the following: the location of the Project within their traditional territory and Mathias Colomb Cree Nation traplines; aesthetics of the two sites; disturbance effects from heavy truck traffic on the transportation corridor between the sites (e.g., dust, wildlife collisions, public safety); and adverse effects on harvesting areas. Mathias Colomb Cree Nation members noted that water and fish up to the Keewatin River is of importance and expressed concerns regarding the Project location and potential effects.

Traditional activities practiced by Métis citizens include (Chapter 17):

- Gathering plants and natural materials for food, medicine, and other purposes, including berries to consume or store (preserve) at Lynn Lake, Cockeram Lake, Burge Lake, Zed Lake, and along Provincial Road (PR) 394 between Zed and Little Brightsand lakes, and north of Eden Lake.
- Fishing (under general public licence) on Barrington Lake, Simpson, and Swede lakes, as well as Hughes Lake, Hughes River, Chepil Lake, Keewatin River, West Lynn Lake, Cockeram Lake, Burge Lake, Zed Lake, Little Brightsand Lake, and Goldsand Lake.
- Hunting (under general public licence) at Simpson Lake, Hughes River, and at a location west of the Gordon access road, hunting at Eldon Lake, Goldsand Lake, and hunting for ptarmigan nearer to the MacLellan site, hunting for caribou and moose throughout the area, and trapping and snaring in the area around Burge, Little Brightsand, and Goldsand lakes.

- Occupancy in cabins, an active camp, and a trailer on Hughes, Burge, and Little Brightsand lakes.
- Access routes or trails including snowmobile routes, boat launches and routes, canoe routes and portages, walking trails, trails used by other vehicles, and water routes on Hughes Lake, the Hughes River, Cockeram Lake, Burge Lake, and Little Brightsand Lake.
- Sites used for cultural, ceremonial, spiritual, and traditional purposes in the TLRU study area.

The traditional knowledge information and engagement results received contributed to the Project's understanding of the existing land and resource use conditions, informed baseline conditions, and supported the scope of issues assessed.

15.1.2.2 Stakeholder and Community Engagement

Four open house public meetings have been held to date in Lynn Lake (in 2015, 2016, 2017 and 2020) and one in Nelson House (Chapter 3). Open house attendees were invited to complete questionnaires to provide feedback on the Project, as well as identify issues, concerns or inquiries related to the Project.

Respondents who attended the 2017 open house identified fishing as the activity conducted by the most respondents, followed by boating, gathering, hunting, snowmobiling, and trapping. Other activities mentioned were hiking, tourism, swimming, outfitting, and camping. Respondents also identified the following areas used for land use or water-based activities: Burge, Cockeram, Barrington, and Zed lakes; the Hughes and Churchill rivers, Fox Mine Road, PR 391, PR 397, Black Sturgeon Reserve, and the general vicinity of the Gordon and MacLellan sites, and/or Lynn Lake.

Respondents who attended the 2020 open house in Lynn Lake identified boating as the activity conducted by the most respondents (76%), followed by fishing, snowmobiling, gathering, hunting, and trapping. The following areas were identified for land or water-based activities: Burge, Hughes, Eden, Matriach, and Cockeram lakes; Hughes and Laurie rivers; Chepil, Dunphy, McGavock, Cartwright, Laurie River, Barrington, Newton, Snare, Moose, Hanson, Simpson, Swede, and McVeigh lakes. Activities were also identified along the Fox (mine) Road, PR 391, Black Sturgeon Reserve, and more generally in the Lynn Lake area.

Respondents who attended the open house in Nelson House identified hunting, gathering, and fishing as the top three activities conducted in the Project area (23%), followed by trapping, snowmobiling, and boating. Areas frequented included the Black Sturgeon Reserve, Suwannee Lake, and north of Lynn Lake and the 53rd parallel.

15.1.2.3 Regulatory Engagement

Government departments and agencies, including municipal government, were contacted as part of the engagement process for the Project. Areas of interest and issues identified during this regulatory engagement, directly or indirectly related to the assessment of land and resources, were:

- Requirement that environmental baseline studies be undertaken.

- The socio-economic environment (in general).
- Indigenous sacred and cultural sites, and traditional knowledge.
- Water resources, exploration investigations, and environmental aspects of the Project.
- Importance of proactively engaging with local First Nations and other potentially affected Indigenous communities.

Regulatory engagement with federal, provincial, and municipal levels of government continued through the environmental assessment process and will be ongoing, as needed, for the duration of the Project (Chapter 3). Engagement feedback related to land and resource use has been addressed through updates to baseline information (e.g., trapping data, mineral dispositions, forestry data) and contributed to an understanding of existing land and resource uses in the area.

15.1.3 Potential Effects, Pathways and Measurable Parameters

The potential environmental effects, effects pathways, and measurable parameters used in the assessment of effects on land and resource use, are provided in Table 15-1. Measurable parameters facilitate the qualitative or quantitative measurement of potential Project and cumulative effects and provide a means to characterize potential effects to land and resource use. Measurable parameters used in qualitative analyses are defined in the absence of metrics or standards to support quantitative analyses. The selection of effects included in the assessment of environmental effects on land and resource use was based on regulatory requirements (Section 15.1.1), and key issues and concerns identified during the engagement process (Section 15.1.2).

Table 15-1 Potential Effects, Effects Pathways and Measurable Parameters for Land and Resource Use

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in land use	• Project activities incompatible with applicable land use plans and zoning • Disturbance and nuisance effects on property (noise, dust) • Project presence and site activities may affect use/future development	• Qualitative description of property development potential based on zoning • Proximity to land use sites (km) • Land use types (ha)
Change in recreation	• Project clearing may result in the loss of area available for recreational use • Project presence and site activities may affect access to or quality of recreational use (inclusive of land and water-based activities)	• Area of current recreation use overlapped by the Project (ha) • Access to recreational areas • Qualitative use of area

Table 15-1 Potential Effects, Effects Pathways and Measurable Parameters for Land and Resource Use

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in resource use	• Project can reduce productive forest land, annual allowable cut (AAC) and merchantable timber, and cause disturbance to high-value forest sites • Disruption effects to development/extraction (minerals and aggregate) • Can disrupt resource harvesting success (hunting, trapping, fishing)	• Attribute data on overlapping uses (e.g., hunting and trapping) within area affected (ha) • Area of commercial forest (ha); reduction of AAC (m^3/ha/year), number of high- value forest sites affected • Proximity to resource use sites • Change or disruption affecting resource use (ha); sensory disturbance affecting harvest and experience

15.1.4 Boundaries

15.1.4.1 Spatial Boundaries

The following spatial boundaries are used to assess residual and cumulative environmental effects of the Project on land and resource use (Map 15-1):

- Project Development Area (PDA): encompasses the immediate area in which Project activities and components occur at the Gordon and MacLellan sites, respectively, plus a 30-metre (m) buffer and is the anticipated area of direct physical disturbance associated with the construction and operation Project (i.e., the Project footprint).
- Local Assessment Area (LAA): includes the PDAs and a 1.5-km buffer around the PDA for the Gordon and MacLellan sites, and a 1.5-km buffer along a stretch of PR 391 between the Gordon site access road and the MacLellan site access road. The LAA for the land and resource use includes the area where effects (e.g., noise, dust) on land and resource use are likely to be most prevalent.
- Regional Assessment Area (RAA): includes the PDAs and LAA and an approximate 30-km buffer encompassing the boundaries of the Town of Lynn Lake and the Marcel Colomb First Nation (Black Sturgeon Reserve) Community Interest Zone (CIZ). Effects of other projects and activities occurring within the RAA that have potential to act cumulatively with the Project are assessed based on the RAA.

15.1.4.2 Temporal Boundaries

The temporal boundaries for the Project consist of the following phases:

- Construction – two years (scheduled to be carried out concurrently from Year -2 to Year -1 at both sites).

- Operation – 13 years (scheduled to be carried out from Year 1 to Year 6 at the Gordon site and from Year 1 to Year 13 at the MacLellan site).
- Decommissioning/closure – five to six years of active closure (scheduled to begin in Year 6 at the Gordon site and in Year 14 at the MacLellan site). Active closure will be followed by post-closure, which is the time period during which active reclamation measures are complete, but monitoring is still required. The expected duration for post-closure is approximately 10 years. Pit filling is expected to take 11 years at the Gordon site and 21 years at the MacLellan site under average conditions (Chapter 9, Section 9.4.1). Permanent closure will occur when the site is stable, and monitoring is no longer required. For land and resource use, this will occur once vegetation and animal habitats have reestablished (i.e., natural appearance) and the sites have been restored to a condition that will provide opportunities for other land uses. The duration and conditions for post-closure monitoring and permanent closure will be detailed in subsequent submissions of the Closure Plan to regulatory agencies as Project design and execution progresses.

There are additional seasonal temporal boundaries that are applicable to land and resource use related to regulated hunting, trapping, and fishing seasons (Section 15.2.2.3).

15.1.5 Residual Effects Characterization

Residual environmental effects are socio-economic effects that remain after the application of mitigation measures. Characterization of residual effects is based on criteria in Table 15-2.

Table 15-2 Definition of Terms used to Characterize Residual Effects on Land and Resource Use

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Positive –** a residual effect that moves measurable parameters in a direction beneficial to land and resource use relative to baseline. **Adverse –** a residual effect that moves measurable parameters in a direction detrimental to land and resource use relative to baseline.
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	**Negligible –** no measurable change in current land and resource use capacity **Low –** a small, measurable change in land and resource use capacity, but land and resource use activities can take place at or near current levels **Moderate –** a measurable change in land and resource use capacity that is greater than low, but land and resource use activities can take place at or near current levels **High –** a measurable change in land and resource use capacity, such that land and resource use activities cannot take place at or near current levels

Table 15-2 Definition of Terms used to Characterize Residual Effects on Land and Resource Use

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Geographic Extent	The geographic area in which a residual effect occurs	**PDA –** residual effects are restricted to the PDA **LAA –** residual effects extend into the LAA **RAA –** residual effects extend to the RAA
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	**Not Applicable –** seasonal aspects are unlikely to affect land and resource use **Applicable –** seasonal aspects may affect land and resource use
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	**Single event** – effects occur once **Multiple irregular event –** occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	**Short-term –** residual effect restricted to no more than the construction phase (2 years) **Medium-term –** residual effect extends through the operation phase (6 years for Gordon, 13 years for MacLellan) **Long-term –** residual effect extends beyond the life of the project (>13 years)
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	**Reversible –** the residual effect is likely to be reversed after activity completion and reclamation **Irreversible –** the residual effect is unlikely to be reversed
Ecological and Socio-economic Context	Existing condition and trends in the area where residual effects occur	**Undisturbed –** area is relatively undisturbed or not adversely affected by human activity **Disturbed –** area has been substantially previously disturbed by human development or human development is still present

15.1.6 Significance Definition

A residual effect on land and resource use is considered significant if:

- The Project does not comply with established land use plans, policies, or by-laws.
- The Project will create a change or disruption that restricts or degrades present land and resource use capacity to a point where activities cannot continue at or near current levels and where compensation is not possible.

15.2 EXISTING CONDITIONS FOR LAND AND RESOURCE USE

Existing conditions for land and resource use for the Project are presented in detail in the Socio-Economic Baseline Technical Data Report and associated Validation Report provided in Volume 4, Appendix P. The existing conditions and the methods used to characterize baseline conditions are summarized below.

15.2.1 Methods

Information on existing conditions for land and resource use was obtained through primary and secondary research (Volume 4, Appendix P). Primary data were collected through government, stakeholder and community, and Indigenous engagement activities undertaken for the Project, including open houses and stakeholder meetings. Liaison with identified stakeholders and data requests of government agencies were also conducted. Secondary research included a desktop review of past research, previous studies, research findings, other environmental assessments, and a review of traditional knowledge, where applicable. The following sections (15.3.1.1 to 15.3.1.4) present additional information on the sources used to characterize baseline conditions and how the information was interpreted and analyzed.

15.2.1.1 Sources of Information

The following sources and types of information were used to characterize the baseline conditions for land and resource use:

- Published reports from government agencies related to land and resource use.
- Previous environmental assessments and information from past research in the region, including previous project reports (e.g., regional assessment of Manitoba Hydro Developments on the Churchill, Burntwood, and Nelson River Systems).
- TLRU reports on Indigenous resource use.
- Government, stakeholder, community, and Indigenous engagement.
- Municipal government development plans and zoning by-law reports.
- Provincial Crown land data and reports, public registry plans of subdivision.
- Data from provincial government agencies with respect to furbearer harvest statistics, outfitter allocation areas, and commercially fished lakes.
- Information from provincial and federal government websites on provincial forests, wildlife management areas (WMAs), provincial parks, provincial Crown lands, ecological reserves, protected areas, and Areas of Special Interest (ASIs), and First Nation Reserves.
- Municipal government and organization websites (e.g., Town of Lynn Lake, Trails Manitoba, SnoMAN, Travel Manitoba) for land use and spatial data on use areas (e.g., campgrounds and resorts), lodges,

remote cottage areas, recreational areas, wildlife viewing, hiking trails, all-terrain vehicle (ATV) trails and snowmobile trails and shelters.

- Provincial government websites (e.g., MCC Forestry and Peatlands Management Branch) for forestry information (inventories, timber sales and permits).
- Provincial government websites (e.g., Province of Manitoba - Resource Development) for land use and spatial data on mineral dispositions, including mining claims, mineral leases, quarry leases, quarry permits, mining locations, and aggregate resources; provincial aggregate inventory reports.
- Other VC chapters: Chapter 3; Chapter 6; Chapter 7; Chapter 10; Chapter 11; Chapter 12 ; and Chapter 17 and associated Technical Data Reports and Validation Reports (Volume 4).

15.2.1.2 Desktop and Geographic Information System Analysis

Baseline data sources and secondary sources were used to describe existing conditions for land and resource use. Land and resource use metrics generated through geographic information system (GIS) analysis informed the assessment from the land and resource use perspective. Geospatial data were plotted using GIS software to determine the spatial distribution, and nature of overlapping land-uses with the Project PDAs. By using GIS overlay mapping, the following information on other land uses occurring in the vicinity of the Project were quantified:

- The number of land use permit and lease sites (e.g., remote cabins, recreation lots) in the LAA and RAA.
- The number and/or area of provincial forests, WMAs, provincial Crown lands, conservation lands, ecological reserves, protected area lands and ASIs, First Nation reserves in the LAA and RAA.
- The number and/or area of recreational use areas (e.g., campgrounds and resorts, lodges, recreational sites, canoe routes, hiking trails, ATV trails, snowmobile trails) in the LAA and RAA.
- The number and/or area of forest land, high-value forest sites (including enhanced silviculture sites), research and monitoring sites, and private land forest values in the LAA and RAA.
- The number and/or area of mineral dispositions (e.g., mining claims, mineral leases, quarry leases, quarry permits, mining areas, aggregate resources) in the RAA.
- The extent of potential Project interaction with registered traplines, game hunting areas and outfitter allocation areas, and game bird hunting zones in the LAA and RAA.
- The extent of potential Project interaction with commercially fished and sport fished lakes in the LAA and RAA.

15.2.1.3 Primary Research/Field Programs

Liaison and personal communication were conducted during the field programs (Volume 4) and as part of engagement activities for the Project (Chapter 3). Activities were undertaken with local stakeholders (e.g., resource users) and community representatives (e.g., Town officials) to supplement baseline information. Contact with representatives of provincial government agencies provided information on big game and game bird hunting license types, furbearer species harvest by registered trapline, and commercial fish harvest data for lakes in the RAA. Data collected helped to inform baseline conditions on land and resource use.

15.2.2 Overview

Land and resource use is organized into:

- Land use (i.e., development and zoning controls, provincial Crown, municipal and Indigenous lands, designated lands, and protected areas).
- Recreation activities (e.g., hiking, camping, cottaging, fishing, canoeing/kayaking, snowmobiling).
- Resource use (e.g., hunting, outfitting, trapping, fishing, and forestry).

15.2.2.1 Land Use

Development and Zoning

Municipal jurisdictions are required to adopt development plans and zoning by-laws to guide land use decisions within their respective boundaries. The MacLellan site is located within the administrative boundary of the Town of Lynn Lake, which extends more than 10 km beyond the built up townsite (Map 15-1). Within the RAA, most of the land outside the built-up townsite is designated as “Limited Development” land use under the development plan (Map 15-2). Mineral exploration and development are encouraged in the “Limited Development” land use under the development plan. The “Limited Development” area comprises approximately 103,261 hectares (ha).

The townsite (i.e., built-up area) of Lynn Lake is divided into “Limited Development”, “Residential”, “Commercial and Public”, “Industrial”, and “Recreation and Open Space” land uses under the development plan (Map 15-2). Under the zoning by-law, land is zoned variously as “LD – Limited Development District”, “R1 – One-family Dwelling District”, “R2 – Two-family Dwelling District”, “R3 – Multiple-family Dwelling District”, “CG – General Commercial District”, “P – Public Open Space District”, and “M – Industrial District” (Map 15-3). These areas comprise approximately 213 ha of developed land.

The PLUPs, as defined under Section 15.1.1.2, also apply on provincial Crown lands as they relate to mineral resource development (Manitoba Indigenous and Municipal Relations 2017).

Provincial Crown, Municipal and First Nation Lands

The RAA is mainly unoccupied provincial Crown land. Crown lands includes land, “whether within or without the province, vested in the Crown (meaning Her Majesty the Queen in the right of the province), and includes provincial lands wherever that expression is used in an Act of the Legislature” (pers. comm. 2019g). The RAA encompasses the Town of Lynn Lake and unoccupied Crown lands in the Thompson Community and Regional Planning Area of northwest Manitoba. The land base consists of unsurveyed land under the section-township-range system. Provincial Crown land in the RAA includes publicly owned parcels set aside as provincial parks. Designated lands in Order-in-Council areas (e.g., Provincial Parks) are administered under applicable statutory authority (e.g., *The Provincial Parks Act*).

There are numerous provincial Crown land permits and leases in the RAA (Map 15-4). These consist of general permits and leases for remote cottages (cabins), lodges and outcamps, camps/campgrounds, fish farm/fish camps, trapper cabins, communal cabin, recreation sites/lots, park cottage subdivision lots, commercial lots and sites; treaty land entitlement parcels; infrastructure facilities (e.g., airstrip, communication tower, seaplane base, waste sites); and a forest research site (Crown Lands and Property Agency 2017).

Land use types within the townsite of Lynn Lake include residential and commercial service and retail developments. Industrial land is limited to a parcel along the remnants of a railway spur line within the townsite, and on provincial Crown land located approximately 3.6 km southeast of the townsite at Eldon Lake. There is an additional land development site at Hughes Lake. Three existing provincial Crown land subdivisions are within the RAA: the Zed Lake Subdivision and Burge Lake Subdivision, on Zed and Burge lakes respectively west of the MacLellan site, and the Eden Lake Subdivision at the Eden Lake Wayside southeast of the Gordon site on the west shore of the northwest arm of the lake (MSD 2019a, b, c).

Federal Crown land in the RAA includes First Nation Reserve land and related Treaty Land Entitlement (TLE) land, encompassing approximately 3,139 ha (Map 15-5). Unoccupied provincial Crown land encompasses Registered Trapline Districts and Community Interest Zones (CIZs). The Marcel Colomb First Nation (Black Sturgeon Reserve [i.e., 2,318 ha]) and its associated CIZ fall within the RAA. Approximately 133 ha of the Black Sturgeon Reserve falls within the LAA. Treaty land entitlement selections, or land owed to First Nations under terms of Treaties signed with Canada between 1871 and 1910, occur within the RAA (Treaty Land Entitlement Committee of Manitoba Inc. 2017a, b). Nisichawayasihk Cree Nation (Nelson House) and O-Pipon-Na-Piwin Cree Nation (South Indian Lake) have four existing TLE sites within the RAA, at Barrington Lake North, Barrington Lake/Brooks Island, Melvin Lake South, and Melvin Lake North (Crown Lands and Property Agency 2017; Manitoba Growth, Enterprise and Trade 2019).

Parks, Protected Areas and Management Areas

There are no parks or protected areas within the PDAs or LAA.

There are two provincial parks within the RAA encompassing approximately 24 ha: Burge Lake Provincial Park (10 ha) and Zed Lake Provincial Park (14 ha), located approximately 5 km and 17 km west of the MacLellan site, respectively (Map 15-5).

There are no other conservation areas or ecological reserves within the RAA. The only Areas of Special Interest (ASIs) in the RAA are Eden Lake ASI, located approximately 14 km southeast of the Gordon site and Goldsand Lake ASI, located approximately 13 km northwest of the MacLellan site.

The provincial Kamuchawie Caribou Management Unit and the federal Woodland Caribou Manitoba North Range (MB9) both encompass the RAA (Map 15-5). No provincial woodland caribou (species of conservation concern) range has been delineated to date within the Kamuchawie Caribou Management

Unit (MBWCMC 2015). However, a small aerial track survey for woodland caribou was conducted in MB9 following the detection of caribou on wildlife cameras in early winter of 2019; the animals surveyed are part of the Manitoba North Range herd (pers. comm. 2019d). There are no other wildlife management areas in the RAA.

15.2.2.2 Recreation Activities

Current use of lands for traditional purposes is described in Chapter 17. Recreational land use activities within the RAA include sport fishing, hiking, camping, snowmobiling, cross-country skiing, snowshoeing, and ice fishing. Lakes and rivers in the Lynn Lake area are often used for northern pike (jackfish), walleye (pickerel), and trout (lake trout, rainbow trout, brown trout, and speckled trout) fishing (Map 15-6). The Town of Lynn Lake promotes outdoor recreation opportunities during all seasons. The town is the self-proclaimed Sport Fishing Capital of Manitoba and is the location of the annual Great Northern Pike Derby (Town of Lynn Lake 2019c).

In addition to recreational fishing, lakes within the Northwest Region around the Town of Lynn Lake offer opportunities for wildlife viewing, and for canoeing and kayaking. Winter land and resource uses in the Lynn Lake area include ice fishing, snowmobiling, ice-skating, cross-country skiing, snowshoeing, tobogganing, and dog-sled racing. The wilderness areas around Lynn Lake contains various wildlife, including moose, black bear, wolf, caribou, geese, ducks, partridge, and other small game. Recreational hunting is also a common activity in this area (Town of Lynn Lake 2019c).

There are two campgrounds in the RAA, at Burge Lake and Zed Lake provincial parks. The campground at Burge Lake is approximately 5 km west of the MacLellan site; Zed Lake is further to the west. The campgrounds are not within the LAA. Recreational opportunities at Burge Lake Provincial Park include swimming, boating and pickerel and pike fishing (Manitoba Government n.d.). Facilities at the park include a boat launch, fish cleaning station, picnic shelters, playground, a sandy beach with beach volleyball, and change rooms and pit toilets (Mussio Ventures Ltd. 2018). Zed Lake Provincial Park offers swimming, boating, and lake trout, pickerel, and pike fishing. Facilities at Zed Lake Provincial Park include a sandy beach with a change room, group use area with shelter, boat dock and launch, playground, and a fish cleaning station (Mussio Ventures Ltd. 2018).

There are several remote cabins within the LAA (Map 15-4), some of which are unoccupied, temporarily or seasonally used, or permanently used. Some examples include the following:

- A remote cabin on Simpson Lake (currently unoccupied), located approximately 4.7 km southwest of the Gordon site and within 1 km (west) of the Gordon site access road (pers. comm. 2019e).
- A trapper's cabin on Swede Lake, located approximately 2.0 km south of the Gordon site and approximately 1.5 km east of the access road.
- Four remote cabins and two recreation lots at Hughes Lake, located approximately 13 km southwest of the Gordon site, within approximately 1.5 km of PR 391.
- A remote cabin (currently unoccupied) within 100 m of PR 391 at its junction with the road to the Black Sturgeon Reserve at Hughes Lake (pers. comm. 2019e).

There are recreational cottage subdivision lots on provincial Crown land within the RAA at Zed Lake, Burge Lake, and Eden Lake. The LAA and RAA also contain lands that may be used for private recreation purposes consisting of remote cabins, a trailer located outside of provincial park cottage subdivisions (e.g., on Brightsand and Burge lakes). The park cottage subdivisions are not within the LAA.

Recreational trails in the RAA are limited to an informal network. While there are no designated snowmobile trails or cross-country ski trails in the RAA, informal snowmobiling and cross-country skiing are known to occur within the RAA, particularly within the vicinity of Lynn Lake and Leaf Rapids. Informal gathering activities (e.g., berry picking) likely occur across the RAA for berries of interest that grow wild in the north, including blueberry, saskatoon berry, raspberry, and strawberry (Manitoba Agriculture 2011).

Recreational water use in the RAA consists of canoeing and boating (Map 15-6). The “Land of Little Sticks” recreational canoe route encompasses many lakes and rivers across the RAA including (from west to east): Vandekerchove, Zed, Little Brightsand, Goldsand and Burge lakes, Keewatin River, Cockeram, Anson, Cartwright and Hughes lakes, Hughes River, Eden Lake, and Barrington River (Berard 1978). This recreational canoe route crosses through the LAA and is adjacent to the PDA for the MacLellan site. Navigable waterbodies by canoe/kayak in the LAA include the Keewatin River, Cockeram Lake, Hughes Lake, and Hughes River.

There are numerous public boat launches on lakes in the RAA, including Vandekerckhove, Zed, Little Brightsand, Burge, Cockeram, and Eden lakes (Town of Lynn Lake 2019b; pers. comm. 2019d). The Cockeram Lake boat launch is located within the LAA south of the MacLellan site off PR 391.

15.2.2.3 Resource Use

Hunting and Outfitting

A description of Indigenous peoples traditional hunting activities in the LAA and RAA is provided in Chapter 17. Hunting opportunities are available across thousands of hectares of open provincial Crown land, including some leased provincial Crown lands and provincial parks (MSD 2019d). The regulated hunting season generally begins in early September, though specific hunting seasons vary by species, Game Hunting Areas (GHAs), and Game Bird Hunting Zones (GBHZ). Methods of hunting (e.g., rifles and bows) also vary depending on game hunted and season (MSD 2019d).

The RAA falls within Manitoba GHA 9 and Game GBHZ 1 and 2 (Map 15-9). Hunting opportunities are allowed on undesignated Crown lands and leased Crown land unless specifically prohibited. Common big game species found in the RAA include moose, black bear, and gray wolf. Hunting numbers for moose tend to be low and widespread because access is limited due to limited road access (MSD 2019d). Data on general hunting licences are gathered for the entire province, not by specific GHA. There is very little area-specific information on non-draw hunting licences (i.e., licences where one has to win a draw). There are no big game draws (i.e., drawing for a big game licence) in GHA 9 (pers. comm. 2017b).

Upland game birds hunted include grouse, ptarmigan, and migratory game birds such as ducks, coots, snipe, Canada geese, snow geese, Ross’s geese, and sandhill cranes. Migratory game bird hunting licence records (e.g., geese, ducks and other waterbirds) are kept by the Environment and Climate Change

Canada's Canadian Wildlife Service and are recorded at a GBHZ level. Because the geographic span of GBHZ 1 and 2 is much larger than the RAA (i.e., north of 53°), game bird and migratory bird data are not presented because they would not be representative of game and migratory birds harvested within the RAA. Non-migratory game bird (e.g., ruffed, sharp-tailed and spruce grouse) seasons and licensing are under the jurisdiction of MCC's Wildlife and Ecosystem Protection Branch. Game bird hunting opportunities for ptarmigan and spruce grouse are also available in GHA 9 (Mussio Ventures Ltd. 2018).

There are four lodges/outfitters that have operated or are operating in the RAA (Map 15-9). Laurie River Lodge, open from May to September and accessible only by air, provides non-resident hunting for black bear in GHA 9. Wolverine Lodge, accessible by road with a season from May to October and currently not active, provided non-resident hunting of black bear in GHA 9 (Travel Manitoba n.d.). Outfitters operating in the RAA consist of Grey Owl Outfitters and Lynn Lake Fly-In Outpost Camps.

Big game mammal, furbearer, and bird species observed in the PDAs during 2015-2017 fieldwork included moose, gray wolf, and a species of conservation concern, wolverine. Trail camera programs undertaken in 2019 captured several woodland caribou in the western RAA; additional caribou signs were observed during an aerial caribou survey also conducted in 2019, as a result of the camera observations (Stantec 2019a). These were the first signs of woodland caribou in the western RAA since the start of mammal baseline program in 2015 (pers. comm. 2019d). Habitat for big game mammal and bird species of interest to hunters that are present in the LAA are described in Chapter 12. Moose habitat is widespread and abundant in the RAA. Black bear is widely distributed in the RAA and is an important species to local resource users and provides economic benefit through guided hunting for local outfitters. Common waterbird species observed during field surveys included mallard, ring-necked duck, and Canada goose. Two species of upland game birds – ruffed grouse and spruce grouse – were observed within the LAA near the Gordon and MacLellan sites. No additional bird surveys have been undertaken since 2017. Local knowledge identified several moose and goose hunting areas within the RAA (Chapter 12). A moose kill near the road into the Gordon site and an outfitter bear bait station were noted in the LAA during the 2016 wildlife field surveys. Subsequent trail camera programs were conducted between 2017 and spring of 2019 (Volume 4, Appendix M).

Grey Owl Outfitters holds a black bear allocation area covering about 139,374 ha. Approximately 12,717 ha (8.0%) of this area overlaps with the LAA and 938 ha (0.6%) of the PDA for the MacLellan site. Several current and former bear bait stations set up by Grey Owl Outfitters were noted in the LAA (Volume 4, Appendix M). Grey Owl Outfitters have been allocated 28 bear tags per year over the last 20 years, with a usage of approximately 90% over the last 10 years (pers. comm. 2017c). This outfitter has focused his attention in the last few years to an area south and west from the MacLellan site, mostly along the Burnt Timber road (pers. comm. 2019d).

Trapping

A description of Indigenous peoples traditional trapping activities in the LAA and RAA is provided in Chapter 17. The registered trapline system in Manitoba is a commercial furbearer harvest management system. Registered trapline holders are granted exclusive commercial harvest rights of furbearing animals within their traplines. The number of trapping licences issued in the province has fluctuated from 2014 to 2018

(MSD 2018b). The trapping season generally extends from October to May. Environmental conditions (i.e., late onset of winter or warm conditions) can cause reductions in trapper effort and harvest in registered trapline areas. Furbearer harvest is also closely tied to market demand. Marten and muskrat have been the most-harvested species in Manitoba over recent years, while wolf and wolverine were the highest value species (MSD 2018b).

The RAA falls within the Pukatawagan and Southern Indian Lake Registered Traplines (Map 15-10). Furbearer species most heavily harvested in the RAA and LAA include marten and mink, followed by lynx and beaver. Furbearer and other small mammal species observed near the Gordon and MacLellan sites during fieldwork included snowshoe hare, marten, lynx, beaver, and red fox.

The RAA overlaps 20 registered traplines, all of which have had trapper permits. Six of the 20 are overlapped by the LAA – Pukatawagan Registered Traplines 30, 32, 35, 36, and a Community Youth Trapline (YTC), and Southern Indian Lake Registered Trapline 42. The PDAs for the Gordon and MacLellan sites overlap four individual traplines (Table 15-3): Pukatawagan Registered Traplines 36, 30, and YTC (MacLellan site area), and 32 (Gordon site area).

Table 15-3 Registered Traplines within the PDAs at the Gordon and MacLellan Sites

Registered Traplines	Percentage PDA in Trapline	PDA Trapline Area (ha)	Percentage of Total PDA*
Pukatawagan YTC	0.1%	20.8 (MacLellan)	1.7%
Pukatawagan 36	2.1%	808.2 (MacLellan)	66.9%
Pukatawagan 30	0.2%	108.9 (MacLellan)	9.0%
Pukatawagan 32	0.4%	269.4 (Gordon)	22.3%
Note: *Percentage of total PDAs for Gordon and MacLellan combined.			

Fishing

A description of Indigenous peoples traditional fishing activities in the LAA and RAA is provided in Chapter 17. Commercial fishing is an important industry in Manitoba and is a major source of income for people living in northern Manitoba. The primary fish species subjected to commercial quota restrictions include lake whitefish, walleye (pickerel), sauger, northern pike, lake trout, goldeye, and yellow perch. Species such as lake cisco, suckers (mullet), and carp are not subject to a quota (MSD 2017b). Fish species commercially caught from lakes in the RAA include walleye, northern pike, trout, and whitefish.

There are no commercial fish waterbodies overlapped by the PDAs. There are portions of two listed commercial fish lakes (Cockeram and Cartwright lakes) within the LAA along the PR 391 haul route between the sites (Map 15-11). These lakes have commercial fish quotas of ≤1,000 kg and were last commercially fished in 1997 and 2012, respectively (pers. comm. 2017d; pers. comm. 2019b). There are 17 commercial fish waterbodies in the RAA (Map 15-11), of which only three support round weight commercial fish quotas ≥10,000 kg: Barrington Lake, Goldsand Lake, and Suttie Lake. Simpson and Swede lakes are in the Commercial Harvest Schedule with one quota of 2,300 kg for walleye or whitefish; however, these lakes have not been commercially fished since prior to 2010 (pers. comm. 2019h). There is no commercial bait gathering fishery in the RAA (pers. comm. 2017d; pers. comm. 2019b). No commercial fish waterbodies are overlapped by the Project PDAs. In the region, commercial fishing activities have remained relatively stable over the last several years, with a decrease in pressure and production. Quotas have not changed in the region, and it is rare for a commercial fisher to hit a quota, especially in the Lynn Lake District (pers. comm. 2019b).

Located within the Northern Central Fishing Division of Manitoba, watercourses in the RAA support a recreational sport fishery (Map 15-6). Sport fish species targeted in the RAA include: burbot, goldeye, northern pike, perch, walleye, whitefish, brook trout, lake trout, and rainbow trout (MSD 2002, 2018c). There are no sport fish lakes within the PDAs for the Gordon and MacLellan sites. Four waterbodies are overlapped by the LAA: Keewatin River, Cockeram Lake, Hughes Lake and Hughes River (Map 15-6), all of which are road accessible. Fish species confirmed in lakes in the Gordon and MacLellan RAA during 2016 aquatic field programs consisted of northern pike, white sucker, yellow perch, cisco, longnose sucker, and burbot. Additional field sampling occurred at Lynn River in 2018 and Farley Lake in 2018 and 2019. Species captured in the Lynn River consisted of white sucker. Northern pike and white sucker were captured in Farley Lake in 2019. No small-bodied fish were caught at Farley Lake during the 2018 and 2019 field surveys (Volume 4, Appendix J).

Minerals and Aggregate

Exploration activity in the Lynn Lake area and surrounding region has focused on copper, lead, zinc, gold, silver, nickel, and cobalt. The PDAs and LAA have historically been subject to mining development. Blocks of mining claims and mineral leases have been staked at Lynn Lake and the surrounding area commencing in 1941 and this has continued to the present day (Maps 4-3 and 4-4). One of the richest nickel strikes was first laid claim in 1945 by Sherritt Gordon Mines at a site between two lakes at Lynn Lake (Town of Lynn Lake 2019d). Other properties staked in the Lynn Lake area in subsequent years (Province of Manitoba n.d.) include:

- “A” Mine (underground) and “EL” Mine (combined open pit and underground) properties that operated from 1953 to 2002, and 1954 to 1963, respectively.
- Fox Lake property, which was first staked in 1947 (production did not commence until 1970).
- Farley Mine, an open pit mine that operated from 1972 to 2002 (i.e., the Gordon site).
- MacLellan Mine (underground) that operated from 1986 to 1989 (i.e., the MacLellan site).
- Burnt Timber Mine (open pit) that operated from 1993 to 1996 (operated as Keystone Gold Mine from 1996 to 2000).

Currently, the Gordon site has been reclaimed and the MacLellan site is under care and maintenance.

More recent mineral exploration activity in the Lynn Lake area consists of various projects and properties (Province of Manitoba 2017), including:

- Lynn Lake Gabbros Project, involving over 38 km^2 of mining claims in the Lynn Lake nickel belt (2007).

- Burnt Timber Project involving mining claims at the Burnt Timber deposit southeast of Lynn Lake (2012).
- Linkwood Property deposit, consisting of mining claims in an area west of the Burnt Timber deposit southeast of Lynn Lake (2012).
- Last Hope Project, consisting of mining claims at the Last Hope property 20 km southeast of Lynn Lake (2012).
- Lynn Lake Nickel Sulphide Project, consisting of mining claims at Lynn Lake (2015-2018).

Table 15-4 lists the active claims and leases overlapped by the PDAs and LAA. Carlisle Goldfields Limited (now Alamos Gold Inc. [Alamos]) is the largest claim holder in the LAA and the principal lease holder in the PDA at both sites.

Table 15-4 Active Mining Claims and Mineral Leases in the PDAs, LAA and RAA, 2019

Mineral Disposition	Gordon PDA	MacLellan PDA	LAA	RAA
Number of Active Claims	7	16	83	429
Area of Active Claims (ha)	94	773	9,815	75,315
Number of Active Leases	3	5	9	9
Area of Active Leases (ha)	120	308	1,184	1,184
Source: Manitoba Growth, Enterprise and Trade, Resource Development 2019				

There has been an increase in other claim staking activity within the Project LAA along PR 396 (Fox Lake Road), PR 391 east of Black Sturgeon Reserve, as well as other areas along the Lynn Lake mineral belt (pers. comm. 2019c). The recent activity of new claims being staked in this area (as of the fall of 2019) is not a concern to Mines Branch with respect to Project development (pers. comm. 2019e). The Project LAA also encompasses one quarry withdrawal area (i.e., Manitoba Highways) along PR 391 and the existing access roads to the Gordon (partially) and MacLellan sites.

The Lynn Lake area is covered mainly by glacial till (Matile and Keller 2006a, b). The Vandekerckhove Lake esker has a relief up to 50 m and extends approximately 80 km south to Russell Lake. This esker represents the most favourable source of coarse gravel in the Lynn Lake area. Lower volume sources of gravel remain within the Eileen Lake complex, that has a relief of 30 m, and consists of localized kame and kame delta deposits (Manitoba Department of Mines, Resources and Environmental Management 1976).

Manitoba Infrastructure has an expansive quarry withdrawal area encompassing PR 391 through the LAA, and the existing access roads to the Gordon (partially) and MacLellan sites, and the MacLellan PDA (Manitoba Growth, Enterprise and Trade 2019). The status of this quarry withdrawal area (e.g., if it is depleted), and whether Manitoba Infrastructure has concerns with respect to it, are unknown.

Forestry

Productive forest land is scattered within Forest Management Units (FMUs) 71 and 72 of the Churchill River Forest Section (Map 15-7; Manitoba Government 2017). The productive forest land in the PDAs represents a very small area of the total productive forest land in the LAA and RAA, ranging from 6.3% to 0.2% respectively. In terms of merchantable timber in the PDAs, the volumes are very small in relation to what is present in the LAA and RAA (8.9% and 0.2%). There are no forest industry timber allocations or currently active commercial timber sales or timber permits (i.e., timber harvesting or logging) within FMU 71 and 72 (pers. comm. 2019a). The extent and amount of productive forest land and estimated merchantable timber occurring within the PDAs, LAA and RAA are summarized in Table 15-5.

Table 15-5 Productive Forest Land in PDAs, LAA and RAA and Net Merchantable AAC in FMUs 71 and 72

	PDA		LAA	RAA	FMU 71	FMU 72
	Gordon	MacLellan				
Productive Forest Land (ha)	122.6	498.9	9,800	300,339	142,880	157,460
Net Merchantable Timber (m^3)	10.5	9,061	101,873	4,220,646	1,788,365	2,431,207
Net Merchantable AAC[1] (m^3)	0.1	218	2,526	77,889	36,653	41,236
Net Operable 1 AAC[2] (m^3)	0	0	0	234,256	63,791	170,465

Note: AAC = Annual Allowable Cut; Cutting class is based on size, vigour, state of development and maturity of the stand for harvesting purposes; [1] Net merchantable AAC is defined as trees or stands that have attained sufficient size, quality, and/or volume which are considered suitable for harvesting, including cutting class 3, 4, and 5 for all species regardless of stand yield; [2] Net Operable 1 AAC = refers to cutting class 4 and 5 for jack pine, black spruce, white spruce, and balsam fir stands ≥ 55 m^3/ha.

n/a – not applicable

Source: Manitoba Conservation 2007; pers. comm. MSD, Forestry and Peatlands Management Branch 2017a, 2019a

High-value forest sites include enhanced silviculture sites, research and monitoring sites, and private land forest values (Map 15-7). There are six Research and Monitoring Forest Resource Inventory (FRI) - Permanent Sample Plots (pers. comm. 2017a; 2019a) in the RAA, but not in the LAA. The Forest Land Inventory (FLI) indicates areas of other productive forest land in the LAA and RAA, consisting of Local Government District (LGD) productive forest land, First Nation Reserve/Federal Land, and private productive forest land (Map 15-7; Table 15-6).

Table 15-6 Other Productive Forest Land in the LAA and RAA

Ownership	LAA	RAA
Municipal/LGD Land (ha)	4	344
First Nation Reserve/Federal Land (ha)	79	1,846
Private (Patent) Land (ha)	n/a	42

Source: pers. comm. MSD, Forestry and Peatlands Management Branch 2017a

Firewood or fuelwood has been used historically and continues to be used by Manitobans for everything from heating homes to enjoying outdoors while camping. Timber permits are available through MCC for “Own Use” or “Personal Use” to cut fuelwood on provincial Crown land. The availability of fuelwood and demand for permits varies across the province. The Timber Permit system allows for personal utilization of up to 25 m^3 (MSD 2017a; 2018a).

A description of Indigenous peoples traditional gathering activities (e.g., cutting firewood) in the LAA and RAA is provided in Chapter 17.

15.3 PROJECT INTERACTIONS WITH LAND AND RESOURCE USE

Project activities for each phase are described in detail in Chapter 2, Section 2.3 and 2.4. Project related emissions and discharges are described in Chapter 2, Section 2.8.

The potential interactions between Project activities and the environment were considered for the construction, operation, and decommissioning/closure phases of the Project. The identification of Project activities and their potential interactions was based on engagement with interested parties, the professional judgment of technical specialists involved in the assessment, and a review of existing conditions. The selection of interactions is also informed by the potential effects and effects pathways for each VC as described in Section 15.1.3.

Project employment and expenditures are generated by most Project activities and components and are the main drivers of many socio-economic effects. Rather than acknowledging this by placing a check mark against each of these activities, “Employment and Expenditure” has been consolidated as integrated activity for efficiency of approach. This activity includes the employment and expenditures generated by all other project activities under each Project phase.

Table 15-7 identifies, for each potential effect, the physical activities that might interact with the VC and result in the identified potential environmental effect. These interactions are indicated by check mark and are discussed in detail in Section 15.4, in the context of effects pathways, standard and project-specific mitigation/enhancement, and residual effects. A justification for no effect is provided following the table.

Table 15-7 Potential Project Interactions with Land and Resource Use

Project Activities and Components	Environmental Effects					
	Change in land use		Change in recreation		Change in resource use	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
Construction						
Site Preparation at Both Sites (removal of existing buildings; removal of contaminated materials; vegetation clearing and earthworks; development of temporary construction camp at MacLellan site)	✓	✓	✓	✓	✓	✓
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	✓	✓	✓	✓	✓	✓
Mine Components at Both Sites (construction of: ore pads; ore, overburden and mine rock storage areas (MRSAs); mill feed storage area and crushing plant, ore milling and processing plant, and Tailings Management Area (TMF) at MacLellan site; water management facilities [e.g., sumps, ponds and ditches])	✓	✓	–	–	–	–
Utilities, Infrastructure and Other Facilities at Both Sites (construction of: buildings and yards; access roads [i.e., upgrades at Gordon and MacLellan sites] and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at MacLellan; on-site pipelines at MacLellan; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities)	✓	✓	–	–	–	–
Water Development and Control at Both Sites (dewatering of existing pits at Gordon site and underground workings at MacLellan site; re-alignment of existing built diversion channel at Gordon site; interceptor wells at the Gordon site)	–	–	–	–	✓	–
Emissions, Discharges and Wastes[1]	✓	✓	✓	✓	✓	✓
Employment and Expenditure[2]	–	–	✓	✓	✓	✓
Operation						
Open Pit Mining at Both Sites (drilling; blasting; removal, loading and on-site hauling of mined material [i.e., ore, overburden, and mine rock])	✓	✓	✓	✓	✓	✓

Table 15-7 Potential Project Interactions with Land and Resource Use

Project Activities and Components	Environmental Effects					
	Change in land use		Change in recreation		Change in resource use	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA, including truck transportation of ore from the Gordon site to the MacLellan site)	✓	✓	✓	✓	✓	✓
Storage/Stockpiling of Ore, Overburden, and Mine Rock at both sites	✓	✓	✓	✓	✓	✓
Ore Milling and Processing at MacLellan Site (ore crushing and conveyance; ore milling)	–	–	–	–	–	–
Water Management at Both Sites (mine water collection and storage; process water supply for MacLellan site including water intake on Keewatin River at the MacLellan site; pumping fresh/fire water from Farley Lake at Gordon site; operation of interceptor wells at the Gordon site)	–	–	–	–	✓	✓
Tailings Management at MacLellan Site	–	–	–	–	–	–
Utilities, Infrastructure, and Other Facilities at Both Sites (presence and operation of: buildings and yards; access roads and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at MacLellan; on-site pipelines at MacLellan; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities; explosives storage)	–	–	✓	✓	✓	✓
Emissions, Discharges, and Wastes[1]	✓	✓	✓	✓	✓	✓
Employment and Expenditure[2]	–	–	–	–	–	–
Decommissioning/Closure						
Decommissioning at Both Sites	–	–	–	–	–	–
Reclamation at Both Sites	✓	✓	✓	✓	✓	✓
Post-Closure at Both Sites (long-term monitoring)	–	–	–	–	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	–	–	–	–	–	–
Emissions, Discharges, and Wastes[1]	–	–	✓	✓	–	–

Table 15-7 Potential Project Interactions with Land and Resource Use

Project Activities and Components	Environmental Effects					
	Change in land use		Change in recreation		Change in resource use	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
Employment and Expenditure[2]	–	–	✓	✓	✓	✓

NOTES:
✓ = Potential interaction
– = No interaction
[1] Emissions, Discharges, and Wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many Project activities. Rather than acknowledging this by placing a check mark against each of these activities, "Wastes and Emissions" have been introduced as an additional component under each Project phase.
[2] Project employment and expenditures are generated by most Project activities and components and are the main drivers of many socio-economic effects. Rather than acknowledging this by placing a check mark against each of these activities, "Employment and Expenditures" have been introduced as an additional component under each Project phase.

The following activities or components are not anticipated to interact with land and resource use:

- Water management at both sites and tailings management at the MacLellan site will not affect land use and recreation once operational. Once established, no further ground disturbance will occur.
- Utilities, infrastructure, and other facilities at both sites will not affect land use during operation because there will be no further ground disturbance once operational.

15.4 ASSESSMENT OF RESIDUAL ENVIRONMENTAL EFFECTS ON LAND AND RESOURCE USE

Current local and regional land designations and use in the general Lynn Lake area consists of provincial Crown lands, First Nation reserves, numerous outdoor recreational activities, and resource uses related to hunting, outfitting, trapping, fishing, and mining. It is anticipated that the Project has the potential to change land use, recreation, and resource use during construction, operation, and decommissioning/closure phases. While Lynn Lake is known for its local outdoor recreation activities, the Project PDAs are not especially important or unique given the past history of the Gordon and MacLellan sites as former mines. Although recreational and resource use activities will be displaced to other parts of the LAA/RAA, there is ample space and resources available to conduct these activities. Only a small amount of productive forest land will be affected through removal of AAC during operation (i.e., commercial forestry cannot occur within the PDAs). Decommissioning/closure activities have the potential to reverse adverse effects related to some local use of land and resources and may ultimately restore access. During the decommissioning/

closure phase, rehabilitation activities as part of active closure (Appendix 23B) will be designed to achieve desired end land uses.

15.4.1 Analytical Assessment Techniques

15.4.1.1 Assessment Approach and Methods

Techniques used to carry out the assessment on land and resource use include spatial analysis to quantify the extent of land and resource use activity in the PDAs, LAA and RAA. Consideration of the nature of Project effects on land and resource use also relied on factual and anecdotal information from primary and secondary research, an understanding of Project interactions and mitigation, information collected from other VCs, and professional judgement.

The assessment of potential Project effects on land and resource use activities considered the interactions and relationship between the land and resource use VC and other socio-economic and biophysical VCs. For example, residual effects on wildlife and fish species and habitats are important considerations for commercial harvesting and recreational hunting and fishing activities.

Spatial analysis was used to determine the reduction of land available for land and resource use associated with the Project.

Development plans, zoning by-laws and provincial land use policies were reviewed to evaluate development potential and controls within the RAA. Land use designations and zoning districts were identified and summarized from the applicable development plan and zoning by-law. The designations and zones were mapped for analysis purposes to inform land use development within the RAA.

Data on provincial Crown productive forest land values were collected and analyzed to assess potential Project effects on productive forest land area, merchantable timber, and AAC using FRI/FLI, a stock stand volume table, and mean annual increment values. Data on high-value forest sites, including enhanced silviculture sites and research and monitoring sites, and private forest land values in the PDAs, were collected and analyzed to assess effects on high-value forest sites. A Forest Damage Appraisal and Valuation (FDAV) determination was also conducted for both sites.

15.4.2 Assessment of Change in Land Use

The assessment of change in land use considered whether Project activities would be incompatible with land use plan designations and zoning. The Project also has the potential to degrade land, cause disturbance and nuisance effects (e.g., construction noise, dust, disruption of access) and restrict access. Decommissioning/closure activities have the potential to disrupt land use but may ultimately result in the restoration of access and land use.

15.4.2.1 Project Pathways

Gordon and MacLellan Sites

Construction

Project clearing and construction activities within the Gordon and MacLellan PDAs has the potential to change land use and development through the loss of area and the restriction of access to designated lands including provincial Crown lands. Clearing and construction activities within portions of the Gordon and MacLellan PDAs and movement along access roads can affect land use, including sensitive receptors such as remote cabins within the LAA, due to nuisance disturbance (e.g., noise and dust) and visible project components. Noise sources within the PDAs are anticipated to be typical of construction activities and will include some temporary noise disturbances (e.g., movement of equipment, excavated materials). Operation of heavy equipment during construction can affect the occupants of remote cabins in the vicinity of the Project PDAs. Access issues will be addressed through traffic control measures.

The construction phase will not affect protected areas as established under Manitoba's Protected Areas Initiative.

The clearing of the power distribution line right-of-way (ROW) and construction of the wood pole distribution line will re-disturb land. Project clearing and construction activities at the MacLellan site will include a new 34.5 kV distribution line that will be routed beside an existing disturbed ROW along the existing access road to the site. The segment from PR 391 to the site will be approximately 5 km long and routed adjacent to the existing access road on a former power supply line ROW. The single pole distribution line will be situated on a 20 m (approximately) wide ROW. Clearing for the distribution line ROW segment from PR 391 to the site will involve approximately 10 ha of land. An additional 3.2 km segment from a new station built by Alamos near Lynn Lake to PR 391 at the entrance to the site is also required. Routing and ROW access are in progress. The power distribution line may require new access road(s) of 500 m (approx.) in length to be built for access to the distribution line. The distribution line will involve a crossing of the outlet of Dot Lake to the Keewatin River and a crossing of the Keewatin River at the existing bridge crossing to reach the MacLellan site. A standard wooden H-frame structure with guywire on a 40 m ROW will be used for long span crossings (e.g., water crossings).

Operation

The operation of the open pit mines at the Gordon and MacLellan sites will not result in additional ground disturbance. Storage of ore stockpiles, overburden, and mine rock at the Gordon and MacLellan sites has the potential to degrade land use within the Project PDAs. The presence of the stockpiles, overburden and mine rock can affect land use through visual disturbance effects. Project operation can affect sensitive receptors such as remote cabins (i.e., if they are occupied) due to noise from truck hauling of ore along the Gordon PDA access road and along PR 391 between the Gordon and MacLellan sites.

Electrical power at the Gordon site is expected to be supplied from two duty/stand-by diesel generators, which will contribute to nuisance effects during their operation.

No new areas will be disturbed by operation activities at the Gordon and MacLellan sites. The operation phase will not affect protected areas for either site.

Decommissioning/Closure

The decommissioning/closure phase will allow for restoration of affected land use areas and the reincorporation of the rehabilitated lands into the land base for Gordon and MacLellan sites.

15.4.2.2 Mitigation

The implementation of the mitigation measures will be the responsibility of Alamos and/or its contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection. Industry standard mitigation measures include the use of existing access roads, trails, and ROW, use of signage, and implementation of traffic control measures.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Gordon and MacLellan Sites

Mitigation measures of potential Project effects on land use for the Gordon and MacLellan sites, include the following:

- The Project footprint will be limited to the extent possible (i.e., PDAs) including site clearing and disturbance associated access routes and distribution line ROW.
- Existing access roads, trails and ROW will be used to the extent possible; access routes will be developed in compliance with provisions of *The Crown Lands Act* and *The Mines and Minerals Act.*
- Alamos will implement traffic control measures which may include gating approaches to Project access roads, placing large boulders and/or gated fencing to restrict public access to the PDAs.
- Signage will be installed around the PDAs to alert land users of the presence of the Project and its facilities.

- Alamos will engage with Town of Lynn Lake Municipality and provincial Crown land use permit holders to address potential conflict, disturbance, or access restrictions to municipal and Crown land use areas.
- Alamos will undertake rehabilitation activities in consideration of desired end land uses that are achievable in the preparation of a Closure Plan under the provisions of *The Mines and Minerals Act* for both the Gordon and MacLellan sites. A Conceptual Closure Plan is provided to support the EIS in Appendix 23B.

15.4.2.3 Project Residual Effects

Gordon Site

Construction

The Gordon site will be developed on provincial Crown land. The unoccupied Crown land within the PDA is subject to numerous mining claim and mineral lease dispositions. Under *The Planning Act*, the PLUPs, as laid out under the *Provincial Planning Regulation (No. 81/2011)*, do not apply to planning areas where there is an adopted development plan. The Gordon site is located on provincial Crown land where there is no development plan and as such the PLUPs are applied when undertaking planning activities and land use decision-making. The PDA for the Gordon site intersects with approximately 269 ha of provincial Crown land. Schedule 3 of the Regulation, Policy Area 8: Mineral Resources expresses the provincial government's interest in mineral resources development. No conflict with mineral resources development policy is anticipated at this site subject to full consideration of the PLUPS. In addition, the Gordon site is located within the Marcel Colomb First Nation CIZ. The CIZ applies to all dispositions of provincial Crown land except for the staking of mining claims, conversion to leases, and quarry permits. The Province is obligated to provide notice to entitled First Nations with respect to proposed dispositions of provincial Crown land within its CIZ (Treaty Land Entitlement Committee of Manitoba Inc. 1997). The Gordon site does not overlap with other existing Crown lands (e.g., provincial parks, First Nation lands, TLE sites) or other provincial Crown land permit or lease sites.

Given the small area of provincial Crown land affected by the PDA (269 ha for the Gordon site), Project disturbance is predicted to be of low magnitude.

There are two remote cabins within the LAA southwest of Hughes Lake (occupancy unknown), one along the access road to the Gordon site at Simpson Lake (unoccupied), and another (unoccupied) along PR 391 at the junction with the road to Black Sturgeon Reserve (pers. comm. 2019e). One trapper's cabin that was occupied in the 1990s, but of unknown occupancy currently, is located just outside the LAA along the existing access road to the Gordon site (pers. comm. 2019f). Chapter 7 provides a detailed assessment of potential noise effects, and a description of mitigation measures.

Low frequency noise effects are not expected at receptors because predicted sound levels are below Health Canada targets (Volume 5, Appendix C). Nuisance effects associated with vibration levels from construction activities and equipment (e.g., excavator, compactor, bulldozer) at the Gordon site are predicted to be below annoyance levels for the closest receptors (Chapter 7).

Access to the Gordon site will be via the existing Gordon access road. Access restrictions will be put in place for the period of construction. Traffic control measures will be developed to address access accommodation plans and logistics and lessen effects during construction.

Overall, the residual effects for the Gordon site are anticipated to be adverse, low magnitude (low to moderate for noise), short-term in duration, irregular in frequency, and reversible upon Project decommissioning/closure.

MacLellan Site

Construction

The MacLellan site will be developed on lands within the Town of Lynn Lake Municipality designated as "Limited Development" under the Town of Lynn Lake Development Plan By-law No. 1329-2009, and "LD – Limited Development District" under the Town of Lynn Lake Zoning By-law No. 675. The PDA for the MacLellan site contains approximately 938 ha of municipally administered land (4.5% of the total land area within the LAA). Mineral exploration and development are encouraged in the "Limited Development" land use under the Town of Lynn Lake Development Plan. As such, there will be no conflict between the development of the site and municipal development policies. As with the Gordon site, the MacLellan site does not overlap with other designated lands or provincial Crown land permit/lease sites.

Given the small areas of provincial land affected by the PDA (938 ha within the LAA for MacLellan, with approximately 10 ha of land for the power distribution line ROW), Project disturbance is predicted to be of low magnitude.

The route for the proposed power distribution line to the MacLellan site follows an existing grown-in ROW alongside an existing access road. The distribution line will be developed on provincial land within the Town of Lynn Lake and designated as "Limited Development" and zoned "LD – Limited Development District" under the applicable Town of Lynn Lake Development Plan (No. 1329-2009) and Zoning By-law (No. 675). General development related to public services provided by government and public or private utilities is permitted in any land use designation subject to requirements stated in the Zoning By-law (Town of Lynn Lake 2009). Under the Zoning By-law, Public Utilities are defined as "any system, works, plant, equipment, or service which provides services and facilities related to the production, transmission, delivery, or furnishing of water, gas and electricity to the public at large". The Zoning By-law states that "Nothing in this By-law shall be interpreted as to interfere with the construction, maintenance and operation of the facilities of any public utility, as defined by this By-law, … provided that the requirements of such public utility or public service is of a standard compatible with the adjacent area and that any building or structure erected in any zoning district complies with the requirements applicable to the zoning district" (The Local Government District of Lynn Lake 1984).

There are no sensitive receptors (e.g., remote cabins, trapper's cabins) along the alignment and access road to the MacLellan PDA or within the MacLellan LAA. The closest land use to MacLellan PDA is a municipal waste disposal ground in the LAA. The distribution line and access road will be constructed in such a manner to limit possible disturbance and annoyance effects associated with noise generation (Chapter 7).

The mitigation noise level from pile-driving activities at the Keewatin River bridge (i.e., 47 dBA) was used as the target for noise effects from short-term construction activities. Predicted noise levels at all receptors were below this target level. Low frequency noise effects are not expected at receptors because predicted sound levels are below Health Canada targets (Volume 5, Appendix C). Nuisance effects associated with vibration levels from construction activities and equipment (e.g., piling, excavator, compactor, bulldozer) at the MacLellan site are predicted to be below annoyance levels for the closest receptors (Chapter 7).

As noted for the Gordon site, access restrictions are anticipated to be in place for the period of construction. Traffic control measures will be developed to address access accommodation plans and logistics and lessen effects during construction.

Overall, the residual effects for the MacLellan site are anticipated to be adverse, low magnitude (low to moderate for noise), short-term in duration, irregular in frequency, and reversible upon Project decommissioning/closure.

Gordon and MacLellan Sites

Operation

The effects caused by construction associated with the ongoing presence of the Project, as described in the previous section, will continue through operation.

Audible noise generated from the use of access roads to the sites and along PR 391 between the Gordon and MacLellan sites (e.g., ore truck hauling) will be limited to the PDA and LAA. In consideration of the small number of remote cottages directly affected during operation, the Project is anticipated to have a low effect on land use within the LAA, overall.

The predicted Project sound level at select receptors for the Project are below the Manitoba noise guideline targets of 55 dBA (daytime) and 45 dBA (nighttime). Low frequency noise effects are not expected at receptors because predicted sound levels are below Health Canada targets (Volume 5, Appendix C). The noise assessment results further indicate that nighttime equivalent sound levels from the Project will be below 40 dBA for residential receptors, including remote cabins, the trapper's cabin, and Lynn Lake residences. As such, no noise-related sleep disturbances at residential receptors are predicted from operation during the nighttime. Nuisance effects associated with vibration levels from operation activities (e.g., blasting) at the Gordon and MacLellan sites are predicted to be below the vibration target level (i.e., 10 mm/s) for all receptors. With mitigation measures, the overpressures from blast charges are predicted to meet the regulatory target at all receptors (Chapter 7).

The new distribution line to the MacLellan site will be subject to routine operation and maintenance activities as conducted by Alamos. The power distribution line will operate at a low voltage (i.e., 34.5 kV) to limit noise generation (i.e., humming). As such, audible noise effects from distribution line operation are anticipated to be negligible. The presence of the distribution line will facilitate access along the ROW. Alamos will post warning signs to discourage unauthorized access and snowmobiling on the ROW.

Visual effects could be an issue at the MacLellan site given the proximity to the Keewatin River and land and water-based activities, and along the access road to the Gordon site at the crossing of the Hughes River. The Project will have some visibility as the landscape of the LAA has generally variable topographical relief. For the most part, the Project is expected to be visible only to receptor sites in the immediate vicinity. The Gordon site will not be visible from a viewpoint at the crossing of the Hughes River along the Gordon site access road. Visible areas from this viewpoint are limited to surrounding environments only (Maps A-6 to A-8, Volume 5, Appendix B). A 3D visualization of the sites has been modelled by Paraminerals Consulting based on preliminary engineering data and available LiDAR information, based on the full extent of operation. The Gordon site will be just barely visible from Black Sturgeon Reserve (Appendix 15A). The Project's presence will result in some visual disturbance and will be long-term in duration (i.e., from reclamation of stockpiles). A viewpoint on the Keewatin River west of the MacLellan site is likely to see portions of the ore stockpile, overburden stockpile, and MRSA. The current headframe at the MacLellan site is visible while travelling along PR 391 to Lynn Lake (pers. comm. 2019d). Portions of the ore stockpile, overburden stockpile, and MRSA at the MacLellan site will also likely be visible from a high viewpoint along PR 391 (Appendix 15A).

Access roads restrictions implemented during the construction phase will continue during operation at the Gordon and MacLellan sites and along the existing Gordon and MacLellan access roads. Traffic control measures will be developed to address access accommodation plans and logistics during mine operation.

The residual effects, overall, for the Gordon and MacLellan sites are anticipated to be adverse, low magnitude (low to moderate for noise), medium-term in duration (long-term for visual), continuous in frequency, and reversible upon Project decommissioning/closure.

Decommissioning/Closure

During decommissioning/closure activities, no new interactions with designated lands, including those associated with access, are anticipated. Rehabilitation activities will be conducted to achieve desired end land uses for both the Gordon and MacLellan sites, except for the open pits which will remain permanently inaccessible. Closure activities will aim to promote the reestablishment of vegetation (i.e., to promote a natural appearance) and animal habitats on site. The site will be open to the public after final closure, although there will likely be some restrictions in place due to the remaining formed open pit lakes and reclaimed MRSAs (e.g., due to safety concerns). Recreational activities (e.g., snowmobiling) and resource uses, such as hunting and trapping, will be permitted to the extent feasible.

Summary

With the implementation of mitigation measures, residual effects from the Project on land use are anticipated to be of low magnitude. Noise levels at the Gordon and MacLellan sites are predicted to have low to moderate magnitude residual effects. Access to areas in the PDAs and LAA will be affected by construction activities and restrictions will extend to the operation period. The socio-economic context for residual effects includes a PDAs and LAA that have historically been affected by mining development (i.e., the Gordon site has been reclaimed and the MacLellan site has been under care and maintenance) and continues to experience disturbance from major transportation infrastructure (i.e., PR 391). The Project is not expected to affect protected areas under Manitoba's Protected Areas Initiative, First Nation land, TLE sites or other provincial Crown land permit/lease sites. Project effects on unoccupied Crown land and provincial land within the boundaries of Lynn Lake are expected to be short-term and irregular in frequency for the construction phase, medium-term (long-term for visual), and continuous in frequency occurring during operation, and reversible upon Project decommissioning/closure (with the exception of the permanent formed open pit lakes).

15.4.3 Assessment of Change in Recreation

The assessment of change in recreation considered how Project clearing, Project presence and site activities may affect the viability of, restrict access to, or cause loss of areas used for, recreation. The Project may lead to direct loss of, or loss of access to, recreation areas and may disrupt recreational enjoyment due to sensory disturbance (e.g., noise, visual aesthetics). Decommissioning/closure activities can also disrupt or intrude on recreation activities but may ultimately restore access.

15.4.3.1 Project Pathways

Gordon and MacLellan Sites

There is a variety of outdoor recreational land use and water-based activities in the LAA, and to a lesser extent within the PDAs, which can be affected by the Project. Recreational use (e.g., canoeing) could be affected adjacent to the MacLellan PDA and within the LAA. Informal recreational activities that could be affected includes recreational hiking, snowmobiling, cross-country skiing, ATV use, hunting, and fishing. Both the Gordon and MacLellan sites have been historically mined, and therefore current land use in the PDAs has been influenced by past mining activity.

Potential Project pathway effects on hunting and fishing are discussed in Section 15.4.4.

Construction

Project construction at the Gordon and MacLellan sites may reduce the available land base for various recreational activities. Clearing and construction activities, including the refurbishment of access to sites, can affect the use of lands for outdoor recreation through change in access to recreational areas within the PDAs. Access issues will be addressed through traffic control measures as well as community engagement (e.g., community youth programs). Recreational users in the LAA, including boaters, may also be affected by sensory disturbance (i.e., noise, visual) resulting from construction activities, including Project-related transportation within the LAA (i.e., movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA) potentially affecting the quality of the outdoor recreation experience. Population increase associated with the construction phase can increase competition for resources, which may also affect the quality of the outdoor recreation experience being sought by recreational users.

Project clearing and construction activities at the MacLellan site also includes a 34.5 kV distribution line that will be routed along the existing access road and former distribution line ROW to the site.

Effects related to noise are discussed in Section 15.4.2.

Navigation on non-scheduled navigable waterways where navigation is possible (e.g., canoe/kayak) is protected under the CNWA. Both the Keewatin River and Hughes River, part of a recreational canoe route, would be considered navigable within the LAA, as would Cockeram Lake and Hughes Lake.

Operation

Operation of the Project could also affect recreational use and visual aesthetic values through Project presence (e.g., recreational user's quality of experience due to operation activities at both sites) and restricted access to recreational use areas. However, operation at the Gordon and MacLellan sites will not result in additional ground disturbance.

During operation, noise emitted from the mine facility and mobile vehicles and equipment will result in a change in noise levels due to use of the existing road network from heavy truck traffic (i.e., haul trucks). Access issues will be addressed through traffic control measures.

The existing access road to the Gordon site includes a bridge crossing of a recreational canoe route. The MacLellan site and associated facilities are adjacent to the Keewatin River (i.e., approximately 53 m from the open pit and 720 m from the overburden stockpile), which is also part of a recreational canoe route. No local municipal recreational facilities will be affected by Project development at the Gordon or MacLellan sites.

There is potential for the distribution line ROW to the MacLellan site to be used as a recreational trail for ATVs and snowmobiles.

The presence of the stockpiles, overburden and mine rock and continued Project-related traffic have the potential to affect recreational use (e.g., canoeing/kayaking) through visual disturbance effects.

Decommissioning/Closure

During decommissioning/closure, mined lands at the Gordon and MacLellan sites will be restored and reincorporated into the land base. Rehabilitation will be undertaken to achieve desired end land uses. Within the PDAs, access restrictions will remain in place during decommissioning/closure. As well, sensory disturbance from rehabilitation activities to recreational land users are expected to continue throughout the active closure period of the decommissioning/closure phase.

15.4.3.2 Mitigation

Gordon and MacLellan Sites

The implementation of the mitigation measures will be the responsibility of Alamos and/or its contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection. Industry standard mitigation measures include the posting of warning signs, application of noise mitigation measures as described in Chapter 7 (i.e., use of exhaust mufflers, noise insulated panels at the work camp, reduced idling of heavy fleet vehicles), implementation of traffic control measures, and adherence to waterbody crossing conditions related to minor works on navigable waters.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Mitigation measures of potential Project effects on recreational land use at the Gordon and MacLellan sites include the following:

- Signage will be installed around the perimeter of the PDAs to alert local land and resource users of the presence of the Project and its facilities.
- Project lighting will be limited to that which is necessary for safe and efficient Project activities. Directional lighting will be used to limit the transmission of light outside of the PDAs. Portable lighting equipment will be positioned to limit visibility at nearby receptors, to the extent feasible.
- Noise mitigation measures will be selected and installed as described in Chapter 7 (Section 7.4.1.3)
- Workers will be prohibited from bringing firearms and fishing gear to the sites while working to limit competition for wildlife and fish species of value to resource users.
- Alamos will post warning signs on the access roads and power distribution line ROW to discourage unauthorized access and snowmobiling due to safety concerns.
- Alamos will implement traffic control measures, which may include gating approaches to Project access roads, placing large boulders and/or gated fencing to restrict public access to the PDAs.
- Alamos will engage local land and resource users (e.g., recreational harvesters) and the Town of Lynn Lake to address, to the extent possible, issues related to the removal and inaccessibility of lands and resources within the PDAs at the Project sites, including the restriction in use of the Gordon site access road, and with local boaters to address navigation issues as well as access and safety issues related to navigation along watercourses affected by the Project, including engagement regarding the need to provide marked portages to circumvent obstructions.
- Desired end land and resource uses will be considered in the preparation of the Closure Plan as part of Project rehabilitation. A Conceptual Closure Plan has been prepared to support the EIS and is provided in Appendix 23B.

Transport Canada CNWA approvals will be required for the construction of permanent non-scheduled waterbody crossings and/or other in-water structures. Where applicable, provisions of the Minor Works Order for classes of work related to Aerial Cables and Outfalls and Water Intakes will be adhered to. Alamos will submit the locations of the water crossings and works to Transport Canada for review related to effects on navigation. Conditions specified in a permit and other directives will apply to the work.

Mitigation measures identified in other VCs will also reduce the potential effects on a change in recreation (Chapters 6; 7; 10; and 12).

15.4.3.3 Project Residual Effects

Gordon and MacLellan Sites

Construction

Residual effects related to hunting and fishing are discussed in Section 15.4.4.

Both sites are surrounded by vegetated land, forest cover, scattered lakes, and watercourses. Participation in outdoor activities in the surrounding area is anticipated from both residents and visitors to the region. Adverse changes in the access to and availability of recreational areas are expected during Project construction. Direct residual effects will primarily occur in the PDAs (i.e., 269 ha [Gordon site] and 938 ha [MacLellan site]), where access will be restricted, resulting in a shift of recreational users to other areas of the LAA (i.e., 20,678 ha). For safety and security reasons, informal recreational activities will be restricted near construction activities. Access restrictions will be put in place for the period of construction. Traffic control measures will be developed to address access accommodation plans and logistics and lessen effects during construction. Signage and/or fencing will be installed around Project facilities to protect public safety, and the local community will be informed of the location and timing of construction activities. Indirect effects associated with the restriction of access along the Gordon site access road could occur within the LAA to recreational users who have previously used the access road for the last 10+ years to quickly and easily get to other lakes outside of the LAA (e.g., Ellystan, Nickel, White Owl, and Barrington lakes).

Project construction is predicted to result in changes to the outdoor recreational experience in the LAA. Sensory and visual disturbance from physical works and activities may affect nearby user's quality of experience. The areas surrounding the Town are used for sport fishing, hunting, boating, swimming, camping, cross-country skiing and snowmobiling activities. Local recreational opportunities may be adversely affected. Sensory and visual disturbances will be reduced through the implementation of mitigation to reduce noise and light emissions where feasible. The lands within the PDAs are not considered "prime" recreational land, given that they are former mine sites. There are also alternative lands within the LAA available for recreational use. The continued use of the Keewatin River as a recreational canoe route is not expected to be affected by the Project. Residual effects to recreational water use such as canoeing will be reduced through the engagement of local boaters to seek to address access and safety issues related to navigation along watercourses affected by the Project.

A mitigation noise level target from pile-driving activities at the Keewatin River bridge at the MacLellan site was used for noise effects related to short-term construction activities (i.e., 47 dBA). The predicted sound levels at all receptors were below this, including recreation lots, park vacation homes, and remote cabins. Low frequency noise effects are not expected at receptors because the predicted sound levels are below the Health Canada targets (Chapter 7).

The route for the 34.5 kV distribution line will follow a ROW off PR 391 and cross the Keewatin River to the MacLellan site. Informal snowmobile usage along PR 391 is likely in the winter and recreational use along the Keewatin River during the summer is possible given its use as recreational canoe route. These recreational activities may be disturbed by nuisance effects (i.e., noise) during construction, but this disruption is expected to be short-term and irregular in frequency.

The Keewatin River and Hughes River within the PDAs could be considered non-scheduled navigable waters where navigation is possible (e.g., canoe/kayak). Transport Canada Navigation Protection notifications and/or approvals may be required for the construction of permanent waterbody crossings and/or other in-water structures, particularly at the MacLellan site for the access road bridge and distribution line crossing, and the water intake and effluent discharge pipes. Alamos will obtain these approvals, as required.

The presence of construction workers is predicted to result in increased demand for outdoor recreation within the LAA, therefore affecting the quality of the outdoor recreation experience. The work schedules for Project construction workers (who will be subject to long workhours and fly-in/fly-out employment) will deter them from hunting and fishing locally outside of working hours. Construction workers will also be prohibited from bringing firearms or fishing gear while working at the sites to limit competition for wildlife and fish species of value to land and resource users.

Overall, the residual effects on recreation from construction activities are expected to be adverse, low in magnitude (low to moderate for noise), limited to the PDAs and LAA, short-term in duration, irregular in frequency, and reversible upon Project decommissioning/closure.

Operation

Residual effects described for the construction phase will continue throughout operation. No new areas of ground disturbance are anticipated during operation at the sites other than pit expansion. Provision of new snowmobile access along the cleared distribution line ROW is possible as a result of the ease of access created. Alamos will not promote the use of the distribution line ROW for this purpose due to safety concerns.

The noise assessment results indicate that nighttime equivalent sound levels from the Project will be below 40 dBA for receptors, including remote cabins, park vacation homes, and recreation lots (Chapter 7). As such, no noise-related sleep disturbances at these receptors are predicted from operation during the daytime or nighttime.

Access roads restrictions implemented during the construction phase will continue during operation at the Gordon and MacLellan sites and along the existing Gordon and MacLellan access roads. Traffic control measures will be developed to address access accommodation plans and logistics during mine operation.

The continued use of the existing renewed access road to the Gordon site during operation crosses a designated canoe route. Potential interactions during Project operation activities relate to ongoing noise associated with truck usage along the access road at the crossing. Project residual effects on recreation are predicted to be of low magnitude, limited to the PDAs and LAA, and long-term in duration (i.e., from reclamation of stockpiles).

The restriction in use of the Gordon site access road is potentially adverse indirect effect to recreational users in the LAA who have used this road to access other lakes outside of the LAA. The effects are expected to be medium-term in duration.

The presence of the ore stockpile, overburden stockpile, and MRSA and the view of the existing headframe at the MacLellan site could result in some visual disturbance to recreational users (e.g., canoeing/kayaking) and those travelling along PR 391. However, based on modelled analyses (Appendix 15A), mine infrastructure and stockpile/storage areas at the MacLellan site will hardly be visible. Visual disturbance will be limited to the surrounding environments at the crossing of the Hughes River at the existing Gordon access road. The Gordon site will be visible from Black Sturgeon Reserve, but just barely, and likely visible from the north portion of Hughes Lake (Appendix 15A).

Worker presence could also result in increased demand for outdoor recreation within the LAA, therefore affecting the quality of the outdoor recreation experience. The work schedules for Project operation workers (12 hours per day, seven days per week) will deter them from hunting and fishing locally outside of working hours. Workers will also be prohibited from bringing firearms or fishing gear to the site during working hours to limit competition for wildlife and fish species of value to land and resource users.

The residual effects, overall, for recreation during operation are expected to be low in magnitude, limited to the PDAs and LAA, medium- to long-term in duration, continuous in frequency, and reversible upon Project decommissioning/closure.

Decommissioning/Closure

Following the operation phase, the sites will be restored to a condition that will provide opportunities for other land uses, such as recreational uses. The open pits/formed pit lakes themselves will remain permanently inaccessible. A final Closure Plan will be developed and implemented to re-establish a land use that is of value for wildlife and/or humans (Chapter 23, Section 23.5.20). Decommissioning/closure activities may cause disruption (e.g., through sensory and/or nuisance effects) but may ultimately restore access for recreational activities. It is the intent that closure activities will promote the reestablishment of vegetation (i.e., a natural appearance) and animal habitats on site. The site will be open to the public after final closure, although there will likely be some restrictions in place due to the remaining pits and rock piles (e.g., due to safety concerns). Recreational activities (e.g., snowmobiling) will be permitted to the extent feasible.

Summary

With the implementation of mitigation measures, residual effects from the Project on recreation are anticipated to be low in magnitude for each Project phase. Noise levels at the Gordon and MacLellan sites are predicted to have low to moderate magnitude residual effects. Because there are numerous recreational opportunities available across the landscape, it is predicted that recreational activities will be able to continue at or near current levels. Access to recreational areas will be restricted directly in the PDAs (269 ha at the Gordon site and 938 ha at the MacLellan site); however, the PDAs are not considered to provide "prime" recreation areas given past mine use, and alternative recreational areas are available throughout the LAA (20,678 ha). Indirect effects extend to recreational users of lakes located outside of the LAA through the restriction of access along the Gordon site access road. Seasonal aspects are considered in the context of recreational activities, including canoeing, since many recreational activities are seasonal. The socio-economic context for residual effects includes the LAA encompassing an area that has been previously disturbed by mining (i.e., the Gordon site has been reclaimed and the MacLellan site has been under care and maintenance). Residual effects are expected to be short- to medium- to long-term, irregular to continuous (occurring throughout the life of the Project), and reversible following Project decommissioning/ closure (with the exception of permanent open pits) because closure activities will include consideration of desired end uses such as recreation.

15.4.4 Assessment of Change in Resource Use

The assessment of change in resource use considered how Project clearing and Project presence and site activities at Gordon and MacLellan sites may affect the viability of, restrict access to, or result in a direct loss of, resources. Project construction and operation can lead to direct loss of, or access to, local resource use areas (e.g., clearing associated with the PDAs), as well as disruption to resource activities. Disturbance effects on resource use considers the reduction in wildlife harvesting success as result of sensory disturbance (e.g., noise, visual), increased pressure on the resource (e.g., hunting, trapping and fishing), and direct effects on those wildlife species used (as assessed by Chapters 11 and 12). There is the potential to affect productive forest land (through the reduction of AAC). The Project will not result in changes to high value forest sites. Decommissioning/closure activities can also disrupt or intrude on local resource use activities (during active closure).

15.4.4.1 Project Pathways

Gordon and MacLellan Sites

Construction

Construction activity and access in the area, including Project-related transportation within the LAA (i.e., movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA) can provide sensory disturbance (e.g., noise, visual) to harvesting activities and affect the presence of wildlife species. This could result in the reduction of harvesting success due to disruption of wildlife. This could also lead to greater pressure on game resources as a result. The presence of construction workers could increase the competition for species harvested by local hunters, fishers, and trappers. The Project could also create undesired access to these resources, which could affect the resource or the experience of hunters, fishers and trappers using an area.

Changes to fish habitat, and thus the availability of fish resources, may occur as a result of the placement of materials or structures in water during construction. This could involve the placement of new road crossing structures at both sites, new water intake and water outfall structures at both sites, and the realignment of a diversion channel at the Gordon site. Changes to fish habitat may also occur as a result of the potential changes in water levels in Gordon and Farley lakes due to the depression of the groundwater table and loss of surface water due to development of the open pit during construction (Chapters 8, 9, and 10).

The clearing of a ROW and construction of a distribution line along the existing access road to the MacLellan site has the potential to adversely affect hunting, outfitting, fishing and trapping from temporary nuisances (e.g., noise and traffic) and activity-related disturbances as noted above. The creation of an access trail along the cleared ROW could result in an increase in hunter or trapper access. An increase in access may be viewed as either a benefit to some resource users or a hindrance by creating undesired access to big game animals or furbearers. Increased access along the ROW during construction could lead to incidents of vandalism with respect to, for example, hunting stations or trapping equipment. Access issues will be addressed through traffic control measures.

Land clearing for the PDAs will remove a small portion of timber from the commercial forest area for the life of the Project in FMUs 71 and 72. The removal of productive forest land from the commercial forest area could affect the determination of AAC levels. The loss of productive forest land resulting from the Project will contribute to the reduction in AAC.

Operation

As with construction, potential project pathways for affecting hunting, outfitting and trapping are direct disturbance of hunting, outfitting and trapping activities due to Project-related noise and activities, use of the existing road network by heavy truck traffic, and potential for reduction in harvesting success and greater competition for wildlife resources from worker presence. Access issues will be addressed through traffic control measures.

Disturbance effects on hunting, outfitting, and trapping related to access will be similar to those identified for Project construction. Sensory disturbance (e.g., noise, visual) from access to the area and use of the road network (e.g., heavy truck traffic) can affect the presence of wildlife. This could result in the reduction of harvesting success due to disruption of animals and furbearers, which could lead to greater pressure on game resources. Worker presence could increase the competition for species harvested by local hunters and trappers. The Project could also create additional access to these resources, which could affect the resource or the experience of hunters and trappers using a particular area. The stockpiles of ore, overburden and mine rock at the Gordon and MacLellan sites could be visible to resource users operating in the area.

The power distribution line ROW to the MacLellan site can also result in additional access to resources during operation, potentially resulting in an increase in hunting and trapping pressure, which could affect the resources or experience of the resource users. The ROW may provide increased hunting opportunities in designated hunting areas, resulting in a benefit to hunting activity. Trappers may benefit from being able to travel along the new ROW to set new traps thereby accessing previously unexploited areas and wildlife. The existence of the distribution line ROW and resultant increase in access could result in incidents of vandalism (e.g., equipment or stations) or affect a resource user's quality of experience on the land.

Potential project pathways for affecting fishing during operation are similar to those identified for Project construction related to access. Project presence and use of the access road and PR 391 from the Gordon site to the MacLellan site has the potential to disturb sport fishing activities.

Changes to fish and fish habitat as noted for Project construction for both the Gordon and MacLellan sites will continue during operation (Chapter 10).

Decommissioning/Closure

Rehabilitation activities at the sites will result in sensory disturbance (e.g., noise, visual) to resource users engaged in hunting and trapping and fishing activities, which will continue throughout the decommissioning/ closure phase. The presence of workers could result in an increase in competition for species harvested by hunters and trappers and anglers.

Changes to fish habitat may occur as a result of the potential changes in water levels in Gordon and Farley lakes due to the diversion of contact water to fill the open pits during decommissioning/closure activities. This could potentially affect fish and fish habitat in Gordon and Farley lakes by reducing the quantity and quality of habitat (Chapter 10).

During decommissioning/closure activities, access to some areas within the PDAs will be restricted; however, rehabilitation activities will allow for natural reforestation of affected lands. Once reclamation activities are complete, the area lost will be restored within the PDAs and will be reincorporated into the land base as part of ongoing maintenance at the Gordon and MacLellan sites, including reincorporation of reforested lands into the FMUs for the determination of AAC levels.

15.4.4.2 Mitigation

Gordon and MacLellan Sites

The implementation of the mitigation measures will be the responsibility of Alamos and/or its contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection. Industry standard mitigation measures include the use of existing access roads and trails, implementation of traffic control measures, the removal of timber in accordance with *The Forest Act* (Manitoba), and the salvage of merchantable timber.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Mitigation measures to reduce potential Project effects on resource use for the Gordon and MacLellan sites include:

- The Project footprint will be limited to the extent possible (i.e., PDAs) including site clearing and disturbance associated access routes and distribution line ROW.
- Existing access roads and trails will be used to the extent possible; renewed access routes will be developed in compliance with provisions of *The Mines and Minerals Act* (in the case of the Gordon site).
- Signage will be installed around the PDAs to alert local resource users of the presence of Project facilities and activities.
- Alamos will implement traffic control measures which may include gating approaches to Project access roads, placing large boulders and/or gated fencing to restrict public access to the PDAs.
- Work schedules will be implemented for Project construction workers (subject to fly-in/fly-out employment) to deter workers from hunting locally outside of working hours during a shift.
- Workers will be prohibited from bringing firearms and fishing gear to the sites while working to limit competition for wildlife and fish species of value to resource users.
- Alamos will communicate the schedule of Project activities throughout the construction, operation, and decommissioning/closure phases to potentially affected local resource users and MCC Regional Officials.
- Alamos will engage with local resource users (hunters, outfitters, trappers, anglers) and MCC Regional Officials to address to the extent possible the potential conflict, disturbance, or access restrictions to hunting, trapping, and fishing areas in the PDAs, and availability of wildlife and fish resources.
- Timber removal will be completed in accordance with *The Forest Act* (Manitoba).
- Merchantable timber may be salvaged and used, if feasible, to enhance carbon storage, or it will be made available to local communities for fuelwood.
- Construction and operation activities will be restricted to the PDAs, as much as possible, to reduce disturbances to adjacent productive forest land.

Loss of provincial Crown forest land from Project clearing will require compensation, due to the Crown, to be paid by Alamos for Project effects on provincial Crown forest as specified in the forest damage appraisal and valuation (FDAV) policy. The estimated compensation payable to MCC under the FDAV is summarized in Table 15-8.

Table 15-8 Provincial Crown Land Forest Damage Appraisal and Valuation Summary – Gordon and MacLellan Sites

Softwood (m^3)	Hardwood (m^3)	Provincial Crown Charges	Total All (m^3)	Total ($)
Gordon Site (PDA)				
10.3	0.2	Crown Dues, Forest Production Charge, Forest Renewal Charge	10.5	**$79.38**[1]
MacLellan Site (PDA)				
8,713.3	348.1	Crown Dues, Forest Production Charge, Forest Renewal Charge	9,061.4	**$67,673.46**[1]

Source: Manitoba Conservation and Climate, Forestry and Peatlands Management Branch 2019.

[1] This evaluation is an estimate only and recalculations may be required by MCC after the construction phase to ensure timber dues and the PDAs are accurately reflected in the results.

Crown Dues - $1.75 m^3; Forest Renewal Charge - softwood $5.75 m^3, hardwood $0.50 m^3; Forest Protection Charge - $0.17/$m^3$. Considers merchantable volume using Stock Stand Volumes (pers. comm. 2019i).

Total compensation payable to the Crown for timber removal from the Gordon and MacLellan sites is estimated to be approximately $67,753. Alamos will work with MCC to finalize the required compensation payable to MCC under the FDAV, for removal of provincial Crown forest timber at the Gordon and MacLellan sites.

15.4.4.3 Project Residual Effects

Gordon and MacLellan Sites

Construction

Project clearing and construction activities will lead to a loss of area for resource harvesting in the PDAs. The loss of area will vary for hunters, outfitters, and affected trapline holders. Much of the area lost will be off-limits until Project decommissioning/closure, except for the open pits and TMF, which will remain permanently inaccessible. Table 15-9 lists the trapline and outfitter allocation areas by PDAs, LAA and RAA.

Project construction may result in temporary sensory disturbance (e.g., construction noise, visual) and nuisance effects (e.g., traffic) displacing big game or furbearers and reducing harvesting success rates in the LAA. The creation of new access trails, renewed access roads and use of the existing road network (e.g., heavy truck traffic) could also affect the experience quality for hunters/outfitters and trappers using a particular area. Access restrictions will be in place for the period of construction. Traffic control measures will be developed to address access accommodation plans and logistics and lessen effects during construction.

Table 15-9 Total and Relative Trapline and Allocation Areas by PDAs, LAA and RAA

Resource Area	Percentage PDA of Trapline or Allocation Area (%)	Percentage of Total PDA (%)	PDA Area (ha)	Percentage of LAA (%)	Area in LAA (ha)
Pukatawagan Trapline 36	2.1	66.9	808	46.5	9,613
Pukatawagan Trapline YTC	0.1	1.7	21	8.5	1,764
Pukatawagan Trapline 35	0	0	0	7.3	1,515
Pukatawagan Trapline 32	0.4	22.3	269	33.3	6,896
Pukatawagan Trapline 30	0.2	108.9	109	3.1	639
Black Bear Allocation Area*	0.7^	100	938**	62	12,717
Note: *Grey Owl Outfitters Inc.; ** MacLellan site PDA only; ^ of RAA					

The MacLellan site is located within one black bear outfitter allocation area, held by Grey Owl Outfitters Inc. A bear bait station established by this outfitter is within the MacLellan PDA. There is potential for further disturbance to bears and hunting during construction activities. This would only occur during the period when bait stations are active (i.e., April 24 to June 30 and August 28 to November 1 [MSD 2017b]). During construction, Project-related noise has the potential to disturb wildlife resources of interest to outfitters in the LAA as a result of habitat avoidance and/or a change in habitat use around the site (Chapter 12). The operator of the bait station has indicated that exploration activity at the MacLellan site has already caused disturbance to bear and has been enough to push bears away for the site (pers. comm. 2019d).

The remoteness and quality of the guide outfitting experience, which are valued by clientele, may be affected by construction activities and the presence of construction workers in the PDAs and LAA. Project activities could therefore result in a decrease in interest in guide outfitting services in a certain area, particularly if undisturbed or undeveloped areas are available elsewhere. However, the Project is in two areas of historical mining activity that have already been developed with buildings and infrastructure in-place under post-operation care and maintenance (i.e., the MacLellan site) or has been rehabilitated (i.e., the Gordon site). Commercial operators therefore have for some years been operating within an existing disturbed and/or developed socio-economic context. The residual effects on outfitting operations during construction in the PDAs will be low magnitude (given the small number of outfitters affected), irregular in frequency, and short-term in duration.

The Gordon and MacLellan sites are within the Pukatawagan Registered Trapline Section, traplines 30, 32, 36, and YTC (community youth trapline). Clearing and construction activities may temporarily displace furbearers from areas in proximity to the PDAs due to sensory disturbance (e.g., noise), and therefore disrupt trapping activity. During construction, potential disturbance effects on trapping activity in the LAA will be similar to that for outfitters, including changes to the availability of wildlife resources of interest to trappers, due to wildlife disturbance and mortality risk (Chapter 12). Positive effects could occur for some harvesters as a result of improved access to resource or trapping areas. Because the PDAs will only overlap a small proportion of four trapline areas, anticipated effects are considered to be low.

Project clearing and construction activities may result in temporary sensory disturbance effects (e.g., construction noise, visible project components) related to availability of resources of interest to sport fishers angling in the LAA. The restriction of access to resources could also affect sport fishers using a waterbody. Indirect effects associated with the restriction of access along the Gordon site access road could occur within the LAA. This would apply to recreational users who have previously used the access road for the last 10 or more years to get to other lakes outside of the LAA quickly and easily (e.g., Ellystan Lake, Nickel Lake, White Owl Lake, and Barrington Lake. Accessing Simpson and Swede lakes from the Gordon site access road in the LAA will become more difficult. The residual effects are low magnitude, irregular in frequency, and short-term in duration.

Analysis of the noise assessment results indicate that the predicted sound level of short-term construction activities (e.g., pile-driving at the Keewatin River bridge) will be below the mitigation noise level target of 47 dBA for receptors, including a trapper cabin, trapping areas and fishing camps. Low frequency noise effects are not expected at receptors because the predicted sound levels are below the Health Canada target (Chapter 7).

There are currently no commercially fished waterbodies within the PDAs or LAA. There are several waterbodies within the LAA (or adjacent) that are sport fished or have sport fish species, including: Minton Lake, Keewatin River, Lynn River, Cockeram Lake, Cartwright Lake, Hughes Lake, Hughes River, Simpson Lake, and Swede Lake. Existing access to Keewatin River, Lynn River, Cockeram Lake and Hughes Lake off PR 391 will not be affected by the Project. Accessing both Simpson and Swede lakes along the existing access road to the Gordon site will be interrupted during construction. However, there is alternative access to these lakes through existing trails and old winter roads that can be utilized. The residual effect is of low magnitude, limited to the LAA, short-term in duration, irregular in frequency, and reversible upon Project decommissioning/closure.

The presence of a construction workforce could lead to increased competition for fish resources that are of interest to sport fishers in the LAA. However, workers will be prohibited from bringing fishing gear to the sites to limit competition for fish species of value to resource users. The residual effect is expected to be low magnitude given the number of sport fishing lakes affected.

Fish habitat will be lost in the East and Wendy pits at Gordon; however, neither pit supports any fish species that are part of a commercial, recreational, Aboriginal (CRA) fishery (e.g., northern pike, yellow perch, lake whitefish) and neither pit is hydraulically connected to Gordon or Farley lakes. As such, the loss of habitat in the pits does not mean “serious harm to fish” under the *Fisheries Act* (Chapter 10). However, East Pond at MacLellan contributes fish that support CRA fisheries in the Keewatin River and the loss of East Pond is considered “serious harm to fish” (Chapter 10). These habitats, particularly the Keewatin River, are important for CRA fish species (Chapter 10). Offsets under Alamos’ Fisheries Offsetting Plan have been identified under its application for a *Fisheries Act* Authorization for this loss. Changes in flow in the Keewatin River are unlikely to have any measurable effect on fish habitat for CRA fish species (Chapter 10).

The construction phase of the Project will affect 122.6 ha and 498.9 ha of productive provincial Crown forest land at the Gordon and MacLellan sites, representing 0.1% and 0.3% of the total productive forest land in FMUs 72 and 71, respectively. The Project will result in a decline in net merchantable timber in the RAA and LAA of 0.2% and 8.9% respectively. The Project also represents a theoretical reduction of 0.06% of the net merchantable AAC in FMUs 72 and 71 combined.

Given that the Project will only result in a reduction of 0.06% of the net merchantable AAC in FMUs 72 and 71, the effect on the AAC is considered to be of low magnitude. The adverse effect on AAC will be a single medium-term event because the affected productive forest land will remain deforested for the duration of the Project. The reduction of AAC levels will only affect timber harvesting opportunities if, and when, timber utilization in FMUs 72 and 71 approaches full utilization of the AAC.

Overall, the residual effects on resource use from construction are expected to be adverse, low in magnitude (low to moderate for noise), limited to the PDAs and LAA, short-term in duration, irregular in frequency, and reversible upon Project decommissioning/closure.

Operation

During Project operation, the loss of harvesting areas, disturbance effects (e.g., noise, visual), access restrictions and the reduction in AAC implemented during the construction phase and use of the existing road network will continue as a result of the presence of the Project and resultant heavy truck traffic. Traffic control measures will be developed to address access accommodation plans and logistics during mine operation.

Commercial hunters/outfitters and trappers may experience residual adverse effects related to the availability of big game and furbearers of interest in the LAA (e.g., effects from habitat avoidance due to disturbance and wildlife mortality risk; Chapter 12), and sensory disturbance to land and resource users related to Project presence, heavy truck traffic, and worker presence. A potential residual effect will be the ongoing mine operation at the MacLellan site. The outfitter operator encompassing the MacLellan PDA has indicated that mineral exploration activity has been enough to cause disturbance to bears in the area and has pushed bears away from a bait station site. It is expected that this bait station will not be used for the life of the Project (pers. comm. 2019d). The residual effects are characterized as low in magnitude, given the small number of hunters, outfitters and trappers affected in the LAA, medium-term in duration, continuous over the life of the Project, and reversible upon Project decommissioning/closure.

The noise assessment results indicate that nighttime equivalent sound levels from the Project will be below 40 dBA for receptors, including a trapper cabin, trapping areas and fishing camps. No noise-related sleep disturbances at these receptors are predicted from operation during the daytime or nighttime (Chapter 7).

Visual effects from the presence of the ore stockpiles, overburden and mine rock areas could be an issue to resource users operating and travelling in the area. Portions of the ore stockpile, overburden stockpile, and mine rock storage area at the MacLellan site will be visually apparent and could result in a visual disturbance to some resource users of the Keewatin River and those travelling along PR 391. The extent of visual disturbance to the Gordon site will be limited to the surrounding environments at the crossing of the Hughes River at the existing Gordon access road. Based on modelled analyses, components of the Gordon and MacLellan sites may be marginally visible from certain vantage points (Appendix 15A).

During operation, disturbance to sport fisheries initiated during construction will continue. The restriction in use of the Gordon site access road is potentially adverse indirect effect to resource users in the LAA who have used this road to access other lakes inside (e.g., Simpson and Swede lakes) and outside (White Owl and Barrington lakes) of the LAA. The residual effects are expected to be medium-term in duration as there are alternative routes to access these areas, but just not as easy to use.

Potential residual effects to fish and fish habitat at the Gordon site in Farley Creek will continue for operation (Chapter 10). For the MacLellan site, potential effects due to changes in flow in the Keewatin River are not expected to alter the ability of fish to use the Keewatin River (Chapter 10). Potential effects from changes in water levels at Gordon and Farley lakes and Minton Lake will also continue for both sites, but any changes to these lakes are expected to be within the range of natural variability. The loss of East Pond will not have a measurable effect on CRA fish population in the Keewatin River. Losses of fish habitat that cannot be avoided (i.e., East Pond) will be addressed through the implementation of Alamos' Fisheries Offsetting Plan (Chapter 10).

Overall, the residual effects on resource use during operation are expected to be low in magnitude (low to moderate for noise), limited to the PDAs and LAA, medium-term in duration (long-term for visual), continuous in frequency, and reversible upon Project decommissioning/closure.

Decommissioning/Closure

During Project decommissioning/closure, no new residual effects on areas or access for hunting, outfitting, and trapping are expected. Decommissioning/closure activities will require a small workforce, less than during operation, resulting in less pressure on resources. Project decommissioning/closure can result in disturbance effects on hunters, outfitters, and trappers related to the availability of big game and furbearers of interest in the LAA, and sensory disturbance to land and resource users.

Depending on the end use of the sites, once rehabilitation and closure activities are completed, some areas may become accessible again for commercial harvest activities (e.g., hunting/outfitting and trapping), except for such permanent mine components as the open pit areas (formed pit lakes). The rehabilitated PDAs will likely have a mixture of accessible and inaccessible areas and hence be similar in nature to existing conditions on site. During Project decommissioning/closure, no new residual effects on waterbodies fished for sport are expected. As with operation, the residual effect during Project decommissioning/closure is characterized as being negligible given the very low number of affected sport fisheries.

Potential residual effects identified during operation to fish and fish habitat at the Gordon site in Farley Creek will continue through decommissioning/closure (Chapter 10). Changes in water levels in Gordon and Farley lakes are expected to be within the range of natural variability. For the MacLellan site, the potential effects from changes in flow affecting the ability of fish to use the Keewatin River and changes in lake levels affecting fish and fish habitat will also extend through the decommissioning/closure phase. Flows in the Keewatin River are expected to return to near baseline conditions at the conclusion of closure and lake levels are expected to be within the range of natural variability (Chapter 10).

Decommissioning/closure will allow for site rehabilitation and reforestation. Decommissioning/closure and the resultant reforestation will have a low magnitude effect on productive forest land and AAC levels within the PDAs and FMUs 71 and 72. The Project effects are reversible because compensation provided through the FDAV (Section 15.4.4.2, Tables 15-9 and 15-10) provides funds for reforestation activities to take place once the Project is decommissioned.

Project decommissioning/closure will occur 6 years after the end of construction for the Gordon site and 13 years after construction for the MacLellan site. Most of the PDAs will be rehabilitated and the land base at the end of decommissioning/closure activities will be returned to approximately pre-development topography after stockpiled material is removed. MRSAs will remain and be covered (revegetated; Appendix 23B). No further residual effect is anticipated.

Summary

With the implementation of mitigation measures, residual effects from the Project on resource use (i.e., hunting, outfitting, trapping, forestry, and fishing) are anticipated to be low in magnitude. Noise levels at the Gordon and MacLellan sites are predicted to have low to moderate magnitude residual effects. Physical Project disturbance on outfitting represents approximately 0.8% of the total area for outfitting in the RAA (i.e., bear allocation area) and an overlap of trapping activities ranging from 0.2% to 5.8% of the total area of registered trapping in the RAA and LAA. Loss of productive provincial Crown forest land in FMUs 72 (0.1%) and 71 (0.3%) and the theoretical reduction in the net merchantable AAC (0.06%) are low in relation to the total commercial forest area and total available AAC in the RAA. The related change in the affected land base represents a small area. Because there are numerous opportunities to hunt, trap and fish outside of the PDAs, it is predicted that hunting, outfitting, trapping, and fishing activities will be able to continue at or near current levels. There are no waterbodies that are commercially fished within the PDAs. Potential changes to fish habitat, and thus the availability of fish resources, are not expected to cause measurable reductions in the productivity of focal fish populations in the Gordon and MacLellan LAA (Chapter 10).

The restriction in use of the Gordon site access road will potentially result in an adverse indirect effect to resource users in the LAA who have used this road to access other lakes inside (e.g., Simpson and Swede lakes) and outside (e.g., White Owl and Barrington lakes) the LAA. There are several waterbodies within the LAA (or adjacent to it) that are sport fished or have sport fish species: Minton Lake, Keewatin River, Lynn River, Cockeram Lake, Cartwright Lake, Hughes Lake, Hughes River, Simpson Lake, and Swede Lake. Existing access to Keewatin River, Lynn River, Cockeram Lake and Hughes Lake off PR 391 will not be affected by the Project. Accessing both Simpson and Swede lakes and other points east of the Gordon site will be made more difficult during operation. Even with the restriction and difficulty in access, there will be other opportunities to sport fish across the land base and fishing activities should be able to continue at or near current levels.

Seasonal aspects are unlikely to alter residual environmental effects on resource use as the effects will be the same regardless of the season, occurring year-round. The socio-economic context for residual effects includes the Project encompassing an area that has been previously disturbed by mining (i.e., the Gordon site has been reclaimed and the MacLellan site has been under care and maintenance). Residual effects related to hunting, outfitting, trapping, and sport fishing will be short-term (for construction noise) to medium-term (for sensory disturbance) and long-term for visual, irregular to continuous in frequency, and reversible following Project decommissioning/closure (with the exception of permanent open pits [formed pit lakes]). The adverse effect on AAC will be a single, medium-term, event because the affected productive forest land will remain deforested for the duration of the Project. The Project effects are considered reversible upon decommissioning/closure given compensation provided through the FDAV for reforestation activities.

15.4.5 Summary of Project Residual Environmental Effects on Land and Resource Use

A summary of residual environmental effects that are likely to occur on land and resource use, including recreation, as a result of the Project is provided in Table 15-10.

The residual effect on land use will be low in magnitude (low to moderate for noise) for each Project phase. The Project is not expected to affect protected areas under Manitoba's Protected Areas Initiative, First Nation lands, TLE sites or provincial Crown land permit and lease sites. The residual effect is limited to the PDAs and LAA, short- to medium-term in duration, irregular to continuous in frequency, and reversible upon Project decommissioning/closure (with the exception of the permanent open pits).

The residual effects from the Project on recreation are anticipated to be low in magnitude (low to moderate for noise) for each Project phase. Seasonal aspects with respect to recreation activities, including recreational canoeing, were considered because recreational activities are affected by timing. Residual effects are expected to be medium- to long-term, irregular to continuous (occurring throughout the life of the Project) and are reversible following Project decommissioning/closure (except for the permanent open pits [formed pit lakes]).

Table 15-10 Project Residual Effects on Land and Resource Use

Residual Effect	Residual Effects Characterization								
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-Economic Context
Gordon Site									
Change in Land Use	C/O/D	A	L-M	PDA/LAA	ST-LT	N/A	IR/C	R/IR	D
Change in Recreation	C/O/D	A	L-M	PDA/LAA	ST-LT	A	IR/C	R/IR	D
Change in Resource Use	C/O/D	A	L	PDA/LAA	ST-LT	N/A	S/IR/C	R/IR	D
MacLellan Site									
Change in Land Use	C/O/D	A	L-M	PDA/LAA	ST-LT	N/A	IR/C	R/IR	D
Change in Recreation	C/O/D	A	L-M	PDA/LAA	ST-LT	A	IR/C	R/IR	D

Table 15-10 Project Residual Effects on Land and Resource Use

Residual Effect	Residual Effects Characterization								
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-Economic Context
Change in Resource Use	C/O/D	A	L	PDA/LAA	ST-LT	N/A	S/IR/C	R/IR	D

KEY
See Table 15-2 for detailed definitions

Project Phase
C: Construction
O: Operation
D: Decommissioning

Direction:
P: Positive
A: Adverse

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term

N/A: Not applicable

Timing:
N/A: Not Applicable
A: Applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

The residual effect on resource use will be low in magnitude (low to moderate for noise) for each Project phase:

- Loss of productive provincial Crown forest land and the reduction in the AAC are both small in relation to the total commercial forest area and total available AAC. The adverse effect on AAC will be a single medium-term event because the affected productive forest land will remain deforested for the duration of the Project. The Project effects are considered reversible upon decommissioning/closure.
- The related change in the affected land base represents a small area in relation to numerous other areas in which hunting, outfitting, and trapping activities can occur in the RAA. Indirect effects on resource users in LAA will be adverse related to the restriction in use of the Gordon site access road by those who have previously used the road to access other lakes inside (e.g., Simpson and Swede lakes) and outside (e.g., White Owl and Barrington lakes) the LAA. There are currently no commercially fished waterbodies within the LAA; six waterbodies within the Project LAA, including Keewatin River, Lynn River, Cockeram Lake, Hughes Lake, Simpson Lake, and Swede Lake, are sport fished or have sport fish species. Residual effects will be short-term (for the construction phase) to medium-term (during operation), irregular to continuous (throughout the life of the Project) and reversible following Project decommissioning/closure (with the exception of the permanent open pits).

The socio-economic context in which residual effects from the Project have been assessed is one where land and resource uses are able to accommodate some change in land use and where activities are able to continue at or near current levels. The context includes a local environment (PDAs and LAA) that has been disturbed by mining development (i.e., the Gordon site has been reclaimed and the MacLellan site has been under care and maintenance) and continues to experience disturbance from major transportation infrastructure (i.e., PR 391).

15.5 ASSESSMENT OF CUMULATIVE ENVIRONMENTAL EFFECTS ON LAND AND RESOURCE USE

The Project residual effects described in Section 15.4 are likely to interact cumulatively with residual environmental effects from other physical activities (past, present, and reasonably foreseeable).

The effects of past and current projects relative to conditions prior to historical mining activities contribute to baseline conditions upon which Project effects are assessed. Conditions prior to historical mining activities are generally considered to be similar to currently undisturbed and undeveloped areas of the RAA.

The resulting cumulative environmental effects (future scenario with the Project) are assessed. Cumulative environmental effects (the future scenario without the Project) are also described. This is followed by an analysis of the Project contribution to cumulative effects. Future projects and activities that are reasonably foreseeable are defined as those that (a) have been publicly announced with a defined project execution period and with sufficient project details that allow for a meaningful assessment, (b) are currently undergoing an environmental assessment or (c) are in a permitting process.

The assessment of cumulative effects is initiated with a determination of whether two conditions exist:

- The Project has residual environmental effects on the VC, and
- The residual effects could act cumulatively with residual effects of other past, present, or reasonably foreseeable future physical activities.

If either is not met, the assessment of cumulative effects concludes with a statement that further assessment of cumulative effects is not warranted because the Project does not interact cumulatively with other projects or activities. If the conditions are met, further assessment is carried out to determine whether additional mitigation is required, and how conclusions may be affected, as discussed in Section 15.5.1.

15.5.1 Project Residual Effects Likely to Interact Cumulatively

Table 4D-1 in Chapter 4, Appendix D presents the project and physical activities inclusion list, which identifies other projects and physical activities that might act cumulatively with the Project (Maps 4-3 and 4-4). Where residual environmental effects from the Project act cumulatively with residual effects from other projects and physical activities (Table 15-11), a cumulative effects assessment is undertaken to determine their significance.

Table 15-11 Interactions with the Potential to Contribute to Cumulative Effects

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Environmental Effects		
	Change in Land Use	Change in Recreation	Change in Resource Use
Past and Present Physical Activities and Resource Use			
Mineral Development			
• "A" Mine	–	–	–
• EL Mine	–	–	–
• Fox Mine	–	–	–
• Farley Mine	–	–	–
• Ruttan Mine	–	–	–
• MacLellan Mine (Historical)	✓	✓	✓
• Burnt Timber Mine	–	–	–
• Farley Lake Mine	✓	✓	✓
• Keystone Gold Mine	–	–	–
• East/West Tailings Management Area	–	–	–
Mineral Exploration	–	✓	✓
Water and Waste Projects (sewage plants, waste disposal grounds)	–	–	–
Residential and Community Development (including cottage subdivisions)	–	–	–
Infrastructure Development (transmission line, airport, highways, roads, rail)	–	–	–
Other Resource Activities (hunting, fishing, berry picking)	–	–	–
Future Physical Activities			
Mineral Development	–	–	–
Mineral Exploration	–	✓	✓
Traditional Land Use	–	–	–
Resource Use Activities	–	–	–
Recreation	–	✓	–

NOTES:
✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with Project residual environmental effects.
– = Interactions between the residual effects of other projects and residual effects of the Project are not expected.
For a detailed description and mapped locations of Projects and Physical Activities, where applicable, see Chapter 4, Table 4D-2 and Maps 4-3 and 4-4.

Environmental effects identified in Table 15-11 as not likely to interact cumulatively with residual effects of other projects and physical activities (no check mark) are not discussed further (i.e., where no Project residual effects overlap in space and time). Past and present projects and activities identified in Table 15-11 form the baseline conditions for the land and resource use VC. It is within the existing baseline where the Project residual effects are anticipated to occur. As such, the past and present projects and activities are assessed as part of Project residual effects. With respect to change in land use, there are no residential or community developments, water and waste projects or infrastructure development in the RAA that spatially and temporally overlap with the Project's residual environmental effects. Resource use and development in the RAA is limited to mineral development at the Gordon and MacLellan sites and other mineral exploration activity (i.e., claim staking) outside of these sites. No timber harvest through the allocation of timber sales or timber leases are present in the RAA.

The assessment of the cumulative environmental effects that are likely to result from the Project in combination with other projects and physical activities are discussed in the following subsections.

15.5.2 Cumulative Change in Land Use

15.5.2.1 Cumulative Effect Pathways

Effects from past and present projects and activities are captured by the existing conditions in the assessment of the Project's residual effects. A small portion of the RAA has already been disturbed by residential, community and industrial development. Within the RAA, disturbance from residential development at Black Sturgeon Reserve is outside of the Gordon PDA. No reasonably foreseeable projects have been identified. As such, no pathway for cumulative effects related interactions with future residential, community or industrial development is anticipated. Therefore, a cumulative effect of a change in land use is not anticipated.

15.5.3 Cumulative Effect for Change in Recreation

15.5.3.1 Cumulative Effect Pathways

Conceptually, the residual effects of future use of lands and waterbodies in the RAA for non-recreational purposes (e.g., mineral exploration) have the potential to interact cumulatively with the residual effects of the Project where those activities are planned to occur within or adjacent to recreational areas. Cumulative effects arising from future activities potentially have similar effects mechanisms as effects arising from the Project related to the degradation of recreational opportunities, activities, disturbance and nuisance effects, and restriction of access.

15.5.3.2 Mitigation for Cumulative Effects

Implementation of the mitigation measures described in Section 15.4.3 will reduce the adverse effects on recreation from the Project and the Project's contribution to cumulative effects. Specific locations for the use of lands and waterbodies for non-recreational purposes (e.g., mineral exploration) by others is not defined, but it is likely that regulatory approvals (e.g., land use permitting) will involve measures to mitigate effects related to the degradation of recreational land and subsequent reclamation of developed sites for potential recreational use.

15.5.3.3 Residual Cumulative Effects

The use of waterbodies for recreational purposes associated with the canoe route along the Hughes River along the access road to the Gordon site and the Keewatin River adjacent to the MacLellan site is evidence of some spatial overlap. Otherwise, there is limited interaction potential in the RAA overall for cumulative effects on recreation. It is anticipated that there is sufficient area within the RAA for these activities to occur in the future.

The cumulative effects from the use of other waterbodies for change in recreation is considered of low magnitude, long-term in duration, continuous in frequency, and reversible.

15.5.4 Cumulative Effect for Change in Resource Use

15.5.4.1 Cumulative Effect Pathways

Conceptually, the residual effects of future use of resources in the RAA (e.g., mineral exploration) have the potential to interact cumulatively with the residual effects of the Project where those activities are planned to occur within or adjacent to resource areas. Cumulative effects arising from future mineral exploration activities potentially have similar pathways as effects arising from the Project, including degradation and disturbance effects on resource use activities (e.g., hunting and trapping) due to noise disturbance, damage to areas and sites, visual aesthetics, as well as change in access and loss of wildlife habitat. Activities that can affect resource use activities include developments that involve land clearing (e.g., mineral claim staking).

15.5.4.2 Mitigation for Cumulative Effects

Implementation of the mitigation measures described in Section 15.4.4 will reduce the Project's contribution to cumulative effects on resource use. As well, mitigation designed to reduce effects on fish and wildlife (including habitat) will benefit resource use (Chapters 10 and 12).

15.5.4.3 Residual Cumulative Effects

Part of Game Hunting Area (GHA) 9, parts of Game Bird Hunting Zones (GBHZ) 1 and 2, and portions of the Pukatawagan and Southern Indian Lake registered traplines (RTL) encompass the RAA, totaling an area of 607,281 ha. A minimal portion of the RAA is disturbed, as urban and developed (anthropogenic) areas account for approximately 2,677 ha (0.4%) of the RAA. Hunting opportunities are allowed on undesignated Crown lands and leased Crown land unless specifically prohibited. The Gordon PDA intersects 269 ha, or 0.04 % within GHA 9 while the MacLellan PDA intersects 938 ha, or 0.1% of GHA 9. Both the Gordon and MacLellan PDAs only overlap with GBHZ 2 (i.e., over the same area as GHA 9). One outfitter allocation area (OAA) encompasses a total area of 139,374 ha in the RAA. Of this total, only the MacLellan PDA overlaps with the OAA, encompassing 938 ha or 0.6% of the OAA. RTLs provide lineholders with exclusive opportunity to harvest (trap) furbearing animals in certain areas (i.e., RTL). Of the RAA total, the Project intersects 1,207 ha or 0.2% of RTL area in the RAA. Mining claims and leases in the RAA correspond to an area totaling approximately 74,499 ha. The area of total mining activities corresponds to 188,082 ha of the RAA which includes claim staking. The Project overlap (1,207 ha) represents 1.6% of the total area of mining claims and leases and 0.6% of all mining activities in the RAA.

The potential for cumulative interactions is limited given the lack of future projects and activities. The exact areas for future hunting, outfitting, and trapping activities are unknown at this time. Future projects and activities would have the effect of removing areas from the resource base such that they would no longer be available for hunting, outfitting, and trapping to occur. As a result, these activities would be displaced to other locations. However, it is anticipated that there is sufficient area within the RAA for these activities to occur in the future.

As noted previously, portions of the land in the RAA have been already been developed. As discussed in Section 15.2.2.3, there is some Project overlap with waterbodies used for sport fishing and access. The potential for cumulative interactions is limited given the lack of defined future projects or activities. The exact areas for future resource activities are currently unknown. Future projects and activities would have the effect of removing areas from the resource base such that these areas would no longer be available for sport fishing to occur. As a result, these activities would be displaced to other locations. However, it is anticipated that there is sufficient area within the RAA for these activities to occur in the future.

Future mineral exploration activity within the RAA can cause degradation and disturbance effects during site development. New exploration activity would continue to cause disturbance effects for the life of the project. The cumulative effects from mineral exploration activity would be low in magnitude and long-term in duration, continuous, and reversible.

15.5.5 Cumulative Effects Without the Project

The assessment of cumulative effects provides an assessment from all interacting physical activities on land and resource use. The future scenario without the Project is the overall effect less that of the Project contribution. As such, the future scenario without the Project would be similar to that described in the Existing Conditions sub-sections for the land and resource use VC (Section 15.2.2).

15.5.6 Summary of Cumulative Effects

Table 15-12 summarizes cumulative environmental effects on land and resource use. The Project is anticipated to have minimal cumulative effects, and with mitigation measures, the cumulative effects are anticipated to be of low magnitude. Cumulative effects will occur in a disturbed socio-economic context and are anticipated to occur throughout the RAA. Limited cumulative effects will be long-term, occur on a continuous basis, and reversible (with the exception of the permanent open pits [formed pit lakes]).

Table 15-12 Residual Cumulative Effects

Residual Cumulative Effect	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context
Residual Cumulative Change in Recreation								
Without the Project	A	N	RAA	LT	A	C	R/IR	D
With the Project	A	L	RAA	LT	A	C	R/IR	D
Contribution from the Project to the residual cumulative effect	The Project is the main contributor to future cumulative effects on recreation in the RAA.							
Residual Cumulative Change in Resource Use								
Without the Project	A	N	RAA	LT	N/A	C	R/IR	D
With the Project	A	L	RAA	LT	N/A	C	R/IR	D
Contribution from the Project to the residual cumulative effect	The Project is the main contributor to future cumulative effects on resource use in the RAA.							

KEY
See Table 15-2 for detailed definitions

Direction:
P: Positive
A: Adverse

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term

N/A: Not applicable

Timing:
N/A: Not Applicable
A: Applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

The Project's contribution to cumulative effects are as a result of degradation or disturbance to land use, recreation, and resource use for the long term. The Project's contribution to the cumulative effects is summarized in Section 15.6.2.1.

15.6 EFFECTS TO FEDERAL LANDS

Federal lands within the LAA and RAA for land and resource use consist of Black Sturgeon Reserve, which falls within the LAA.

The Project is not expected to adversely affect land and resource use on federal lands (i.e., First Nation Reserves). The effects of the Project on land and resource use, due to change in land use, recreation, and resource use activities (hunting/outfitting, trapping, fishing, and forestry) are anticipated to be similar to other areas in the LAA, as described in Sections 15.4 and 15.5. In terms of visibility, the Gordon site will be just barely visible from Black Sturgeon Reserve (Appendix 15A). Mitigation measures for land and resource use are provided in Section 15.4 for these various components. No additional mitigation measures beyond those identified are specifically required for federal lands.

15.7 DETERMINATION OF SIGNIFICANCE

15.7.1 Significance of Project Residual Effects

Although the Project will adversely affect land and resource use during construction, operation, and decommissioning/closure, the effects are low in magnitude. The Project does not conflict with established land use plans, policies or by-laws related to land use development. The residual effects will occur in an existing defined disturbed area context that is dominated by historical mining activity. The Project activities are consistent with historical uses in the area. Land and resource use is anticipated to continue at current levels in the LAA and RAA because there are alternative lands available for recreational pursuits and activities, and alternative wildlife resources for hunting, outfitting, trapping, and fishing. The Project will not disrupt, restrict, or degrade these land uses to a point where they cannot continue at or near current levels.

With the implementation of mitigation measures, the residual environmental effects on land and resource use due to change in land use, recreation, and resource use are predicted to be not significant.

15.7.2 Significance of Cumulative Effects

The existing land base in the RAA has seen partial modified industrial and residential development over the past 75 years. About 31% of the RAA is comprised of mining resource use activities (i.e., mining claims, mineral leases), with approximately 99% of the RAA comprised of unoccupied provincial Crown land.

The cumulative effects from disruption, disturbance of land and resource use, and the reduction or loss of resources are not anticipated to occur at levels that restrict land and resource activities such that existing activities cannot continue within the RAA at current levels. The Project PDAs are predicted to make a minimal contribution to the cumulative effects case (i.e., 269 ha or 0.04% for the Gordon site and 938 ha or 0.1% for the MacLellan site of the RAA). None of the land and resource uses assessed are at a threshold where cumulative effects will be significant in terms of disruption that widely disturbs present land and resource use to a point where they cannot continue at or near baseline levels.

With mitigation measures, the residual cumulative environmental effects on land and resource use are predicted to be not significant.

15.7.2.1 Project Contribution to Cumulative Effects

The Project's contribution to the cumulative effects case will be small and is not expected to:

- Result in a change that widely disrupts continued land use or potential development overall within the RAA.
- Result in a change that widely disrupts continued recreational land use activities within the RAA. Similarly, the Project's cumulative effects contribution is not expected to degrade present recreational use activities within the RAA that are not mitigated.
- Result in a measurable change that widely disrupts continued resource use activities (e.g., hunting and trapping) within the RAA and is not mitigated.

It is anticipated that much of the Project's contribution to the identified cumulative effect will be of low magnitude, long-term, continuous, reversible (with the exception of the permanent open pits), and within a disturbed socio-economic context (i.e., area has been substantially previously disturbed by human development, or human development is still present). Therefore, the Project's contribution to cumulative effects is not anticipated to appreciably affect the land base for land and resource use activities in the RAA.

15.7.3 Significance of Effects on Federal Lands

Federal lands within the LAA and RAA consist of Black Sturgeon Reserve, which falls within the LAA. Based on the results in Section 15.6, the residual environmental effects on federal lands from changes to land and resource use are predicted to be not significant.

15.8 PREDICTION CONFIDENCE

The level of confidence in the predictions for Project-related residual effects on land and resource use is moderate to high. The prediction confidence is based on information collected as part of desktop data compilation and understanding of current baseline conditions, GIS data analyses, understanding of Project activities, locations and described interactions, the known effectiveness of mitigation measures, and experience of the assessment team. While some of the desktop data were limited in terms of availability (e.g., intensity of recreational usage) or scale (e.g., big game hunting and game bird hunting areas to support harvest evaluation) giving a moderate level of confidence, the environmental effects mechanisms are well-understood. Many of the effects analyzed were supported through quantification. Many of the mitigation measures identified in Section 15.9 are standard practice and have been implemented in previous mining projects.

15.9 FOLLOW-UP AND MONITORING

Dedicated follow-up and monitoring activities are not anticipated for the land and resource use VC. It is expected that Alamos will develop a Project-specific Environmental Management Program and associated plans (Chapter 23) where mitigation measures are stipulated for the construction, operation, and decommissioning/closure activities related to the atmosphere (Chapters 6 and 7), surface water (Chapter

9), fish and fish habitat (Chapter 10), vegetation and wetlands (Chapter 11), wildlife and wildlife habitat (Chapter 12), and human health (Chapter 18) VCs. These measures are subject to regular review as to their effectiveness as part of a process of adaptive management in Project monitoring and follow-up.

In the event that an unexpected deterioration of the environment is observed as part of follow-up and/or monitoring, intervention mechanisms will include the adaptive management process described in Chapter 23, Section 23.2. This may include an investigation of the cause of the deterioration and identification of existing and/or new mitigation measures to be implemented to address it.

Land and resource use activities within the RAA are the subject of ongoing planning, management, regulatory enforcement, and monitoring by the federal, provincial, and municipal governments. This includes the monitoring and collection of information on, for example, municipal land use, hunting, trapping, and fishing activity and development for the purposes of licensing, enforcement, and resource management. Alamos has provided, and will continue to provide, Project information to relevant agencies and organizations.

15.10 SUMMARY OF COMMITMENTS

The following summarizes proposed measures to mitigate Project adverse residual effects for land and resource use:

- The Project footprint will be limited to the extent possible (i.e., PDAs) including site clearing and disturbance access routes and distribution line ROW.
- Existing access roads, trails and ROW will be used to the extent possible; access routes will be developed in compliance with provisions of *The Crown Lands Act* and *The Mines and Minerals Act.*
- Project lighting will be limited to what is necessary for safe and efficient Project activities. Directional lighting will be used to limit the transmission of light outside of the PDAs. Portable lighting equipment will be positioned to limit visibility at nearby receptors, to the extent feasible (Volume 5, Appendix B).
- Installation of noise mitigation measures will be selected and installed as described in Noise and Vibration VC (Chapter 7).
- Signage will be installed around the PDAs to alert local land and resource users of the presence of Project and its facilities.
- Alamos will post warning signs on the access roads and distribution line ROW to discourage unauthorized access and snowmobiling due to safety concerns.
- Alamos will implement traffic control measures which may include gating approaches to Project access roads, placing large boulders and/or gated fencing to restrict public access to the PDAs.
- Work schedules will be implemented for Project construction workers (subject to fly-in/fly-out employment) to deter workers from hunting locally outside of working hours during a shift.

- Workers will be prohibited from bringing firearms and fishing gear to the sites while working to limit competition for wildlife and fish species of value to resource users.
- Alamos will communicate the schedule of Project activities throughout the construction, operation, and decommissioning/closure phases to affected local resource users and MCC Regional Officials.
- Alamos will engage with Town of Lynn Lake Municipality and provincial Crown land use permit holders to address potential conflict, disturbance, or access restrictions to municipal and Crown land use areas.
- Alamos will engage local land and resource users (e.g., recreational harvesters) and the Town of Lynn Lake to address, to the extent possible, issues related to the removal and inaccessibility of lands and resources within the Project site PDAs, including the restriction in use of the Gordon site access road and with local boaters to address navigation issues as well as access and safety issues related to navigation along watercourses affected by the Project, including engagement regarding the need to provide marked portages to circumvent obstructions.
- Alamos will submit the locations of water crossings and works to Transport Canada for review related to effects on navigation. Conditions specified in a permit and other directives will apply to the work.
- Alamos will engage with local resource users (hunters/outfitters, trappers, commercial fish harvesters, anglers) and MCC Regional Officials to address to the extent possible potential conflict, disturbance, or access restrictions to hunting, trapping, fishing areas in the PDAs, and availability of wildlife resources.
- Timber removal will be completed in accordance with *The Forest Act* (Manitoba).
- Merchantable timber may be salvaged and used, if feasible, to enhance carbon storage or made available to local communities for fuelwood.
- The Project footprint will be limited to the extent possible (i.e., PDAs) including construction and operation activities to reduce disturbances to adjacent productive forest land.
- Alamos will work with MCC to finalize the required compensation payable to MCC under the FDAV, for removal of provincial Crown forest land at the Gordon and MacLellan sites.
- Alamos will undertake rehabilitation activities in consideration of desired end land uses that are achievable in the preparation of a Closure Plan under the provisions of *The Mines and Minerals Act* for both the Gordon and MacLellan sites (Chapter 23). A Conceptual Closure Plan has been prepared to support the EIS and is provided in Appendix 23B.

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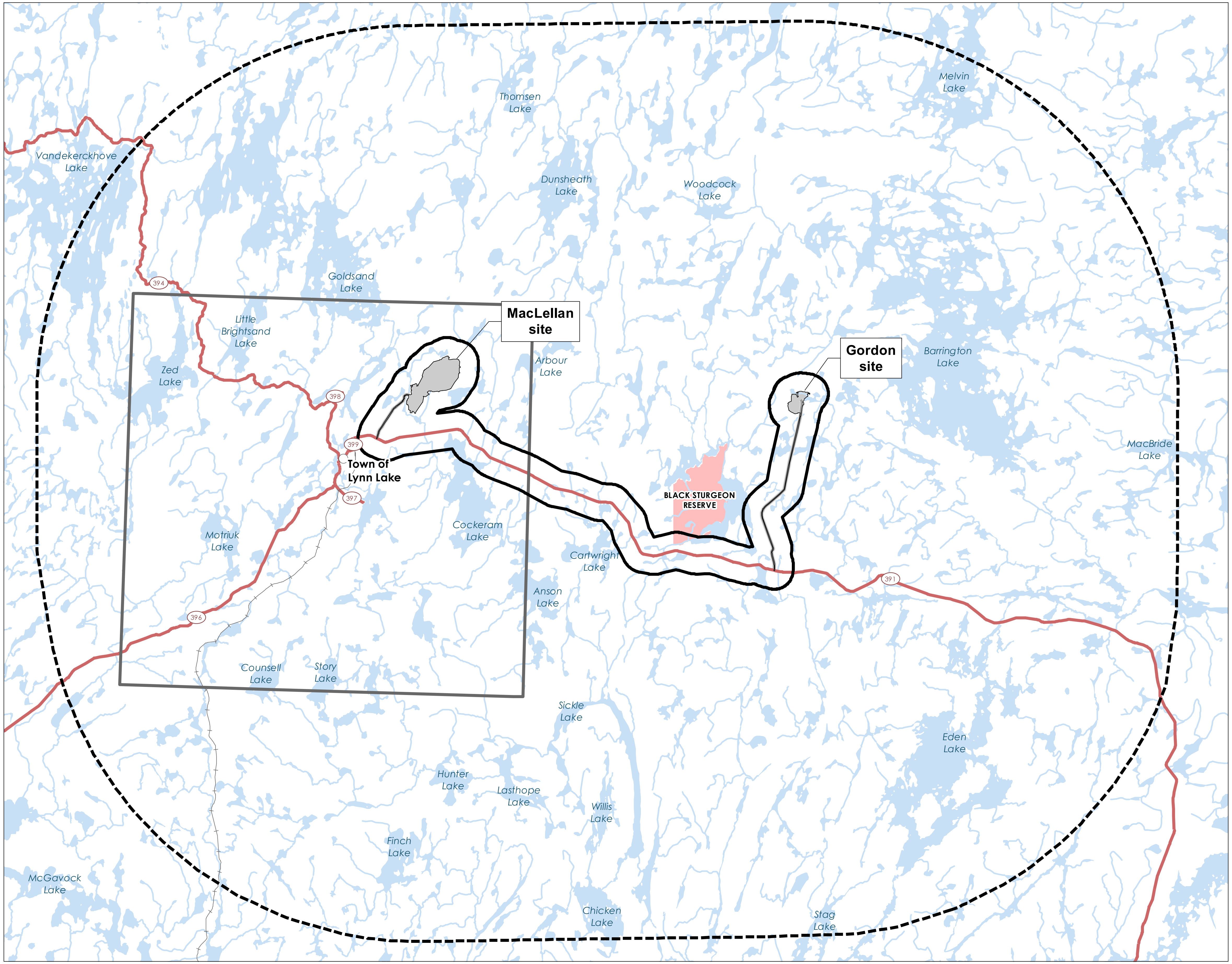


Stantec

Alamos Gold Inc.

Project Infrastructure

Project Development Area

Study Area

Land and Resource Use Local Assessment Area (LAA)

Land and Resource Use Regional Assessment Area (RAA)

Landbase

Highway

Access Road

Rail

Watercourse

Waterbody

First Nation Reserve

Lynn Lake Municipal Boundary

(At original document size of 11x17)
1:320,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

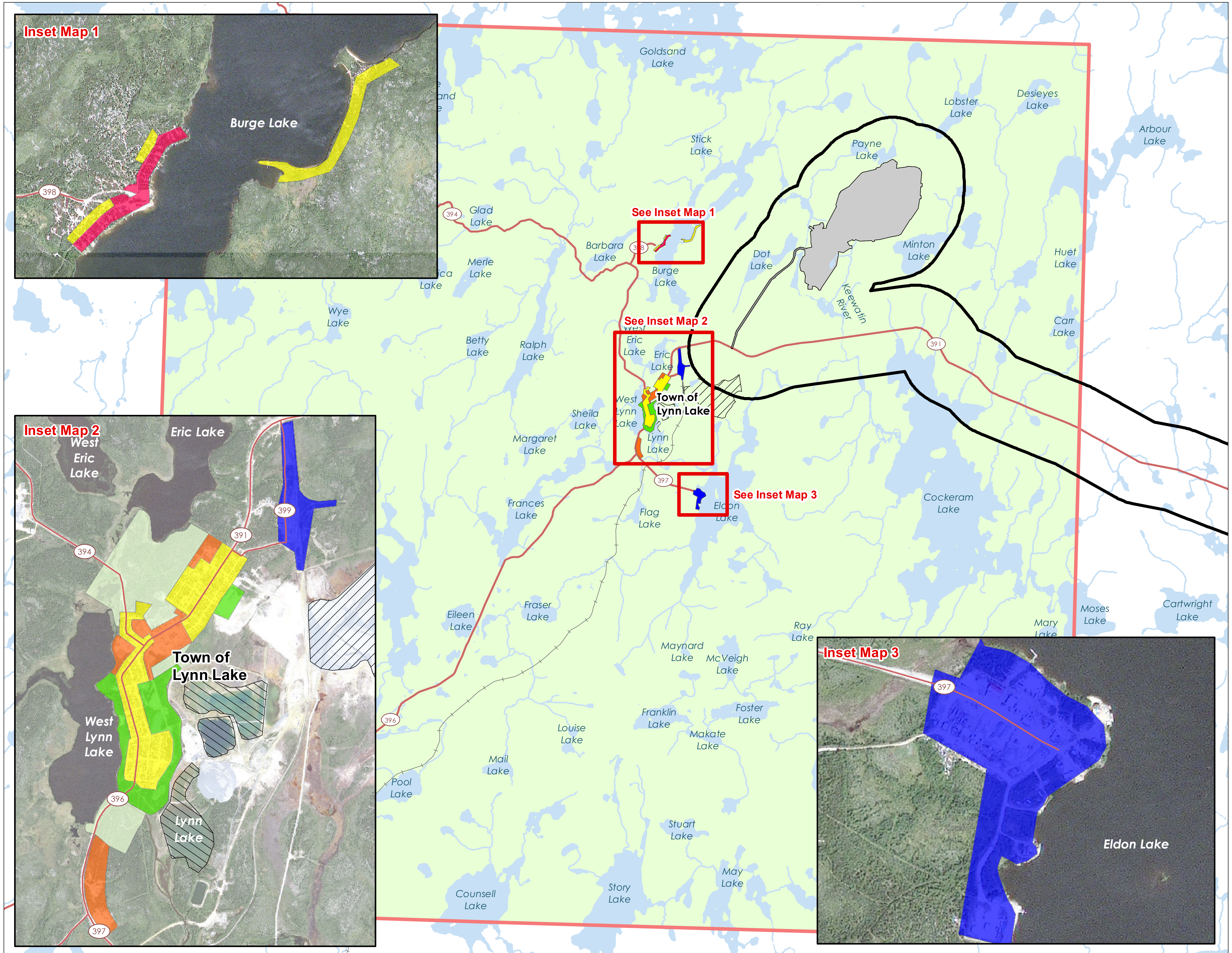
Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-01-20
Technical Review by BKrawchuk on 2020-01-20
Senior GIS Review by GKroupa on 2020-01-20

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
15-1

Title
Spatial Boundaries



Stantec

Alamos Gold Inc.

Project Infrastructure

Project Development Area

Study Area

Land and Resource Use Local Assessment Area (LAA)

Development Plan

Land Use Designations

- Commercial and Public
- Industrial
- Parks and Open Space
- Provincial Park
- Residential
- Limited Development Area
- East Tailings Management Area
- West Tailings Management Area

Landbase

- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- Lynn Lake Municipal Boundary

N

0 2 4 Kilometres

(At original document size of 11x17)
1:140,000

Notes

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2. Base Data Sources: Government of Manitoba and Government of Canada
3. Imagery: SPOT-7 imagery, BlackBridge Gemoatics Corp. July 2015.

Project Location
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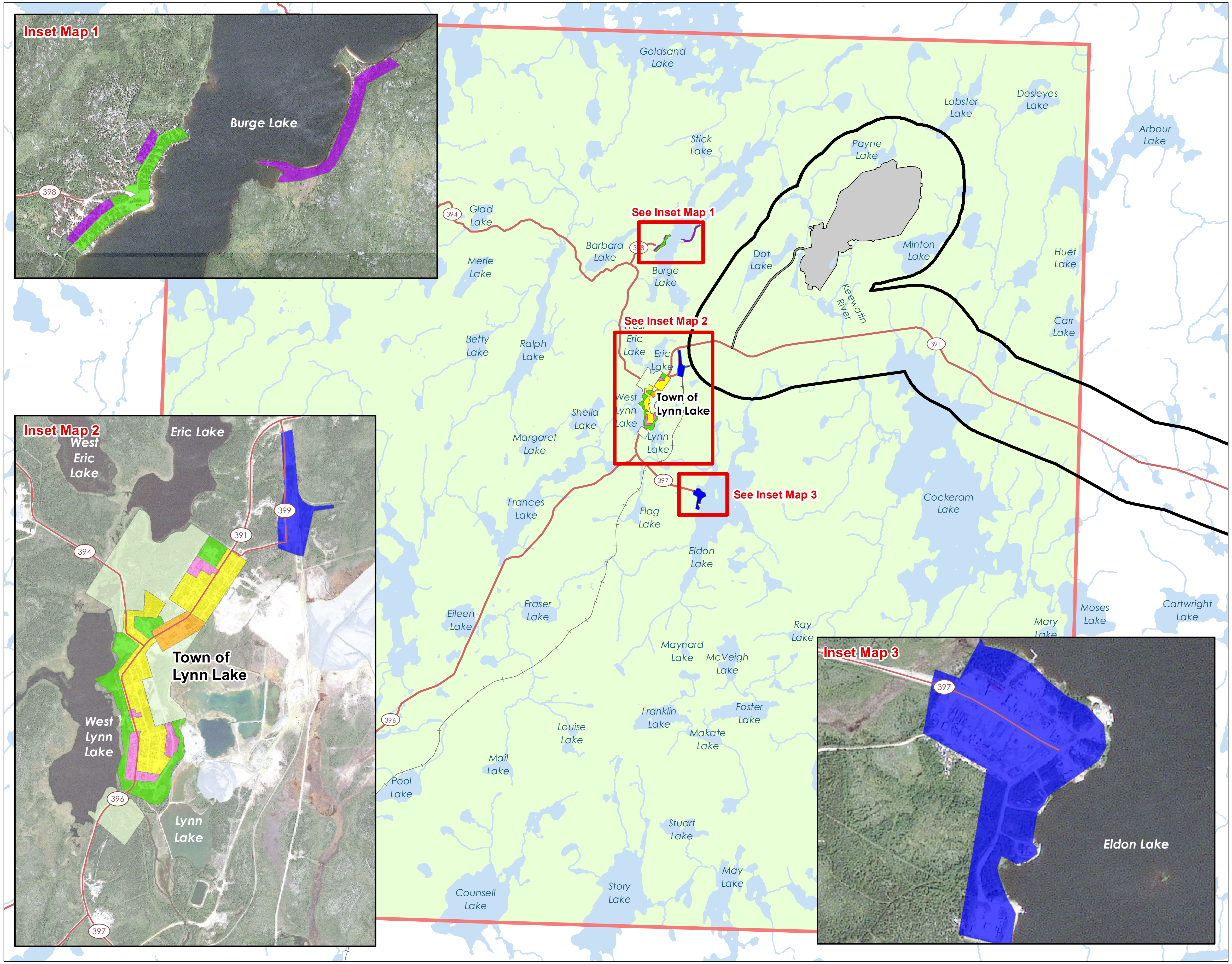
Prepared by ACampigotto on 2020-01-20
Technical Review by BKrawchuk on 2020-01-20
Senior GIS Review by GKroupa on 2020-01-20

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
15-2

Title
Development Plan Designations



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Alamos Gold Inc.

Project Infrastructure

Project Development Area

Study Area

Land and Resource Use Local Assessment Area (LAA)

Zoning Districts

CG - General Commercial District

M - Industrial District

LD - Limited Development District

R - Residential

R2 - Two-Family Dwelling District

R3 - Multiple-Family Dwelling District

P - Public Open Space District

Landbase

Highway

Access Road

Rail

Watercourse

Waterbody

Lynn Lake Municipal Boundary

N

0 2 4 Kilometres

(At original document size of 11x17)
1:140,000

Notes

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3. Imagery: SPOT-7 imagery, BlackBridge Gemoatics Corp. July 2015.

Project Location
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Senior GIS Review by GKroupa on 2020-01-20

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
15-3

Title
Zoning Districts

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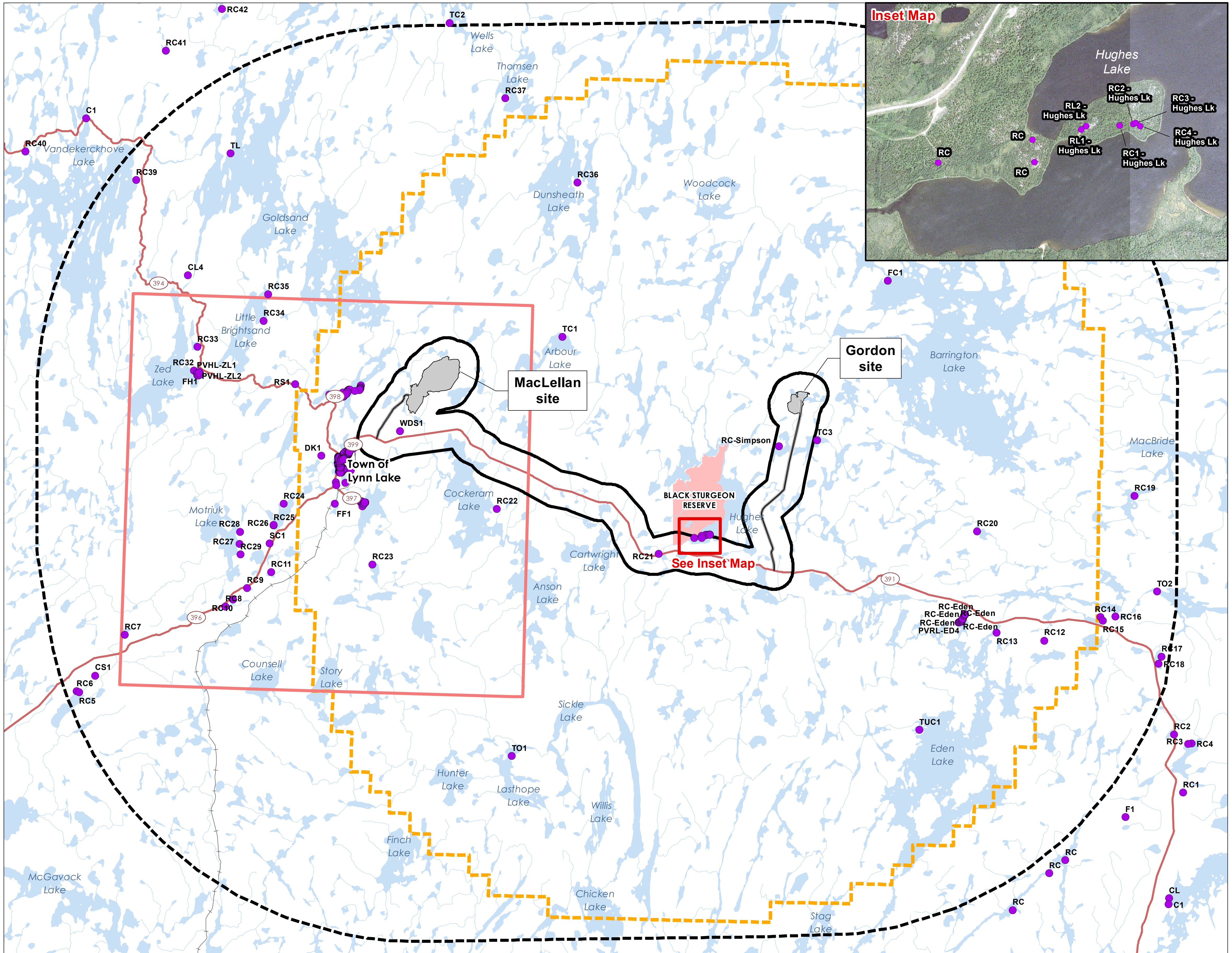

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Alamos Gold Inc.

Project Infrastructure

Project Development Area

Study Area

Land and Resource Use Local Assessment Area (LAA)

Land and Resource Use Regional Assessment Area (RAA)

Land Use

Permit or Lease Site

RC - Remote Cabin	**AS** - Admin Site
RL - Recreation Lot	**LG** - Lagoon
RB - Riding Stable	**DW** - Dwelling
TC - Trapper Cabin	**RS** - Recreation Site
TO - Tourist Outcamp	**DK** - Dog Kennel
TL - Tourist Lodge	**PK** - Park
TUC - Traditional Use Cabin	**MS** - Museum Site
WDS - Waste Disposal Site	**HY** - Highway Maintenance Yard
WS - Warehouse Site	**CR** - Community Recreation
YC - Youth Camp	**SC** - Snowmobile Club
C - Campground	**CS** - Communication Site
CL - Commercial Lot	**PVHL** - Park Vacation Home Lease
FH - Fire Hall	**PVHP** - Park Vacation Home Permit
FP - Float Plane	**F** - Forestry
FF - Fish Farm	**IS** - Industrial Site
FC - Fish Camp	

Community Interest Zone

Landbase

Highway

Access Road

Rail

Watercourse

Waterbody

First Nation Reserve

Lynn Lake Municipal Boundary

N

0 5 10 Kilometres

(At original document size of 11x17)
1:320,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada
3. Imagery: SPOT-7 imagery, BlackBridge Gemoatics Corp. July 2015.

Project Location
Lynn Lake,
Manitoba

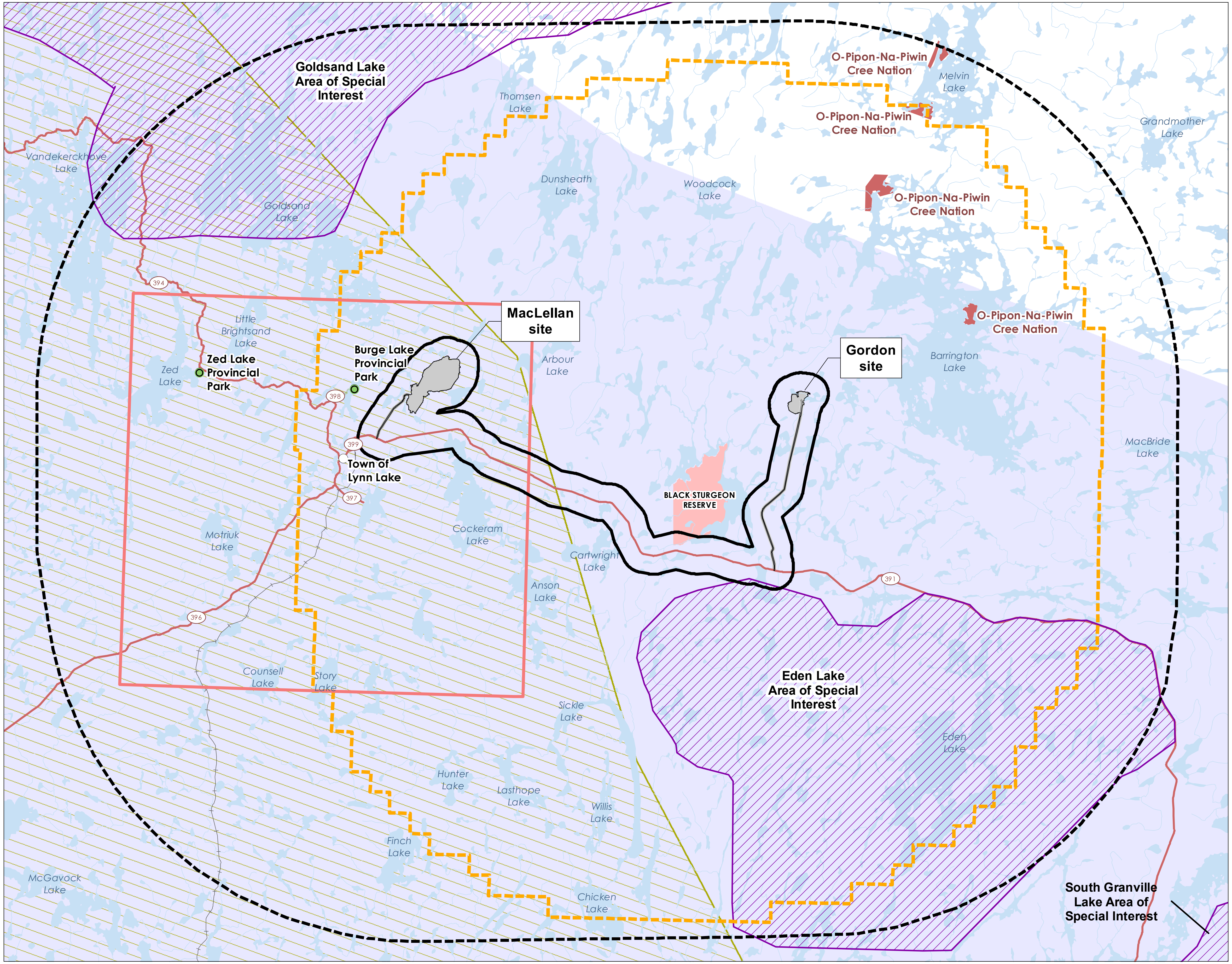
Prepared by ACampigotto on 2020-01-20
Technical Review by BKrawchuk on 2020-01-20
Senior GIS Review by GKroupa on 2020-01-20

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
15-4

Title
Crown Land Permits and Leases



Stantec

Alamos Gold Inc.

Project Infrastructure

- Project Development Area

Study Area

- Land and Resource Use Local Assessment Area (LAA)
- Land and Resource Use Regional Assessment Area (RAA)

Designated Lands / Management Units

- Treaty Land Entitlement (TLE) Sites
- Woodland Caribou Manitoba North Range (MB9)
- Kamuchawie Caribou Management Unit

Protected Areas

- Area of Special Interest

Land Use

- Community Interest Zone

Landbase

- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- First Nation Reserve
- Lynn Lake Municipal Boundary
- Provincial Park

N

0 5 10 Kilometres

(At original document size of 11x17)
1:320,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-01-20
Technical Review by BKrawchuk on 2020-01-20
Senior GIS Review by GKroupa on 2020-01-20

Client/Project 111473008

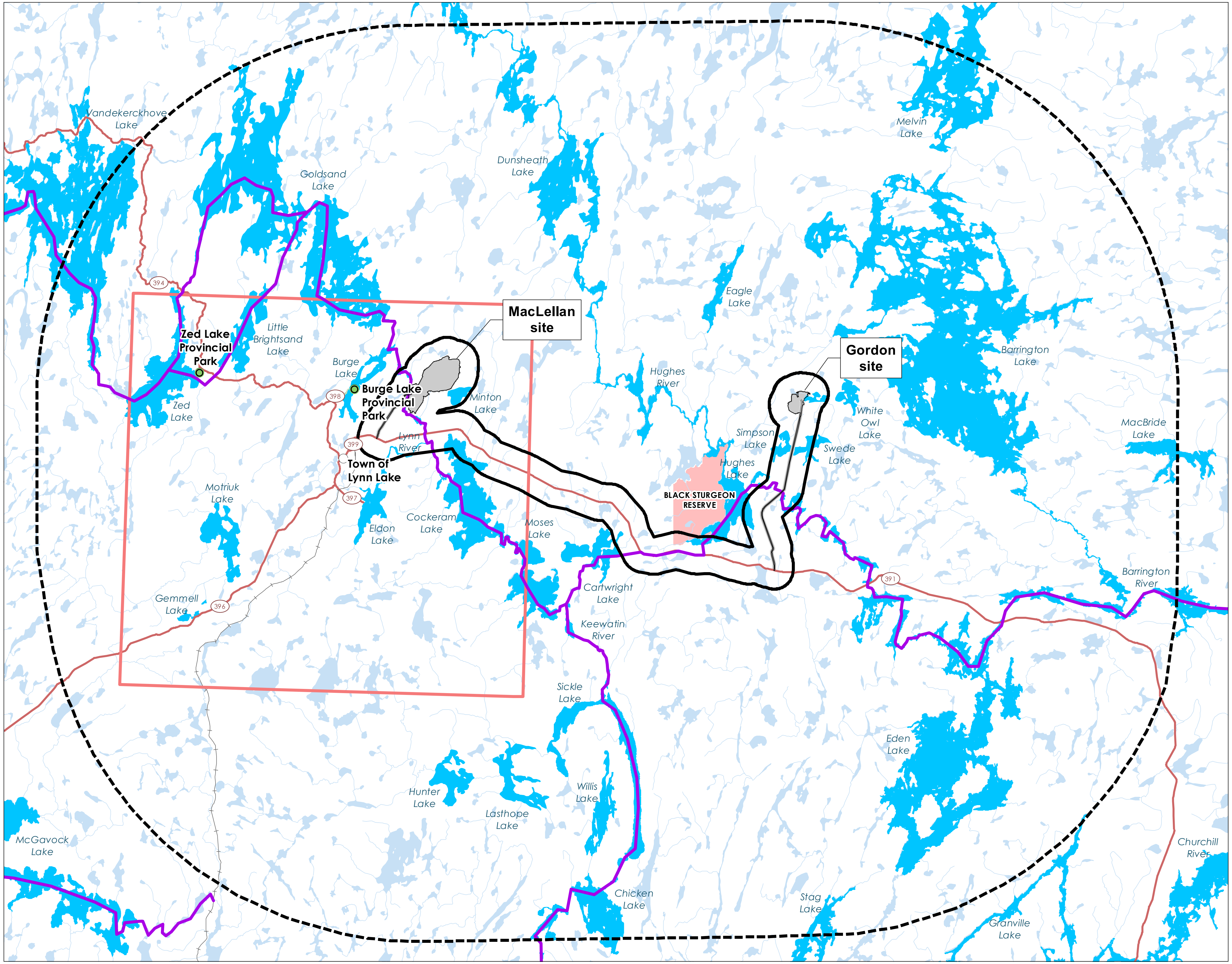
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.

15-5

Title

Parks, Protected Areas & Management Areas



Stantec

Alamos Gold Inc.

Project Infrastructure

- Project Development Area

Study Area

- Land and Resource Use Local Assessment Area (LAA)
- Land and Resource Use Regional Assessment Area (RAA)

Recreational Information

- Canoe Route
- Sport Fishing Lakes

Landbase

- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- First Nation Reserve
- Lynn Lake Municipal Boundary
- Provincial Park

N

0 5 10 Kilometres

(At original document size of 11x17)
1:320,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

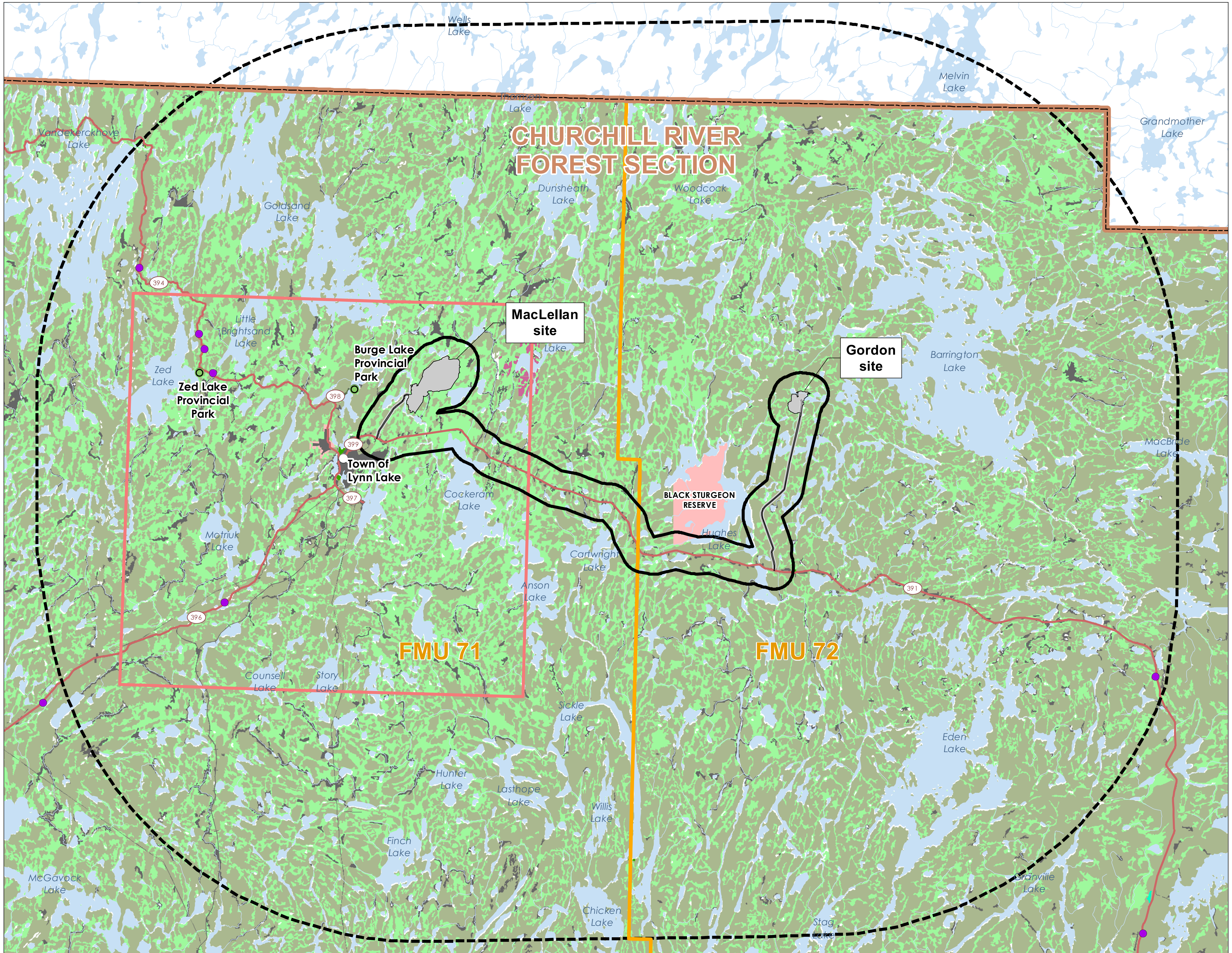
Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-01-20
Technical Review by BKrawchuk on 2020-01-20
Senior GIS Review by GKroupa on 2020-01-20

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
15-6

Title
Recreational Areas and Routes



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Alamos Gold Inc.

Project Infrastructure and Study Area
- Project Development Area
- Land and Resource Use Local Assessment Area (LAA)
- Land and Resource Use Regional Assessment Area (RAA)

Forest Resources
- FRI Permanent Sample Plot
- Forest Section Boundary
- Forest Management Unit Boundary

Productive Forest Land

Land Ownership
- First Nation Reserve/Federal
- Municipal/Local Government District
- Private
- Crown Land
- Plantations

Landbase
- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- First Nation Reserve
- Lynn Lake Municipal Boundary
- Provincial Park
- Non Productive Forest
- Non Forested

N

0 5 10 Kilometres

(At original document size of 11x17)
1:320,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
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Manitoba

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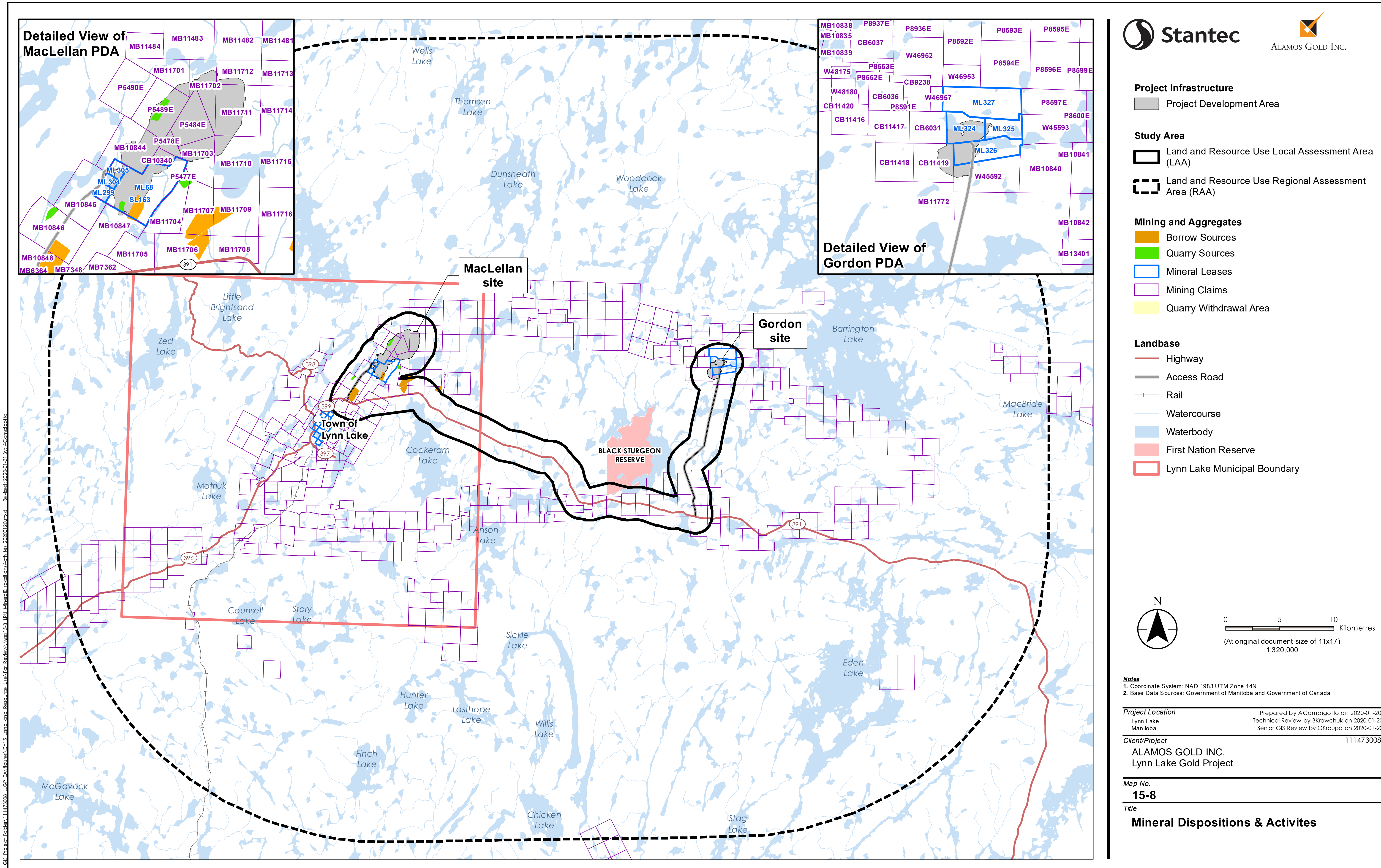
Technical Review by BKrawchuk on 2020-01-20
Senior GIS Review by GKroupa on 2020-01-20

Client/Project 111473008

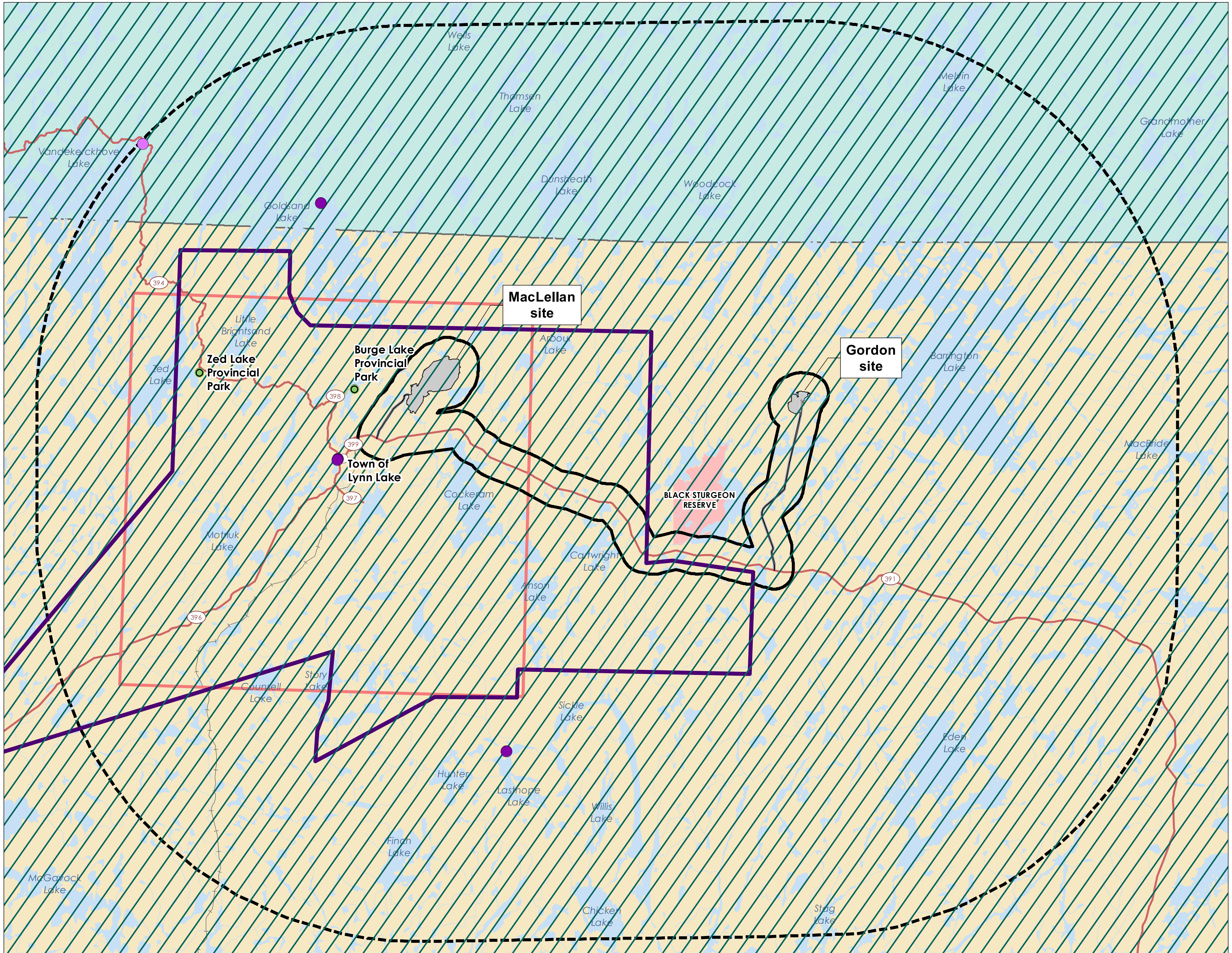
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
15-7

Title
Forest Resources & Activities



Detailed View of MacLellan PDA
MB11484
MB11483
MB11482
MB11481
MB11701
MB11712
MB11713
P5490E
MB11702
P5489E
MB11711
MB11714
P5484E
P5478E
MB10844
MB11703
CB10340
MB11710
MB11715
ML305
ML304
ML68
P5477E
ML299
SL163
MB10845
MB11707
MB11709
MB11716
MB11704
MB10846
MB10847
MB10848
MB11705
MB11706
MB11708
MB6364
MB7348
MB7362
391
Detailed View of Gordon PDA
MB10838
P8937E
P8936E
P8593E
P8595E
MB10835
CB6037
P8592E
MB10839
W46952
P8594E
P8553E
P8596E
P8599E
W48175
P8552E
CB9238
W46953
W48180
CB6036
W46957
ML327
P8597E
CB11420
P8591E
P8600E
CB11416
CB11417
CB6031
ML324
ML325
W45593
ML326
MB10841
CB11418
CB11419
W45592
MB10840
MB11772
MB10842
MB13401
MacLellan site
Gordon site
Wells Lake
Thomsen Lake
Dunsheath Lake
Woodcock Lake
Little Brightsand Lake
Zed Lake
Barrington Lake
MacBride Lake
Town of Lynn Lake
Cockeram Lake
BLACK STURGEON RESERVE
Motriuk Lake
Anson Lake
Counsell Lake
Story Lake
Sickle Lake
Eden Lake
Hunter Lake
Lasthope Lake
Willis Lake
Finch Lake
McGavock Lake
Chicken Lake
Stag Lake
398
399
397
396
391
Stantec
Alamos Gold Inc.
Project Infrastructure
Project Development Area
Study Area
Land and Resource Use Local Assessment Area (LAA)
Land and Resource Use Regional Assessment Area (RAA)
Mining and Aggregates
Borrow Sources
Quarry Sources
Mineral Leases
Mining Claims
Quarry Withdrawal Area
Landbase
Highway
Access Road
Rail
Watercourse
Waterbody
First Nation Reserve
Lynn Lake Municipal Boundary
N
0 5 10 Kilometres
(At original document size of 11x17)
1:320,000
Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada
Project Location
Lynn Lake, Manitoba
Prepared by ACampigotto on 2020-01-20
Technical Review by BKrawchuk on 2020-01-20
Senior GIS Review by GKroupa on 2020-01-20
Client/Project
111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project
Map No.
15-8
Title
Mineral Dispositions & Activites



Stantec

ALAMOS GOLD INC.

Project Infrastructure

Project Development Area

Study Area

Land and Resource Use Local Assessment Area (LAA)

Land and Resource Use Regional Assessment Area (RAA)

Wildlife Areas

Lodges and Outfitters (active)

Lodges and Outfitters (inactive)

Game Hunting Area #9

Bear Allocation Area (Grey Owl Outfitters Inc)

GBHZ1

GBHZ2

Landbase

Highway

Access Road

Rail

Watercourse

Waterbody

First Nation Reserve

Lynn Lake Municipal Boundary

Provincial Park

N

0 5 10 Kilometres

(At original document size of 11x17)
1:320,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

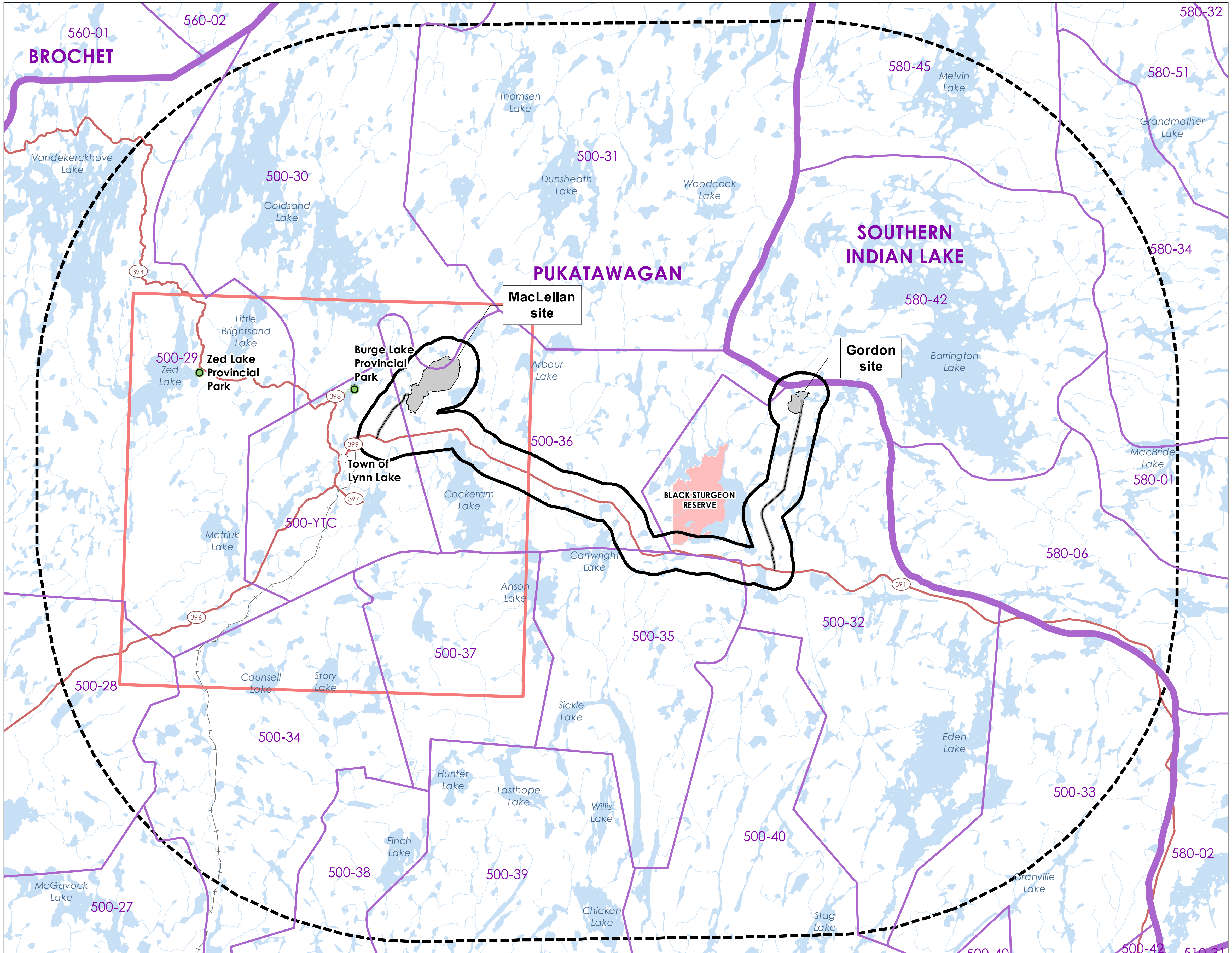
Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-01-20
Technical Review by BKrawchuk on 2020-01-20
Senior GIS Review by GKroupa on 2020-01-20

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
15-9

Title
Hunting and Outfitter Allocation Areas



Project Infrastructure

Project Development Area

Study Area

Land and Resource Use Local Assessment Area (LAA)

Land and Resource Use Regional Assessment Area (RAA)

Administrative Boundaries

Registered Traplines (Sec and Line No.)

Registered Trapline Sections (Name)

Landbase

Highway

Access Road

Rail

Watercourse

Waterbody

First Nation Reserve

Lynn Lake Municipal Boundary

Provincial Park

N

0 5 10 Kilometres

(At original document size of 11x17)
1:320,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

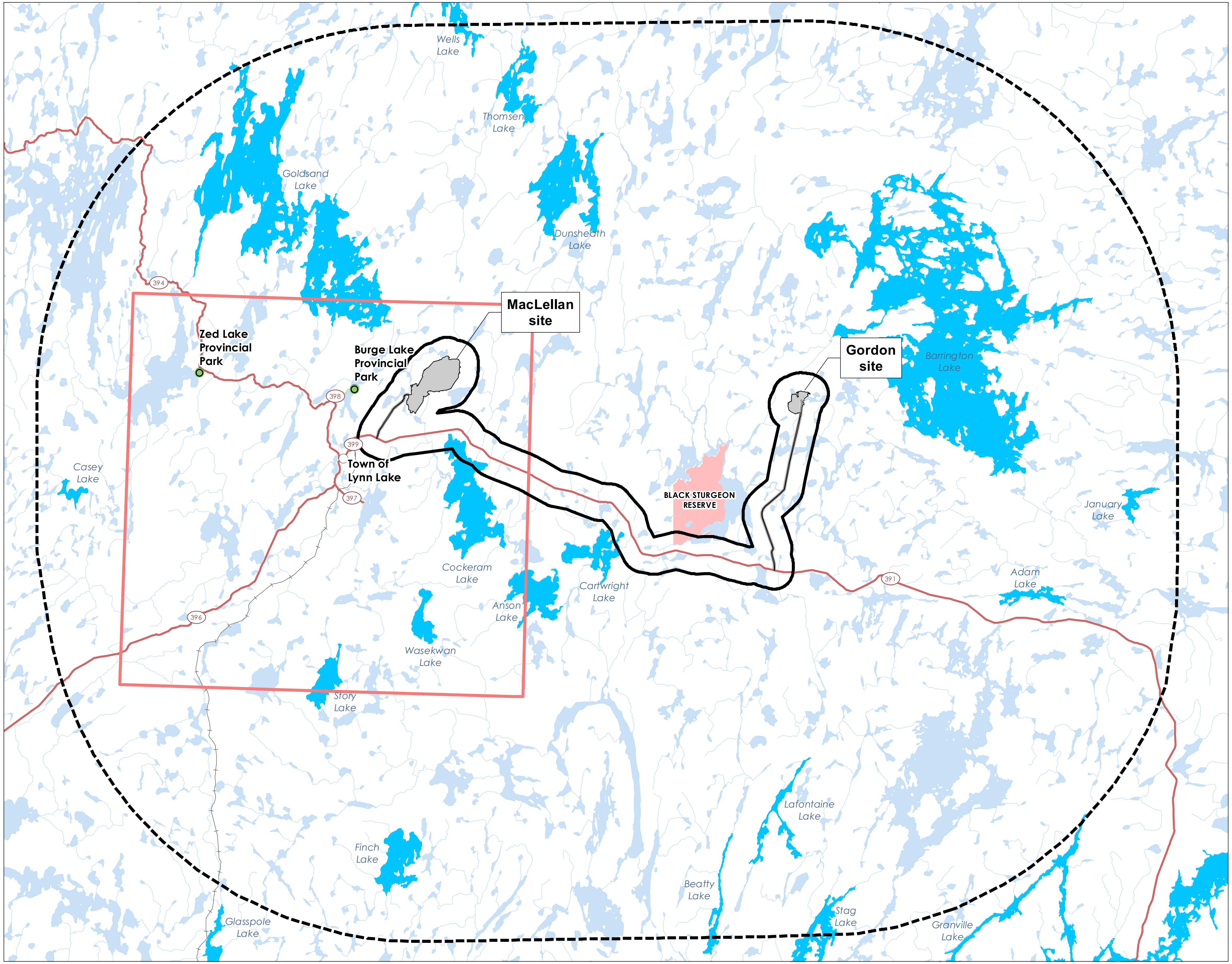
Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-01-20
Technical Review by BKrawchuk on 2020-01-20
Senior GIS Review by GKroupa on 2020-01-20

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
15-10

Title
Registered Trapline Sections



Stantec

Alamos Gold Inc.

Project Infrastructure

Project Development Area

Study Area

Land and Resource Use Local Assessment Area (LAA)

Land and Resource Use Regional Assessment Area (RAA)

Historical Information

Commercial Fishing Lakes

Landbase

Highway

Access Road

Rail

Watercourse

Waterbody

First Nation Reserve

Lynn Lake Municipal Boundary

Provincial Park

N

0 5 10 Kilometres

(At original document size of 11x17)
1:320,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-01-20
Technical Review by BKrawchuk on 2020-01-20
Senior GIS Review by GKroupa on 2020-01-20

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.

15-11

Title

Commercial Fishing Lakes

Appendix 15A VANTAGE POINT PHOTOS

Photo Log
Lynn Lake Gold Project: Black Sturgeon Reserve Vantage Point

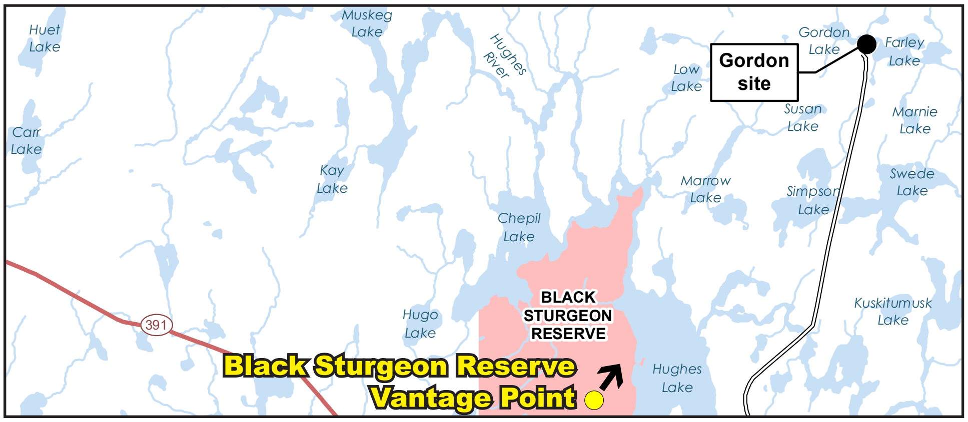


Photo 15A-1: View of existing Gordon site looking north from Black Sturgeon Reserve vantage point

Photo 15A-2: View of future Project infrastructure at Gordon site looking north from Black Sturgeon Reserve vantage point

G:_GIS_Project_Folder\111473008_LLGP_EA\admin\data_in\Alamos\Photos_dl_20200518\Gordon_VantagePoints_Alamos_PhotoLog_20200518.indd

Photo Log
Lynn Lake Gold Project: PR 391 Vantage Point

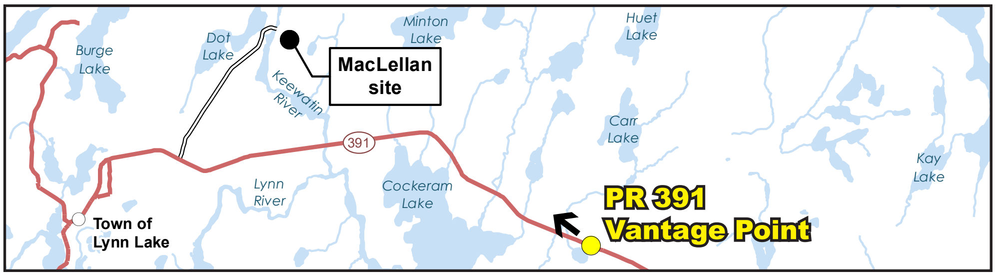


Photo 15A-3: View of existing infrastructure at MacLellan site looking northwest from PR 391 vantage point

Photo 15A-4: View of future Project infrastructure at MacLellan site looking northwest from PR 391 vantage point

ALAMOS GOLD INC.

Lynn Lake Gold Project Environmental Impact Statement Chapter 16 – Assessment of Potential Effects on Heritage Resources

Stantec

Prepared by:

Stantec Consulting Ltd.

May 25, 2020

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Acronyms and Abbreviations

Alamos	Alamos Gold Inc.
CEA Agency	Canadian Environmental Assessment Agency (now the Impact Assessment Agency of Canada or IAAC)
HBC	Hudson's Bay Company
HCRPP	Heritage and Cultural Resources Protection Plan
HRB	Historic Resources Branch
HRIA	heritage resources impact assessment
IAAC	Impact Assessment Agency of Canada (formerly the CEA Agency)
LAA	Local Assessment Area
m	metre
MRSA	mine rock storage area
km	kilometre
PDA	Project Development Area
RAA	Regional Assessment Area
TDR	technical data report
TLRU	traditional land and resource use
TMF	tailings management facility
VC	valued component

16.0 ASSESSMENT OF POTENTIAL EFFECTS ON HERITAGE RESOURCES

This chapter considers the potential environmental effects of the Project on heritage resources. Heritage resources are a valued component (VC) based on legislated requirements; scientific relevance and interest; Indigenous and public concern; and because they provide people from the past the opportunity to be heard in the present.

16.1 SCOPE OF ASSESSMENT

Heritage resources include objects and properties that are of importance for their architectural, historical, cultural, environmental, archaeological, palaeontological, aesthetic, or scientific value. Heritage resources are the tangible remains of past land use activities, are non-renewable, and are susceptible to loss or damage because of Project activities. The value of heritage resource sites is measured by the artifacts they contain; the information about past human history or culture that might be obtained from studying the objects; the spatial relationships of artifacts within sites; the context of assemblages and sites across the landscape; and their identity within the cultural landscape. These values are based on the definition of heritage resources listed in *The Heritage Resources Act* and relate to the discussion of heritage resources impact assessments in Section 12(2) of that Act. The Canadian Environmental Assessment Agency (CEA Agency, now the Impact Assessment Agency of Canada [IAAC]), considers the value of heritage or any structure, site, or thing to be a function of its association with one or more aspects of human history or culture; its historical, archaeological, palaeontological, or architectural significance; and its association with a particular group's practices, traditions, or customs (CEA Agency 2015).

Palaeontological resources are not considered in this environmental effects assessment because the Project is in ancient bedrock covered by thin, post-glacial soils. There is no potential for palaeontological resources in either context. "'Palaeontological object' means the remains or fossil or other object indicating the existence of extinct or prehistoric animals but does not include human remains" (*The Heritage Act* 2003). The bedrock at the Gordon and MacLellan sites is Precambrian basalt (Manitoba Energy and Mines 1986) overlain by Quaternary stratified drift, glacial till, and peat (O'Donnell 1976). Dyke et al. (2003) report that deglaciation occurred in recent geological time in the Lynn Lake region: about 7,600 years ago. Therefore, it is unlikely that post-glacial deposits in the region will contain the fossils of extinct species, as defined by *The Heritage Act* (2003) The assessment considers the environmental effects of the Project on the cultural landscape. The concept of cultural landscapes is used to describe any geographical area that has been modified, influenced, or given special cultural meaning by people (CEA Agency 2015).

Heritage resource sites are fragile and the product of unique processes and conditions of preservation. The vertical and horizontal provenience of artifacts provides valuable context and insights, from both a time and space perspective. Thus, removing or mixing artifacts and soils, without scientific recording, results in the loss of important information about the activities that occurred at a heritage site.

The potential for effects on heritage resources primarily occurs during construction, including loss or disturbance to site contents and site contexts through brush or topsoil removal, compaction, vehicle traffic, and grading. Project operation also has the potential to affect heritage resources particularly in areas that were not developed during the construction phase. These effects consist of loss or disturbance to site contents and site contexts through additional brush or topsoil removal during vegetation management, compaction, and vehicle traffic.

16.1.1 Regulatory and Policy Setting

16.1.1.1 Federal Regulatory

Cultural and heritage resources require consideration relative to the Project under the *Canadian Environmental Assessment Act*, 2012. As noted in Section 5(1c) of the Act, "the environmental effects that are to be taken into account in relation to an act or thing, a physical activity, a designated project or a project area, with respect to aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on …any structure, site or thing that is of historical, archaeological, paleontological, or architectural significance". The CEA Agency has also published technical guidance for assessing Project effects on physical and cultural heritage (CEA Agency 2015).

16.1.1.2 Provincial Regulatory

Manitoba's regulatory requirements are outlined in Section 12(2) of *The Heritage Resources Act.* The Act stipulates that if the Minister of Manitoba Sport, Culture, and Heritage has reason to believe that heritage resources or human remains that are upon, within, or beneath a site are likely to be damaged or destroyed by reason of any work, a heritage resource impact assessment (HRIA) of the Project may be required. Potential impacts to paleontological resources are also addressed in *The Heritage Resources Act*.

An HRIA is a written evaluation of the effect that a proposed development may have on heritage resources that are known or thought likely to be present at a development site. The goal of the HRIA is to facilitate investigation prior to Project construction. Alamos Gold Inc. (Alamos) proactively completed an HRIA of the Project in 2015 (McLeod 2016). The HRIA is separate and distinct from an environmental assessment, but the information collected during the HRIA assists in making informed decisions regarding potential residual effects and mitigation measures to address these effects. It also provides data required for monitoring and mitigation, such as the potential for undiscovered heritage resources in the project area and assists with developing contingency plans and field measures that would be required if heritage resources were discovered during construction.

The Province of Manitoba also enforces *The Policy Respecting the Reporting, Exhumation, and Reburial of Found Human Remains* (1987) that is administered by the Historic Resources Branch (HRB) of Manitoba Sport, Culture, and Heritage (Historic Resources Branch 2014). This policy outlines the protocols if human remains, or objects thought to be human remains, are found.

16.1.2 The Influence of Engagement on the Assessment

Engagement has been ongoing prior to and throughout the EIS process, and will continue with local Indigenous communities, stakeholders, the public, and government agencies through the life of the Project. More detail on the Engagement process can be found in Chapter 3. Key engagement feedback that influenced the heritage resources effects assessment is provided below.

16.1.2.1 Indigenous Engagement

As part of the information sharing throughout the engagement process, Project-related information was provided by Indigenous communities in the form of traditional land and resource use (TLRU) studies and other forms of information sharing. Information within these TLRU studies assisted in the assessment of Project effects on heritage resources, important places, and cultural landscapes.

A Project-specific TLRU study was completed collaboratively with Marcel Colomb First Nation with a final report provided to the community on January 11, 2018 (Stantec 2018). The TLRU study included interviews with participants selected by Marcel Colomb First Nation regarding traditional land use in the Project area, including availability of traditional resources, access to traditional resources or areas, occupancy, cultural sites and areas, and experience of TLRU. The TLRU data extended the timeline of human activity, developed through archaeological and archival data, into the 1950s and 1960s. The information highlighted the importance of the Keewatin River as a travel route between resource areas on Cockeram and Goldsand lakes (MC17-18-19 2017: 14). The TLRU indicated that there was limited seasonal use along the Keewatin River at the MacLellan site. Swede Lake, south of the Gordon site, and White Owl Lake, east of the Gordon site, were resources used by Marcel Colomb First Nation members but there was limited use of the Gordon and Farley lakes (MC8 2016: 26-27).

A Project-specific TLRU study was completed in collaboration with Peter Ballantyne Cree Nation but has not yet been released by community leadership for use in the environmental assessment. The TLRU study included interviews with community members in Kinoosao, Saskatchewan.

A TLRU study (Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project) was completed by an independent consultant for the Manitoba Metis Federation (SVS 2020), the results of which were received in February 2020. The study documents harvesting and land use by the Manitoba Métis Community within a 100-kilometre (km) radius of the Project. This study did not identify any cultural sites within the Project Development Areas (PDAs) or Local Assessment Area (LAA; Section 16.1.4.1). However, there is a burial site reported on the west shore of Hughes Lake within the Regional Assessment Area (RAA; SVS 2020; Chapter 17).

Alamos will continue to consider traditional knowledge information received during Project planning and detailed engineering design.

16.1.2.2 Provincial Engagement

The HRB was contacted on July 7, 2015, for an inventory of recorded sites in the Town of Lynn Lake and national topographic map sheet 64C/16, which includes the PDA/LAA. These data were received on July 10, 2015. The Branch was subsequently contacted on November 27, 2015, for an expanded list of recorded sites for inclusion in the Heritage Resources Baseline Technical Data Report (TDR; Volume 4, Appendix Q). This information was received November 30, 2015.

On July 7, 2015, a heritage permit application was submitted to the HRB to complete an HRIA of the Project as required by the HRB's conditions for the Project in accordance with Section 53 of *The Heritage Resources Act*. The HRB issued permit A37-15 on July 8, 2015. An HRIA heritage permit report detailing the assessment objectives, methods, results, and recommendations was submitted to the HRB on May 25, 2016. The HRB reviewed the report and responded on August 1, 2017, that the scope of investigations and reporting complied with HRIA requirements and that the HRB concurred with the HRIA conclusions and recommendations.

The HRB was contacted on June 15, 2017, regarding heritage significance of the MacLellan site historical operation facilities (e.g., the historical headframe structure). The HRB was asked whether they considered the extant structures from the historical operations to have thematic heritage significance pertaining to northern Manitoba mining. If so, the site would be regarded as an industrial site and structures planned for demolition would require as-found recording.

The HRB responded on June 15, 2017, that the components of the historical operations were of local thematic value only and that the HRB had no concerns with demolition of any of the buildings. The HRB requested additional information regarding a storage building and Stantec submitted the data to the HRB on June 28, 2017. The HRB acknowledged receipt of the additional data on June 28, 2017, and no further information regarding the MacLellan site was required.

16.1.3 Potential Effects, Pathways and Measurable Parameters

The potential environmental effects and measurable parameters used in the assessment of effects on heritage resources are provided in Table 16-1. The number of known heritage resource sites from existing conditions, the number of known cultural sites obtained from Indigenous engagement, and the number of possible heritage resource sites identified through predictive modelling (Volume 4, Appendix Q, Section 3.3), provide an indication of the potential for Project interactions.

Table 16-1 Potential Effects, Effects Pathways and Measurable Parameters for Heritage Resources

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change to heritage resources	• Project components requiring ground disturbance have the potential to change the horizontal and vertical context of known or potential heritage resource sites	• Number of known, intact and inadvertently exposed heritage resource sites in PDA/LAA • Percentage of site disturbance (ha)

There is the potential for the Project to interact with known or presently unknown heritage and cultural resources. The potential environmental effect is a change in heritage resources, measured by the number of known, intact, and inadvertently exposed heritage resources. A change in heritage resources may result in the loss of information about or alteration to site contents or context.

Direct and indirect potential effects from the Project on heritage resources at both Gordon and MacLellan sites include:

- Direct effects may occur during construction and include loss or disturbance to site contents and site contexts through brush or topsoil removal, compaction, vehicle traffic, grading for access roads and infrastructure, and mine infrastructure construction.
- Indirect effects may include unauthorized collection of heritage resources if the Project creates new human access opportunities or exposes artifacts.

16.1.3.1 Effect Pathways During Construction

The potential effect pathways during construction at the Gordon site include:

- Brushing activities required for new internal roads or access road upgrades and the mine rock storage area (MRSA) could disturb potential heritage sites by dislocating artifacts that are within or just beneath tree roots.
- The removal of standing vegetation could create unstable soil environments and associated surface runoff that could result in the horizontal and vertical displacement of surface or shallowly buried artifacts.
- Soil removal required for new internal roads or access road upgrades and the MRSA could disturb potential heritage resource sites by removing artifacts from their horizontal and/or vertical context.
- Compaction from vehicular traffic could disturb surface or shallowly buried heritage resources.
- Construction of access roads could provide increased entry to areas of intact heritage resource sites by vandals or unauthorized site collection.

The potential effect pathways during construction at the MacLellan site are the same as above with additional pathways that include:

- Soil removal required for the storage, stockpile, and infrastructure areas; water treatment plant; water pipeline; and the work camp could disturb surface or shallowly buried heritage resources by removing artifacts from their horizontal and/or vertical context.
- Installation of new prefabricated single-lane steel bridge constructed alongside the existing bridge may require soil removal on the Keewatin River banks for bridge abutments.

16.1.3.2 Effect Pathways During Operation

The potential effect pathways during operation at both the Gordon and MacLellan sites include:

- Brushing activities to expand Project components could disturb surface or shallowly buried heritage resources by dislodging artifacts within or just below tree roots.
- Subsoil removal or regrading in areas that were not developed during construction could result in disturbance to heritage resources by disturbing the horizontal and/or vertical context of artifacts.
- Spill remediation (if required) where subsurface excavation results in a disturbance to heritage resources by disturbing the horizontal and/or vertical context of artifacts.

Mining projects may have potential to interact with palaeontological resources; however, there is no potential for these to be found at the Project, as described in Section 16.1.

16.1.3.3 Effect Pathways During Decommissioning/Closure

The are no potential effects pathways for Project decommissioning/closure at either site as heritage resources concerns will have been addressed during construction or operation, and decommissioning/ closure will not result in ground disturbance to areas not previously disturbed during the Project.

16.1.4 Boundaries

16.1.4.1 Spatial Boundaries

The assessment areas can be summarized as follows:

- Project development area (PDA): the PDA at each of the Gordon and MacLellan sites encompasses the immediate area in which Project activities and components may occur plus a 30-metre (m) buffer and is the anticipated area of direct physical disturbance associated with construction and operation of the Project (i.e., the Project footprint, Maps 16-1 and 16-2).
- Local assessment area (LAA): the LAA for the Gordon and MacLellan sites is the same as the PDAs (Maps 16-1 and 16-2).

- Regional assessment area (RAA): the RAA for the Gordon and MacLellan sites is a portion of the Churchill River Upland Ecoregion of the Boreal Shield Ecozone (Smith et al. 1998; Map 16-3). This ecoregion is contained within the Churchill River watershed and was selected as it encompasses the seasonally available resource locations that were harvested by the Precontact and Historic Period cultural groups in the northwest portion of the province as identified in archival research completed for the Project, the archaeological database provided by the HRB, and from TLRU data collected from members of Marcel Colomb First Nation and Manitoba Metis Federation. The RAA covers a relatively large area owing to the historical and precontact mobility of Indigenous peoples and the need to capture a representative sample of archaeological sites to characterize the region's culture history.

16.1.4.2 Temporal Boundaries

The temporal boundaries for the Project consist of the following phases:

- Construction – two years (scheduled to be carried out concurrently from Year -2 to Year -1 at both sites).
- Operation – 13 years (scheduled to be carried out from Year 1 to Year 6 at the Gordon site and from Year 1 to Year 13 at the MacLellan site).
- Decommissioning/closure – five to six years of active closure (scheduled to begin in Year 6 at the Gordon site and in Year 14 at the MacLellan site). Active closure will be followed by post-closure, which is the time period during which active reclamation measures are complete, but monitoring is still required. The expected duration for post-closure is approximately 10 years. Pit filling is expected to take 11 years at the Gordon site and 21 years at the MacLellan site under average conditions (Chapter 9, Section 9.4.1). Permanent closure will occur when the site is stable, and monitoring is no longer required. For heritage resources, this will occur when there are no further ground disturbing activities at portions of the PDA previously undisturbed during construction or operation. The duration and conditions for post-closure monitoring and permanent closure will be detailed in subsequent submissions of the Closure Plan to regulatory agencies as Project design and execution progresses.

Historical temporal boundaries for heritage resources consider the existing database of recorded sites and general cultural chronologies for northern Manitoba. The heritage resources historical temporal boundary spans a time of approximately 9,500 years ago to 75 years ago. The lower historical temporal boundary of 9,500 years ago was chosen because it corresponds to the period when glacial Lake Agassiz drained, and the environment of northern Manitoba began to be conducive to human habitation. It should be noted, however, that Dyke et al. (2003) indicate that the Lynn Lake area was not exposed from postglacial lakes water until about 7,600 years ago. Therefore, archaeological sites predating 7,600 B.P. are not anticipated in the PDA/LAA. The upper historical temporal boundary of 75 years ago, or the end of the second World War, was selected because this is the latest date recognized by the HRB for a site to be recorded in the provincial inventory.

16.1.5 Residual Effects Characterization

Residual effects are those effects remaining after implementing mitigation measures. The PDA/LAA at the Gordon site is within an area that, based on predictive modelling (Volume 4, Appendix Q) and TLRU data, has a low potential to contain intact heritage and cultural resources. Previous development and reclamation has also altered the natural landscape within the PDA.

Predictive modelling and TLRU data within the PDA/LAA at the MacLellan site suggest that the areas of highest heritage resource potential are along the east and west banks of the Keewatin River. However, it is difficult to accurately predict or identify the location of all archaeological sites. In addition, accepted archaeological sampling strategies for buried site discovery cannot guarantee identification of sites in areas not sampled. Therefore, despite completing an HRIA and implementing proposed mitigation measures, the possibility of interactions with heritage resource sites during Project construction and operation still exists (Table 16-2).

Table 16-2 Definition of Terms used to Characterize Residual Effects on Heritage Resources

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Positive –** a residual effect that moves measurable parameters in a direction beneficial to heritage resources relative to baseline. **Adverse –** a residual effect that moves measurable parameters in a direction detrimental to heritage resources relative to baseline.
Magnitude	The amount of change in the number of heritage resource sites relative to existing conditions	**Negligible –** no measurable change to a heritage resources site. **Low –** a measurable change but insufficient to disturb the vertical and horizontal location of artifacts. **Moderate –** measurable change but less than high measurable change to a heritage resource site. Encounters with undiscovered sites during construction or operation would have at least a moderate magnitude effect on the site, but an assessment by a professional archaeologist would be required to evaluate the magnitude. **High –** physical disturbance and primary effects on a large portion of a heritage site with loss of site integrity and interpretive context.
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant	**Not Applicable –** seasonal aspects are unlikely to affect land and resource use **Applicable –** seasonal aspects may affect land and resource use

Table 16-2 Definition of Terms used to Characterize Residual Effects on Heritage Resources

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Geographic Extent	The geographic area in which a residual effect occurs	**PDA/LAA –** residual effects are restricted to the PDA/LAA **RAA –** residual effects interact with those of other projects in the RAA
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	**Single event –** one-time occurrence during subsurface construction activity at a specific location, such as a known archaeological site or an area of heritage resource potential.
Duration	The time period required until the measurable parameter or the VC returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	**Long-term –** residual effect extends beyond the life of the Project.
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	**Irreversible –** residual effects on heritage resources cannot be reversed; once a heritage site has been disturbed the action cannot be reversed to return the site to pre-project status.
Ecological and Socio-economic Context	Existing condition and trends in the area where residual effects occur	**Undisturbed –** area is relatively undisturbed or not adversely affected by human activity and, thus, increases the value of heritage resources. **Disturbed –** area has been previously disturbed by human development or human development is still present and lessens the value of heritage resources.

16.1.6 Significance Definition

The significance of adverse environmental effects that are likely to result from the Project after considering the implementation of mitigation measures must be determined. An adverse effect on heritage resources is one that destroys the context of the heritage resources site or introduces elements that damage or are detrimental to the site. Therefore, a significant adverse residual effect on heritage resources is defined as a Project-related effect that results in unmitigated disturbance to, or destruction of, heritage sites in the Project PDA/LAA or a disturbance or destruction of a culturally important area identified by members of potentially affected Indigenous communities through Project-specific TLRU studies.

16.2 EXISTING CONDITIONS FOR HERITAGE RESOURCES

Existing conditions for heritage resources for the Project are presented in detail in the Heritage Resources Baseline Technical Data Report and associated Validation Report provided in Volume 4, Appendix Q. The existing conditions and the methods used to characterize baseline conditions are summarized below.

16.2.1 Methods

No previous heritage assessments have been completed at the Gordon site prior to that associated with the Project. A literature search determined that Western Heritage Services Inc. completed an HRIA at the MacLellan site in 2012 (Evans 2012).

A database of known heritage resources within the PDA/LAA for the Gordon and MacLellan sites was acquired from the HRB to develop existing conditions for the heritage resources assessment. Other databases accessed for heritage resource locations including the HRB website listing Provincial and Municipal Designated Sites, the Manitoba Historical Society website that contains an inventory of historic sites, and the CanWeb website of recorded cemeteries, had no data pertinent to the Project PDA/LAA. Therefore, the inventory of recorded archaeological sites was the primary data source used to develop the cultural background for heritage resources (Volume 4, Appendix Q).

Archival research of Hudson's Bay Company (HBC) trade post journals and annual district reports from the late 1790s to the late 1940s, which was conducted as a component of the heritage resources baseline assessment and the Marcel Colomb First Nation TLRU study (Volume 4, Appendix Q; Stantec 2018), overlaps the late 1940s providing a reasonably continuous documentary record of land and resource use for the past 200 years. The trade post journals summarize the daily events at the post and provide information about the seasonal activities of Indigenous and HBC employees within the area. These seasonal activities would have been developed by the first groups of Indigenous people who moved into the area approximately 9,500 years ago. It is assumed that the activities conducted and recorded by the HBC employees to provide subsistence, travel through the area, and survive the harsh winters were either taught to them by the local Indigenous people or learned through observation. Therefore, the journals provide data that can be incorporated into a timeline of Indigenous TLRU for the past 9,500 years. These data help develop an understanding of Indigenous TLRU and how environmental and social factors have changed that use through time. The information summarized in the HBC post journals and annual district reports vary geographically and temporally. The district reports usually contain a summary of trade goods stocked by the post during the year, annual fur returns, often include a list of names of the First Nation men who accumulated debt at the post, and the names of the employees in the district. The surnames of these employees are still prevalent in the Indigenous communities.

16.2.2 Overview

An HRIA for the environmental assessment was conducted at the Gordon and MacLellan sites in August 2015. The assessment consisted of applying predictive modelling to the PDA for each site, examining areas of heritage resource potential that had been determined by predictive modelling, and locating the recorded heritage resource sites in the MacLellan site PDA as described in the Heritage Resources Baseline TDR and associated Validation Report (Volume 4, Appendix Q). Information from the HRIA supported assessment of the Project by providing knowledge of existing conditions within the PDA/LAA. For the purpose of the overview of existing conditions the MacLellan site LAA includes the areas between the PDA and the Keewatin River and adjacent to the access to include heritage resources that or near, but not within the PDA.

No heritage resource sites have been recorded in the Gordon site PDA and there is a low potential for such resources to be present based on predictive modelling. There are 10 recorded sites within the MacLellan site PDA (Table 16-3, Map 16-4). Sites were intact except for HfMf-7. This site was a historic building that was in the initial stages of collapse.

Table 16-3 Summary of Previously Recorded Heritage Resource Sites in the Project PDA (All within the MacLellan Site PDA/LAA)

Site Type	Number
PDA: Camp site (HfMf-8)	1
LAA: Camp site (HfMf-9, HfMf-11)	2
PDA: Uninterpreted (HfMf-3, HfMf-4, and HfMf-6)	3
LAA: Uninterpreted (HfMf-1, HfMf-2, HfMf-5)	3
PDA: Structural (HfMf-7)	1
PDA: Trail (HfMf-10)	1
TOTAL	**11**

Three of the MacLellan recorded sites, all from the Historic Period, were concluded to be camp sites (Table 16-3). HfMf-8 in the PDA was located on a terrace on the east side of the Keewatin River. Artifacts observed at the site consisted of a folding stove, a steel washtub, and several tin cans and bottles (Evans 2012). Reassessment of the site in 2015 recorded a rectangle depression that may be the remnants of a *ca*. 1940s cabin foundation. A trail remnant, consisting of a narrow, linear cleared area parallel to the river, was recorded west of the foundation. HfMf-8 relates to either an early mineral exploration camp or a habitation. The site covers an area of approximately 150 m^2.

HfMf-9 and HfMf-11 in the LAA were located on the west side of the Keewatin River and were identified by refuse piles of tin cans. HfMf-9 covered an area of approximately 30 m^2, while HfMf-11 was approximately 1,406 m^2. These sites probably relate to early mineral exploration camps or temporary habitation sites.

The structural site, HfMf-7, in the PDA, was a wood-framed building beside a mine access road and adjacent to an old quarry. The building measured approximately 4 m by 4 m. The site was reassessed in 2015 by documenting structure size and method of construction. Surface reconnaissance was conducted around the building to retrieve heritage resources that would suggest either a building function or relative date of construction. No heritage resources were observed. The structure may have been a storage building. Site HfMf-10 pertains to a section of the Minton Lake portage (Evans 2012).

Uninterpreted sites pertain to locations where only a few artifacts are recovered and the activities that produced the cultural deposit are not evident. The artifacts that were recovered in the PDA indicated that the Uninterpreted sites dated to the Precontact Period.

Five of the six Uninterpreted sites were identified based on lithic flakes recovered from test excavations, A shovel test at HfMf-3 produced 34 quartz flakes (Evans 2012). The remaining Uninterpreted sites contained a small assemblage of one to two lithic flakes.

The database of recorded sites at the MacLellan site indicates that 8 of the 11 heritage resource sites in the PDA/LAA are located within 100 m of the Keewatin River. The three exceptions are the storage building, HfMf-7, that relates to the historical operations at the MacLellan site, the portage remnant, HfMf-10, and an Uninterpreted site, HfMf-3, in an upland area in the northwest portion of the PDA/LAA. There is the potential for additional sites such as that recorded at HfMf-3 to be present in the upland portions of the PDA/LAA. However, based on the 2015 field assessment at this site, it is evident that while heritage resources are shallowly buried, and therefore more susceptible to disturbance during vegetation clearing, the site is extremely small horizontally and vertically and is contained immediately below the organic layer.

The sites are relatively undisturbed except for the storage building that is in an advanced stage of collapse. Undisturbed sites consist of either surface heritage resources or objects shallowly buried and therefore susceptible to disturbance during construction.

While the archival data contained no mention of locations within the PDA/LAA, the records indicated that ancestors of the Swampy Cree, Rock Cree, Dene, and Métis lived and harvested resources throughout the RAA for the past 200 years (Provincial Archives of Manitoba, n.d.). The archival information traced the hunting territories of Indigenous communities. The TLRU data amassed during Indigenous engagement indicated that many community members continue to practice seasonal activities like those of their ancestors.

TLRU data suggest that members of Marcel Colomb First Nation do not extensively use the Gordon site PDA/LAA. Moose hunting was once conducted at Gordon and Farley lakes, but the moose population disappeared after historical construction of the mine. There were no cultural sites or cultural landscapes identified at the Gordon site.

Marcel Colomb First Nation participants stated that the MacLellan site PDA/LAA was used on a limited basis. The TLRU data indicate that the Keewatin River was a travel route between Cockeram and Goldsand lakes to access trap lines, hunting and fishing locations, and plant gathering areas (MC17-18-19 2017). Fishing along the Keewatin River and in Cockeram Lake was abandoned after the historical MacLellan site began operation, as the fish did not taste the same as before (MC9 2016). Those community members interviewed made no mention of using the Minton Lake portage to access Minton Lake or the upland areas within the MacLellan site PDA/LAA. No cultural sites or landscapes were identified by Marcel Colomb First Nation members.

There are 781 heritage resource sites recorded in the RAA (Map 16-5, Table 16-4). Most of the sites date to the Precontact Period and were recorded during HRIAs for Manitoba Hydro developments, particularly in the Southern Indian and Wuskwatim lakes locales. Several sites contained sequential layers with artifacts from several distinct time periods indicating that the site witnessed repeated, albeit primarily seasonal, occupation for thousands of years.

Table 16-4 Summary of Heritage Resource by Site Type in the RAA

Site Type	Number
Camp Site	524
Camp Site/Burial	23
Burial	37
Settlement	8
Workshop	24
Petroform	2
Pictograph	8
Uninterpreted	83
Isolated Find	64
Trade Post	4
Residential	3
Structural	1
TOTAL	**781**

16.3 POTENTIAL PROJECT INTERACTIONS WITH HERITAGE RESOURCES

Table 16-5 identifies the physical activities that might interact with heritage resources and result in a change to heritage resources. These interactions are indicated by check mark and are discussed in detail in Section 16.4, in the context of effects pathways, standard and project-specific mitigation/enhancement, and residual effects. Where no potential effect is anticipated, a justification is provided following the table.

Project activities for each phase are described in detail in Chapter 2, Sections 2.3 and 2.4. Project related emissions and discharges are described in Chapter 2, Section 2.8. The potential interactions between Project activities and the environment were considered for the construction, operation, and decommissioning/closure phases of the Project. The identification of Project activities and their potential interactions was based on engagement with interested parties, the professional judgment of technical specialists involved in the assessment based on experience with other similar projects, and a review of existing conditions. The selection of interactions is also informed by the potential effects and effects pathways for each VC as described in Section 16.1.3.

Table 16-5 Potential Project-Environment Interactions with Heritage Resources

Project Activities and Components	Environmental Effects: Change to Heritage Resources — Gordon Site	Environmental Effects: Change to Heritage Resources — MacLellan Site
Construction		
Site Preparation at Both Sites (removal of existing buildings; removal of contaminated materials; vegetation clearing and earthworks; development of temporary construction camp at the MacLellan site)	✓	✓
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	--	--
Mine Components at Both Sites (construction of ore pads; ore, overburden and MRSAs; mill feed storage area and crushing plant, ore milling and processing plant, and Tailings Management Facility (TMF) at the MacLellan site; water management facilities [e.g., sumps, ponds and ditches])	✓	✓
Utilities, Infrastructure, and Other Facilities at Both Sites (construction of: buildings and yards; access roads [i.e., upgrades at the Gordon and MacLellan site] and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at the MacLellan site; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities)	✓	✓
Water Development and Control at Both Sites (dewatering of existing pits at the Gordon site; interceptor wells at the Gordon site and underground workings at the MacLellan site; re-alignment of existing diversion channel at the Gordon site)	--	--
Emissions, Discharges, and Wastes[1]	--	--
Employment and Expenditure[2]	--	--
Operation		
Open Pit Mining at Both Sites (drilling; blasting; removal, loading and on-site hauling of mined material [i.e., ore, overburden, and mine rock])	--	--
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA, including truck transportation of ore from the Gordon site to the Maclellan site)	--	--
Storage/Stockpiling of Ore, Overburden, and Mine Rock at both sites	--	--
Ore Milling and Processing at the MacLellan Site (ore crushing and conveyance; ore milling)	--	--

Table 16-5 Potential Project-Environment Interactions with Heritage Resources

Project Activities and Components	Environmental Effects	
	Change to Heritage Resources	
	Gordon Site	MacLellan Site
Water Management at Both Sites (mine water collection and storage; process water supply for the MacLellan site including water intake on Keewatin River at the MacLellan site; pumping fresh/fire water from Farley Lake at Gordon site; operation of interceptor wells at the Gordon site)	--	--
Tailings Management at the MacLellan Site	--	--
Utilities, Infrastructure, and Other Facilities at Both Sites (presence and operation of: buildings and yards; access roads and internal mine roads; site lighting and security; diesel generators at the Gordon site; on-site power lines; potable water treatment plant at the MacLellan site; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities; explosives storage, maintenance of access roads and bridges)	✓	✓
Emissions, Discharges, and Wastes[1]	--	--
Employment and Expenditure[2]	--	--
Decommissioning/Closure		
Decommissioning at Both Sites	--	--
Reclamation at Both Sites	--	--
Post-Closure at Both Sites (long-term monitoring)	--	--
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	--	--
Emissions, Discharges, and Wastes[1]	--	--
Employment and Expenditure[2]	--	--

NOTES:
✓ = Potential interaction
– = No interaction
[1] Emissions, Discharges, and Wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many Project activities. Rather than acknowledging this by placing a check mark against each of these activities, “Emissions, Discharges and Emissions” have been introduced as an additional component under each Project phase.
[2] Project employment and expenditures are generated by most Project activities and components and are the main drivers of many socio-economic effects. Rather than acknowledging this by placing a check mark against each of these activities, “Employment and Expenditures” have been introduced as an additional component under each Project phase.

Construction and operation at the Gordon site will not interact with known heritage resources because none have been previously recorded in the PDA/LAA. Available TLRU data indicate there was limited use of the area during the historical temporal boundaries developed for this assessment. There is, however, potential for accidental discovery of previously unknown resources during ground disturbing construction and operation activities.

Activities that do not involve some form of ground disturbance will not interact with heritage resources.

Activities proposed during operation, except for utilities, infrastructure, and other facilities, will not interact with heritage resources at either the Gordon or MacLellan site because these activities will not further disturb areas previously disturbed during construction.

Decommissioning/closure at either the Gordon or MacLellan site will not interact with heritage resources because at this point in the development life cycle, mitigation will have addressed heritage resource concerns to known or inadvertently exposed archaeological sites.

16.4 ASSESSMENT OF RESIDUAL ENVIRONMENTAL EFFECTS ON HERITAGE RESOURCES

Project-related effects on heritage resources generally have the potential to occur within the PDA and occur primarily during the construction phase. These effects are mitigated before or at construction. There are no previously recorded heritage resource sites within the Gordon site PDA/LAA and the potential for heritage resources is low. Baseline information from Indigenous community members indicate that there are no known burial sites; cultural landscapes; sacred, ceremonial, or culturally important places, objects, or things; nor is there archaeological potential and/or artifact places. Therefore, as described below, there are no anticipated residual effects on heritage resources at the Gordon site.

The archaeological sites within the MacLellan site PDA/LAA are outside of the areas proposed for development. Baseline information from Indigenous community members indicate that there are no known burial sites; cultural landscapes; sacred, ceremonial, or culturally important places, objects, or things. Therefore, as described below, there are no anticipated residual effects on heritage resources at the MacLellan site.

16.4.1 Analytical Assessment Techniques

There are three components to the analytical assessment of effects on heritage resources:

- Evaluation of potential Project effects on known heritage resources.
- Evaluation of potential Project effects on inadvertently exposed heritage resources.
- Evaluation of potential Project effects on culturally important spaces.

The evaluation of potential Project effects on heritage resources compares the locational data of known archaeological sites, areas of potential archaeological sites based on predictive modelling within the

PDA/LAA, and community TLRU information to identify points of interaction. The analysis evaluates whether sites are in the PDA/LAA and if they are subject to direct disturbance by the Project.

Evaluation of potential Project effects on undiscovered sites considers that there is the possibility that intact heritage resources could be inadvertently exposed during construction and/or operation. Given the non-systematic nature of shovel test placement when the HRIA was conducted, intact buried cultural materials may not be revealed during testing. Predictive modelling, developed from an analysis of the existing heritage resources database in the PDA/LAA, proxy variables such as distance to water, topography, past land use, soils, and archival information were used to determine interaction between Project components and potential heritage resources.

The evaluation of potential Project effects on the cultural landscape was based on information obtained from Indigenous community members, primarily Marcel Colomb First Nation, who were asked to identify any cultural or spiritual areas within the Gordon and MacLellan site PDAs/LAAs and within the RAA.

16.4.2 Change to Heritage Resources

16.4.2.1 Project Pathways

Gordon Site

No archaeological sites have been recorded in the PDA/LAA and the 2015 HRIA determined that there is a low potential for heritage resources to be present. Therefore, there are no anticipated Project pathways at the Gordon site that would change the number of currently known heritage resources sites. If currently undiscovered heritage resources are exposed during construction, the mitigations described in 16.4.2.2 will alleviate loss of heritage resources from the following potential Project pathways during construction:

- Removal of standing vegetation, which could also create unstable soil environments and associated surface runoff that could result in the horizontal and vertical displacement of surface or shallowly buried artifacts.
- Grading, which could disturb known or potential heritage resource sites by removing artifacts from their horizontal and/or vertical context.
- Compaction from vehicular traffic, which could disturb surface or shallowly buried heritage resources.

During operation, mitigations described in 16.4.2.2 will alleviate loss of heritage resources from the following potential Project pathways during construction:

- Brushing activities, which could disturb known or unknown heritage resource sites if areas that were not previously cleared during construction are disturbed.
- Subsoil removal or regrading of access roads in areas that were not developed during construction, which could result in disturbance to heritage resources by disturbing the horizontal and/or vertical context of artifacts.

Engagement with Marcel Colomb First Nation members identified no cultural sites or landscapes within the Gordon site PDA/LAA. The Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project indicates no cultural spaces in the Gordon site. One stone cairn was recorded during the 2015 heritage assessment of the Gordon site, but the feature was concluded to relate to a mine claim marker erected in the late 1970s (Stantec 2018; Volume 4, Appendix Q).

MacLellan Site

The potential Project pathways for currently known heritage resources including sites HfMf-3, 4, 6, 7, 8, and 10 as described in Section 16.2.2, during construction include:

- Brushing activities and soil removal required for the ore milling and processing plant, associated infrastructure, the ore and overburden stockpiles, MRSA, and the TMF, which could disturb known or unknown heritage sites by dislocating artifacts that are within or just beneath tree roots.
- Removal of standing vegetation, which could also create unstable soil environments and associated surface runoff that could result in the horizontal and vertical displacement of surface or shallowly buried artifacts.
- Grading, which could disturb known or potential heritage resource sites by removing artifacts from their horizontal and/or vertical context.
- Compaction from vehicular traffic, which could disturb surface or shallowly buried heritage resources, particularly in the upland areas in the northwestern portion of the MacLellan site PDA/LAA.

The potential Project pathways for currently known heritage resources during operation include:

- Brushing activities for the ore and overburden stockpiles, MRSA, and the TMF, which could disturb known or unknown heritage resource sites if areas that were not previously cleared during construction are disturbed.
- Subsoil removal or regrading of access roads, the ore and overburden stockpiles, MRSA, and the TMF in areas that were not developed during construction, which could result in disturbance to heritage resources by disturbing the horizontal and/or vertical context of artifacts.

None of the Project components currently interact with known heritage resources. Therefore, there is a low potential for a change to the number of heritage resource sites because of the Project.

Indigenous engagement and Project-specific TLRU studies identified no cultural sites, buildings, or landscapes within the MacLellan site PDA/LAA. Community members did not provide information regarding use of the portage to Minton Lake, which is recorded as an archaeological site.

16.4.2.2 Mitigation

The objective of mitigation is to reduce the potential loss of heritage resource materials and sites or site integrity caused by Project-related activities. The best mitigation practice for heritage resources is avoidance. Mitigation measures are determined by professional experience from previous environmental assessments and through the HRB review of the HRIA report. The HRIA report detailed the results of the archaeological assessment and the recommended heritage resource management strategy to address potential effects.

Despite preconstruction HRIAs, which identified sites HfMf-3, 4, 6, 7, 8, and 10 as described in Section 16.2.2 at the MacLellan site, there is always a potential for heritage resources, including human remains, to be found during construction. Alamos will develop a Heritage and Cultural Resource Protection Plan (HCRPP) to mitigate this happenstance. The HCRPP will allow Alamos to safeguard heritage and cultural resources discovered or disturbed during Project construction and operation. The HCRPP will be based on past learnings from previous projects, knowledge of the existing heritage resource conditions within the Gordon and MacLellan sites, and recommendations from the HRB. The HCRPP will also incorporate TLRU information and outline engagement protocols with the Indigenous communities if heritage or cultural resources are found during construction or operation.

The implementation of the mitigation measures will be the responsibility of Alamos and/or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable to justify the selection. Industry standard mitigation measures include the use of existing access roads, trails, and ROW, use of signage, and implementation of traffic control measures. Recommendations regarding mitigation for heritage resources are approved by Manitoba Sport, Culture and Heritage. The HCRPP is standard practice for the change discovery of previously unidentified sites.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Gordon Site

No potential effects on heritage resources are anticipated at the Gordon site. However, mitigation measures recommended for the Gordon site include:

- Implementation of the HCRPP when heritage or cultural resources, or objects thought to be heritage or cultural objects, are exposed.

- Protective barriers placed around heritage resource sites that are inadvertently found during construction so that the area can be protected while work proceeds.
- Evaluation by a professional archaeologist of PDA/LAA changes or added development components.
- Education of construction contractors for the appropriate protocols if heritage or cultural resources, or objects thought to be heritage or cultural resources, are discovered.

MacLellan Site

Most of the Project development is proposed in locations that have a low to moderate potential for heritage resources. None of the proposed Project components interact with known heritage resources at the MacLellan site, with the exception of HfMf-7, which is a shed related to historical mining activities, that will be mitigated with as-found recording. The east and west banks of the Keewatin River are areas considered to have a high heritage resource potential but are outside the PDA/LAA.

Mitigation measures recommended for the MacLellan site include:

- Implementation of the HCRPP when heritage or cultural resources, or objects thought to be heritage or cultural objects, are exposed.
- Protective barriers placed around heritage resource sites that are inadvertently found during construction so that the area can be protected while work proceeds.
- Controlled surface collection or salvage excavation of discovered heritage resource sites, or a portion thereof, that cannot be avoided.
- Construction monitoring by a professional archaeologist in areas that are heritage sensitive such as sites identified as being culturally sensitive by Indigenous engagement.
- Evaluation by a professional archaeologist of PDA/LAA changes or added development components.
- Education of construction contractors for the appropriate protocol if heritage or cultural resources, or objects thought to be heritage or cultural resources, are discovered.
- As-found recording of site HfMf-7, a shed related to historical mining activity.

The HRB has reviewed recommendations and mitigation measures outlined in heritage permit reports and concurred with the proposed mitigation measures (Historic Resources Branch 2017).

16.4.2.3 Project Residual Effects

Gordon Site

No heritage resources are known in the Gordon site PDA/LAA. Predictive modelling has indicated that there is a low potential for the PDA/LAA to contain unknown heritage resources. Engagement with Marcel Colomb First Nation and the Manitoba Metis Federation through TLRU studies suggest that there are no culturally important spaces in the PDA/LAA. A HCRPP will be in place to mitigate inadvertently exposed heritage resources. As such, no Project residual effects are anticipated for changes to heritage resources at the Gordon site.

MacLellan Site

None of the proposed Project components interact with known heritage resources at the MacLellan site. With application of the mitigation described above, including the HCRPP that will mitigate inadvertently exposed heritage resources, no changes to heritage resources are anticipated at the MacLellan site and therefore, no residual Project effect to heritage resources.

16.5 ASSESSMENT OF CUMULATIVE ENVIRONMENTAL EFFECTS ON HERITAGE RESOURCES

It has been concluded that the Project will not have residual effects on heritage resources at either the Gordon or MacLellan sites. Therefore, since there are no residual effects, there are no cumulative effects.

The effects of past and current projects relative to conditions prior to historical mining activities contribute to baseline conditions upon which Project effects are assessed. Conditions prior to historical mining activities are generally considered to be similar to currently undisturbed areas of the RAA and may have contained heritage resources that were removed by historical mining activities, and thus were permanently affected.

16.6 EFFECTS TO FEDERAL LANDS

Federal lands within the RAA for Heritage Resources consist of:

- Black Sturgeon Falls Reserve
- Highrock 199
- Hills Island Indian Reserve
- Kamihkowapihskak Pawistik Indian Reserve
- Kapawasihk
- Kimosominahk Indian Reserve
- Mile 20 Second Revision Indian Reserve
- Mistiategameek Sipi Indian Reserve
- Monahawuhkan
- Moosowhapihsk Sakahegan Indian Reserve

- Napahkapihskow Sakhahigan Indian Reserve
- Nelson House 170 / 170a / 170b / 170 C
- Nihkik Ohnikapihs Indian Reserve
- Numaykoos Sakaheykun
- Odei River Indian Reserve
- Ohpahahpiskow Sakahegan Indian Reserve
- Opekanowi Sakaheykun
- Opekunosakakanihk
- O-Pipon-Na-Piwin Cree Nation 1
- Pachapesihk Wasahow Indian Reserve
- Pukatawagan 198
- Sisipuk Sakahegan (A) / (B) / (C) Indian Reserve
- Suwannee Lake Indian Reserve
- Wapasihk
- Wapikunoo Bay Indian Reserve
- Wapisu Lake Indian Reserve
- Wepuskow Ohnikahp Indian Reserve
- Wuskwi Sakaheykun
- Wuskwi Sipi

As there are no residual or cumulative effects predicted for heritage resources as described in Section 16.4 and 16.5, no effects on federal lands are anticipated.

16.7 DETERMINATION OF SIGNIFICANCE

16.7.1 Significance of Project Residual Effects

A significant adverse residual effect on heritage resources is defined as a Project-related effect that results in unmitigated disturbance to, or destruction of, heritage sites. Therefore, an environmental effect on heritage resources is considered to be significant if the environmental effects of the Project results in a change to the known heritage resources sites currently listed in the PDA/LAA for the MacLellan site or a previously unknown heritage resources at the Gordon site or MacLellan site that may be exposed during construction and operation. The Project components avoid known and intact heritage resources as indicated by the baseline conditions. Therefore, with proposed mitigation, and the HCRPP, there will be no residual environmental effects on heritage resources. Because there is no residual effect, there is no significant adverse residual effect.

16.7.2 Significance of Effects on Federal Lands

Based on the results in Section 16.6, because there is no residual effect, there is no significant adverse residual effect on federal lands.

16.8 PREDICTION CONFIDENCE

A conservative approach is taken in the evaluation of potential environmental effects. Prediction confidence is high at the Gordon site because there are no recorded archaeological sites, previous development has modified the landscape, the HRIA recorded no heritage resource sites, and Indigenous engagement recorded no culturally important sites. The HCRPP will mitigate effects on inadvertently exposed heritage resources and the HRB has reviewed and approved the recommendations of the HRIA.

Prediction confidence is also high at the MacLellan site because of the low number of recorded archaeological sites within the MacLellan PDA/LAA, past development has altered the landscape, and the results of the field assessment. The HCRPP will mitigate effects on inadvertently exposed heritage resources and the HRB has reviewed and approved the recommendations of the HRIA.

16.9 FOLLOW-UP AND MONITORING

By developing the HCRPP, Alamos will verify the accuracy of this environmental assessment and determine the effectiveness of the recommended mitigation measures to address adverse environmental effects of the Project.

Alamos and its construction contractors will abide by requirements issued by the provincial regulator for site avoidance, excavation, or heritage resource monitoring. The HCRPP describes the intervention mechanism to be applied during construction and operation of the Project to allow Alamos to safeguard cultural and heritage resources discovered or disturbed during the construction and operation of the Project. If cultural and heritage resources are found, Alamos and its contractors will leave all artifacts *in situ*, that is, in the same position, and will not remove objects from the site until advised by a permitted archaeologist. There will be no activities within a 50 m radius buffer until the archaeologist has completed an archaeological investigation. No reports related to any such find and its analysis will be published, other than such reports provided to the HRB or other agencies, as may be required by law. Table 16-6 illustrates the protocol for the chance discovery of archaeological materials during construction or operation.

Table 16-6 Protocols if Cultural and/or Heritage Resources are Discovered

	On-Site Project Manager	Alamos	Contract Archaeologist	Historic Resources Branch (HRB)
Step One	**STOP WORK IMMEDIATELY**			
Step Two	Mark location with flash tape and cordon with temporary fencing (minimum buffer 50 m from centre point of discovery)			
Step Three	Contact Alamos	Contact Contract Archaeologist, HRB, and Communities/ Organizations with Protocols	Apply for a heritage permit from HRB	Issue heritage permit
Step Four			Direct investigation to determine nature, extent, and significance of heritage resources	
Step Five		If discovery includes sacred or ceremonial objects, Community Representative(s) may arrange and facilitate appropriate ceremony		
Step Six			Complete scientific assessment of location through controlled surface collection and/or test pit excavation	
Step Seven			Report findings and recommendations to HRB	Evaluate heritage resources sit and findings presented to determine if further mitigative action is necessary before construction can continue
Step Eight	Construction activities in vicinity of site that will not disturb artifacts or related archaeological activities may proceed		If site cannot be avoided based on progress of construction, direct site's removal by scientific and most appropriate methods	

Table 16-6 Protocols if Cultural and/or Heritage Resources are Discovered

	On-Site Project Manager	Alamos	Contract Archaeologist	Historic Resources Branch (HRB)
Step Nine			Contact HRB to advise status of site's removal, summary of findings, and recommendations	No construction activities will take place at site until HRB issues clearance
Step Ten	Remove barriers and continue construction at location			

Chapter 23 outlines additional information on Environmental Management and Monitoring Programs.

16.10 SUMMARY OF COMMITMENTS

The confidential HRIA report was filed with the province, as required under archaeological investigation permits. Alamos will complete an as-found record of site HfMf-7, a shed related to historic mining activity. During construction, inadvertent discoveries of heritage resources will be reported to provincial authorities, as required under provincial heritage legislation. Procedures to follow for chance finds will be documented in the HCRPP.

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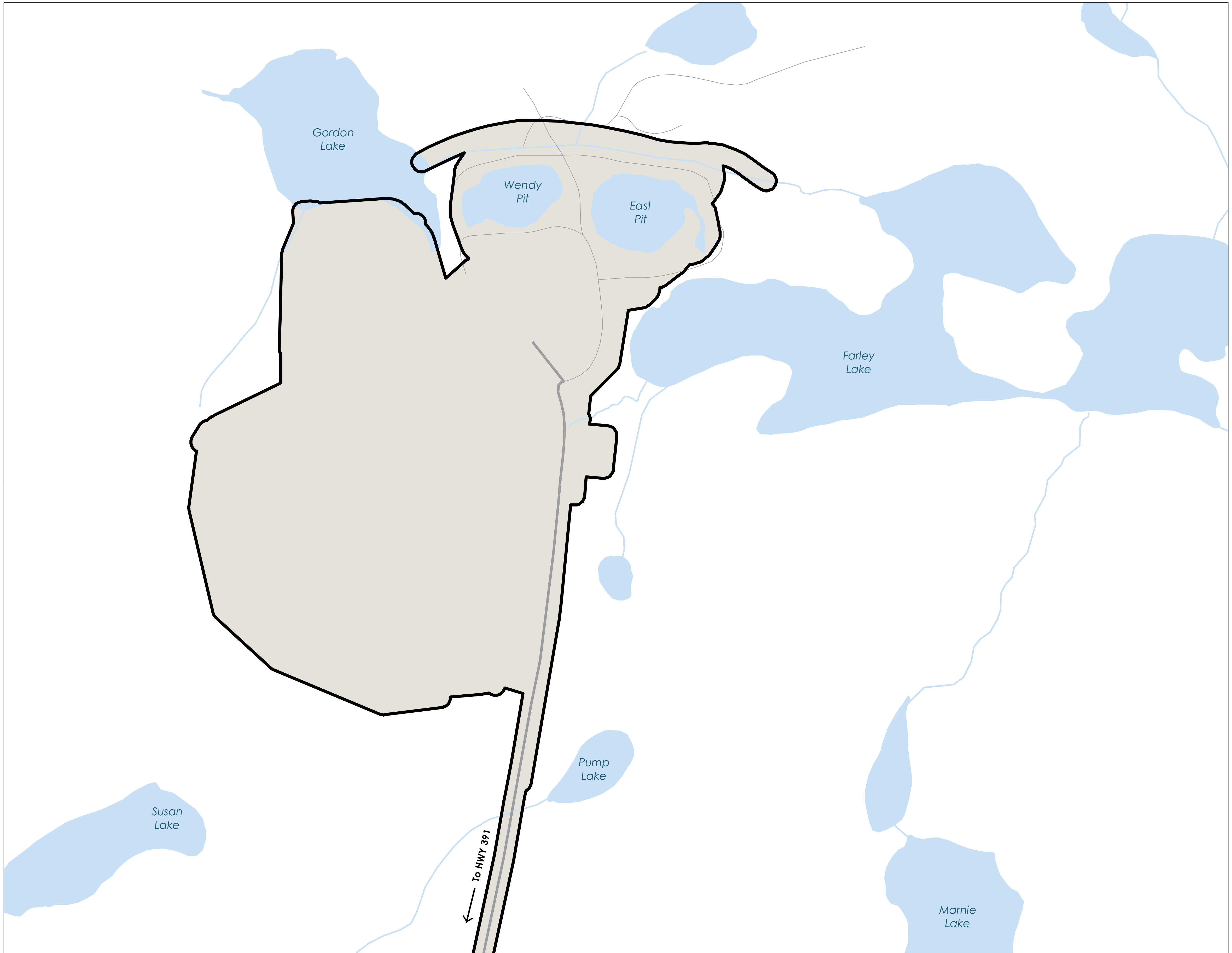


Stantec

Alamos Gold Inc.

Project Infrastructure

Project Development Area

Study Area

Heritage Resources Local Assessment Area (LAA)

Landbase

Existing Access Road

Existing Roads

Watercourse

Waterbody

N

0 250 500 Metres

(At original document size of 11x17)
1:12,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N

2. Base Data Sources: Government of Manitoba and Government of Canada.

3. Project Infrastructure features provided by QPit and Ausenco.

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-01-20
Technical Review by BAmundson on 2020-01-20
Senior GIS Review by GKroupa on 2020-01-20

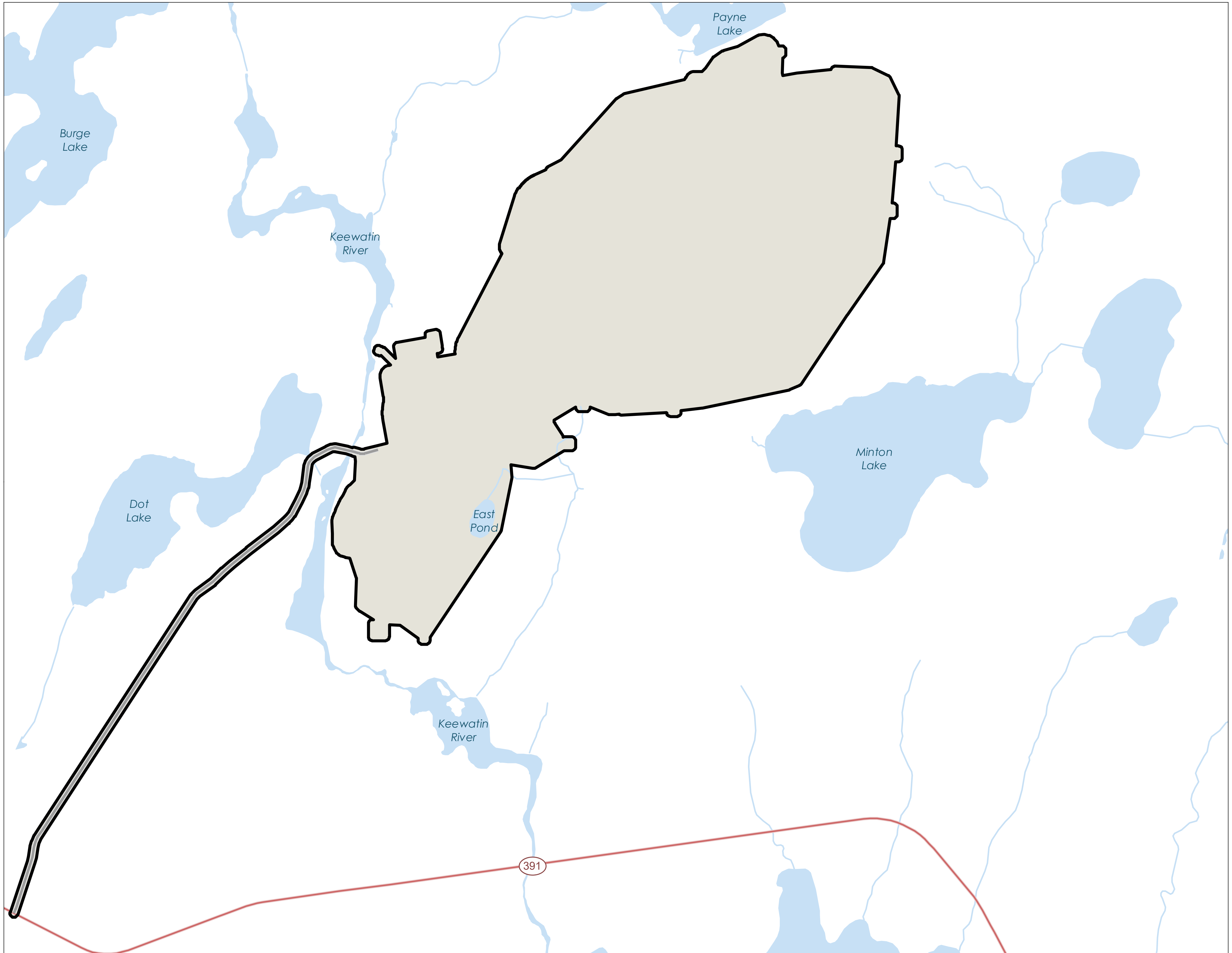
Client/Project
111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
16-1

Title
Spatial Boundaries
Gordon site

G:_GIS_Project_Folder\111473008_LLGP_EA\figures\Ch16_Heritage_Resources\For_Review\Map16-1_HRU_SpatialBoundaries_20200120.mxd Revised: 2020-01-31 By: ACampigotto



Stantec

Alamos Gold Inc.

Project Infrastructure

Project Development Area

Study Area

Heritage Resources Local Assessment Area (LAA)

Landbase

Highway

Existing Access Road

Watercourse

Waterbody

N

0 0.5 1 Kilometres

(At original document size of 11x17)
1:30,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N

2. Base Data Sources: Government of Manitoba and Government of Canada.

3. Project Infrastructure features provided by QPit and Ausenco.

Project Location

Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-01-20
Technical Review by BAmundson on 2020-01-20
Senior GIS Review by GKroupa on 2020-01-20

Client/Project

111473008

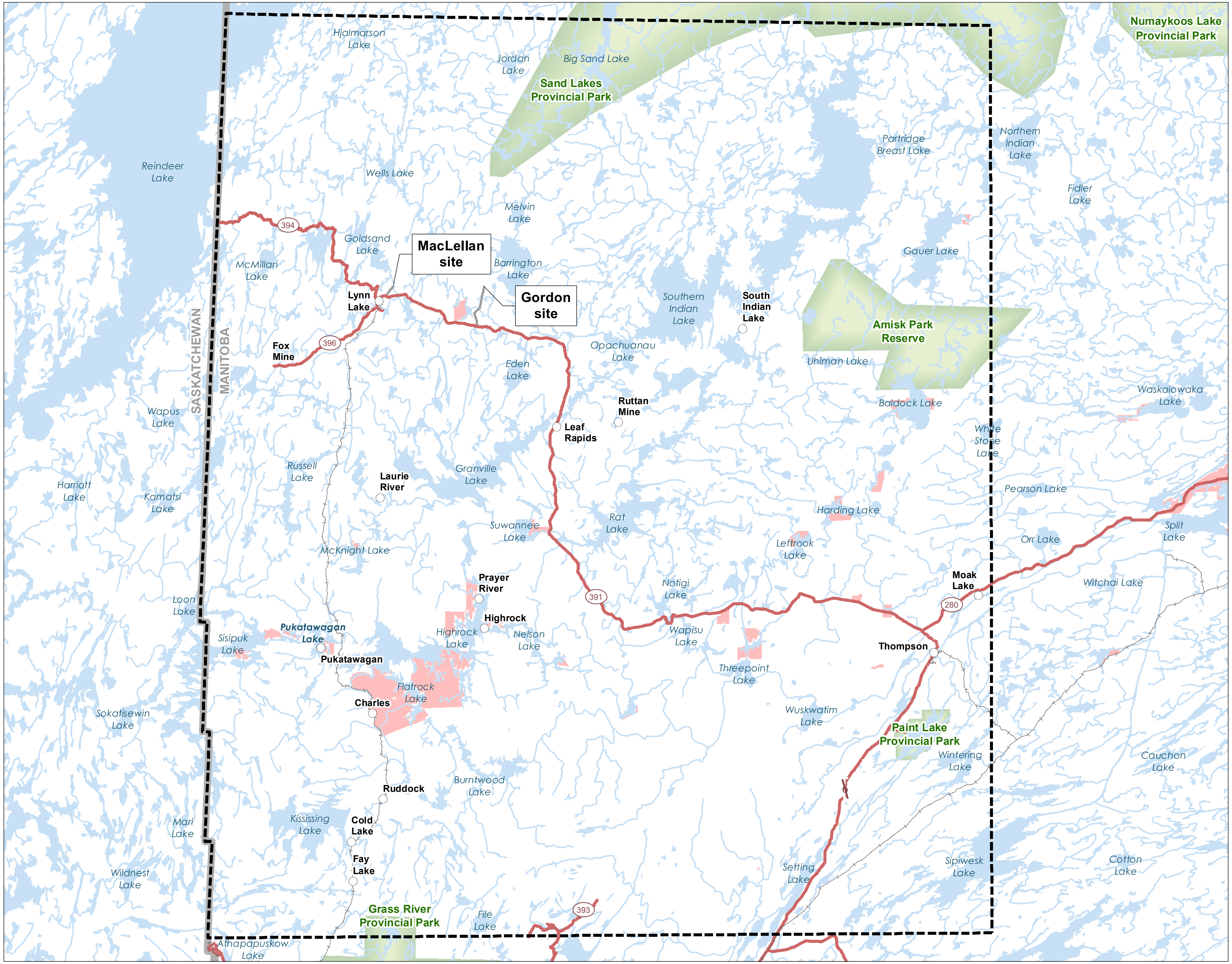
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.

16-2

Title

Spatial Boundaries
MacLellan site



Stantec

Alamos Gold Inc.

Study Area

Heritage Resources Regional Assessment Area (RAA)

Landbase

- Community
- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- First Nation Reserve
- Provincial Park
- Provincial Border

N

0 20 40 Kilometres

(At original document size of 11x17)
1:1,400,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake, Manitoba

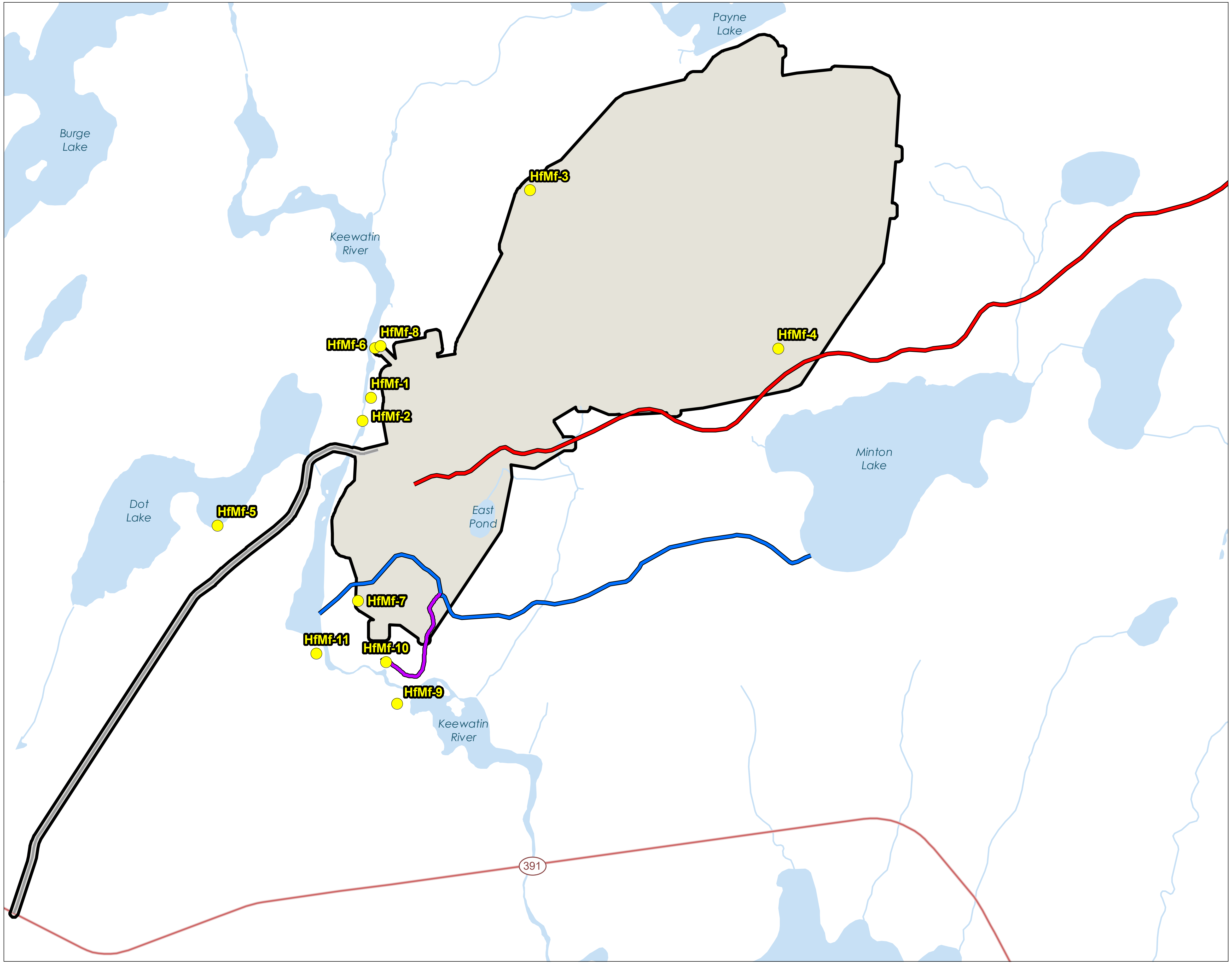
Prepared by ACampigotto on 2020-01-20
Technical Review by BAmundson on 2020-01-20
Senior GIS Review by GKroupa on 2020-01-20

Client/Project
111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
16-3

Title
Regional Assessment Area



Stantec

Alamos Gold Inc.

Project Infrastructure

Project Development Area

Study Area

Heritage Resources Local Assessment Area (LAA)

Survey Locations

Archaeological Site

Minton Lake Portage

Portage

Trail

Landbase

Highway

Existing Access Road

Watercourse

Waterbody

N

0 0.5 1 Kilometres

(At original document size of 11x17)
1:30,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada.
3. Project Infrastructure features provided by QPit and Ausenco.

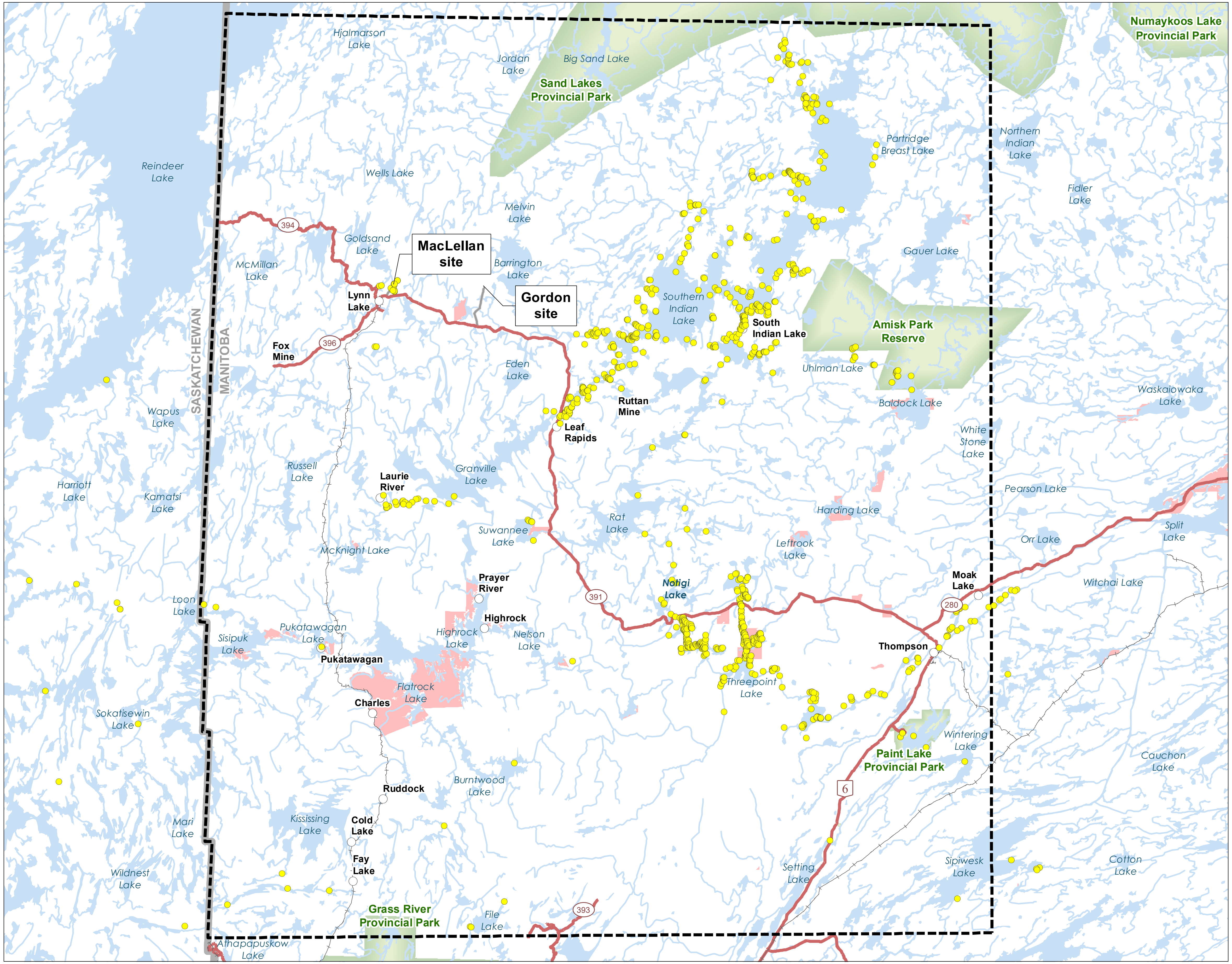
Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-01-20
Technical Review by BAmundson on 2020-01-20
Senior GIS Review by GKroupa on 2020-01-20

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
16-4

Title
Heritage Resources in the MacLellan site LAA



Stantec

Alamos Gold Inc.

Study Area

Heritage Resources Regional Assessment Area (RAA)

Heritage Resource Locations

Archaeological Site

Landbase

Community
Highway
Access Road
Rail
Watercourse
Waterbody
First Nation Reserve
Provincial Park
Provincial Border

N

0 20 40 Kilometres

(At original document size of 11x17)
1:1,400,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-01-20
Technical Review by BAmundson on 2020-01-20
Senior GIS Review by GKroupa on 2020-01-20

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
16-5

Title
Heritage Resources in the Regional Assessment Area

ALAMOS GOLD INC.

Lynn Lake Gold Project Environmental Impact Statement Chapter 17 - Assessment of Potential Effects on Current Use of Lands and Resources for Traditional Purposes by Indigenous Peoples

Stantec

Prepared by:

Stantec Consulting Ltd.

May 25, 2020

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APPENDIX 17A PROJECT-SPECIFIC TRADITIONAL LAND AND RESOURCE USE STUDIES 17A.1

Acronyms and Abbreviations

Alamos	Alamos Gold Inc.
CEA Agency	Canadian Environmental Assessment Agency, now Impact Assessment Agency of Canada
CEAA	*Canadian Environmental Assessment Act, 2012*
Current Use	Current Use of Lands and Resources for Traditional Purposes
EA	environmental assessment
EIS	environmental impact statement
Final EIS Guidelines	Final Guidelines for the Preparation of an Environmental Impact Statement, pursuant to CEAA, 2012, dated November 2017
ha	hectare(s)
HBC/HBCA	Hudson's Bay Company/ Hudson's Bay Company archives
IAAC	Impact Assessment Agency of Canada
km	kilometre
LAA	Local Assessment Area
m	metre
MCC	Manitoba Conservation and Climate
MVKT	million vehicle kilometres travelled
PDA	Project Development Area
RAA	Regional Development Area
the Project	Lynn Lake Gold Project
TK	traditional knowledge
TLRU	traditional land and resource use
VC	valued component

17.0 ASSESSMENT OF POTENTIAL EFFECTS ON CURRENT USE OF LANDS AND RESOURCES FOR TRADITIONAL PURPOSES BY INDIGENOUS PEOPLES

The objective of this chapter is to understand and document Indigenous peoples' current use, describe potential Project interactions, identify mitigation strategies, and characterize anticipated Project residual effects. Current Use of Lands and Resources for Traditional Purposes by Indigenous Peoples is a valued component (VC) for assessment because of the potential for the Project to affect traditional activities, sites, and resources identified by First Nations and Métis (hereinafter referred to as Indigenous communities[1]). "Indigenous", in the context of this Environmental Impact Statement/Environmental Assessment (EIS/EA) corresponds with "Aboriginal" as used in section 35 of the *Constitution Act*, 1982.

The Canadian Environmental Assessment Act, 2012 (CEAA 2012) Section 5(1)(c)(iii) identifies "current use of lands and resources for traditional purposes" as an environmental effect to be considered in an environmental assessment (CEAA 2012). The Canadian Environmental Assessment Agency (CEA Agency; now the Impact Assessment Agency of Canada or IAAC) Final Guidelines for the Preparation of an EIS, dated November 2017, issued for the Project (Appendix 4A) indicate that current use of lands and resources for traditional purposes by Indigenous peoples may include activities such as hunting, trapping, fishing, and plant gathering. In the remainder of this assessment, the term "Current Use" refers to "current use of lands and resources for traditional purposes by Indigenous peoples." Current Use encompasses various traditional activities, practices, sites, areas, and resources, including, but not limited to:

- Hunting
- Trapping
- Fishing
- Plant gathering
- Use of trails and travelways, including navigation
- Use of habitation areas (e.g., cabins, campsites, temporary shelters)
- Use of cultural and spiritual sites and areas.

Information on Current Use is based on Project-specific traditional land and resources use (TLRU) studies, as well as Project engagement activities, and existing literature as well as the analysis of relevant biophysical and socio-economic assessments. This information, current to May 22, 2020, confirms that the

[1] Indigenous communities is used to align with the terminology used by Crown-Indigenous Relations and Northern Affairs Canada www.rcaanc-cirnac.gc.ca/eng; Manitoba Indigenous and Northern Relations www.gov.mb.ca/inr/; the Government of Saskatchewan www.saskatchewan.ca/residents/first-nations-citizens/duty-to-consult-first-nations-and-metis-communities; and the Final EIS Guidelines for the Project (2017; Appendix 4A).

Project has the potential to affect traditional activities, sites and resources identified by Indigenous communities.

Project-specific engagement was conducted with Marcel Colomb First Nation, Mathias Colomb Cree Nation, Peter Ballantyne Cree Nation, Manitoba Metis Federation, Métis Nation-Saskatchewan Eastern Region 1, Nisichawayasihk Cree Nation, O-Pipon-Na-Piwin Cree Nation, Métis Nation-Saskatchewan Northern Region 1, Barren Lands First Nation, Hatchet Lake First Nation, Northlands Denesuline First Nation and Sayisi Dene First Nation.

A Project-specific TLRU study was completed collaboratively with Marcel Colomb First Nation with a final report provided to the community on January 11, 2018 (Appendix 17A; Stantec 2018). The TLRU study included interviews with participants selected by Marcel Colomb First Nation regarding traditional land use in the Project area, including availability of traditional resources, access to traditional resources or areas, occupancy, cultural sites and areas, and experience of TLRU.

A Project-specific TLRU study was completed in collaboration with Peter Ballantyne Cree Nation but has not yet been released by community leadership for use in the environmental assessment. The TLRU study included interviews with community members in Kinoosao, Saskatchewan.

A TLRU study (Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project) was completed by an independent consultant for the Manitoba Metis Federation (Appendix 17A; SVS 2020), the results of which were received in February 2020. The study documents harvesting and land use by the Manitoba Métis Community within a 100-kilometre (km) radius of the Project.

A Project-specific TLRU study is underway by Mathias Colomb Cree Nation, but is not available for this assessment.

Activities associated with the Project's construction, operation, and closure phases have the potential to affect Current Use activities, sites, and locations. The Project may affect Current Use through local changes to:

- Availability of traditional resources for Current Use.
- Access to traditional resources or areas for Current Use.
- Current Use sites or areas.
- Experience of Current Use and cultural values of traditional resources.

Current Use described in this chapter has links to biophysical and socio-economic VCs. The assessment of Current Use integrates discussions and conclusions from the following VCs:

- Atmospheric environment (Chapter 6) – Project construction and operation have the potential to increase dust and combustion gas emissions, and ambient lighting conditions, which have the potential to affect the use and experience of property.

- Noise and vibration (Chapter 7) – changes in noise and vibration levels have the potential to affect Current Use because of sensory disturbance.
- Groundwater and Surface water (Chapters 8 and 9) - changes in water quality that may affect potability or habitat for traditionally used resources, and water quantity may affect the navigability of watercourses and the ability to participate in water-based activities (e.g., fishing).
- Fish and fish habitat (Chapter 10) – due to linkages with fishing practices.
- Vegetation and wetlands (Chapter 11) – due to linkages with plants used for traditional foods and medicines, as well as for crafts, ceremonial, and other traditional purposes.
- Wildlife and wildlife habitat (Chapter 12) – due to linkages with species traditionally hunted and trapped.
- Land and resource use (Chapter 15) – due to linkages with shared use of the land.
- Heritage resources (Chapter 16) – due to linkages between current and historical traditional land use.
- Indigenous Peoples (Chapter 19) – due to linkages between Indigenous and treaty rights and Current Use.

The assessment of effects on Current Use informs the assessment of effects on human health (Chapter 18) as changes in chemical uptake in vegetation, animals or fish can affect human health through direct consumption of country foods.

This assessment assumes that the exercise of traditional activities depends on the health and abundance of traditionally harvested species and the continued availability of and access to traditional use sites and areas.

17.1 SCOPE OF ASSESSMENT

This section defines and describes the scope of the assessment of potential effects on the Current Use VC.

17.1.1 Regulatory and Policy Setting

The following section summarizes federal and provincial acts, regulations, policies, and/or guidelines considered in the assessment of Current Use. The environmental effects assessment for Current Use has been prepared in accordance with the requirements of the Final EIS Guidelines (Appendix 4A).

17.1.1.1 Federal Regulatory and Policy Setting

For federal EAs with respect to Indigenous people, the *Canadian Environmental Assessment Act, 2012* CEAA 2012 requires the consideration of:

> "*an effect occurring in Canada of any change that may be caused to the environment on the current use of lands and resources for traditional purposes*" (section 5(1)(c)(iii)).

Technical guidance for assessing effects on current use of lands and resources for traditional purposes (Current Use in this document) where the CEA Agency (now IAAC) is the responsible authority is provided in *Technical Guidance for Assessing the Current Use of Lands and Resources for Traditional Purposes under CEAA 2012* (CEA Agency 2015).

The Final EIS Guidelines (Appendix 4A) also identify requirements for engagement with twelve Indigenous communities (Section 17.1.3), integrating Indigenous traditional knowledge (TK) in the assessment of environmental effects, provision of information regarding existing conditions to support the analysis of predicted effects on Current Use, and documenting specific suggestions raised by Indigenous communities for mitigating effects of changes to the environment.

17.1.1.2 Provincial Regulatory and Policy Setting

Manitoba Sustainable Development (now Manitoba Conservation and Climate or MCC) provides guidance in Information Bulletin – Environment Act Proposal Guidelines (MCC 2017). In the Description of Environmental and Human Health Effects of the Proposed Development, the guidelines require a description of potential effects of the development on Indigenous communities, including, but not necessarily limited to:

- Direct effects on communities in the Project area.
- Resource use, such as hunting, fishing, trapping, and gathering.
- Cultural or traditional activities in the Project area.

17.1.2 Indigenous and Treaty Rights and Current Use of Lands and Resources for Traditional Purposes

Federal and provincial regulations require detailed consideration of the environmental effects of development projects situated within the traditional territories of Indigenous communities, and the assessment of effects on traditional land users and knowledge holders' ability to exercise their Indigenous[2] and treaty rights. This includes the use of traditional lands and resources (which is linked to disturbance to animal, fish, and plant habitat), as well as disruption to sacred cultural sites including burial grounds. It is generally accepted that Indigenous and treaty rights may encompass more than specific harvesting activities such as hunting, trapping, fishing and gathering, and may include an array of values, customs, traditions and practices that are important and unique to each Indigenous community, such as performing traditional ceremonies and burials (INAC 2011). If development activities have the potential to adversely affect potential or established Indigenous or treaty rights, the Crown has a duty to consult and, where appropriate, accommodate potentially affected Indigenous communities. Information regarding potential effects on Indigenous or treaty rights is often obtained through TLRU studies that seek to gauge the extent of past and present use of the land for traditional purposes including, but not limited to, hunting, fishing, trapping, plant gathering, as well as trails and travelways, habitation areas, and cultural and spiritual sites

[2] "Indigenous" has the meaning assigned by the definition of Aboriginal peoples of Canada in subsection 35(2) of the *Constitution Act, 1982*: (2) In this *Act*, "aboriginal peoples of Canada" includes Indian, Inuit, and Métis peoples of Canada.

and practices. TK studies provide information relevant to gauge the use of the area and how that use could be affected by a development project (INAC 2011). A detailed consideration of Indigenous and treaty rights is provided in Chapter 19.

First Nations considered in this EIS include members of Treaties 5, 6 and 10. Métis peoples considered in the EIS are Métis citizens of Manitoba and Saskatchewan.

17.1.3 The Influence of Engagement on the Assessment

Engagement has been ongoing prior to and throughout the EIS process and will continue through the life of the Project. More detail on the Engagement process can be found in Chapter 3.

Alamos Gold Inc.'s (Alamos's) engagement with Indigenous communities began in 2014 when Marcel Colomb First Nation was provided with the opportunity to provide information regarding current use, to conduct site visits in the Project Development Area (PDA; Section 17.1.5.1) and to conduct a TLRU study. In 2017, an additional 11 Indigenous communities were engaged, including eight First Nations in Treaties 5, 6 and 10, the Manitoba Metis Federation and, two Regions of Métis Nation-Saskatchewan, in accordance with the Final EIS Guidelines (Appendix 4A; Chapter 3, Map 3-1). Project information was sent to these additional communities and organizations and they were provided with an opportunity to learn more about Alamos, the Project, and its potential effects, as well as share information on current use, visit the PDA and conduct TLRU studies. Alamos has engaged with potentially affected communities through letters of introduction and information packages, in-person meetings, telephone conversations and email as well as open houses in Lynn Lake, Winnipeg, and Nisichawayasihk Cree Nation. An open house with O-Pipon-Na-Piwin Cree Nation planned for February 2020 was postponed at the request of the community and is to be rescheduled.

Indigenous communities identified for engagement are categorized by IAAC as 'most affected' and 'affected to a lesser degree' as follows:

IAAC 'Most Affected' Indigenous communities:

- Treaty 5 First Nations
    - Barren Lands First Nation
    - Nisichawayasihk Cree Nation
    - O-Pipon-Na-Piwin Cree Nation
- Treaty 6 First Nations
    - Marcel Colomb First Nation
    - Mathias Colomb Cree Nation
    - Peter Ballantyne Cree Nation

- Manitoba Metis Federation

IAAC Indigenous communities ‘Affected to a Lesser Degree’:

- Treaty 5 First Nations
  - Northlands Denesuline First Nation
  - Sayisi Dene First Nation
- Treaty 10 First Nation
  - Hatchet Lake First Nation
- Métis Nation – Saskatchewan Northern Region 1
- Métis Nation – Saskatchewan Eastern Region 1

In addition to specific Current Use sites and areas identified, issues and concerns related to effects of the Project on Current Use were reported by Indigenous communities through the Indigenous engagement program for the Project, described below.

17.1.3.1 Consideration of Indigenous Interest and Community Knowledge Regarding Current Use of Lands and Resources for Traditional Purposes

The IAAC requested the information on Indigenous communities to be provided on a community-by-community basis. In response, the existing conditions section provides information on each of the potentially affected communities for which information regarding current land and resource use through Project-specific studies, publicly available secondary sources, and consultation activities, is available. Project mechanisms were also assessed on a community basis, and residual effects were considered on a community-by-community basis. Residual effects are amalgamated in summary because the effects pathways and Project effects identified for each potentially affected community were similar and lead to similar conclusions. Where information leads to different conclusions for one or more communities, a unique residual effects characterization is presented.

17.1.3.2 Access to Land and Change to Harvested Resources

Marcel Colomb First Nation, Mathias Colomb Cree Nation, and the Manitoba Metis Federation have expressed a general concern regarding historical mining practices in northern Manitoba and their past effects on food and medicinal plants, animals, fish, air quality, acoustic environment, and water quality (including snow). Water and air quality are of concern to Marcel Colomb First Nation and Mathias Colomb Cree Nation, especially as they may affect hunting and fishing habitats. Marcel Colomb First Nation is concerned about potential effects on country food and pointed to the Cockeram Lake fishery as an example of mining effects on the safe consumption of fish from that lake. Use of herbicides and their potential effect on the food chain is of concern as well.

Peter Ballantyne Cree Nation expressed concerns about water quality and its effects on fisheries in Reindeer Lake. Mathias Colomb Cree Nation was concerned with the effects on fisheries in the Keewatin River, Granville Lake and Granville Falls. O-Pipon-Na-Piwin Cree Nation also expressed general concerns about the effects of changes in water quality to fishing resources. Manitoba Metis Federation shared concerns regarding water quality and contamination of water from pollutants such as arsenic. Nisichawayasihk Cree Nation shared concerns about general surface and groundwater quality; aquatic resources including species at risk, *Fisheries Act* triggers, and invasive species; and, the potential release of hazardous materials into the environment from the transportation of dangerous goods throughout their Resource Management Area (RMA) as well as the proximity of the Project to the RMA and potential effects to traditional harvesting.

Marcel Colomb First Nation shared concerns regarding sensory effects such as noise disturbing animal movements and their resultant effect on hunting and trapping near the Gordon and MacLellan sites during construction and operation. Mathias Colomb Cree Nation expressed concern over these same sensory effects on general aesthetics.

Manitoba Metis Federation shared concerns about disrupting the natural environment including the effects to the species present on the land.

Peter Ballantyne Cree Nation expressed concerns about sensory effects on wildlife, particularly the barren ground caribou migration patterns, due to the reliance of their people on this food source. These concerns were also expressed by Hatchet Lake First Nation and the Métis Nation of Saskatchewan Eastern Region 1. Nisichawayasihk Cree Nation shared concerns regarding impacts to terrestrial species at risk, migratory birds, and big game species.

Mathias Colomb Cree Nation shared concern about increased traffic due to the Project resulting in traffic collisions with wildlife and affecting resource availability. Nisichawayasihk Cree Nation shared concerns regarding increased traffic on Provincial Road (PR) 391 and the further deterioration of main access roads.

Marcel Colomb First Nation indicated that plant harvesting sites within the Local Assessment Area (LAA; Section 17.1.5.1) require protection from vegetation clearing and management practices. Vegetation clearing was also highlighted as a concern regarding potential unmarked graves.

Marcel Colomb First Nation expressed a desire to clarify access restrictions within the PDA and LAA, including harvesting areas, and access to those areas as it pertains to gates, shooting restrictions and signage.

Manitoba Metis Federation shared a concern that effects on water quality, habitat availability and habitat quality due to the presence of the Project will affect resource use. Manitoba Metis Federation indicated that current government regulations restrict resource use by its citizens, and they are concerned that additional harvesting pressures by an increased population or workforce will further affect resource availability.

17.1.3.3 Effects on Exercise of Indigenous and Treaty Rights to Lands and Resources

Alamos, at the time of application filing, has funded TLRU studies with Marcel Colomb First Nation, Peter Ballantyne Cree Nation, Manitoba Metis Federation, and Mathias Colomb Cree Nation. The Mathias Colomb Cree Nation study is ongoing. These studies provide Project-specific information on the exercise of Aboriginal and Treaty Rights as they pertain to access and availability of lands and resources for communities that currently conduct traditional practices within the Regional Assessment Area (RAA; Section 17.1.5.1). Information from the Marcel Colomb First Nation TLRU (Appendix 17A; Stantec 2018) and Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project (Appendix 17A; SVS 2020) have been included herein, in accordance with their terms of use. Alamos is awaiting an information sharing agreement regarding the Project-specific TLRU with Peter Ballantyne Cree Nation.

17.1.3.4 Anticipated Project Effects Identified by Indigenous Communities

This section summarizes the input provided throughout the Indigenous engagement program; communities have identified concern related to the potential effects of the Project.

Marcel Colomb First Nation

Marcel Colomb First Nation shared concerns about noise (including helicopters), air quality and the effects of blasting on the community. They shared concerns regarding groundwater and surface water quality and the effect on fish habitat, citing cumulative effects in Cockeram Lake due to historical tailings seepage. Of further concern are potential long-term effects of the Project on surface and freshwater supply, including volume, quality, and the cost of remediation in the event of an accident or malfunction.

Regarding wildlife and wildlife habitat, Marcel Colomb First Nation expressed concerns about terrestrial habitat degradation by vegetation clearing, increased hunting pressure, and traffic interactions that may affect moose and caribou populations and, therefore, hunting success. They also expressed concerns about Project interactions with traplines and limited access to those traplines due to gated roads.

Mine rock and tailings management, and the potential to affect downstream lakes by surface drainage (especially Keewatin River) that run near the Project were concerns expressed by Marcel Colomb First Nation. Effects on Eldon, Cockeram, Moses, Mary, Anson, Granville, and Sickle lakes from the MacLellan site and on Swede Lake from the Gordon site were specifically highlighted by Marcel Colomb First Nation.

Mathias Colomb Cree Nation

Mathias Colomb Cree Nation expressed concern about noise, dust, and other emissions from the Project as well as truck traffic and wildlife collision risks. Mine rock effects on surface water was of concern as was the potential to affect downstream lakes by surface drainage (especially Keewatin River) that run near the Project. The potential for effects on Eldon, Cockeram, Moses, Mary, Anson, Granville, and Sickle lakes from the MacLellan site and on Swede Lake from the Gordon site was specifically highlighted by Mathias Colomb Cree Nation. Earth moving required for the Project, which may cause changes to landscapes, aesthetics, and associated effects to Indigenous rights is of concern as well. Additional concerns include interactions between Project transportation routes and traplines as well as external pressure on wildlife, migratory birds and fish resources by Project employees and contractors. Mathias Colomb Cree Nation cited a concern over the cumulative effects on an already vulnerable ecosystem, as well as potential damage to archaeological and cultural sites in and around Lynn Lake.

Mathias Colomb Cree Nation also shared concerns about increased road traffic due to the Project and sensory effects on general aesthetics.

O-Pipon-Na-Piwin Cree Nation

O-Pipon-Na-Piwin Cree Nation expressed concern regarding surface water quality and effects to resources that depend on surface water, especially in Barrington Lake, which is partially within the RAA and South Indian Lake, which is outside the RAA.

Nisichawayasihk Cree Nation

Nisichawayasihk Cree Nation raised concerns about the potential effects of increased truck traffic on the provincial road from Thompson including introduction of invasive species and potential spills in the RAA.

Manitoba Metis Federation

Manitoba Metis Federation expressed concerns about overprinting of aquatic habitats and seepage causing degradation of water quality, quantity, and affecting wetlands, rivers, lakes, and wildlife, as well as loss and fragmentation of habitat for sensitive species. These interactions may affect current harvesters who are active in the Project area and affect collective rights in a region with known contemporary and historical use for fishing, hunting, trapping, and cultural purposes. The Manitoba Metis Federation is further concerned that the mine workforce will bring people who will engage in hunting, fishing, and recreation that could negatively affect wildlife.

Manitoba Metis Federation, in their Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project, expressed concerns regarding changes in caribou migration patterns and behaviour. Manitoba Metis Federation also expressed concerns regarding site cleanup including reclamation and decommissioning.

Peter Ballantyne Cree Nation

Peter Ballantyne Cree Nation expressed concern regarding surface water and potential effects on Reindeer Lake and Hughes River. They were concerned about effects on the harvest of barren ground caribou in Manitoba as the Project is within traditional territory of the Southend, Saskatchewan community.

Barren Lands First Nation

Barren Lands First Nation expressed concern about effects to air quality, water quality, and barren ground caribou due to their reliance on caribou meat.

Métis Nation-Saskatchewan Eastern Region 1

Métis Nation-Saskatchewan Eastern Region 1 hunters were most concerned about effects on the migration of woodland caribou.

Hatchet Lake First Nation

Hatchet Lake First Nation had concerns about potential effects to barren ground caribou herds as they have hunted at South Indian Lake as recently as the winter of 2018.

17.1.4 Potential Effects, Pathways and Measurable Parameters

Current Use as defined in this EIS meets both the provincial guidelines and Final EIS Guidelines for the Project (MCC 2017 [Appendix 4B], CEA Agency 2017 [Appendix 4A]). Current Use includes the rights-based harvesting of resources through the practice of hunting, fishing, trapping, gathering plants and other natural materials, right of access to areas where teaching or transfer of knowledge regarding cultural practices occur, and to ceremonial sites, travel routes, and sacred sites. Current Use also accounts for the conditions of use, seasonal cycles, intergenerational knowledge transmission, landforms and named places, and other factors that provide context, setting or understanding for the practice of current use activities.

Current Use must be understood in the context of past and future use. Historical traditional land and resource use information, and information based on community members' living memory situates contemporary activities and long-term observations of existing conditions. Future use pertains to the opportunities for generations of descendants of the Indigenous communities to continue to practice cultural traditions in a modern form. Framing traditional activities and practices in this way serves to acknowledge that TLRU (while having continuity with historical practices, traditions, or customs) is dynamic and changing. Conceived of in this way, current use situates long-standing cultural practices in a contemporary context.

Characterizing the effects of the Project on Current Use employs parameters that can evaluate each type of predicted effect. Ideally, these parameters are measurable and quantifiable (e.g., availability of habitat for harvested species). However, some effects on Current Use lack defined measurable parameters and are therefore evaluated qualitatively based on comments received from Indigenous communities, past project experience and professional judgment. Potential effects, effects pathways and measurable parameters used to characterize and assess effects on Current Use are provided in Table 17-1. The potential environmental effects on Current Use were measured by change to availability of resources for current use and access to resources and areas for current use. Availability refers to the physical presence, the abundance and distribution of lands and resources for Current Use activities as well as the integrity of cultural and spiritual sites and areas. Access considers the change to the ability to access lands and resources for Current Use activities or alteration of lands and resources for Current Use activities. When assessing the effect of a development project on Indigenous and treaty rights, the measurable parameter used is the degree to which the project will affect the ability of that Indigenous community to undertake the activities and practices upon which the exercise of Indigenous and treaty rights depends.

A conservative approach is used to address uncertainty in the environmental effects assessment, which increases confidence in the final determination of significance by reducing the risk of understating Project effects. Assumptions used to address uncertainty are identified as part of the description of analytical assessment techniques for each of the respective environmental effects (Sections 17.4.2, 17.4.3, and 17.4.4). The prediction confidence of the assessment for Current Use (Section 17.7) incorporates these assumptions and other elements that contribute to the conservative approach.

The potential environmental effects listed in Table 17-1 represent a wide range of potential tangible effects on Current Use. The intangible, experiential and spiritual aspects of Current Use are discussed below.

Table 17-1 Potential Effects, Effects Pathways and Measurable Parameters for Current Use of Lands for Traditional Purposes

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in availability of resources currently used for traditional purposes	• Vegetation clearing associated with Project construction could result in a loss of habitat for species of traditional importance, including plants and animals relied on for traditional hunting, trapping, or plant harvesting • Loss or alteration of fish habitat resulting from disturbance to watercourses • Sensory disturbance from Project operation has the potential to affect the availability of habitat for species traditional importance • An increase in hunting or fishing pressure by non-Indigenous people has the potential to affect the availability of traditionally used species Potential effects on wildlife, fish, and vegetative health that could affect the availability of traditional resources	• Area of habitat (ha) for traditionally used plant or animal species • Area of habitat for fish species • Qualitative evaluation of change in hunting and fishing pressure as a result of the Project and other planned developments • Identification of change in resource from participating Indigenous community
Change in access to resources or areas currently used for traditional purposes	• Loss, alteration, or restriction of access (including trails and travelways) to current lands and resources used for traditional purposes	• Area (ha) of trails and travelways with access restrictions • Identification of change in access from participating Indigenous communities
Change to traditional cultural and spiritual sites and areas	• Project construction and operation could result in a loss or alteration of identified current use harvesting sites, habitation areas, cultural and sacred sites Indirect effects on the experience of Indigenous peoples which adversely alter the perceived values of current use sites or areas	• Number of traditional cultural and spiritual sites and areas affected • Area (ha) of traditional cultural and spiritual sites and areas affected

Table 17-1 Potential Effects, Effects Pathways and Measurable Parameters for Current Use of Lands for Traditional Purposes

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change to the environment that affects cultural value or importance associated with Current Use	• Indirect effects on the experience of Indigenous peoples which adversely alter the perceived value of access to traditional resources for current use or current use sites and areas • Change to values or attributes of the area that make it important • Presence of worker or increased access to the area by non-Indigenous peoples • Sensory disturbance from Project construction and operation has the potential to affect • Changes that could detract from use of the area or lead to avoidance of the area as a result of real and perceived disturbance of the environment	• Note: The experience of Indigenous peoples on the land, cultural identity, opportunities for intergenerational knowledge transmission, and spiritual connections represent intangible values, which are largely subjective and conditional, reflecting beliefs, perceptions, values, and qualitative experience. As such, given the complexities involved, it is not possible to establish meaningful and applicable measurable parameters or assess intangible values to current assessment conventions. Effects on intangible values, however, are discussed narratively and considered in assessment conclusions.

Effects on Current Use may incorporate both tangible values (e.g., biophysical or socio-economic resources and sites) and intangible values (e.g., spiritual, cultural, artistic, aesthetic, and educational elements).

There are two elements of Section 6.3.4 of the Final EIS Guidelines that require information about intangible values:

- Cultural value or importance associated with physical and cultural heritage.
- Cultural value or importance associated with traditional uses or areas.

Tangible values include specific resources, physical sites, and observable activities that can be more readily considered in an effects assessment. For example, tangible values often have a demonstrable link to a biophysical VC (e.g., traditional hunting linked to wildlife and biodiversity) and are measurable. In Chapter 17, potential Project effects on these tangible values have been subjected to a conventional environmental assessment methodology that characterizes residual effects.

Intangible values relate to beliefs, perceptions, values, and qualitative experience. Given the subjective and conditional nature of intangible values, these potential effects are considered only when an Indigenous community has identified a related concern. Potential effects on experiential values often include changes to cultural transmission, language retention, governance systems, patterns of cultural behaviour, and the sensorial experience of traditional practices. Intangible effects can only be meaningfully evaluated by individuals and communities experiencing these values in their cultural context; however, such effects are difficult to mitigate or quantitatively assess by an external party. These effects are not amenable to conventional residual effects characterizations that were developed for the assessment of objective, measurable phenomena from a Western scientific perspective. In addition, intangible effects might not realistically be mitigated in the context of an environmental assessment. For example, while it is entirely possible to mitigate effects on water quality to meet Health Canada thresholds, it is not possible to effectively mitigate someone's belief that the water is not safe to drink. Therefore, potential effects on intangible values will not be subject to a full effects assessment (e.g., that includes residual effects characterization). Rather, when an Indigenous community has identified a related concern, the subjective and experiential components of Current Use that cannot be measured will be considered narratively. Both tangible and identified intangible values contribute to the conclusion for the Current Use assessment.

17.1.5 Boundaries

17.1.5.1 Spatial Boundaries

The spatial boundaries for the assessment of Current Use were developed by considering the spatial extent of the LAAs or RAAs for the relevant VCs, wildlife and wildlife habitat (Chapter 12), vegetation and wetlands (Chapter 11) and surface water VC (Chapter 9), considering information gathered through Project specific engagement, and by applying available TK and Current Use information. The areas applied for the assessment of potential environmental effects on Current Use are described below and shown in Map 17- 1.

- Project Development Area (PDA): encompasses the immediate area in which Project activities and components may occur plus a 30-metre (m) buffer and is the anticipated area of direct physical disturbance associated with construction and operation of the Project (i.e., the Project footprint; Map 17-1). The PDA of Gordon site is approximately 271.52 hectares (ha). The PDA of MacLellan site is approximately 937.88 ha.

- Local Assessment Area (LAA): aligns with the LAA established for the wildlife and wildlife habitat VC (Chapter 12). This LAA also encompasses the predicted extent of potential effects on terrestrial uses (effects on vegetation and wetlands VC, Chapter 11) and was established to consider the area in which the Project activities could have direct or indirect effects on Current Use. This is because traditional practices rely on the resources as assessed in these biophysical VCs, as well as fish and fish habitat (Chapter 10) and on access to these resources. The LAA is a 1 km buffer around the PDA to account for sensory disturbance to harvested wildlife species, to traditional practices, and dust on harvested plants. It is approximately 14,392.32 ha (Map 17-1).

- Regional Assessment Area (RAA): aligns with the RAA selected for the wildlife and wildlife habitat VC (Chapter 12) due to Indigenous use and reliance on moose in the area, as described by Marcel Colomb First Nation. As traditional harvesting depends on the species considered in this VC and it covers a broad area of the most mobile species, the RAA is used to provide regional context for the significance of residual effects and is also the area within which the potential for cumulative effects of the Project in combination with other past, present, or reasonably foreseeable projects or activities are considered. The RAA is approximately 176,378.84 ha (Map 17-1).

Where site-specific TLRU information is available, Current Use sites that fall within the spatial boundaries of the Current Use assessment are identified. Indigenous communities may identify spatial boundaries in relation to their traditional lands or traditional territories; however, boundaries identified by various Indigenous communities often vary considerably. Aligning the Current Use boundaries with those of wildlife and surface water provides consistent boundaries throughout the EIS where changes can be quantified. While certain references to Current Use activities may be beyond the RAA, including them is intended to characterize the extent and nature of traditional practices in the region.

17.1.5.2 Temporal Boundaries

The temporal boundaries for the Project consist of the following phases:

- Construction – two years (scheduled to be carried out concurrently from Year -2 to Year -1 at both sites).
- Operation – 13 years (scheduled to be carried out from Year 1 to Year 6 at the Gordon site and from Year 1 to Year 13 at the MacLellan site).
- Decommissioning/closure – five to six years of active closure (scheduled to begin in Year 6 at the Gordon site and in Year 14 at the MacLellan site). Active closure will be followed by post-closure, which is the time period during which active reclamation measures are complete, but monitoring is still required. The expected duration for post-closure is approximately 10 years. Pit filling is expected to take 11 years at the Gordon site and 21 years at the MacLellan site under average conditions (Chapter 9, Section 9.4.1). Permanent closure will occur when the site is stable, and monitoring is no longer required. For Current Use, this will occur when the PDA returns to its pre-Project state, except for the open pits and mine rock, which will be permanent features.

The temporal boundary for Current Use also considers each local Indigenous community's current and future use of lands and resources for traditional purposes during the Project construction, operation, and closure. Current Use was defined as extending back from the present time to within the last 25 years; therefore, information regarding existing conditions, with associated temporal details is limited to 1994 to present and into the reasonably foreseeable future. Twenty-five years was chosen as the temporal boundary for considering effects of a change in the environment on Indigenous people because knowledge about traditional practices or locales may be lost or may not be passed on to younger members of the community if it goes unused for a generation. Future use pertains to the opportunities for generations of descendants to practice traditional activities (in modern form) and maintain traditional cultural and spiritual values.

17.1.6 Residual Effects Characterization

Residual effects are those effects remaining after implementing mitigation measures. Table 17-2 defines residual environmental effects through characterizing direction, magnitude, geographic extent, timing, frequency, duration, reversibility, and ecological and socio-economic context, and provides quantitative measures or definitions for qualitative categories.

Table 17-2 Definition of Terms used to Characterize Residual Effects on Current Use of Lands and Resources for Traditional Purposes

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Positive –** a residual effect that is beneficial to availability and access to resources, culturally important sites, or the cultural value of sites currently used for traditional purposes, relative to baseline. **Adverse –** a residual effect that is detrimental to availability and access to resources, culturally important sites, or the cultural value of sites currently used for traditional purposes, relative to baseline.
Magnitude	The amount of change in current use of lands and resources for traditional purposes relative to existing conditions	**Negligible –** no measurable change to availability and access to resources, culturally important sites, or the cultural value of sites currently used for traditional purposes **Low –** the residual effect will not reduce the ability to access or use resources and sites for traditional purposes **Moderate –** the residual effect will reduce the ability to access or use resources and sites for traditional purposes **High –** the residual effect will substantially diminish or remove the ability to access or use resources and sites for traditional purposes or substantially increase the difficulty and or travel distance to conduct traditional practices
Geographic Extent	The geographic area in which a residual effect occurs	**PDA –** residual effects are restricted to the PDA **LAA –** residual effects extend into the LAA **RAA –** residual effects interact with those of other projects and activities in the RAA
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant	**Not Applicable –** seasonal aspects are unlikely to affect Current Use of Lands and Resources for Traditional Purposes **Applicable –** seasonal aspects may affect Current Use of Lands and Resources for Traditional Purposes
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	**Single event** **Multiple irregular event** – occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Duration	The period of time required until the ability to use lands and resources for traditional purposes returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	**Short-term –** residual effect restricted to construction phase **Medium-term –** residual effect extends through operation **Long-term –** residual effect extends beyond the life of the project

Table 17-2 Definition of Terms used to Characterize Residual Effects on Current Use of Lands and Resources for Traditional Purposes

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Reversibility	Pertains to whether the ability to use lands and resources for traditional purposes can return to its existing condition after the project activity ceases	**Reversible –** the residual effect is likely to be reversed after activity completion and reclamation **Irreversible –** the residual effect is unlikely to be reversed
Ecological and Socio-economic Context.	Existing condition and trends in the area where residual effects occur	**Undisturbed –** area is relatively undisturbed or not adversely affected by human activity **Disturbed –** area has been substantially previously disturbed by human development or human development is still present

17.1.7 Significance Definition

CEAA 2012 requires a determination of significance for residual environmental effects on Current Use. The lack of laws, policies, management plans or standard industry practice regarding thresholds for this VC makes selecting significance thresholds methodologically challenging. The subjective nature of describing and understanding the importance of effects on current use of lands and resources for traditional purposes means that selected thresholds might not evenly apply across Indigenous communities and circumstances. Section 17.6 discusses the determination of significance of residual effects on Current Use. The determination of significance for the assessment of residual environmental effects considers TK/TLRU data from TK information sharing (Project-specific TLRU studies), applicable literature review, review of significance determination for assessment of residual effects of related biophysical and socio-economic VC assessments, review of detailed biophysical existing conditions work conducted in the PDA, outcomes of Project engagement activities, past project experience, and professional judgment.

Given these considerations, a significant adverse effect on Current Use is defined as a long-term loss of availability of traditional use resources or access to lands relied on for current use practices or current use sites and areas, such that will be substantially diminished or lost from the RAA.

17.1.8 Methods

The description of existing conditions for Current Use relies on results of the Indigenous engagement program for the Project, including available TLRU reports. At the time of application submission, TLRU study reports were received from Marcel Colomb First Nation and Manitoba Metis Federation. Alamos has also funded TLRU studies with Peter Ballantyne Cree Nation and Mathias Colomb Cree Nation, which remain in progress.

In addition, information was gathered through a review of publicly available literature containing TLRU information for Indigenous communities engaged on the Project to deepen the understanding of Current Use by these Indigenous communities. Each Indigenous community received an annotated list of the publicly available literature and the community profile for review, comment and feedback on specific sources used. At filing, these have been approved without revision by Marcel Colomb First Nation and with revision by Manitoba Metis Federation. If potentially affected communities have not responded to the request for review at the time of filing, the secondary sources and community profiles are used in the EIS with the assumption that each community is aware of these. The following types of information sources were considered:

- Project-specific TLRU studies conducted by Indigenous communities.
- Supplemental filings, and hearing evidence for other developments.
- Government reports and databases.
- Historical and ethnographic literature.
- Relevant internet sources (such as Indigenous community websites).

Information relevant to the PDA, LAA, and RAA, or for understanding potential interactions with the Project is included in the existing conditions section. This includes species harvested and other resources required for Current Use, sites, and areas of use, as well as trails, travelways, and other means of access to resources or sites. Concerns regarding the Project and concerns raised on other development projects that may apply to the Project are also presented.

Historical information for the regional context relied primarily on archaeological research literature and on fur trade journals at the Hudson's Bay Company Archives at The Manitoba Museum.

17.2 REGIONAL CONTEXT

The Final EIS Guidelines (Appendix 4A) require that, with respect to potential effects of changes to the environment caused by the Project on Indigenous peoples and related VCs, baseline information be compiled to characterize the regional context of these changes to inform the assessment of Project-related residual and cumulative effects. Baseline Current Use information considers traditional activities that include hunting, fishing, trapping, plant gathering, and cultural practices. The information also includes a characterization of the attributes of the activity that may be affected by environmental and socio-economic changes as a result of the Project. Characterizing the regional context of Current Use identifies species of importance, preferred traditional resources and locations, timing as indicated by seasonality, distance from community, and the cultural environment including historical connections.

This historical context includes a summary of documentation from the Hudson's Bay Company archives (HBCA) that provides a review of TLRU information from the late 1790s to the late 1940s. The archival data provide the link between the present and the time before European contact as revealed through archaeology. This historical context may allow examination of changes to the environment in the time following European contact that may have altered Indigenous peoples' ability to exercise their inherent and, later on, treaty and Indigenous rights to harvest resources and use the lands and waters.

17.2.1 Precontact Period Regional Context

Archaeological data, archival records, and Indigenous oral tradition agree that there is a long history of Indigenous occupation of northern Manitoba, extending back thousands of years. Archaeological time in northern Manitoba includes the Early Precontact Period [from approximately 9,500 to 6,500 years before present (BP)]; the Middle Precontact Period (approximately 6,500 to 2,500 BP); and the Late Precontact Period (2,500 BP to time of contact with Europeans about 325 BP).

People moved into northern Manitoba following the post-glaciation retreating shoreline of Lake Agassiz beginning about 9,500 years ago (Pettipas, 1984). The nearest evidence of early occupation of the Project region is site GjLp-7, at the north end of Wuskwatim Lake (outside the RAA) on the traditional lands of Nisichawayasihk Cree Nation (NCN). Radiocarbon assays of a moose antler and human bone indicate the site is about 6,390 years old (Smith, 2002). Six archaeological sites in the MacLellan site PDA/LAA indicate a precontact presence in there, although there are no artefacts that suggest the age of these sites.

There is evidence of a northerly influence from the Taltheilei Tradition during this period as well. The Taltheilei people primarily hunted barren-ground caribou and are considered by archaeologists to be the immediate ancestors of the present-day Dene people (Pettipas1984; Kroker 1990; McMillan & Yellowhorn, 2004, p. 237; Gordon, 2004, p. 159; Hanna, 2004, p. 135).

Other northern influences are represented by the Arctic Pre-Dorset culture, with sites in the northern-most Manitoba but outside of the RAA (Nash, 1969). These sites represent the most southerly occupation of this culture and are between approximately 4,000 to 2,800 years old.

Ceramic pottery suggests southern influences. Distinctive pottery styles indicate the presence of three cultural groups in the Boreal Forest: Laurel, Blackduck, and the Selkirk Composite. Archaeologists generally agree that the ancestors of the modern Cree produced Selkirk composite pottery and its associated variant styles (Kroker, 1990; Hanna, 2004, p. 135).

Map 17-2 illustrates the locations of known Taltheilei Tradition and known Selkirk composite sites in Manitoba and Saskatchewan along with the estimated precontact ranges of these cultures. Historical fur trade posts and trading routes are also identified on this map. Though the information here extends beyond the RAA for the Project, it is included here to broadly define the context of Indigenous history and traditional practice in the region.

17.2.2 Post-Contact Period Regional Context

The archaeological record described above and its connection with Indigenous communities currently living in northern Manitoba is reflected in the records of early explorers and fur traders in the region. Russell (1991) in his study of the Western Cree, found no documentary evidence that the typical ranges of the Dene and the Cree had changed over the first hundred years of the fur trade, so it is likely that the distribution of archaeological sites roughly outlines the range of Cree and Dene occupation of the region at contact (early 1600s). This suggests that the overlap between the archaeological record and the fur trade record provides evidence of cultural continuity extending beyond 400 years ago. Again, the information here extends beyond the RAA for the Project, it is included here to broadly define the context of Indigenous history and traditional practice in the region.

In the 1680s, the Hudson's Bay Company (HBC) and traders from new France built and occupied posts on the Nelson River and Hayes River (Maurice, 1970). York Factory, at the mouth of the Hayes River, was established in 1713 and, at the mouth of the Churchill River, Fort Prince of Wales, in 1717 (Payne, 1978). These two posts dominated the northern Manitoba fur trade for the next 250 years. The transfer of goods and furs between northern Manitoba and Great Britain was through either Fort Prince of Wales or York Factory and, by extension, the Churchill and Hayes rivers were major transportation corridors for Indigenous peoples and the European fur traders. This was particularly the case after inland expansion by the HBC in the 1770s. For instance, Samuel Hearne, an HBC trader who spent most of the 20 years between 1767 and 1787 in northern Manitoba and the North West Territories, accompanied both Cree and Dene trading parties through the RAA out of Fort Prince of Wales and York Factory (Hearne & Tyrrell, 1911).

Construction of trade posts in the northern interiors of Manitoba and Saskatchewan brought the fur trade directly to most of the Indigenous ancestors of the communities involved in this assessment. It also provided the catalyst for the formation of the Manitoba and Saskatchewan Métis communities: "The Métis Nation—as a distinct Indigenous people—evolved out of relations between European men and First Nations women who were brought together as a result of the early fur trade in the Northwest. In the eighteenth century, both the Hudson Bay Company and the Northwest Company created a series of trading posts that stretched across the upper Great Lakes, through the western plains, and into the northern boreal forest. These posts and fur trade activities brought European and Indigenous peoples into contact. Inevitably, unions between European men—explorers, fur traders, and pioneers—and Indigenous women were consummated. The children of these families developed their own collective identity and political community so that '[w]thin a few generations, the descendants of these unions developed a culture distinct from their European and Indian forebears' and the Métis Nation was born—a new people, indigenous to the western territories'" (Appendix 17A; SVS 2020).

The following summarizes information recorded from select HBC journals held on microfilm at the HBCA at the Provincial Archives of Manitoba and includes journals from 1794 to 1941 for posts throughout present-day Saskatchewan and Manitoba. Table 17-3 summarizes fur trade post information and Indigenous communities that may have interacted with the HBC employees.

Table 17-3 List of Hudson's Bay Post Data Examined for Lynn Lake Gold Project

HBC ID	Post Name	Location	Date	Dates Researched	Indigenous Community
B141	Bedford House	Reindeer Lake (North End)	1796 - 1797	1796 - 1797	PBCN
B399	Caribou Post	Caribou River at Caribou Lake	1930 - 1941	1930 - 1931; 1937 - 1938	SDFN
B29	Carlton House	Kississing River near its confluence with the Churchill River	1795 - 1796	1795 - 1796	MCFN; MCCN; NCN

Table 17-3 List of Hudson's Bay Post Data Examined for Lynn Lake Gold Project

HBC ID	Post Name	Location	Date	Dates Researched	Indigenous Community
B40	Chipewyan Lake	Churchill River possibly on Northern Indian Lake	1800 - 1801	1800 - 1801	MCFN; MCCN; NCN; OPCN
B42	Churchill	Mouth of the Churchill River	1717 - 1941	1820 - 1821; 1821 - 1822; 1827 - 1828; 1829 - 1830	SDFN; MMF
B55	Duck Portage	Near Sisipuk Lake or Pukatawagan Lake	1795 - 1796	1795 - 1796	MCFN; MCCN
B61	Egg Lake	Confluence of the Reindeer and Churchill Rivers	1809 - 1811	1809 - 1811	PBCN
B66	Fairford House	Confluence of the Reindeer and Churchill Rivers	1795 -1796	1795 -1796	PBCN
B195	Fort Seaborn	On the Burntwood River at Threepoint Lake	1833 - 1938	1889; 1907 - 1910; 1917 - 1918; 1929 - 1932; 1937 - 1938	NCN; MMF
B83	Granville House	Granville Lake on Churchill River	1794 - 1796	1794 - 1796	PNCN; MCFN; MCCN; NCN
B91	Indian Lake	South Indian Lake	1805 - 1824	1805 - 1806; 1808 - 1809; 1818 - 1821	OPCN; MMF
B296	Lac Du Brochet	North shore of Reindeer Lake at Brochet Bay	1872 - 1940	1894; 1896; 1900 - 1901; 1929 - 1931; 1936 - 1940	NDFN; HLFN; BLFN; SMN
B118	Loon River	Churchill River at the mouth of the Loon River	1798 - 1799	1798 - 1799	MCFN; MCCN
B141	Nelson House	Churchill River at Highrock or Nelson Lake	1802 - 1827	1815; 1825 - 1826	MCFN; MCCN; NCN; MMF
B158	Pelican Lake	Pelican Narrows	1798 - 1817 - 1940	1888 - 1889; 1896 - 1900; 1902 - 1903; 1929 - 1930	PBCN; SMN
B469	Pukatawagan	On Churchill River at Pukatawagan Lake	1929 – 1941	1929 1941	MCFN; MCCN; MMF
B174	Rapid River	Churchill River/Lac La Ronge (Stanley Mission)	1856 - 1941	1891(District Report Only)	MN-S

Table 17-3 List of Hudson's Bay Post Data Examined for Lynn Lake Gold Project

HBC ID	Post Name	Location	Date	Dates Researched	Indigenous Community
B179	Reindeer Lake	Various locations on Reindeer Lake	1798 - 1892	1798-1799; 1805 - 1811; 1814 - 1815; 1820 - 1821; 1865 - 1866	PBCN
B482	South Reindeer Lake	Southend Reindeer Lake (Near Southend)	1936 - 1941	1936 - 1941	PBCN; SMN
B210	Sturgeon Creek	Near Sandy Bay on the Churchill River at Island Falls	1800 - 1801	1800 - 1801	PBCN
B229	Wepiskow Lake	Burntwood Lake	1793 - 1794	1793 - 1794	MCFN; MCCN; NCN

MCFN – Marcel Colomb First Nation
MCCN – Mathias Colomb Cree Nation
NCN – Nisichawayasihk Cree Nation
NDFN – Northlands Denesuline First Nation
SDFN – Sayisi Dene First Nation (Fort Churchill Band)
PBCN – Peter Ballantyne Cree Nation
OPCN – O-Pipon-Na-Piwin Cree Nation
HLFN – Hatchet Lake First Nation
BLFN – Barren Lands First Nation
MN-S – Métis Nation -Saskatchewan
MMF – Manitoba Metis Federation

Of these, four posts in the region, though beyond the RAA, were well documented and provide an example of the data available from the HBCA:

- Granville House (1794 to 1796) (on Granville Lake).
- Fairford House (1795 to 1796) (on the Churchill River, 1.6 km below Reindeer River).
- Indian Lake House (1795 to 1809) (on Southern Indian Lake).
- Pukatawagan (1929 to 1941) (Pukatawagan on the Churchill River).

The early journals (Granville House, Fairford House, and Indian Lake House) contain information regarding First Nation traditional lifeways during the period between autumn and early spring when HBC operated the post. While the journal entries are primarily a daily account of life at the post, the underlying assumption of the information is that the HBC traders learned or adopted the daily activities required to survive winter from the local Indigenous people with whom they interacted. The business approach adopted by the HBC during the early years of inland trade was to operate the trading establishment from mid-September to mid-June and either close the post or leave a small contingent to operate during the summer. The remainder of the wintering party would transport the year's furs to Fort Churchill, often referred to as The Factory, and then return the following autumn.

Data from the journals include groups who traded at the posts, goods traded by both First Nations and HBC, travel patterns of the First Nations and HBC, place names either in English or phonetic Cree syllables, and climatic events such as dates of freeze up and thaw.

The early journals do not identify First Nation individuals by name. The Pukatawagan journals, however, do identify some individuals by name, whose names are among those in the local communities.

David Thompson's journal covering the years he was in the northwest with either the HBC or the North West Company (NWC) was also reviewed (Thompson, 1916). Several of his chapters discuss the northern Cree and traditional land use activities. This information is more general than the trade post journals but offers a compendium of Thompson's observations after having spent 28 years in the northwest.

17.2.2.1 Summary of Trade Posts

Map 17-2 illustrates the locations of these fur trade posts.

Granville House

George Charles maintained journals during his tenure at Granville Lake from 1794 to 1795 and 1795 to 1796 (Charles G., 1794-1796). Charles was initially ordered to proceed from Fort Churchill to establish a post on Reindeer Lake. These orders changed en route to proceed to *Lake Aw-Pis-A-Paw-Achi-Panna-Coose* (Granville Lake) at the mouth of the *Mus-Quo-Ayun* River (Laurie River). He established his trade post 3.2 km from the mouth of the Laurie River. Two Canadiens (NWC traders) arrived to set up a rival post approximately 90 m from Charles' post.

Fairford House

Malcolm Ross' journals cover the operation of the post, known as Fairford House, at the confluence of the Reindeer and Churchill rivers, during the winter of 1795 to 1796 (Ross, 1795-1796). Ross laid the foundation for the trade post at the mouth of the Deer (Reindeer) River. Two Canadiens canoes soon arrived to set up a post in opposition.

Indian Lake House

John Charles' journal during his tenure at present-day Southern Indian Lake is for the winter of 1805 to 1806 (Charles J., 1805-1806). John was a brother to George Charles (above). Joseph Spence wintered at Southern Indian Lake between 1808 and 1811. His journal entries follow those of John Charles (Spence, 1808 - 1809).

Charles and three men left Nelson House Post on the Churchill River near present-day Highrock and paddled down the Churchill River. They constructed Indian Lake Post on a small point of land in the southern basin of Indian Lake near a former trade post of unknown affiliation. Spence arrived at Charles' Indian Lake Post in September 1808.

Pukatawagan

The Pukatawagan journals cover the period from 1929 to 1941 (Various, 1929-1943). Several of the authors' names are not listed at the start of the annual and occasionally there were multiple authors as indicated by a change in the hand-writing style. Of interest here is that the late journals overlap with the fur trapping careers of the eldest of the participants in the Marcel Colomb First Nation TLRU study, referenced below. This allows observations from the fur trade era forward into the 20th century to be carried forward with a direct, historical link.

The post opened in 1919 and closed in 1943. Pukatawagan is 125 km southwest of Lynn Lake and 117 km southwest of the RAA. The post was along the banks of the Churchill River near the present-day community. Archival maps showing the exact location could not be located but references within the journal place the post on a point of land along the river well-removed from the main community. The HBC post at Pukatawagan dealt almost exclusively with members of Mathias Colomb Cree Nation.

The following sections summarize ethnographic and environmental observations made in the post journals.

17.2.3 References to Indigenous People in the Trade Post Journals

17.2.3.1 The People

The early HBC winterers referred to the local inhabitants as “Southern Indians” and “Northern Indians” but the journals do not list the distinguishing criteria. It may be a function of dialect or criteria that the First Nations themselves used and instructed the HBC. Malcolm Ross referred to the local population as “Chipewyan.” In journal entries for November 1795, Ross distinguished between “Southern Indians” and “Chipewyan”. David Thompson echoes this distinction:

> *North of the latitude of fifty-six degrees, the country is occupied by a people who call themselves "Dinnie," by the Hudson Bay Traders "Northern Indians" and by their southern neighbours "Cheepawyans.” Southward of the above latitude the country is in the possession of the Nahathaway* (Thompson, 1916, p. 78).

This would suggest that the HBC’s “Northern Indians” are the modern Dene (called themselves “Dinnie”) and the Nahathaway are the Cree, who referred to their northern neighbours as “Cheepawyans” [Chipewyan]. In this reckoning, the Nahathaway, or “Southern Indians” are the Cree.

By the 1920s, the HBC managers at Pukatawagan referred to the local population either by family name, such as Colomb, or by community name, such as Highrock or Granville. There were several satellite communities that annually congregated at Pukatawagan primarily for church holidays and treaty days.

The HBC journals from 1929 to 1941 provide the best summary of daily and seasonal life for the Mathias Colomb Cree Nation people; the ancestors of the future (1999) Marcel Colomb First Nation. This period coincides with early development of the railroad, air freight/travel, and early mineral exploration; an increase in trade opportunities for furs and fish; a decline in the abundance of fur-bearing animals and the consequent decline of the fur trade; and the establishment of the residential school at Sturgeon Landing, Saskatchewan.

17.2.3.2 Place Names

In 1794, George Charles records the Cree name for Granville Lake as *Aw-Pis-A-Paw-Achi-Panna-Coose* and Laurie River as *Mus-Quo-Ayun* River, translated as “Bear’s Backbone.” On his way to South Indian

Lake, he paddled up the Churchill River and entered Lake *Pa-Thew-A-Muty* in July 1794. On August 2, 1794, he arrived at the mouth of South Indian Lake suggesting that the *Pa-Thew-A-Muty* was downriver of South Indian Lake and possibly corresponds to present-day North Indian Lake. It took Charles about a week to cross Southern Indian Lake to the mouth of the Laurie River where Granville Post was located (Charles G., 1794-1796).

Charles makes several references to "The Forks" and gives the Cree name *Nuit-A-Why-A-Ou*. The HBC and the Canadiens both had houses there in the winter of 1794–1795. Charles' 1795–1796 journal records the distance to The Forks from Granville Post as 112 km (70 miles). However, Charles does not identify whether this distance was up or downstream of Granville House. In a later journal entry, Charles mentions leaving The Forks for Duck Lake, present-day Sisipuk Lake, to set up a temporary post (Charles G., 1794-1796). Duck Portage Post was on the Churchill River, near Pukatawagan Lake. Therefore, The Forks may have been upstream of Granville House.

John Charles' 1805–1806 journal for Indian Lake Post begins with him leaving Nelson House on October 5. At the time, Nelson House was on Highrock Lake near the present-day Prayer River. A trade post operated there from 1800 to 1827. On October 10, 1805, Charles recorded that a group of First Nations arrived from "The Rapids," but he does not identify which rapids.

In December 1805, Charles traveled from Indian Lake Post to Nelson House Post to spend Christmas with his brother, George. He stopped at "The Graves" at the end of his second day of travel. On December 22, he stopped for the night at "Poplar Point", which sat below two falls. On his return trip he stopped at "Paint River".

In January 1806, Charles left for a winter camp in the Trout Lake area, which was one day's travel. In March 1806, Charles accompanied a hunter to his winter camp near Crooked Pine River. It took one day to walk there, and Charles recorded that they walked through open woods.

On April 21, 1806, Charles records that a group of First Nation members had left most of their winter furs at their camp on the Seal River approximately 100 km north of Indian Lake Post (Charles J., 1805-1806).

By the early 1920s, Mathias Colomb Cree Nation, and by extension the ancestors of the future Marcel Colomb First Nation, were residing in several small communities along the Churchill River. The major communities were Highrock, Granville, Duck Lake (present-day Sisipuk Lake), Burntwood Lake, and Island Falls. Other smaller communities included Pickerel Narrows, Old Man River, Trout Lake, and Loon Lake. The Churchill River was the main transportation route for the First Nation families during both the summer and winter (Various, 1929-1943).

Angus Millar recorded a reference to the Lynn Lake area on March 3, 1938, when he wrote that A. Beaucage arrived at the Pukatawagan post on his way to Lynn River (Various, 1929-1943). Beaucage had also set up a claim at Old Man's River in the fall of 1937. The exact location of Beaucage's claims on the Lynn or Old Man's rivers is not known.

17.2.4 References to Air Quality in the Trade Post Journals

Trade post journals usually only referenced air quality with respect to forest fire smoke. Several fires came close to the HBC post at Pukatawagan, particularly during the late 1930s and early 1940s. A fire in August 1940, resulted in the evacuation of the community (Various, 1929-1943).

17.2.5 References to Climate and Meteorology in the Trade Post Journals

Most of the journals recorded dates of first snow fall, first frost, dates of water bodies freezing and thawing, and periods of abnormal weather. The snow falls and dates of waterways freezing and thawing were important because these conditions not only affected the modes of transport but also restricted the ability for First Nation groups to travel at all. Partially frozen waterways prohibited both canoe and pedestrian travel, while only a small amount of snowfall made dogsled travel difficult.

The journals suggest that Marcel Colomb First Nation’s and Mathias Colomb Cree Nation’s ancestors had an uncanny ability to leave for their wintering grounds at least two or three days before the advent of snow and sub-zero temperatures. Evidently, there were indicators of the onset of winter that the people recognized and acted upon by traveling to their winter resource areas.

During Charles’ first year at Granville, the lake completely froze over by November 2, 1794. It opened on May 24, 1795. He does not mention when the lake froze in the fall of 1795, but during the week May 8 to 14, 1796, he states that the lake ice was unsafe for walking (Charles G., 1794-1796).

Malcolm Ross remarked on October 22, 1795, that the river froze in front of the Fairford Post at Reindeer River and they could not access their nets. There is no mention of when the river opened but Ross departed by canoe for Churchill Factory on May 26, 1796 (Ross, 1795-1796).

John Charles mentions that Southern Indian Lake nearly completely froze over by October 29, 1805. By May 19, 1806, the ice was off the lake (Charles J., 1805-1806). Joseph Spence recorded the lake completely frozen as of October 20, 1808. It reopened during the first week of May 1809 (Spence, 1808 - 1809).

The late 1920s and early 1930s experienced several abnormal weather patterns across northern Manitoba. The HBC journal records on November 18, 1929, that the river had frozen over, and this was the latest ever recorded at Pukatawagan. In 1931, the lake did not freeze until November 16 (Various, 1929-1943).

John Charles recorded heavy snowfall at Southern Indian Lake during the winter of 1805 to 1806. Hunters used the accumulation to their advantage as they could mire moose in the deep snow and kill them with knives thus conserving ammunition (Charles J., 1805-1806).

The winter of 1929 to 1930 recorded one of the heaviest accumulations of snow ever witnessed at Pukatawagan. By the end of January 1930, the snow was too deep for the people to visit their trap lines. The summer of 1930 was one of the wettest on record at Pukatawagan. This caused the Churchill River to rise several metres throughout the summer (Various, 1929-1943).

Table 17-4 compiles these climate observations.

Table 17-4 Climate Observations 1794 to 1940

Observer	Location	Freeze-up	Thaw	Snow	Rain	Air Quality	Surface Water
George Charles	Granville Lake	November 2, 1794	May 24, 1795	-	-	-	-
George Charles	Granville Lake	-	After May 14, 1796	-	-	-	-
Malcolm Ross	Reindeer River	October 22, 1795	Before May 26, 1796	-	-	-	-
John Charles	Southern Indian Lake	October 29, 1805	May 19, 1806	Deep snow winter 1805/1806	-	-	-
Joseph Spence	Southern Indian Lake	October 20, 1808	Before May 8, 1809	-	-	-	-
HBC Journal	Churchill River	November 18, 1929 (latest on their record)	-	Deep snow winter 1929/1930	Very high rainfall 1930	-	Water rose several metres summer 1930
HBC Journal	Churchill River	November 16, 1931	-	-	-	-	-
HBC Journal	Pukatawagan	-	-	-	-	Extreme smoke August 1940/more than usual smoke late 1930s to early 1940s	-

Notes:
- = Data not available

17.2.6 References to Fish and Fish Habitat in the Trade Post Journals

Fish was one of the main winter provisions for both First Nations and the HBC and was also the main food source for the sled dogs. During the winter of 1795 to 1796, Charles' journal indicates that the HBC winterers relied more heavily on fish for provisions. The arrivals of Cree hunters were not as frequent during the second winter at Granville as they were in the year previous (Charles G., 1794-1796). The HBC at Fairford House relied on First Nation support for provisions. During the first two weeks of November no First Nation groups came to the post and the HBC had to rely on fish returns from the nets. Fishing shortly after freeze-up was not lucrative (Ross, 1795-1796). Nets were generally set under the ice and examined daily (Spence, 1808 - 1809).

HBC winterers called the main fish species caught "guineard" or whitefish. In November 1805, Joseph Spence reported that they had four nets set at Southern Indian Lake and were obtaining 40 or 50 whitefish per day. By February 1, 1806, they had six nets set and procured about two meals per day for ten people excluding his companion and four children. By April 2, 1806, the run of whitefish had ended, and the HBC was catching primarily pike, perch, and suckers (Spence, 1808 - 1809).

Sturgeon was originally abundant in the Churchill River and formed an important component of the community's diet and source of income. Sturgeon fishing was generally in the early spring, usually the latter part of May or early June, and in early fall, usually the latter part of September or the first weeks of October. In the 1920s and 1930s air freighting enabled Mathias Colomb Cree Nation communities to ship sturgeon to Cold Lake and The Pas. The HBC also purchased sturgeon from the communities and shipped to The Pas. For example, during September 1938 the HBC shipped nearly one ton of sturgeon to City Meat Market in The Pas (Various, 1929-1943).

In July 1929, the HBC journal remarks that there were very few inhabitants as the fishing was starting to fail at Pukatawagan. HBC staff went to Duck Lake to obtain a load of fish. Also, in July 1929, the Churchill River was rising although there was no explanation of the cause. In July, the river had risen about 2 m (7 feet) in one month. By September 6, 1929, the river had risen about 3 m (11 feet). The September 25, 1929 entry records that fishing was poor because of the high water (Various, 1929-1943).

17.2.7 References to Water Quality in the Trade Post Journals

A Pukatawagan journal entry for September 11, 1930, states that the Churchill River Power Company at Island Falls had altered the river flow and forced the water over the banks cutting new natural channels. This resulted in stream siltation downstream at Pukatawagan and severely altered the water quality (Various, 1929-1943).

17.2.8 References to Birds in the Trade Post Journals

Geese, ducks, and swans were the main birds used as a food source. First Nation hunters routinely brought migratory wildfowl to the HBC posts, when available. The migrating birds were usually along the Churchill River by the end of April and would depart in the latter part of September. Thompson (1916, p. 36) records that geese were often salted and preserved for the winter. John Charles' journal recorded that First Nation groups from Southern Indian Lake would go to Churchill Factory for spring goose hunting (Charles J., 1805-1806).

Migratory wildfowl departures helped gauge the onset of the fall season. The August 25, 1929 journal entry for Pukatawagan stated that it was an early sign of winter when the crows and ducks begin bunching on that date. One of the earliest sightings of crows returning to the area was at the Pukatawagan post on February 25, 1930 (Various, 1929-1943).

17.2.9 References to Mammals in the Trade Post Journals

Mammal furs and meat were the main trade commodities throughout the history of the fur trade. Beaver was the prime fur traded during the seventeenth and eighteenth centuries. A depletion of the beaver population throughout the western interior during the early 1800s resulted in a greater diversity of mammals trapped. By the late 1930s, furs acquired by the HBC at Pukatawagan included: squirrel, fox, mink, weasel, marten, muskrat, wolf, otter, and lynx (Various, 1929-1943).

The HBC relied heavily on the First Nation groups for provisions. The hunters would trade dried, pounded, and green meat, as well as animal fat. Green meat probably relates to freshly killed and butchered portions of either moose or caribou. Rabbits were also snared when large game or fish were unavailable. Other meat sources were beaver and bear. Moose hides were occasionally tanned and used for tent covering.

In summary, mammal meat sources mentioned included: moose, caribou, rabbit, beaver, and bear.

The Pukatawagan journals record that trappers would leave Pukatawagan for their trap lines from November to April and be away for about two weeks at a time. They would trap grey and mixed fox, lynx, marten, weasel, and wolverine. The annual muskrat hunt usually occurred in spring. Fox and lynx were highly susceptible to cyclical fluctuations. For example, the winter of 1931 to 1932 was an exceptionally good year for fox trapping. The following year their fox returns were extremely poor. By the late 1930s, all fur-bearing species were becoming scarce and the annual hunt was producing poor returns (Various, 1929-1943).

Forest fires affected the quantity and range of many mammals. After a severe fire in the Pukatawagan area in the summer of 1940 devastated a grazing area, the journal reports that by December many people were leaving the community as there were few animals nearby.

17.2.10 References to Vegetation in the Trade Post Journals

David Thompson describes several trees and plants used by the northern First Nation groups. They collected birch bark for a variety of uses including canoe and dwelling covers as well as dishes and domestic utensils. The larch, a strong elastic wood, was used for sleds. Poplar (trembling aspen) made the best firewood for heating and for smoking meat and fish. White spruce branches made bedding and pine saplings, tent poles (Thompson, 1916).

Thompson lists the following edible berries used by both First Nations and the HBC: Dry (summer berry) and swamp cranberry, crow and blackberry, raspberry, strawberry, Saskatoon berry, cherries, red, black and white currants, gooseberry, hipberry (rose hips), juniper berry, eye berry, and bear berry (Thompson 1916, p. 58).

He described bear berry as a low spreading plant that lies flat on the ground and was used for medicine. The First Nation groups also collected and dried the leaves and mixed it with tobacco. Wood from the summer berry [high bush cranberry (Clavelle, 1997)] made pipe stems. Thompson also mentions the saskatoon berry as very sweet and nourishing, the favourite food of small birds and bears. The First Nation groups collected and dried them for future use and mixed the berries with dried meat. The wood made arrow shafts (Thompson, 1916).

In mid-September, the Pukatawagan community partook in the annual blueberry “pic-nic,” where everyone from the community left for about seven days (Various, 1929-1943). The HBC journals do not indicate where berries were gathered but, given the reliance of travel along the Churchill River, it is likely that the locations would be near traditional camps such as Highrock and Granville.

17.2.11 References to Socio-Economics in the Trade Post Journals

The HBC and NWC developed a system of supplying credit to the First Nation groups throughout the western interior. The Cree would acquire goods on credit in the fall and then pay the debt either with furs or provisions obtained during the winter. Based on Charles' journals, furs and provisions seldom if ever totally eradicated the debt and additional credit would be required prior to the next trapping season. The net result was that the Cree were perpetually in debt to either company (Charles G., 1794-1796; Charles J., 1805-1806). However, as the HBC developed additional posts along the Churchill River system throughout present-day northern Manitoba and Saskatchewan, the Cree developed a practice of acquiring credit at each of the posts over several successive seasons.

When the Northern Cree came to trade at the Fairford, Granville, or Indian Lake trade posts, they generally arrived in the afternoon or evening, traded the next morning, and left immediately. Furs and provisions were exchanged for either payment of debt, ammunition, clothing, tobacco, metal tools, or alcohol. Once the lakes were frozen, the Cree continued to come to the post but would inform the HBC winterers that they had provisions at their camp and men from the post would travel with the informant(s) to retrieve the provisions. Distances traveled varied from 40 to 65 km (30 to 40 miles), and a round trip of 130 km (80 miles) took approximately four days. Often several HBC staff went to live with the Cree at their winter camps. This alleviated the numbers to be fed at the post and allowed the HBC men to trade directly with the Cree at their camps thereby restricting the Cree trade relations with the NWC.

Not all the Cree were willing to trade with the HBC or NWC winterers. On April 21, 1806, John Charles recorded that many First Nation families arrived at Indian Lake Post but only traded 30 Made Beaver, a unit of barter that equated all trade goods to the value of a prime winter beaver pelt (Waiser, 2016), and a few martens. Most of their winter catch was stored at their winter camp on the Seal River as they intended to go to Fort Churchill with them in the summer (Charles J., 1805-1806).

The members of Mathias Colomb Cree Nation had several trade partner options during the early 1930s. They could take their furs to the HBC post or the Revillon Frères store at Pukatawagan. On April 3, 1930, W. Yakosaveck arrived and established a store on Trapper's Island to compete with the HBC. Another two individuals went to Pine Cache Lake, 19 km (12 miles) from Pukatawagan, to build a store. Evidently this was another wintering community for members of Mathias Colomb Cree Nation. Revillon Frères Trading Company was an HBC competitor until the HBC purchased a controlling interest in the company in 1926 (Various, 1929-1943).

The Pukatawagan trappers could also travel south to Cold Lake near present-day Sherridon, Manitoba, or they could patronize several independent trade posts that operated in communities including Highrock, Granville, and Burntwood Lake. The independent traders were more flexible in what they could offer for the furs, whereas, head office determined HBC annual prices with only some small degree of flexibility by the individual post manager. The HBC journals at Pukatawagan during the late 1930s continually reported poor annual returns because their prices were set lower than their competitors' prices. During the late 1930s, the resident Roman Catholic priest also bought furs from the various community members and would then resell the furs in Cold Lake (Various, 1929-1943).

During the late 1920s and early 1930s, there were several seasonal economic options for the First Nation people living along the Churchill River. The spring and fall sturgeon catch was either sold independently or to the HBC. The produce from berry picking was sold within the community. The main economic pursuit was fur trapping typically between late September and late March. Community members assisted government surveyors in the late 1920s and early 1930s when several reserves along the Churchill River were being developed (Various, 1929-1943).

Freighting between Pukatawagan and Cold Lake developed during the late 1920s and early 1930s. Goods were brought in either by air during the summer months or by truck or horse team during the winter. The HBC and the independent merchants depended on these goods and often ran out of supplies when deliveries failed. Air travel was dependent on clear conditions and during the late 1930s there were several forest fires, the smoke from which impeded flights. Occasionally the transfer truck would break down or roads would become impassable and this resulted in low stock inventories at Pukatawagan (Various, 1929-1943).

17.2.12 References to Traditional Land and Resource Use in the Trade Post Journals

17.2.12.1 Travel

For much of the period covered by the trade journals, during the open water season, the main mode of transport was canoe. George Charles makes the distinction between “big” and “small” canoes. He set out from Fort Churchill with 40 pieces of trading goods, 8 staff and 2 First Nation guides in 10 big canoes. There were four small canoes used by First Nation guides and porters. Charles did not describe the First Nation canoes in detail (Charles G., 1794-1796). However, because subsequent journal entries list Cree individuals building canoes for Charles, it is logical to assume that these individuals would have also built canoes for the HBC.

In spring, birch bark was gathered to make canoes. They would also harvest wood to construct the frame, but Charles did not identify the type of wood collected. Thompson (1916: 116) describes First Nation canoes as:

> *“from 10 to 16 feet in length, and breadth in proportion, during the open season, they are almost constantly in them; hunting; moving from place to place, the Rivers and numerous Lakes giving free access through the whole country.”*

Canoes were still the main method of water transport during the 1930s and 1940s. By this time, most of the canoes used by the HBC and the people at Pukatawagan had canvas covers that generally had to be replaced annually. Boats with outboard motors were occasionally used during this period but primarily by the HBC, government surveyors, and prospectors (Various, 1929-1943).

Winter transport was usually by foot and dog sled. Sleds were generally made of larch (Thompson 1916:117). At Southern Indian Lake, John Charles records that in November 1805 he had men collecting birch for snowshoes along a small river about 10 km (6 miles) from the post (Charles J., 1805-1806). These modes of winter travel continued into the early 1940s as many members of Mathias Colomb Cree Nation as well as HBC employees used dog sleds. In April 1939, W. McKinnie reported the spread of disease among the dogs at Pukatawagan and Highrock. Several dogs died, and people had difficulty accessing their trap lines (Various, 1929-1943).

The ancestors of Mathias Colomb Cree Nation and Marcel Colomb First Nation were not averse to traveling great distances. George Charles' journal indicates that Cree from the Granville Lake area routinely traveled the Churchill River to Fort Churchill and back, a journey of over 1300 km return. During the winter, it would take approximately eight weeks to travel from Churchill Factory to Granville. In the summer, it took about six weeks to ascend the Churchill River from Churchill Factory to Granville Lake (Charles G., 1794-1796). It would probably take a First Nation family less time as Charles was traveling with a large quantity of trade goods in larger canoes and would have taken longer to portage men, goods, and canoes.

During the 1920s and early 1930s, many families would return to Pukatawagan for the summer as this was where the HBC and Revlon Frères stores and the Roman Catholic Church were located and where annual Treaty Day was held. They would also congregate in the community for religious holidays such as All Saints' Day, Christmas, Easter, and Ascension Sunday. People would generally arrive a day or two prior to the event and then depart a day or two afterward (Various, 1929-1943).

The July 30, 1929 journal entry for Pukatawagan records that the community was extremely quiet as the people had departed for their summer vacations down the river and elsewhere. This time away was generally during the month of July. The families would begin returning in early August in anticipation of Treaty Day (Various, 1929-1943).

Annual Treaty Day, usually during the second week in August, marked the time when the community was busiest. Treaty Day was a major annual event in Pukatawagan and people from the outlying communities. The HBC and Revlon Frères anticipated the arrival of Treaty Day as the community members would then use the money issued to clear debts or purchase goods (Various, 1929-1943).

The HBC journals for 1929 record that people from Pukatawagan conducted one last seasonal fishing trip to their camps in September. They would arrive back just before the river froze in late October or early November. Once the lake had frozen, trappers began accessing trap lines. Usually a large number would leave and return in four to five days. They would go out at least once or twice before Christmas and then at least three or four times after Christmas before the river opened (Various, 1929-1943).

By the early 1940s, band members often remained in the satellite communities on the Churchill River year-round. By this time, independent traders established stores in the communities and the resident Pukatawagan priest visited the outlying communities to provide church services. The HBC at Pukatawagan counted on the various church holidays and gatherings in the community to bolster sales. However, at Christmas 1940 the journal records that very few arrived for church service: the only arrivals were the Chief and a few councilors from Granville Lake (Various, 1929-1943).

17.2.12.2 Seasonal Activities

Data regarding summer activities by the northern Cree during the late 1700s and 1800s refer only to late spring and early autumn. The Pukatawagan journals from the 1930s and 1940s offer a more detailed summary of seasonal activities during the onset of the decline of the fur trade industry and just before mine development in northern Manitoba.

During the summer, the Cree congregated in areas close to active fisheries where they repaired or built new canoes. Fishing, primarily for whitefish and sturgeon, was combined with hunting and harvesting berries and plants. If access to more plentiful fisheries along the river system required travel, people would generally leave two or three times during the summer for a week to ten days (Various, 1929-1943).

The late autumn was a time for gathering materials for sleds and snowshoes. The Cree would then divide into smaller family units and leave for their wintering sites before freeze-up and snowfall (Various, 1929-1943). The early HBC winterers do not identify where these wintering areas were but may have been the same areas such as Highrock, Granville, and Burntwood Lake used as resource bases in the 1930s and 1940s.

The HBC journals seldom mention the Cree using fish as provisions for trade during the winter. Winter activities concentrated on trapping and hunting moose and caribou. Therefore, while the HBC winterers relied heavily on fishing, the Cree relied on hunting.

17.2.13 Indigenous Communities

The following overview organizes the Indigenous Communities by two categories: those which have expressed through engagement that they have traditional interests in the Project RAA and those which have indicated through engagement that they do not undertake current traditional practices in the RAA:

Traditional Interests in the RAA:

- Marcel Colomb First Nation
- Mathias Colomb Cree Nation/Granville Lake Community
- Peter Ballantyne Cree Nation
- Manitoba Metis Federation
- Métis Nation – Saskatchewan Eastern Region 1.

No Current Traditional Practices within the RAA:

- O-Pipon-Na-Piwin Cree Nation
- Nisichawayasihk Cree Nation
- Barren Lands First Nation
- Hatchet Lake First Nation
- Northlands Denesuline First Nation

- Sayisi Dene First Nation
- Métis Nation – Saskatchewan Northern Region 1.

17.2.14 Overview of Current Use

Project-specific TLRU, comments from engagement, and secondary sources (current to May 22, 2020) indicate that Current Use occurs in the PDA, LAA, and RAA. Project-specific TLRU information presented below is from the Marcel Colomb First Nation TLRU study and the Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study (Appendix 17A). Data for other communities is from engagement and secondary sources.

17.2.14.1 Marcel Colomb First Nation

Marcel Colomb First Nation's reserve, Black Sturgeon (INAC No. 09000), is on Hughes Lake, north of PR 391, near Lynn Lake, Manitoba. Black Sturgeon Reserve is 2.8 km from the Gordon site and 19.5 km from the MacLellan site. Chapter 3, Section 3.3.1 provides a detailed profile of this Indigenous community.

Marcel Colomb First Nation is the nearest Indigenous community to the Project. They have a long history of traditional harvesting and practice in the RAA. References to Current Use activities in this section may extend beyond the RAA but are included to illustrate the character of traditional harvesting and practices in the region.

Plant Species and Plant Harvesting Sites and Activities

Plant harvesting for food, medicines, fuel, shelter, and transportation has been an integral part of Marcel Colomb First Nation culture since their ancestors first inhabited northern Manitoba. The following is a list of species identified by Marcel Colomb First Nation in the TLRU study (Appendix 17A). Marcel Colomb First Nation discussed blueberry and cranberry most often as food species and rat root as a medicinal plant.

- Food species include blueberry, cranberry (highbush), strawberry, chokecherry, Saskatoon berry, moss berry (lingonberry/bog cranberry), raspberry, moose berry (lowbush cranberry), orange berry (cloudberry), wild carrot, Labrador tea, and mint.
- Medicinal species include rat root, spruce (gum), Seneca root, beaver pineapple (small yellow pond lily), frog's ears, and chaga (tree fungus).
- Construction/Craft/Fuel Species include spruce, birch, trembling aspen, and jack pine.

Food Species and Gathering Areas

Marcel Colomb First Nation reported harvesting berries and identified preferred berry picking locations in relation to the Project. For instance, Muskeg Lake in the RAA is an area for picking cranberries, raspberries, and blueberries (Appendix 17A, Figure 2b: Plant Gather Food 4).

Marcel Colomb First Nation pick cranberries along a canoe route through the RAA from Eden Lake area into Granville Lake and then by the Churchill River to Pukatawagan (Appendix 17A, Figures 2a and 2b: Plant Gather Food 7) and pick blueberries, cranberries, and moss berries around Moses and Anson lakes (Appendix 17A, Figure 2b: Plant Gather Med 3).

Marcel Colomb First Nation indicated that Cranberries, blueberries, and moss berries were harvested in the RAA, and were said to be abundant in the summer. Marcel Colomb First Nation gathers cranberries and blueberries around the edges of Cockeram Lake, although it was observed that at Hughes Lake the main species were blueberries and cranberries. (Appendix 17A, Figure 2b: Plant Gather Food 1). Participants in the TLRU study report collecting wild carrot in the bush away from rivers or lakes and using berries in cooking, often with fish and potatoes, and making preserves. Marcel Colomb First Nation members collect Labrador tea and mint, which grows on shorelines and in boggy areas, to make tea.

Medicinal Species and Gathering Areas

Marcel Colomb First Nation reported harvesting many varieties of medicines. For example, in an area in the RAA between Hughes and Eden lakes (Appendix 17A, Figure 2b: Plant Gather Food 5, 7 and Plant Gather Med 7, 8, 9) members collect beaver pineapple (*waskatamiw*, probably small yellow pond lily), rat root, seneca root, mint, and chaga fungus from birch trees. Marcel Colomb First Nation gathers rat root, pineapple root, and mint, often near rapids (Appendix 17A, Figure 2b: Plant Gather Food 6) to make medicines for ailments such as colds and headaches. *Wîhkês*, (pronounced “weekees”), the Cree word for rat root, is chewed for energy and to treat colds and collected along the smaller rivers and lakes in the Cockeram Lake area, which overlaps the LAA (Appendix 17A, Figure 2b: Plant Gather Med 1, 2), from the Churchill and Laurie rivers (Appendix 17A, Figure 2c: Plant Gather Food 8) and from Jackson Lake (Appendix 17A, Figure 2c: Plant Gather Med 12) in the RAA, where there is a reported abundance of medicinal plants. Rat root is also collected west of Lynn Lake at the north end of Frances Lake in the RAA (Appendix 17A, Figure 2b: Plant Gather Med 11).

Marcel Colomb First Nation uses the fungus on birch, also known as chaga mushroom or true tinder fungus (*Inonotus obliquus*) for treating cancer and pneumonia and in a tea mixed with salt for headaches or cold chills. Marcel Colomb First Nation identified Goldsand Lake in the RAA as a medicine gathering location (Appendix 17A, Figure 2b: Plant Gather Med 10). Spruce gum is collected and used to treat headaches, migraines, and eczema.

Construction/Craft/Fuel Species and Gathering Areas

Marcel Colomb First Nation reports harvesting wood for a variety of uses. Birch was harvested, and poplar sap was historically mixed with muskrat or beaver tail to make a laundry soap. Cabins are built with whatever wood was available, but the preferred species is jack pine because the logs are straighter. Historically, moss was used to chink the walls and birch bark was used for roofing. A layer of sand was placed on top of the bark to act as a sealant to keep the cabin dry and warm.

Wooden smoke houses were constructed and used to preserve beaver, moose, or fish and used dry shrubs such as willow to make smoke. Marcel Colomb First Nation members cut firewood near Cockeram Lake in the spring and let it dry during the summer and used wood near their camps to fuel their woodstoves for heat, cooking, and boiling water.

Marcel Colomb First Nation uses pine, spruce, or birch to make tent poles and has used birch wood to make toboggans. Historically, snowshoes were made using young birch for the frame and caribou or moose hide webbing and fire keepers used fungus collected from birch trees to light fires.

Fish Species and Fishing Areas and Activities

Historical records, Project-specific TLRU and secondary sources indicates that fish has long been a staple food source for Marcel Colomb First Nation. Sled dogs, essential to winter travel, relied on fish for food as well. Marcel Colomb First Nation reported, in their TLRU study (Appendix 17A), fish species of importance including: lake trout, goldeye, sucker, trout, sturgeon, northern pike (jackfish), whitefish (tullibee), and pickerel (walleye).

Marcel Colomb First Nation indicates that spring is the best fishing time. This was when most fish species spawn, and they are plentiful in areas of moving water such as the Keewatin and Lynn rivers in the LAA and RAA. Marcel Colomb First Nation fishes for northern pike, whitefish, and walleye for food, not sale, at Cockeram Lake (Appendix 17A, Figure 2b: Fishing 8). They report large numbers of spawning sturgeon in Chepil Lake (Appendix 17A, Figure 5b: Environ Obs 1) and in Hughes Lake, where, in the 1950s, there was a large population of sturgeon (Appendix 17A, Figure 2b: Fishing 15 and Figure 5b: Environ Obs 2). Marcel Colomb First Nation identified Simpson, Swede lakes, which overlap the LAA and Ellystan Lake, in the RAA, as fishing areas that were abundant in whitefish (Appendix 17A, Figure 2b: Fishing 24) including jumbo whitefish at Simpson Lake, in the LAA, whose population was “totally depleted” after the Farley Lake Mine opened.

Marcel Colomb First Nation reported fishing with nets in Muskeg Lake in the RAA, for sturgeon and whitefish (Appendix 17A, Figure 2b: Fishing 14). During the summer, on the west shore of Eden Lake in the RAA, there is good walleye and northern pike fishing. Cockeram Lake in the RAA (Appendix 17A, Figure 2b: Fishing 10, 11) is a good place for northern pike; and Hughes River and Hughes and Chepil lakes in the RAA are good sturgeon fisheries (Appendix 17A, Figure 2b: Fishing 17, 18, 19).

Marcel Colomb First Nation also fished while trapping in the winter and in the spring and caught mainly walleye using nets at Hughes Lake in the RAA (Appendix 17A, Figure 2b: Fishing 20). Narrows Lake (the traditional name for Goldsand Lake) is also identified as a good lake for fishing, especially near the narrows (Appendix 17A, Figure 2b: Fishing 1).

Marcel Colomb First Nation catch walleye, sturgeon, goldeye, lake trout, whitefish (tullibee), and northern pike in areas including Flatrock, Hughes, and Glasspole lakes, as well as on the Churchill and Laurie rivers in the RAA (Appendix 17A, Figure 2b: Fishing 21 and Figure 2c: Fishing 45, 47). They report setting nets in lakes to catch whitefish (tullibee), walleye, northern pike, and sturgeon when hunting and trapping in the winter fish at Wetikoeekan (Sasquatch), Swede, Simpson, and Ellystan lakes in the LAA and RAA (Appendix 17A, Figure 2b: Fishing 29, 30, 31, 32). According to a Marcel Colomb First Nation Elder, “Where there’s fish, that is where we would set our nets,” Ellystan Lake in the RAA was a good location to catch jumbo whitefish. Marcel Colomb First Nation fishers would snare fish in the spring when they were spawning in the rivers and rapids (Appendix 17A, Figure 2b: Fishing 32).

Marcel Colomb First Nation reported that there was very good fishing at Laurie, McGavock, and Edgar lakes (Appendix 17A, Figure 2c: Habitation 30) and commercial fisheries at Gallagher, Goldsand, Wells, Barrington, Swede, Simpson, Ellystan, and Dunsheath lakes (Appendix 17A, Figure 2b: Fishing 2, 3, 4, 6, 7, 34, 35, 36). Lake trout were plentiful near the camp at the north end of Barrington Lake (Appendix 17A, Figure 2b: Fishing 7 and Figure 3b: Habitation 6), but jumbo whitefish were more plentiful in Swede, Simpson lakes in the LAA, and Ellystan Lake in the RAA (Appendix 17A, Figure 2b: Fishing 34, 35, 36).

Marcel Colomb First Nation fish at Cartwright and Anson lakes in the RAA (Appendix 17A, Figure 2b: Fishing 13 and Hunting 6) for walleye, northern pike, and suckers and for whitefish, walleye, northern pike, and lake trout at Wetikoeekan (Sasquatch) Lake in the RAA (Appendix 17A, Figure 2b: Fishing 25). There is fishing at Cockeram Lake in the RAA (Appendix 17A, Figure 2b: Fishing 9) and along the Keewatin River (Appendix 17A, Figure 2b: Fishing 41, 42) in the PDA.

Netting occurs in winter and spring at the Hughes camp (Appendix 17A, Figure 2b: Fishing 26, Fishing 28). There are jumbo whitefish at Swede Lake in the LAA, black sturgeon at Chapel Lake, and walleye by the mouth of the Eagle River on Hughes Lake in the RAA (Appendix 17A, Figure 2b: Fishing 16, 26). Fishing occurs along the Hughes River from Hughes Lake to Eden Lake (Appendix 17A, Figure 2b: Fishing 27). One Marcel Colomb fisher currently prefers Eden Lake in the RAA, using rod and reel or netting and catching northern pike, walleye, and whitefish (Appendix 17A, Figure 2b: Fishing 40). Others report fishing for whitefish, pickerel, and northern trout at Eden Lake (Appendix 17A, Figure 2b: Fishing 39).

Marcel Colomb First Nation fishers observe that trout are more abundant in the lakes to the west around McGavock Lake and become less abundant to the east around Lynn Lake. There is a commercial and food fishery at Dunsheath Lake in the RAA for walleye, northern pike, and whitefish (Appendix 17A, Figure 2b: Fishing 5). Fish are sold to the Co-op in Leaf Rapids and the Freshwater Fish Marketing Corporation in Winnipeg.

Hunted and Trapped Species, Areas, and Activities

Archival records (Various 1929-1943) indicate that moose, caribou, rabbit, beaver, and bear were important meat sources to the Indigenous people of northern Manitoba. In terms of trapping and fur trading beaver, squirrel, fox, mink, weasel, marten, muskrat, wolf, otter, and lynx were important species. Fur traders also recorded an annual spring goose hunt among Indigenous communities (Various 1929-1943). Project-specific TLRU indicate that these practices and more continue for Indigenous people in the RAA.

Hunted Species and Hunting Areas

Marcel Colomb First Nation participants in their TLRU study reported hunting: moose, deer, caribou (woodland/unspecified), bear, beaver, rabbit, geese, ducks, grouse (spruce/unspecified), ptarmigan, swan.

Marcel Colomb First Nation hunt for fresh meat including moose, “chickens” (spruce grouse), ducks, ptarmigans, and rabbits, and historically caribou near Muskeg Lake in the RAA (Appendix 17A, Figure 2b:

Hunting 26). In terms of bird species, hunters report harvesting ptarmigans, chickens (spruce grouse), ducks, and geese (Appendix 17A, Figure 2a, Figure 2b: Hunting “6, 18). Geese are hunted in the spring near the rapids on Hughes River in the RAA. Moose was the primary game hunted, but caribou and deer were also harvested (Appendix 17A, Figure 2b: Hunting 2 and Trapping 2, 3).

Marcel Colomb First Nation hunters harvest birds at Black Sturgeon Reserve with the children of the community (Appendix 17A, Figure 2b: Hunting 17). Goose, swans, and ptarmigans provide meat and down. Pilote Lake is also an area for hunting swans in the spring (Appendix 17A, Figure 2b: Hunting 14).

Favoured places to hunt in the RAA include Ghost Lake, west of Chicken Lake (Appendix 17A, Figure 2a), Dunsheath Lake (Appendix 17A, Figure 2b: Trapping 4), and areas around Cockeram (east of the Lynn Lake town site), Moses, and Anson lakes (Appendix 17A, Figure 2b: Hunting 13). Moose is hunted in the bush near a camp at Cartwright Lake (Appendix 17A, Figure 2b: Hunting 5) and around Anson and Moses lakes, west of Huet and Carr lakes, and on the west side of Cockeram Lake (Appendix 17A, Figure 2b: Hunting 7, 8, 9, 10, 25).

Marcel Colomb First Nation hunters harvest moose throughout the season from Hughes Lake to Eden Lake along the Hughes River (Appendix 17A, Figure 2b: Hunting 15). They do not harvest the cows to preserve the population and promote growth. Hunting is primarily from roads, such as old mining trails near Eden Lake, because the moose frequent these areas to eat the salt. As an alternative to using a gun, a harvester reported setting snares along the moose trails and the animals could be caught “with a rope around their neck” (Appendix 17A, Figure 2b: Trapping 11). Moose hide is used to make moccasins, mitts, and parkas. Historically, moose hides were used for tents.

Marcel Colomb First Nation harvesters hunt moose and caribou near Eden Lake and Wetikoeekan (Sasquatch) Lake in the RAA (Appendix 17A, Figure 2b: Trapping 23, Hunting 16). Hunting occurs along the railroad to Pukatawagan (Appendix 17A, Figure 2b: Hunting 27) and around Douglas McKay, Koshelanyk, and Glasspole lakes, to south along the Laurie River (Appendix 17A, Figure 2c: Hunting 31).

Marcel Colomb First Nation reported hunting caribou near Goldsand Lake and Little Brightsand Lake in the RAA (Appendix 17A, Figure 2b: Trapping 2) until about 1952.

Trapped Species and Trapping Areas

Marcel Colomb First Nation in their TLRU study reported trapping the following species for fur and food: beaver, mink, muskrat, lynx, otter, marten, rabbit, wolverine, fox, and ptarmigan.

Marcel Colomb First Nation trappers take muskrat at Cockeram, Simpson, Swede, and Ellystan lakes in the RAA and LAA (Appendix 17A, Figure 2b: Hunting 4 and Trapping 14), and mink at Goldsand Lake in the RAA (Appendix 17A, Figure 2b: Trapping 1), as well as around the Dunphy Lakes and throughout the area east towards Black Sturgeon in the RAA (Appendix 17A, Figure 2c: Trapping 28).

Marcel Colomb First Nation stated that trapping occurs around Eagle Lake in the RAA (Appendix 17A, Figure 2b: Trapping 5) and around Hughes Lake (Appendix 17A, Figure 2b: Trapping 18).

Marcel Colomb First Nation take mink, otter, muskrat, fox, and wolverines (Appendix 17A, Figure 2b: Trapping 2, 3) around Cockeram Lake in the RAA and trap marten, lynx, fox, otter, and beaver in the winter, as well as muskrat in the spring and fall at Anson and Cartwright lakes in the RAA (Appendix 17A, Figure 2b: Trapping 7, 10).

Marcel Colomb First Nation actively trap around Douglas McKay, Koshelanyk, and Glasspole lakes, and further south along the Laurie River (Appendix 17A, Figure 2c: Trapping 31) and harvests primarily beaver but also takes marten and mink. Further to the southwest Marcel Colomb First Nation also reports harvesting marten, weasel, beaver, and otter.

Mink, lynx, beaver, muskrat, and otter were trapped by Marcel Colomb First Nation over a large area from Chepil Lake east to Lake, south to near Eden Lake, and north back to Chepil Lake in the RAA, LAA and PDA (Appendix 17A, Figure 2b: Trapping 15, 16, 17, 23).

Another Marcel Colomb First Nation trapping area extended from the north end of Cockeram Lake south to Anson Lake and many small rivers, creeks, and lakes in the RAA (Appendix 17A, Figure 2b: Trapping 8, 25, 26) and around Eden Lake and along the Numakoos River south toward Granville Lake (Appendix 17A, Figure 2b: Trapping 27); fox, lynx, wolverine, otter, mink, muskrat, and wolf were harvested.

Marcel Colomb First Nation harvesters trap beaver as well as otter, mink, and rabbits from Hughes Lake to Eden Lake along the Hughes River (Appendix 17A, Figure 2b: Trapping 13). At Rabbit Lake (Appendix 17A, Figure 2c: Trapping 29) Marcel Colomb First Nation harvests a variety of animals including beaver and mink. Marcel Colomb First Nation also snare rabbits for food as well as for clothing.

A Marcel Colomb First Nation trap line between Laurie River and Granville Lake and including the area around Rosie (northeast of Elvyn Lake), Seahorse, Trophy, and Oyster (southwest of Numapin Lake) lakes (Appendix 17A, Figure 2a) yields beaver, muskrat, mink, otter, rabbit, and lynx.

Active Marcel Colomb First Nation trappers report beaver, muskrat, lynx, mink, and marten harvest. Marcel Colomb First Nation maintain a base camp at Mile 7 (north of PR 391 at “Mile 7” east of Lynn Lake) in the LAA (Appendix 17A, Figure 2b: Trapping 9). Trapping is now more of an occasional activity, but Marcel Colomb First Nation stated that more people will trap if fur prices were higher and if there was still a fur buyer in Lynn Lake.

Marcel Colomb First Nation described a trap line north of White Owl Lake and the Gordon site extended south around Hughes, Westdal, and Wetikoeekan (Sasquatch) lakes, then back north to White Owl Lake in the RAA, LAA and PDA (Appendix 17A, Figure 2b: Trapping 19, 20, 21, 22). Marcel Colomb First Nation also identified another trap line with a camp around Eden Lake and one around Sickle Lake in the RAA (Appendix 17A, Figure 2b: Trapping 24 and Figure 3b: Habitation 19, 20). Marcel Colomb First Nation trapped mink, lynx, beaver, otter, wolverine, muskrat, and wolf at this location.

Traditional, Cultural and Spiritual Sites and Areas

Habitations, Trails and Travelways

Historically, as today, Marcel Colomb First Nation indicated that travel is seasonally restricted because lakes and rivers need to be solidly frozen and there needs to be adequate snow cover to permit travel by foot or snowshoe, dog team, and later by snowmobile. Conversely, lakes and rivers need to adequately thaw to allow boat transport. Marcel Colomb First Nation participants in the TLRU study have lived in cabins and/or camps and traveled extensively throughout the region over land and on water using long established trails and routes. Reported cabins and camps on lakes and rivers in the RAA and region include: Barrington Lake (n = 1); Cartwright Lake (n = 1); Cockeram Lake (n = 1); Dunphy Lake (n = 2), Dunsheath Lake (n = 4), Eagle Lake (n = 1); Eden Lake (n = 3), Elizabeth Lake (n = 1); Glasspole Lake (n = 1); Goldsand (Narrow) Lake (n = 2); Highrock (n = 1); Hughes Lake/River (n = 3); Keewatin River (n = 1); McGavock Lake (n = 2); Muskeg Lake (n = 1); Rabbit Lake (n = 1); Wetikoeekan (Sasquatch) Lake (n = 3); Sickle Lake (n = 1); South Indian Lake (n = 1); and Swede Lake (n = 5).

To support hunting and trapping, several Marcel Colomb First Nation harvesters built camps around Dunphy, McGavock, Simpson, and Goldsand lakes and along the Hughes River (Appendix 17A, Figure 3b: Habitation 3, 8, 26 and Travel 1; Figure 3c: Habitation 27 and Travel 34). One travel route connected the Churchill River to Vandekerckhove Lake, passing through the RAA to Cockeram and Goldsand lakes (Appendix 17A, Figure 3b: Travel 7). A second route went from Reindeer Lake to the Churchill River passing through the RAA to Chepil and Hughes lakes (Appendix 17A, Figure 3b: Travel 8). Camps were located wherever food was abundant because Marcel Colomb First Nation stated it “is like finding gold—you know you’re going to survive.” Historically, seasonal access to Simpson, Swede, and Ellystan lakes in the LAA and RAA was by canoe in summer and dog team in winter (Appendix 17A, Figure 3b: Travel 1).

Marcel Colomb First Nation reported four cabins around Muskeg and Eagle lakes in the RAA (Appendix 17A, Figure 2b: Trapping 6; Figure 3b: Habitation 22 and Travel 5, 6; and Figure 4b: Trad Activities 1). Three generations of Marcel Colomb First Nation trappers have been active in this area. Marcel Colomb First Nation trappers traveled north by canoe from the Churchill River went through many lakes in the RAA including Granville, Sickle, Hughes and Chepil to access this trap line. A traditional route was from Granville Lake by canoe leaving August and arriving at Muskeg Lake in September (Appendix 17A, Figure 3b: Travel 21).

Marcel Colomb First Nation reports trapping cabins near the mouth of the Hughes River and on the Churchill River near the community of Highrock (Appendix 17A, Figure 3b: Habitation 12) used until ca. 1953 and a cabin on an island in Goldsand Lake (Appendix 17A, Figure 3a and 3b: Habitation 1, 2 and Travel 22).

A north-to-south winter road used by Marcel Colomb First Nation for winter travel traverses the RAA, LAA and PDA to White Owl Lake, located east of the Gordon site, and connects with an east to west Bombardier trail from Westdal Lake, situated south of Black Sturgeon (Appendix 17A, Figure 3b: Travel 25). There is a road to a boat launch on Hughes Lake in the LAA (Appendix 17A, Figure 3b: Travel 23).

Marcel Colomb First Nation indicated that there is a travel route from Elizabeth Lake to Manson Lake to Ellystan Lake through the RAA (Appendix 17A, Figure 3b: Travel 24) and a portage from an unnamed lake to Swede Lake in the RAA (Appendix 17A, Figure 3b: Travel 26), as well as two winter portages from Hughes to Chepil Lake in the RAA (Appendix 17A, Figure 3b: Travel 17 and 27). Areas around Black Sturgeon Reserve are connected by river or winter portage (Figure 3c: Travel 34) used by Marcel Colomb First Nation for winter travel. Marcel Colomb First Nation reports a winter road from Muskeko Lake to Ospowakun Lake in the RAA, one from Swede Lake to Eden Lake through the LAA, and also one from Swede Lake to White Owl Lake in the RAA (Appendix 17A, Figure 3b: Travel 30, 31).

Marcel Colomb First Nation stated that a canoe route exists with a series of portages from Eden Lake that passes through the RAA into Granville Lake and then by the Churchill River to Pukatawagan (Appendix 17A, Figure 3b: Travel 28, 29) from a camp on Eden Lake (Appendix 17A, Figure 3b: Habitation 20).

In the past, Marcel Colomb First Nation trapped near Granville and Dunsheath lakes, and areas near Black Sturgeon and Hughes Lake in the RAA (Appendix 17A, Figure 3b: Habitation 4, 6) Marcel Colomb First Nation used a travel route that connects Sickle Lake with Willis Lake (Appendix 17A, Figure 3b: Travel 32).

In the past, there were neighbouring Marcel Colomb First Nation cabins at Cartwright Lake in the RAA (Appendix 17A, Figure 2b: Trapping 10) as well as cabins in the RAA at Swede, Elizabeth, and Wetikoeekan (Sasquatch) lakes, and on an island at Eden Lake (Appendix 17A, Figure 3b: Habitation 9, 14, 15, 16, 17). Travel between these cabins was along the Hughes River in the RAA (Appendix 17A, Figure 3b: Travel 9).

Marcel Colomb First Nation reports all-season camps at Cockeram Lake and on the Keewatin River in the RAA (Appendix 17A, Figure 3b: Travel 2). Travel routes in the RAA from these camps include to the town of Lynn Lake and other trapping areas (Appendix 17A, Figure 3b: Travel 10, 11, 12).

Marcel Colomb First Nation reported historical travel by train to Lynn Lake to get supplies and travel by dog team along a Bombardier trail. The Bombardier trail went through the RAA from the community of Lynn Lake to the community of South Indian Lake (Appendix 17A, Figure 3b: Travel 15). A Marcel Colomb First Nation cabin still stands at South Indian Lake (Appendix 17A, Figure 3b: Habitation 24). There are also have cabins on Wetikoeekan (Sasquatch) Lake and Hughes River (Appendix 17A, Figure 3b: Habitation 23, 25).

Marcel Colomb First Nation indicated that Travel by snowmobile through the RAA is possible between Pukatawagan and Lynn Lake following the railway right-of-way (Appendix 17A, Figure 3b: Travel 33).

Marcel Colomb First Nation identified a water route in the RAA from Black Sturgeon Reserve to Dunsheath Lake along the Hughes River (Appendix 17A, Figure 3b: Travel 19) and a portage at the north end of Hughes Lake that leads to Chepil Lake (Appendix 17A, Figure 3b: Travel 4). The Keewatin River is commonly used by Marcel Colomb First Nation for travel by boat through the PDA and LAA (Appendix 17A, Figure 3b: Travel 18) and the Bombardier road is a travel route from Mile 14 on PR 391 to Barrington Lake (Appendix 17A, Figure 3b: Travel 20). There is a cabin and camp in the RAA on Swede Lake south of the Gordon site (Appendix 17A, Figure 3b: Habitation 10) and another near a trail by the turn off from the highway close to Black Sturgeon (Appendix 17A, Figure 3b: Habitation 11).

Cultural and Spiritual Sites

Marcel Colomb First Nation reports that the narrows on Goldsand Lake in the RAA is a place of cultural importance because people used to live there and there are possible burial sites in that area (Appendix 17A, Figure 4b: Burial Site 1). Marcel Colomb First Nation related stories of an island in Eden Lake in the RAA where one could visit the grave of a Marcel Colomb First Nation member (Appendix 17A, Figure 4b: Burial Site 2). Marcel Colomb First Nation explained that it is important while traveling not to camp in certain places to avoid disturbing the spirits of people who had died there. There is a burial site on an island at the north end of Hughes Lake in the RAA (Appendix 17A, Figure 4b: Sacred Area 2). Marcel Colomb First Nation reported that there are many burial sites throughout the RAA as people would be buried "where they fall."

Cultural Values Associated with Current Use of Lands and Resources for Traditional Purposes

The following relates to the experiential aspects of TLRU that Marcel Colomb First Nation shared. Apart from species and places, the Marcel Colomb First Nation related how harvesting is practiced and what it means to them, their culture, their link to the past and their hopes for future generations. For example, Marcel Colomb First Nation recognizes a cycle of six seasons: winter, early spring (snow melt), late spring (when everything comes alive), summer, early fall, and late fall (when everything freezes) and reported how the experience of the land has changed in the area since mine, road, and railroad development has created year-round access to traditional areas.

Marcel Colomb First Nation related how knowledge and experience is gained through living on the land, about starting trapping during childhood with their families and carrying on the tradition of trapping in the locations used for generations. Marcel Colomb First Nation trappers typically left summer homes for the trap line in the late summer or early fall, would only make one trip home at Christmas, and would not return until the early summer. When traveling between cabins they used snowshoes, dog sleds, and toboggans made of birch with caribou and moose sinew and would often follow caribou trails. It was warned that "you have to know where you're going, or else you're in trouble" because of dangers such as rapids. Returning to their cabins after a day of trapping, families ate meals in the evening and then, by candlelight, skinned the animals they had trapped that day. They would work late into the night, sleep for a few hours, then wake up and go back out to work the trap line. On the weekends, they prepared the hides but limited their work on Sundays to chopping wood because many of the trappers held Christian beliefs. Trapping beaver was hard work because the pelts were difficult to prepare and difficult to transport, especially on the small travel trails, because they were heavy and bulky. They usually sold prepared furs to the North West Company in Pukatawagan but would occasionally sell furs to a trader at Granville Lake, Lynn Lake or Leaf Rapids, wherever the prices were the highest, or traded the prepared furs for supplies or sold them to the owner of the Northern Store.

Marcel Colomb First Nation noted that hunting for fresh meat was essential for survival on the trap line; however, they would only harvest what they needed. They added that working the trap line was hard work but always found it enjoyable. Marcel Colomb First Nation said they are thankful for the medicines that the earth provides, and words are spoken to the medicine during preparation and use as they carry ancestral spirits.

Marcel Colomb trappers sometimes used snowshoes purchased from people who made them in Pukatawagan. Regarding breaking trail to reach camp or destinations on the trap line, Marcel Colomb First Nation stated: “nothing was easy” and after a week of trapping one would have to come back to home base just to rest. In late winter, travel to the trap line in March was by dog team and the trip to the summer home in June was by canoe. Historically, when traveling to the trap line, there was very little space for supplies so they would only bring the essentials that included flour, salt, baking powder, tea, coffee, and lard. They used dog teams until the mid-1970s and then switched to snowmobiles. They stated that “it’s a lot of work to keep a dog team; snowmobiles were easier and faster.”

An example of Marcel Colomb First Nation’s sharing the stories of their grandparents is this statement by an Elder: “They talked about their hardships, but not in a negative way, nor would they ask for pity … the way they lived was never a hardship because this is their way of living and they enjoyed their way of living, right. It was like a challenge between an animal, a bird, or whatever. They got away when they got away. You know, it was part of a game of fun at the same time. If the animal is better than you, then you get laughed at”.

Marcel Colomb reported hunting grouse using slingshots because “rocks are free” and that they would often set nets in the bush to catch ptarmigans to save the bullets for larger animals and birds.

Moose hides provided material for wrap-arounds, coats, moccasins, mukluks, gloves, mitts, and for snowshoe webbing. Porcupine quills were used to decorate moccasins and rabbit fur to insulate boots and moccasins. Marcel Colomb First Nation reported using as much of a harvested animal as they could. For example, they would eat moose tongue. They also ate many of the animals trapped for furs, including lynx, which was good to eat when the hind quarter meat was sliced and fried with lard. They used duck feathers to fill quilts and pillows and rabbit fur to make blankets.

Some Marcel Colomb First Nation trappers reported having only one camp for each trap line and when trapping away from the camp would sleep in the open in handmade goose down and flannel sleeping bags or used tents as outpost camps when they traveled between their cabins. They cut tent poles from dry birch, pine, or spruce trees at each outpost camp and would leave the poles behind for reuse when they returned. People tended not to gather in large groups but found it helpful to have other people nearby when trapping as they could trade supplies when needed.

Marcel Colomb First Nation members continue to actively pass along their customs and share knowledge. For example, an Elder now takes children from Grades 1 to 8 (10 to 20 children at a time) to the trap line during the winter and another would occasionally take the children to camp, hunt, and catch sturgeon at Dunsheath Lake in the RAA (Appendix 17A, Figure 2b: Fishing 3).

Marcel Colomb First Nation hunters share moose meat with family members who live in Black Sturgeon Reserve. Some Marcel Colomb First Nation Elders report raising their children speaking Cree and eating country foods that were harvested from the land. Meat was often fried, boiled, or cooked in a stew. Moose meat would be dried so that it would last longer. Grease from the moose bones was used for cooking. Most food was taken from the land, by hunting, fishing, or gathering; however, they would have to buy supplies such as flour, sugar, lard, and tea. Families often had an abundance of meat from hunting, especially around Christmas time. A moose could feed two people for up to six months.

Marcel Colomb First Nation fishers shared details about how they preserve and prepare fish. A preferred portion is the butterfly meat beneath the front fins of walleye (often referred to as walleye wings). Cleaned and roasted fish guts are also a favourite and are chewy. White fish are often smoked at camp for preservation. A technique to preserve fish that was learned from parents involved digging a hole in the muskeg, inserting the fish, then filling the hole. The cold temperature of the muskeg due to the permafrost keeps the fish fresh, just like a cooler.

Marcel Colomb First Nation recalls the water being very clear and they drank from lakes. While out trapping, they would chop holes through the ice of lakes to collect drinking water and would also use the holes to catch lake trout. There are several natural springs in the RAA and LAA that were used as traditional drinking water sources. These springs were located near Eden Lake, Hughes Lake, and at Michaluck Bay near Westdal Lake (Appendix 17A, Figure 5b: Environ Obs 10, 11, 12, 13, 14).

17.2.14.2 Mathias Colomb Cree Nation

Mathias Colomb Cree Nation contains 16 reserves and settlements with the governing centre in Pukatawagan, Manitoba, on the Churchill River. Mathias Colomb Cree Nation includes Granville Lake Settlement (INAC No. 06457). INAC recognizes the Granville Lake Settlement as a reserve for Pickerel Narrows Cree Nation under the governance of Mathias Colomb Cree Nation (INAC 2019b). Granville Lake Settlement is on a small peninsula on the south side of Granville Lake on the Churchill River. Granville Lake is 75 km from the Gordon site, and 77 km from the MacLellan site. Chapter 3, Section 3.3.1 provides a detailed profile of this Indigenous community.

Mathias Colomb Cree Nation identifies the Project as within its traditional territory and asserts the Indigenous right to harvest there. Mathias Colomb Cree Nation is preparing a Project-specific TLRU study that is not yet released.

Plant Species and Plant Harvesting Sites and Activities

No Project-specific or secondary source information is currently available regarding plant harvest by Mathias Colomb Cree Nation.

Fish Species and Fishing Areas and Activities

According to INAC (2005), fishing, commercial fishing, and guiding are staples of the economy.

Hunted and Trapped Species and Hunting and Trapping Areas and Activities

According to INAC (2005) subsistence hunting, trapping, and guiding for commercial hunting lodges are staples of the economy.

Traditional, Cultural and Spiritual Sites and Areas

No Project-specific or secondary source information is currently available regarding traditional, cultural, and spiritual sites and areas for Mathias Colomb Cree Nation.

17.2.14.3 Peter Ballantyne Cree Nation

Peter Ballantyne Cree Nation contains eight reserves and settlements with the governing centre in Pelican Narrows, Saskatchewan. Peter Ballantyne Cree Nation includes Kinoosao-Thomas Clark 204 (INAC No. 09394). Kinoosao-Thomas Clark 204 is 100 km from the Gordon site, and 70 km from the MacLellan site. Chapter 3, Section 3.3.1 provides a detailed profile of this Indigenous community.

Peter Ballantyne Cree Nation identifies the Project as within its traditional territory and asserts the Indigenous right to harvest there. They have completed, but not yet shared as of filing, their TLRU study with Alamos.

Plant Species and Plant Harvesting Sites and Activities

No Project-specific or secondary source information is currently available regarding plant harvest by Peter Ballantyne Cree Nation.

Fish Species and Fishing Areas and Activities

According to INAC (2005) commercial fishery and a sport fishing lodge have been staples of the economy since 1952. These occur outside the Project RAA.

Hunted and Trapped Species and Hunting and Trapping Areas and Activities

No Project-specific or secondary source information is currently available regarding hunting and trapping by Peter Ballantyne Cree Nation.

Traditional, Cultural and Spiritual Sites and Areas

No Project-specific or secondary source information is currently available regarding traditional, cultural, and spiritual sites and areas for Peter Ballantyne Cree Nation.

17.2.14.4 Manitoba Metis Federation

The Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project documents harvesting and land use by Manitoba Métis citizens within a 100 km radius of the Project (Appendix 17A; SVS 2020). The study's temporal scope includes current use, including activities within the Métis citizen's lifetimes as well as historic use of sites that the Métis citizens know about through teaching or knowledge transfer from past generations (SVS 2020).

The Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project includes three datasets collected between 2003 and 2019. Study results indicate that Métis harvesters have used, and continue to use, the lands and waters around the Project sites for various purposes including subsistence harvesting, cultural and traditional uses (Appendix 17A; SVS 2020).

Plant Species and Plant Harvesting Sites and Activities

Manitoba Metis Federation reported gathering plants and natural materials for food, medicine, and other purposes, including berries to eat seasonally or to store or preserve (Appendix 17A; SVS 2020). Gathering may be year-round for some species and seasonal for others. Gathered plants, berries, and foods are often shared with Métis community members for subsistence and medicinal purposes (SVS 2020).

Métis citizens reported eating: blueberries, chaga, cranberries, raspberries, Saskatoon berries, strawberries, and wild mint. Medicinal plants reported include muskrat root, and Labrador tea.

Food Species and Gathering Areas

Manitoba Metis Federation reported harvesting berries and identified preferred berry picking locations in the LAA and RAA. The harvested food within the RAA includes birch water, blueberries, cranberries, pincherries, and raspberries (Appendix 17A, Figure 9-15; SVS 2020). These plants were harvested berries to eat seasonally, mostly in the summer. Manitoba Metis Federation reported gathering cranberries in the autumn along PR 391 in two locations within the LAA (Appendix 17A, Figure 14, 7608-51 and 7610-27; SVS 2020). Manitoba Metis Federation also reported habitat for blueberries within the LAA along PR 391 (Appendix 17A, Figure 19, 6103-102; SVS 2020).

Fish Species and Fishing Areas and Activities

Manitoba Metis Federation indicated that fishing was the harvesting activity most frequently identified by Métis citizens in the Project area including the Hughes and Keewatin Rivers, and Cockeram, Simpson, and Swede Lakes in the LAA, and Barbara, Barrington, Burge, Chepil, Goldsand, Hughes, Little Brightsand, Ralph, West Lynn, and Zed Lakes in the RAA (Appendix 17A; SVS 2020). Métis citizens reported eating: lake whitefish, northern pike, pickerel, rainbow trout, sauger, suckers, and yellow perch (SVS 2020).

Manitoba Metis Federation reported fishing for northern pike, lake sturgeon, pickerel, and yellow perch in Cockeram Lake (Appendix 17A; SVS 2020) in the LAA and reported fishing for pickerel and northern pike in Hughes Lake, and pickerel in Chepil Lake (SVS 2020), in the RAA. Manitoba Metis Federation identified fishing year-round in the lakes in the LAA and RAA (SVS 2020).

Manitoba Metis Federation reported fish spawning sites at the mouth of Hughes Lake leading into the Hughes River (Appendix 17A, p. 42; SVS 2020).

Hunted and Trapped Species, Areas, and Activities

Manitoba Metis Federation identified 35 country foods including from hunted and trapped species that they have consumed in the last year (Appendix 17A, p. 46; SVS 2020). Métis citizens reported hunting moose near Simpson Lake in the LAA (Appendix 17A, Figure 14, 6103-066; SVS 2020). Manitoba Metis Federation also identified a hunting location west of the access road to the Gordon site along the Hughes River (Appendix 17A, Figure 14, 6103-081; SVS 2020).

Manitoba Metis Federation identified several hunting sites for both moose and birds including grouse, chickens, ducks, goose and ptarmigan in the RAA near Eldon Lake, Goldsand Lake, Hughes River, Simpson Lake, along PR 391 between One Island and Wetikoeekan lakes, and the south end of Glad Lake (Appendix 17A; SVS 2020). Manitoba Metis Federation identified locations where they hunted ptarmigan nearer to the MacLellan site just south of Glad Lake (Appendix 17A, Figure 13, 7605-35/36; SVS 2020). Manitoba Metis Federation reported hunting grouse and chickens near Simpson Lake (Appendix 17A, Figure 14, 6103-068; SVS 2020) and noted hunting geese and ducks on the west shore of Goldsand Lake (Appendix 17A, Figure 12, 7608-15, SVS 2020). Manitoba Metis Federation reported hunting moose along the shores of Goldsand Lake (Appendix 17A, Figure 12, 7608-11 and 7607-17; SVS 2020) and reported hunting moose on the east shore of Eldon Lake (Appendix 17A, Figure 13, 7605-12; SVS 2020). Manitoba Metis Federation reported moose kill sites in the RAA including near One Island Lake along PR 391 and another north of PR 391 west of Opachuanau Lake (Appendix 17A, Figure 14, 7102-42 and 7609-10; SVS 2020).

Manitoba Metis Federation reported hunting caribou, moose, and deer within 100 km of the Project.

Manitoba Metis Federation reported that meat from hunts is sometimes shared with families, communities, or others who may not be able to hunt for themselves. This tradition of sharing the harvest is a common cultural practice by Manitoba Métis citizens and is one of the ways in which the exercise of harvesting rights is interwoven with cultural and social practices to maintain connections between community members and families.

Manitoba Metis Federation identified non-commercial trapping and snaring locations within 100 km of the Project and discussed the importance of trapping in their connection to the land as well as their families as they pass these practices on to their children (Appendix 17A; SVS 2020). Manitoba Metis Federation reported trapping marten, lynx, fox, wolf, beaver, muskrat, and wolverine (Appendix 17A, p. 40; SVS 2020). Manitoba Metis Federation reported commercial trapping beaver, fox, lynx, martens, mink, muskrat, otter, wolf, and wolverine in the area around Little Brightsand, Ex and Goldsand lakes (Appendix 17A; SVS 2020). Some reported trapping for in the area encompassing PR 391, Burge, Little Brightsand, and the south end of Goldsand lakes (Appendix 17A, Figure 12, 6103-39; SVS 2020).

Manitoba Metis Federation reported eating: black bear fat, caribou meat and tongue, moose meat and heart, rabbit, mallard duck, Canada goose, goose, grouse, and ptarmigan.

Traditional, Cultural and Spiritual Sites and Areas

Routes and Trails

Access routes or trails identified by Manitoba Metis Federation include snowmobile routes, boat launches and routes, canoe routes and portages, walking trails, and trails used by other vehicles. Snowmobile/water routes include the Hughes River, Hughes Lake, and Cockeram Lake (Appendix 17A, Figure 17, 7601-6/10 and 7605-11; SVS 2020). These routes allow access to harvesting areas and, through continued use, a cultural connection to Métis history (SVS 2020).

Culturally Significant Sites

Manitoba Metis Federation identified five sites used for cultural, ceremonial, spiritual, traditional within 100 km of the Project. Manitoba Metis Federation reported a burial site on the east shore of Hughes Lake in the RAA (Appendix 17A, Figure 17, 6103-42; SVS 2020). Manitoba Metis Federation reported a large cemetery, in the RAA but outside the LAA, used by Métis citizens near Lynn Lake (Appendix 17A, p. 39; SVS 2020).

17.2.14.5 Métis Nation – Saskatchewan Eastern Region 1

Métis Nation – Saskatchewan Eastern Region 1 comprises three Locals including Local 89 in Sandy Bay, Saskatchewan which is 195 km from the Gordon site and 175 km from the MacLellan site. Chapter 3, Section 3.3.1 provides a detailed profile of this Indigenous community. Métis Nation - Saskatchewan Eastern Region 1 identifies the Project RAA as within its traditional territory and asserts the Indigenous right to harvest there.

Plant Species and Plant Harvesting Sites and Activities

No Project-specific or secondary source information is currently available regarding plant harvest in the RAA by Métis Nation - Saskatchewan Eastern Region 1.

Fish Species and Fishing Areas and Activities

No Project-specific or secondary source information is currently available regarding fishing in the RAA by Métis Nation - Saskatchewan Eastern Region 1.

Hunted and Trapped Species and Hunting and Trapping Areas and Activities

Through engagement, Métis Nation - Saskatchewan Eastern Region 1 has expressed concern regarding effects of the Project on woodland caribou.

Traditional, Cultural and Spiritual Sites and Areas

No Project-specific or secondary source information is currently available regarding traditional, cultural, and spiritual sites and areas in the RAA for Métis Nation - Saskatchewan Eastern Region 1.

17.2.14.6 O-Pipon-Na-Piwin Cree Nation

O-Pipon-Na-Piwin Cree Nation (INAC No. 06454) is located on Southern Indian Lake on the Churchill River in northern Manitoba. The community is 90 km from the Gordon site and 120 km from the MacLellan site. Chapter 3, Section 3.3.1 provides a detailed profile of this Indigenous community.

Through engagement, O-Pipon-Na-Piwin Cree Nation has indicated that its members do not currently have traditional practices in the Project RAA, but the Band Council noted that some treaty land entitlement areas were close to the Gordon site in the RAA. They expressed concern regarding water quality and its effect on fish health especially in Barrington Lake, which is partially within the RAA and South Indian Lake, which is outside the RAA.

Plant Species and Plant Harvesting Sites and Activities

No secondary source information is currently available regarding plant harvest in the RAA by O-Pipon-Na-Piwin Cree Nation.

Fish Species and Fishing Areas and Activities

According to INAC (2005) a successful hunting and fishing lodge is located on Sand Lake and that food from the land strengthens Indigenous food sovereignty, and that this activity was affected by the Churchill River Diversion.

Hunted and Trapped Species and Hunting and Trapping Areas and Activities

Hrenchuk (1991) reports that the area between Southern Indian Lake and Tadoule Lake, east of the RAA, is intimately known and intensively used by O-Pipon-Na-Piwin Cree Nation. Hrenchuk (1993) writes that trapping once extended as far as Tadoule Lake. This practice became less linear (following watercourse and trails) once registered traplines (blocks) were introduced. Hunting travel still ranges up to 400 km from the reserve. According to INAC (2005) a successful hunting and fishing lodge is located on Sand Lake and that food from the land strengthens Indigenous food sovereignty, and that this activity was affected by the Churchill River Diversion.

Traditional, Cultural and Spiritual Sites and Areas

No secondary source information is currently available regarding traditional, cultural, and spiritual sites and areas in the RAA for O-Pipon-Na-Piwin Cree Nation.

17.2.14.7 Nisichawayasihk Cree Nation

Nisichawayasihk Cree Nation contains 18 affiliated reserves with the governing centre at Nelson House, MB, on Footprint Lake. Nisichawayasihk Cree Nation includes Suwannee Lake (INAC No. 09748) which is 80 km from the Gordon site, and 95 km from the MacLellan site. Chapter 3, Section 3.3.1 provides a detailed profile of this Indigenous community.

Through engagement, Nisichawayasihk Cree Nation has indicated to Alamos that its members do not currently have traditional practices in the Project RAA; however, the NCN Land Guardians raised concerns about the potential effects of increased truck traffic on PR 391, from Thompson that traverses their Resource Management Area, including introduction of invasive species and potential spills in the RAA.

Plant Species and Plant Harvesting Sites and Activities

No secondary source information is currently available regarding plant harvest by Nisichawayasihk Cree Nation.

Fish Species and Fishing Areas and Activities

No secondary source information is currently available regarding fishing by Nisichawayasihk Cree Nation.

Hunted and Trapped Species and Hunting and Trapping Areas and Activities

Hrenchuk (1991) reports that the area between Southern Indian Lake and Tadoule Lake, north of the RAA, is intimately known and intensively used by Nisichawayasihk Cree Nation. Hrenchuk (1993) writes that trapping once extended as far as Tadoule Lake. This practice became less linear (following watercourse and trails) once registered traplines (blocks) were introduced. Hunting travel still ranges up to 400 km from the reserve.

Traditional, Cultural and Spiritual Sites and Areas

No secondary source information is currently available regarding traditional, cultural, and spiritual sites and areas in the RAA for Nisichawayasihk Cree Nation.

17.2.14.8 Barren Lands First Nation

Barren Lands First Nation (INAC No. 06458) is on the northeast shore of Reindeer Lake. The governing centre is in Brochet, Manitoba, approximately 130 km from the Gordon site and 115 km from the MacLellan site. Chapter 3, Section 3.3.1 provides a detailed profile of this Indigenous community.

Through engagement, Barren Lands First Nation advised Alamos that its members do not currently participate in traditional practices within the RAA.

Plant Species and Plant Harvesting Sites and Activities

No secondary source information is currently available regarding plant harvest in the RAA by Barren Lands First Nation.

Fish Species and Fishing Areas and Activities

According to INAC (2005) subsistence fishing, commercial fishing, and guiding are staples of the Barren Lands First Nation economy.

Hunted and Trapped Species and Hunting and Trapping Areas and Activities

As reported in the Tazi Twé Hydroelectric project Environmental Assessment (CEAA 2015), barren-ground caribou is the most important traditional food source of the Indigenous people of Athabasca; however, due to the absence of caribou in the region, they must travel into Northwest Territories, Nunavut, and northern Manitoba to hunt caribou.

According to INAC (2005) subsistence hunting, trapping, and guiding for commercial hunting lodges are staples of the Barren Lands First Nation economy.

Traditional, Cultural and Spiritual Sites and Areas

No secondary source information is currently available regarding traditional, cultural, and spiritual sites and areas in the RAA for Barren Lands First Nation.

17.2.14.9 Hatchet Lake First Nation

Hatchet Lake First Nation, also known as Lac La Hachet (INAC No. 06504), is on the southeastern shore of Wollaston Lake in northern Saskatchewan. Hatchet Lake First Nation is 205 km from the Gordon site and 185 km from the MacLellan site. Chapter 3, Section 3.3.1 provides a detailed profile of this Indigenous community.

Through engagement, Hatchet Lake First Nation advised Alamos that their members do not currently participate in traditional practices within the RAA.

Plant Species and Plant Harvesting Sites and Activities

No secondary source information is currently available regarding plant harvest in the RAA by Hatchet Lake First Nation.

Fish Species and Fishing Areas and Activities

No secondary source information is currently available regarding fishing in the RAA by Hatchet Lake First Nation.

Hunted and Trapped Species and Hunting and Trapping Areas and Activities

As reported in the Comprehensive Study Report: Wollaston Lake Road for Saskatchewan Department of Highways and Transportation (CEAA 2007), Hatchet Lake First Nation is concerned that the Beverly Qamanirjuaq herds of caribou, which travel through northwestern Manitoba, are subject to over-harvesting.

Traditional, Cultural and Spiritual Sites and Areas

No secondary source information is currently available regarding traditional, cultural, and spiritual sites and areas in the RAA for Hatchet Lake First Nation.

17.2.14.10 Northlands Denesuline First Nation

Northlands Denesuline First Nation contains five affiliated reserves with the governing centre at Lac Brochet (INAC No. 06468) on the northeastern shore of Lac Brochet in northern Manitoba. Northlands Denesuline

First Nation includes Sheth Chok (INAC No. 09935) which is 191 km from the Gordon site and 183 km from the MacLellan site. Chapter 3, Section 3.3.1 provides a detailed profile of this Indigenous community.

Through engagement, Northlands Denesuline First Nation advised Alamos that their members do not currently participate in traditional practices within the RAA.

Plant Species and Plant Harvesting Sites and Activities

According to Chan et al. (2010), 79% of Northlands Denesuline First Nation members consume wild berries and nuts, mostly blueberries and cranberries.

Fish Species and Fishing Areas and Activities

According to Chan et al. (2010), in their First Nations food, nutrition and environment study, 93% of Northlands Denesuline First Nation members consume fish, mostly trout, lake whitefish and walleye.

INAC (2005) reports that subsistence fishing is one of the bases of the Northlands Denesuline First Nation economy.

Hunted and Trapped Species and Hunting and Trapping Areas and Activities

According to Chan et al. (2010), 56% of Northlands Denesuline First Nation members consume Canada goose and 17% consume grouse, 100% consume caribou meat and 63% consume moose.

INAC (2005) reports that subsistence hunting and trapping have been a basis of the Northlands Denesuline First Nation economy.

Traditional, Cultural and Spiritual Sites and Areas

No secondary source information is currently available regarding traditional, cultural, and spiritual sites and areas in the RAA for Northlands Denesuline First Nation.

17.2.14.11 Sayisi Dene First Nation

Sayisi Dene First Nation is at the north end of Tadoule Lake in northern Manitoba. Tadoule Lake is 230 km from the Gordon site and 250 km from the MacLellan site. Chapter 3, Section 3.3.1 provides a detailed profile of this Indigenous community.

Through engagement, Sayisi Dene First Nation advised Alamos that members of do not currently participate in traditional practices within the RAA.

Plant Species and Plant Harvesting Sites and Activities

According to Chan et al. (2010), 79% of Sayisi Dene First Nation members consume wild berries and nuts, mostly blueberries and cranberries.

Fish Species and Fishing Areas and Activities

According to Chan et al. (2010), 93% of Sayisi Dene First Nation members consume fish, mostly trout, lake whitefish and walleye.

INAC (2005) reports that subsistence fishing is a basis of the economy.

Hunted and Trapped Species and Hunting and Trapping Areas and Activities

According to Chan et al. (2010), 56% of Sayisi Dene First Nation members consume Canada goose, 17% consume grouse, 100% consume caribou meat, and 63% consume moose.

INAC (2005) reports that subsistence hunting and trapping have been the basis of the Sayisi Dene First Nation economy since they returned to their traditional lands in 1973.

Petch (1998) found that trapping occurs less now among Sayisi Dene First Nation harvesters, due to price of fuel. Caribou hunts are now planned community events involving a rental of aircraft unless the herds pass close to town.

Traditional, Cultural and Spiritual Sites and Areas

No secondary source information is currently available regarding traditional, cultural, and spiritual sites and areas in the RAA for Sayisi Dene First Nation.

17.2.14.12 Métis Nation – Saskatchewan Northern Region 1

Métis Nation – Saskatchewan Northern Region 1 comprises six Locals including Local 19 in La Ronge, Saskatchewan, which is 380 km from the Gordon site and 350 km from the MacLellan site. Chapter 3, Section 3.3.1 provides a detailed profile of this Indigenous community.

Through engagement, Métis Nation – Saskatchewan Northern Region 1 advised Alamos that their members do not currently participate in traditional practices within the RAA.

Plant Species and Plant Harvesting Sites and Activities

No secondary source information is currently available regarding plant harvest in the RAA by Métis Nation – Saskatchewan Northern Region 1.

Fish Species and Fishing Areas and Activities

No secondary source information is currently available regarding fishing in the RAA by Métis Nation – Saskatchewan Northern Region 1.

Hunted and Trapped Species and Hunting and Trapping Areas and Activities

No secondary source information is currently available regarding hunting and trapping in the RAA by Métis Nation – Saskatchewan Northern Region 1.

Traditional, Cultural and Spiritual Sites and Areas

No secondary source information is currently available regarding traditional, cultural, and spiritual sites and areas in the RAA by Métis Nation – Saskatchewan Northern Region 1.

17.3 PROJECT INTERACTIONS WITH CURRENT USE OF LAND AND RESOURCES FOR TRADITIONAL PURPOSES

Table 17-5 identifies, for each potential effect, the physical activities that might interact with the current use of lands and resources for traditional purposes and result in the identified environmental effect. These interactions are indicated by a check mark and are discussed in detail in Section 17.4, in the context of effects pathways, standard and project-specific mitigation/enhancement, and residual effects. A justification for no effect is provided following the table.

Project activities for each phase are described in detail in Chapter 2, Sections 2.3 and 2.4. Project related emissions and discharges are described in Chapter 2, Section 2.8.

The potential interactions between Project activities and the environment were considered for the construction, operation, and decommissioning/closure phases of the Project. The identification of Project activities and their potential interactions was based on engagement with interested parties, the professional judgment of technical specialists involved in the assessment, and a review of existing conditions. The selection of interactions is also informed by the potential effects and effects pathways for each VC as described in Section 17.1.3.

Emissions, discharges, and wastes (e.g., air, waste, noise, light, liquid, and solid effluents) are generated by many and varied Project activities. Rather than acknowledging this by placing a check mark against each of these activities, "Emissions, Discharges and Wastes" have been consolidated as integrated activity for efficiency of approach. This activity includes the emissions, discharges, and wastes generated by all other project activities under each Project phase.

Table 17-5 Potential Project-Environment Interactions with Current Use of Land and Resources for Traditional Purposes

Project Activities and Components	Environmental Effects					
	Change in availability of resources currently used for traditional purposes		Change in access to resources currently used for traditional purposes		Change to Traditional Cultural and Spiritual Sites and Areas	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
Construction						
Site Preparation at Both Sites (removal of existing buildings; removal of contaminated materials; vegetation clearing and earthworks; development of temporary construction camp at the MacLellan site)	✓	✓	✓	✓	✓	✓
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	✓	✓	–	–	–	–
Mine Components at Both Sites (construction of ore pads; ore, overburden and mine rock storage areas; mill feed storage area and crushing plant, ore milling and processing plant, and Tailings Management Facility at the MacLellan site; water management facilities [e.g., sumps, ponds and ditches])	–	–	–	–	–	–
Utilities, Infrastructure, and Other Facilities at Both Sites (construction of: buildings and yards; access roads [i.e., upgrades at the Gordon and MacLellan site] and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at the MacLellan site; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities)	–	–	–	–	–	–
Water Development and Control at Both Sites (dewatering of existing pits at Gordon site; interceptor wells at the Gordon site and underground workings at MacLellan site; re-alignment of existing built diversion channel at Gordon site; dewatering and infilling of East Pond at MacLellan site)	✓	✓	✓	✓	✓	✓
Emissions, Discharges, and Wastes[1]	✓	✓	–	–	✓	✓

Table 17-5 Potential Project-Environment Interactions with Current Use of Land and Resources for Traditional Purposes

Project Activities and Components	Environmental Effects					
	Change in availability of resources currently used for traditional purposes		Change in access to resources currently used for traditional purposes		Change to Traditional Cultural and Spiritual Sites and Areas	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
Employment and Expenditure[2]	–	–	–	–	–	–
Operation						
Open Pit Mining at Both Sites (drilling; blasting; removal, loading and on-site hauling of mined material [i.e., ore, overburden, and mine rock])	–	–	–	–	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA, including truck transportation of ore from the Gordon site to the MacLellan site)	✓	✓	–	–	–	–
Storage/Stockpiling of Ore, Overburden, and Mine Rock at Both Sites	–	–	–	–	–	–
Ore Milling and Processing at the MacLellan site (ore crushing and conveyance; ore milling)	–	–	–	–	–	–
Water Management at Both Sites (mine water collection and storage; process water supply for the MacLellan site including water intake on Keewatin River at the MacLellan site; pumping fresh/fire water from Farley Lake at Gordon site; operation of interceptor wells at the Gordon site)	✓	✓	✓	✓	✓	✓
Tailings Management at the MacLellan Site	–	–	–	–	–	–
Utilities, Infrastructure, and Other Facilities at Both Sites (presence and operation of: buildings and yards; access roads and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at the MacLellan site; on-site pipelines at MacLellan; fuel storage and distribution systems; sewage treatment facilities;	✓	✓	✓	✓	✓	✓

Table 17-5 Potential Project-Environment Interactions with Current Use of Land and Resources for Traditional Purposes

Project Activities and Components	Environmental Effects					
	Change in availability of resources currently used for traditional purposes		Change in access to resources currently used for traditional purposes		Change to Traditional Cultural and Spiritual Sites and Areas	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
domestic solid waste handling facilities; explosives storage, maintenance of access roads and bridges)						
Emissions, Discharges, and Wastes[1]	✓	✓	–	–	✓	✓
Employment and Expenditure[2]	–	–	–	–	–	–
Decommissioning/Closure						
Decommissioning at Both Sites	✓	✓	✓	✓	–	–
Reclamation at Both Sites	✓	✓	✓	✓	–	–
Post-Closure at Both Sites (long-term monitoring)	✓	✓	✓	✓	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	✓	✓	–	–	–	–
Emissions, Discharges, and Wastes[1]	✓	✓	–	–	✓	✓
Employment and Expenditure[2]	–	–	–	–	–	–

NOTES:
✓ = Potential interaction
– = No interaction
[1] Emissions, Discharges, and Wastes (e.g., air, waste, noise, light, liquid, and solid effluents) are generated by many Project activities. Rather than acknowledging this by placing a check mark against each of these activities, “Emissions, Discharges and Wastes” have been introduced as an additional component under each Project phase.
[2] Project employment and expenditures are generated by most Project activities and components and are the main drivers of many socio-economic effects. Rather than acknowledging this by placing a check mark against each of these activities, “Employment and Expenditures” have been introduced as an additional component under each Project phase.

Construction

Project-related transportation within the LAA, mine components, and utilities, infrastructure and other facilities are not expected to cause measurable change in access to resources currently used for traditional purposes. They are not expected to cause changes in traditional, cultural sites and spiritual sites and areas during construction as these changes will be the result of site preparation. Transportation within the LAA following site preparation is not anticipated to further contribute to change in access to resources or to traditional, cultural, or spiritual sites.

Mine components and utilities, infrastructure and other facilities are not expected to interact with Current Use as these activities will be conducted after site preparation has been completed, and wildlife will no longer be present at these sites. Wastes and emissions are also not expected to measurably affect access to resources except potentially upon individual perceptions that resources may no longer be appropriate for use. If this happens, the choice to avoid certain areas can be interpreted as a change to access.

Operation

Open pit mining; storage/stockpiling of ore, overburden, and mine rock; ore milling and processing; and tailings management are not expected to cause change in availability or access to resources currently used for traditional purposes as these activities will be conducted on previously cleared land. There are no known traditional, cultural, or spiritual sites or areas within the PDA.

Project-related transportation within the LAA is not expected to cause change in access to resources currently used for traditional purposes or traditional, cultural sites and spiritual sites and areas as there are no pathways by which this would occur.

Wastes and emissions are also not expected to measurably change access to resources currently used for traditional purposes because there is no pathway by which this could occur except for the perception that resources may no longer be appropriate for use. The choice not to go to certain areas can be interpreted as an unquantifiable change to access.

Decommissioning/Closure

Changes to traditional, cultural, or spiritual sites and areas are not anticipated from activities during decommissioning/closure, as change to these sites will have resulted from site preparation during construction, however some indirect effects might be experienced due to emissions, such as noise and light in the LAA.

Project related transportation, or wastes and emissions during decommissioning/closure are not expected to affect access to resources or traditional, cultural sites and spiritual sites and areas because neither of these activities had interactions during construction or operation, and decommissioning/closure will represent a reduction in the amount of traffic or emissions experienced in the LAA.

17.4 ASSESSMENT OF RESIDUAL ENVIRONMENTAL EFFECTS ON CURRENT USE OF LANDS AND RESOURCES FOR TRADITIONAL PURPOSES

This section discusses the interaction pathways for the Project activities identified in Table 17-5 that have the potential to affect a change in availability, change in access, or change in sites or areas, including analytical assessment techniques, mitigation, and residual effects. Changes to the environment that affect cultural value or importance associated with Current Use is also discussed narratively but does not lend itself to typical analytical techniques. The assessment of potential change in availability, access of traditional, cultural, and spiritual sites and areas is organized by Project components (i.e., Gordon and MacLellan sites). The portion of PR 391 between the Gordon and MacLellan sites is included in the assessment for Gordon site.

17.4.1 Analytical Assessment Techniques

Potential environmental effects on Current Use were determined based on the Project-specific TLRU studies, Project engagement activities, literature review and past project experience. Other VC assessments provide additional relevant information regarding effects on resources, and aspects of the biophysical and socio-economic environment that may affect TLRU. Potential effects on TLRU due to construction, operation and decommissioning/closure of the Project are outlined in Section 17.3.

17.4.1.1 Assumptions and the Conservative Approach

Current Use depends on traditional resources being available to be harvested and lands being accessible including sites, such as trails, sacred areas, campsites, and harvesting areas. The assessment of residual environmental effects on Current Use presents Project interactions and pathways, mitigation measures and residual effects for each potential project effect on Current Use.

The sections on potential interactions and pathways include information from biophysical and socioeconomic assessments where they apply to the potential Project effect on Current Use. Information gathered from Project-specific TLRU studies and results of the Indigenous engagement program for the Project are presented where potential interactions have been identified by Indigenous communities in relation to the Project. Information from the literature review was also considered where Indigenous communities have identified potential pathways on other development projects that could occur on the Project.

Recommendations and mitigation measures were identified during the engagement process with the Indigenous communities as well as requested by the First Nations and Métis citizens through TLRU studies. The mitigation measures sections list those measures proposed by Indigenous communities and present mitigation measures that would be implemented for the Project.

The analysis of residual effects on Current Use is based on information from Project-specific TLRU study reports, the results of the Indigenous engagement program for the Project, the results of the literature review, the conclusions of relevant biophysical and socioeconomic assessments, and feedback on the assessment from participating Indigenous communities. Residual effects are considered on a community-specific basis. Because Project residual effects on Current Use are similar for traditional activities irrespective of which Indigenous community is practicing them, they are summarized and presented in a single table with Project effects that are specific to an Indigenous community presented separately.

The assessment of residual effects considers change in the availability of, and access to, traditionally used resources, and changes to the sites and areas themselves. Project effects on Current Use include the conclusions of related project assessments, the specific environmental effects related to each current use activity and potential effects identified by Indigenous communities. Indigenous communities may choose not to practice traditional activities or use traditional sites and areas near the Project for a variety of cultural, spiritual, aesthetic, or personal reasons, and these potential effects are also considered.

A conservative approach is used to address uncertainty in the environmental effects assessment, which increases confidence in the final determination of significance by reducing the risk of understating Project effects. Assumptions used to address uncertainty are identified as part of the description of analytical assessment techniques for each of the respective environmental effects (Sections 17.4.2, 17.4.3, and 17.4.4). The prediction confidence of the assessment for Current Use (Section 17.7) incorporates these assumptions and other elements that contribute to the conservative approach.

17.4.2 Change in Availability of Resources Currently used for Traditional Purposes

Availability of resources currently used for traditional purposes can be affected in two ways, either by a change in the landscape that removes habitat for wildlife, fish and plants relied upon for traditional food, medicine, or materials, or by a change in mortality or health of these resources in such a way that their numbers are affected. These two changes in availability are assessed in different ways.

Change in habitat (Chapter 10; Chapter 11; and Chapter 12) was assessed by quantifying direct and indirect changes in the amount of habitat available for resources currently used for traditional purposes for each Project phase (i.e., construction, operation, and decommissioning/closure) in comparison with baseline conditions.

Direct change in habitat (i.e., habitat loss) is calculated as the loss of habitat that is no longer available to support resources currently used for traditional purposes resulting from the Project PDA; effects do not extend into the LAA. In general, once vegetation clearing or wetland drainage is completed during the construction component, the PDA will provide no suitable land for Current Use.

Indirect change in habitat (i.e., habitat alteration) is calculated as the area of reduced ecological function of land available for resource use (i.e., the habitat is still available but is compromised in some capacity, adjacent to the Project; effects extend into the LAA. Indirect effects also include the diminished desire to conduct traditional activities in an area perceived to be influenced adversely by Project activities. The extent of the zone of influence of activities causing indirect habitat loss varies depending on the Project component, pathway, and measurable parameter.

Direct causes of mortality risk are vegetation clearing, vehicular collisions and human-wildlife conflicts that may affect availability of resources for Current Use (Chapter 12). The estimations are based on, for example, rate of traffic collision or rate of utility line strikes.

Indirect causes of mortality or loss of health of resources are qualitatively described and include predictions of changes in predator-prey interactions, harvest pressure, soil compaction or dust affecting traditionally harvested plants. Indirect sources of mortality are associated with all phases of the Project.

17.4.2.1 Project Pathways

Gordon Site

Construction

Vegetation clearing and dewatering are the primary pathways for a direct change in availability of traditional resources during site preparation and water development and control activities (Chapter 11, Section 11.4.2 and Chapter 12, Section 12.4.2, respectively). Site preparation activities will require the removal of 1,210 ha of upland and wetland habitat for the PDA, including 143 ha that have been previously disturbed. Once cleared, the PDA will provide no longer be suitable habitat for traditionally harvested wildlife, vegetation, or fish resources. Water development and control activities will include the dewatering of the existing pits and re-alignment of the existing build diversion channel which may affect the availability of fish.

Vegetation clearing (Chapter 11, Section 11.4.2) and sensory disturbances (wastes and emissions; Chapter 12, Section 12.4.2) are the primary pathways for an indirect change in habitat during the site preparation and wastes and emissions activities, respectively. The vegetation clearing described above will fragment habitats, creating an unnatural transition between the cleared PDA and the surrounding environment (i.e., edge effects). Edge effects can include changes in microclimate (e.g., Murcia 1995), vegetation structure and composition (e.g., Harper et al. 2005), predation (e.g., Paton 1994), community structure (e.g., Schmiegelow et al. 1997), or behavioral responses of wildlife (e.g., Machtans 2006).

Project-related noise from most construction activities (e.g., heavy equipment operation, infrastructure construction, increased traffic volumes) have the potential to disturb wildlife and change the use of habitat around the site or highway (e.g., habitat avoidance, as discussed in Chapter 12, Section 12.4.2; Bayne et al. 2008). In turn, these potential effects may contribute to avoidance of the area by traditional harvesters.

Site preparation (e.g., vegetation clearing and earthworks), water development and control (e.g., trenching and water diversion) and Project-related transportation (e.g., traffic collision) within the LAA are expected to be the pathways through which changes in traditionally harvested resource availability due to mortality will occur during construction (Chapter12, Section 12.4.3).

Without mitigation, human-wildlife encounters (e.g., food waste and garbage) may occur at on-site facilities. These encounters may lead to wildlife mortality through elimination of problem wildlife such as bear or fox (Chapter 12, Section 12.4.3).

Operation

During operation, Project-related transportation within the LAA is the primary activity with potential to cause wildlife mortality and change the availability of traditionally harvested resources (Chapter 12, Section 12.4.3). The increase in traffic due to ore hauling to stockpile sites, and to the mill from the Gordon site to the MacLellan site will result in a greater potential for wildlife/vehicle collisions and mortality along the access roads and PR 391. Project-related traffic on PR 391 between Thompson and Suwannee Lake may also result in a greater potential for wildlife/vehicle collisions and mortality. Using the existing average of 0.23 wildlife collisions per MVKT in the LAA, or 0.5 collisions per year (Chapter 12, Section 12.2.2.3), increased traffic due to ore hauling would result in approximately 1.5 reportable wildlife collisions per year for large mammals during operation if no mitigation were to occur (Chapter 12, Section 12.4.3).

Utilities, site infrastructure, and facilities may lead to wildlife mortality, for example through bird collisions with utility wires, poles, or buildings. Direct mortality may also occur through human-wildlife encounters at site facilities and infrastructure during Project operation, such as trapping removal of problem wildlife (Chapter 12, Section 12.4.3).

The potential residual effects to fish and fish habitat due to potential increases in water levels in Gordon and Farley lakes are within the range of natural variability in these lakes, which are continually affected by beaver activity (Chapter 10, Section 10.4.3). Potential changes in flow in Farley Creek pose the greatest potential risk to focal fish populations due to changes in fish habitat at the Gordon site. However, this potential effect is not expected to cause a measurable reduction in the productivity of any focal fish population in the Gordon LAA (Chapter 10, Section 10.6.1). Riparian, terrestrial, and wetland habitats adjacent to Gordon Lake, Farley Lake, and Farley Creek are likely to be temporarily altered (i.e., flooded), which could affect the habitat for species such as moose and waterbirds (Chapter 12, Section 12.4.2.4). Indigenous communities indicated that previous mining activity had affected fish resources, and voiced concerns that the Project would have similar effects.

Noise, light, and vibration is also expected to be a primary pathway that could potentially change the availability of traditional resources. For example, Project-related noise sources (e.g., heavy equipment operation, blasting, and increased traffic levels) could potentially result in avoidance of the LAA by wildlife such as moose and therefore by traditional harvesters.

Decommissioning/Closure

The pathways that affect a direct change in resource availability vary over time as mine operation transitions towards habitat restoration and succession during reclamation and post-closure activities. Water infilling and vegetation succession of the PDA provides increased habitat for fish, plants, and wildlife during reclamation and post-closure activities (Chapter 10, Section 10.4.2, Chapter 11, Section 11.4.2; and Chapter 12, Section 12.4.2, respectively).

Similarly, pathways that cause an indirect change in habitat vary over time from decommissioning to reclamation and post-closure activities. Sensory disturbance and traffic during reclamation are expected to be greatly reduced and returned to baseline conditions during post-closure, lessening the avoidance of the area by wildlife species, and lessening traffic collisions (Chapter 12, Sections 12.4.2 and 12.4.3).

MacLellan Site

Project pathways that could potentially lead to a change in traditional resource availability at MacLellan site are similar to those present at Gordon site. Traffic-related mortality risks for wildlife species occurring on PR 391 are included in the assessment for Gordon site. Because of the smaller transportation infrastructure footprint at the MacLellan site, traffic-related mortality risks for wildlife species during all Project phases are expected to be proportionately lower than for the Gordon site. However, the MacLellan site could potentially have a greater risk of human-wildlife encounters at site facilities and infrastructure during all Project phases due to higher staffing levels at the mill, including the development of a temporary construction camp. If human encounters occur, they will most likely be in the form of removal of problem wildlife due to improperly stored food and waste. Consequently, the MacLellan site could potentially have a greater risk of mortality for rodents, ravens, bears, fox, and other animals that scavenge. These potential mortality risks could result in a change in availability of species used for traditional hunting and trapping purposes (Chapter 12, Section 12.4.3). The MacLellan site also has a higher risk for direct mortality during operation due to the presence of the tailings management facility (Chapter 12, Sections 12.4.3 and 12.4.4).

17.4.2.2 Mitigation

Mitigation for potential effects on the availability of traditionally used resources listed below, are those measures from wildlife and wildlife habitat (Chapter 12), vegetation and wetlands (Chapter 11), fish and fish habitat (Chapter 10), surface water (Chapter 9) and heritage resources (Chapter 16) identified as relevant to Current Use, as well as recommended mitigations from Indigenous communities. These are arranged below according to categories of Current Use.

The implementation of the mitigation measures will be the responsibility of Alamos and/or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists based on consideration of standard design codes and practices and industry standards, and upon engagement with potentially affected Indigenous peoples. Alamos commits to ongoing engagement with potentially affected Indigenous peoples to discuss the efficacy of mitigation measures.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Gordon Site

Mitigation measures that are relevant to availability of traditionally harvested resources will include the following:

- Wetland buffering, silt fencing, and timing of vegetation clearing as described in the vegetation and wetlands assessment (Chapter 11, Section 11.4.3.2) will reduce habitat loss or loss of traditionally important species.
- Dust suppression, as described in the air quality assessment (Chapter 6) will reduce sensory disturbance, effects to habitat or traditionally harvested species.

- Erosion and sediment control measures during construction (Chapter 23; i.e., timing works outside of sensitive periods) will reduce alteration or loss of fish habitat.
- Workers will be prohibited from bringing firearms and fishing gear to the sites while working to limit competition for wildlife and fish species (Chapter 15, Section 15.4.4.2).
- Mitigation as described in the fish and fish habitat assessment (Chapter 10, Section 10.4.1.3) will reduce effects on traditionally important fish species and habitat.
- Offsetting lost habitat area where serious harm to fish will occur (Fish Habitat Offsetting Plan, Chapter 23).
- Relevant mitigation as described in the groundwater assessment (Chapter 8, Sections 8.4.2.2 and 8.4.3.2) to reduce effects on traditionally important species and resources.
- Relevant mitigation as described in the wildlife and wildlife habitat assessment (Chapter 12, Sections 12.4.2.3, 12.4.3.4, and 12.4.4.3) to reduce effects on traditionally important species and resources.
- The application of relevant actions in the Wildlife Monitoring and Management Plan (Chapter 23, Section 23.5.15) to reduce effects on traditionally important species and resources.

MacLellan Site

Mitigation measures at MacLellan site are the same as indicated for Gordon site with the following additional mitigation measure specific to the removal of the existing infrastructure at MacLellan site:

- Application of the Surface Water Monitoring and Management Plan (Chapter 23).
- Relevant mitigation as described in the wildlife and wildlife habitat assessment (Chapter 12, Section 12.4.3.4).

Through engagement, Marcel Colomb First Nation recommends water quality monitoring, monitoring of vegetation clearing by an Elder, cultural sensitivity training for contractors, protection for unmarked burials. Through engagement, Peter Ballantyne Cree Nation suggests third-party monitoring and testing of water quality in the Hughes River. Through their Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project, the Manitoba Metis Federation recommends the development of a closure plan to reduce potential social, economic, and environmental effects from the mine closure upon decommissioning/closure.

17.4.2.3 Project Residual Effects

Gordon Site

Construction

Clearing of natural vegetation or earthworks, including digging of channels or infilling of ponds, cannot be avoided, however, these activities will occur during the winter months where possible. Winter clearing and earthworks should reduce the potential residual effects on wildlife. Should clearing occur in other seasons, appropriate mitigation measures will be applied (Chapters 11 and 12). Once cleared, the PDA will provide no suitable wildlife habitat, except for a few species that may take advantage of developed sites and anthropogenic structures (e.g., barn swallow; Chapter 12, Section 12.4.2).

Site preparation activities will require the removal of upland and wetland habitat for the PDA (Chapters 11 and 12), which represents 0.7% of the wildlife habitat and vegetation available in the RAA. As habitat needs of individual species differ, the percentage of habitat loss for each species due to PDA clearing will differ as well (Chapter 12, Section 12.4.2). Once cleared, the PDA will provide no suitable habitat for wildlife, vegetation, or fish resources, except for a few species that may take advantage of developed sites and anthropogenic structures (e.g., rodents and weeds). Site preparation will negatively affect hunting and trapping activities that currently occur at both the MacLellan and Gordon sites.

Water development and control activities will include the dewatering of the existing pits and re-alignment of the existing diversion channel at the Gordon site, which may affect the availability of fish.

Given the implementation of speed limits as part of the Wildlife Monitoring and Management Plan (Chapter 23, Section 23.5.14), the residual effect of construction traffic on wildlife mortality will be minor in in the LAA (Chapter 12, Section 12.2.2.3).

The use of best management practices is expected to reduce the risk of direct and indirect changes in resource availability, though problem wildlife may still occur during construction due to the presence of attractants (i.e., food odours, coolants) regardless of how well these are stored. In the case of beavers and other aquatic mammals water control issues could have direct and indirect effects on resource availability. Project activities that require the trapping or relocation/ destruction of these large and small mammals could also directly and indirectly effect the availability of those resources for hunting and trapping purposes. Best management practices will be used to reduce noise and other emissions that can disturb and/or displace wildlife. However, residual effects may extend into the LAA and will differ among species (Chapter 12, Section 12.4.2).

Overall, the residual effects on change in resource availability during the construction phases of the Project are characterized as follows:

- Direction is adverse: there will be an increase in mortality and habitat loss for wildlife by vegetation clearing, vehicular collisions, human interactions, and sensory disturbance, loss of fish habitat (e.g., East Pit and Wendy Pit) and plants by vegetation clearing during construction.
- Magnitude is low: with mitigation, the change in resource availability is anticipated to be low, as the Project is not expected to cause population levels effects, despite some mortalities and displacement.
- Geographic extent is the LAA: mortality risk from site preparation and human-wildlife interaction will be confined to the PDA, however traffic mortality risk and avoidance will extend to the LAA.
- Frequency is continuous. mortality risk and loss of habitat will occur throughout the construction phase.

- Duration is short-term: direct and indirect habitat loss and the risk of direct or indirect mortality will be elevated during the construction period.
- Change is reversible: changes to and loss of habitat and the risk of direct or indirect mortality related to traffic and site preparation are reversible after the life of the Project.
- The ecological context for the PDA and LAA is disturbed: most of the RAA is relatively undisturbed.

Operation

Waste and emissions, water management and Project-related transportation will be the primary activities with effects on resource availability during operation. Mitigation will reduce effects though not sufficiently remove all risk of change to resource availability due to loss of habitat or mortality related to human activity, thus an adverse effect will occur.

Wildlife will avoid the PDA and LAA due to continuous disturbance caused by emissions such as noise, light, and traffic throughout the duration of operation. Species vary in their avoidance of these indirect disturbances, but avoidance by ungulates is known to extend up to 1 km from the PDA (Chapter 12, Section 12.4.2). Project wastes and emissions, such as noise, light, and vibration, are expected to have effects on wildlife and wildlife habitat extending into the LAA from the PDA; however, these are difficult to quantify.

These direct and indirect effects will therefore affect existing hunting and trapping activities occurring within 1 km of the Gordon Access road and along PR 391, possibly changing the distribution of these activities.

Fish distribution and health may be affected by changes in habitat quality due to wastes, emissions, and water management activities (Chapter 10).

Water quality will be affected adversely due to changes in concentrations of parameters of potential concern (POPC) to fish and aquatic biota including fluoride and phosphorus downstream of the Gordon site (e.g., East Farley Lake, West Farley Lake, Gordon Lake, and Swede Lake). These effects will be negligible, limited to the fish and fish habitat LAA, and are not expected to affect fish biota health, growth, or survival (Chapters 9 and 10).

Vegetation health will be affected adversely due to changes in air quality from the emission of dust, soil and soil compaction caused by Project-related transportation such as ore hauling and heavy equipment (Chapter 11, Section 11.4). Dust deposition may affect plant productivity (See Section 11.4.3.3). There may be perceived loss of plant species and plant harvesting sites due to dust deposition; plants and berries covered in dust may be avoided by Indigenous communities due to the potential for human health risks from inhalation of dust while picking vegetation or from ingestion of dust on vegetation (Chapter 18, Section 18.4.2.3).

The maximum predicted 30-day and annual dustfall will occur on the east Project Boundary near the open pit (Volume 5, Appendix A, Map 24). There will be an increase in dustfall compared to baseline conditions therefore the effects will be adverse, long-term, extend to the LAA and vary with season and time of day. These effects may have indirect effects on known plant gathering areas.

Transportation of ore to an on-site stockpile or to the processing plant will occur continuously throughout the life of the Gordon site (six years; estimated at seven ore trucks per hour; Chapter 2, Section 2.3). Ford and Fahrig (2007) report that among mammals, herbivores, such as moose, are more at risk from traffic mortality than carnivores, with a peak risk for mammals of approximately 1 kg in weight (e.g., rabbit). Seiler (2003) reports that birds and amphibians are more at risk than mammals; however, the proportion of reported mortalities from each group varies widely (Huijser et. al 2009). A literature review (Seiler 2003) examining the risk of traffic mortality versus posted speed limit found that roads where the posted speed limit is 90 km/h (such as PR 391) have higher collision rates, for moose in particular, than roads whose speed limits are slower or faster. There will be mitigation by signage (speed limit, wildlife crossings) and adherence to the Wildlife Monitoring and Management Plan (Chapter 23, Section 23.5.14), but a residual increased mortality risk will remain for the duration of operation.

The existing wildlife collision rate (2008 to 2012) along the 40 km of road within the RAA is 0.23 per million vehicle kilometers travelled (MVKT) or 0.5 reported wildlife fatalities per year (Chapter 12, Section 12.4.3). This is comparable with the 0.22 MVKT for the stretch of highway from Nelson House to Hughes River. The threshold at which concern is warranted is 1.0 per MVKT (MI 2017).

These collision rates reflect what has been reported to Manitoba Public Insurance. As a result, these wildlife collision statistics are assumed to involve large mammals, large enough to cause reportable vehicle damage; within the RAA this number likely represents vehicle collisions with moose and black bear (Chapter 12, Section 12.4.3).

Current traffic levels in the LAA are estimated conservatively at 150 vehicles per day travelling at speed limits of up to 90 km per hour. The Project description predicts that traffic levels will increase to 462 per day (assuming 7 ore trucks per hour over 20 hours return trip) plus passenger vehicle and material transport traffic. Using the average of 0.23 wildlife collisions per MVKT this represents 1.5 wildlife reportable wildlife collisions per year. This risk maybe reduced with the adoption of Wildlife Monitoring and Management Plan and reduced speed limits in some sensitive areas (Chapter 12, Section 12.4.3.4). This increase in mortality risk due to traffic, however, is limited in area and numbers of individuals, and not expected to have population levels effects, thus the magnitude is considered low. If wildlife populations in the RAA are not affected by Project-related transportation, the magnitude of risk to the availability of hunting and trapping resources due to traffic-related mortality risk in the RAA would also be low.

Wildlife interactions with utilities and infrastructure throughout Project operation will be mitigated through the Wildlife Monitoring and Management Plan (Chapter 12, Section 12.4.3). Residual increases in direct mortality risk are expected due to trapping of nuisance animals in sheds/garages/camps, or trapping/extermination of problem beavers at water control structures. A small increase in mortality risk for birds due to on-site transmission line, tower and guy wire strikes is also expected. While these interactions will occur throughout operation, the magnitude of the effect is expected to be low, with mortalities not affecting wildlife populations in the RAA (Chapter 12, Section 12.4.3).

Overall, the residual effects on change in resource availability during operation of the Project are characterized as follows:

- Direction is adverse: there will be avoidance by wildlife due to sensory disturbance and loss of wildlife due to vehicular collisions and human interactions and indirect effects to plants in the LAA due to dust during operation.
- Magnitude is low: with mitigation measures, the change resource availability is anticipated to be low, as the project is not expected to cause population levels effects, despite some avoidance and mortalities.
- Geographic extent is the LAA: changes in resource availability from site operation will extend to the LAA due to the indirect effects of wastes and emissions.
- Frequency is continuous: change in resource availability will occur throughout operation.
- Duration is medium-term: change in resource availability will be elevated during the operation period.
- Change is reversible: change in resource availability due to direct or indirect effects during operation are reversible after the life of the Project.
- The ecological context for the PDA and LAA is disturbed: most of the RAA is relatively undisturbed.

Decommissioning/Closure

Decommissioning/closure activities are expected to reverse the residual effects to resource availability that commenced during construction and therefore are generally positive. Some avoidance behaviours and traffic-related mortalities will still occur during decommissioning and reclamation but will cease in post-closure. The positive effects of decommissioning and reclamation will continue beyond closure. Residual effects are characterized as follows:

- Direction is positive: there will be a rebound in resource availability with closure as the sites revert to their natural state and traditionally harvested resources return to the PDA.
- Magnitude is low: after mitigation, the project is not expected to cause effects on population levels of most hunted or trapped species in the RAA.
- Geographic extent is the RAA: population level effects on moose will endure following closure and will extend to the RAA due to generalized increase in accessibility.
- Frequency is continuous: change in resource availability will endure throughout project closure.
- Duration is long-term: change in resource availability will extend beyond closure.
- Change is reversible: change in resource availability related to habitat loss, harvest and predator pressure post-closure are reversible except for Project features such as the open pit that extend beyond closure.
- The ecological context for the PDA and LAA is disturbed: most of the RAA is relatively undisturbed.

MacLellan Site

Surface water quality (Chapter 9, Section 9.4.3) will be negligibly affected adversely due to potential changes in concentrations of parameters of potential concern (POPC) to fish and aquatic biota including aluminum, arsenic, cadmium, copper, and fluoride within the LAA. Based on the analysis in Chapter 10, adverse effects on fish health, growth, or survival from changes in water quality downstream of the MacLellan site are not expected.

While the MacLellan site has a higher amount of infrastructure and will have more staff on site than the Gordon site, the Project pathways for change in resource availability and the mitigation suggested are similar for both sites. The increase in infrastructure and personnel will not increase the magnitude of effects, and therefore the assessment of the residual effects for the Project is the same for both sites.

17.4.3 Change in Access to Resources Currently used for Traditional Purposes

Travel routes are transportation corridors that people use to provide access to resources and facilitate harvesting activities. Access to resources may be achieved by boat, ATV/UTV, truck, foot, or other means. Preferred travel routes are generally the most efficient and safest routes used and are used annually. Travel routes have been identified throughout the LAA, and RAA. Identified routes include a travel route that passes through the MacLellan site and several travel routes that use and cross the Gordon site access road (Appendix 17A).

Change in access was assessed by quantifying direct and indirect changes in the number and length of travel routes available for resource users to access the land for each Project component (i.e., construction, operation, and decommissioning/closure) in comparison with baseline conditions.

Direct change in access (i.e., blockage or obliteration of travel routes) is calculated as the loss of access points or travel routes that are no longer available to provide access to resources resulting from the Project PDA; effects do not extend into the LAA. In general, once vegetation clearing or wetland drainage is completed during the construction component, the PDA will provide no suitable travel corridors and will block some existing travel routes.

Indirect change in access (i.e., travel route alteration) is calculated as the area or number of travel routes with reduced function or efficiency due to indirect effects such as changing water levels or soil stability, or the prohibition of hunting near developed areas (i.e., the access is still available but is compromised in some capacity) adjacent to the Project; effects extend into the LAA.

17.4.3.1 Project Pathways

Gordon Site

Construction

Project construction at the Gordon site may restrict access for traditional practices. Clearing and construction activities, including the refurbishment of access to sites, have the potential to affect access to traditional use areas in the LAA. Alamos will post warning signs on the access roads to discourage unauthorized access. Consideration will also be given to placing large boulders and/or gated fencing to prevent access.

Operation

Operation of the Project is expected to cause changes to access via operation of utilities, infrastructure, and other facilities. In particular, security measures, gates and fencing will create a change in access to resources by blocking trails and travelways, and hunting will be prohibited within a given distance of the PDA.

Decommissioning/Closure

Decommissioning/closure of the Gordon site will ultimately result in increased access. Linear features and areas of soil compaction created during construction and operation will cease to have mine-related traffic after closure and will then become attractive and accessible to resource users. This change in access is quantifiable by calculating the number and length of trails and travelways that will be created or returned to use.

MacLellan Site

Project pathways for change in resource availability at the MacLellan site are similar to those present at the Gordon site. The MacLellan site may have more substantial security at site facilities and infrastructure during all Project phases due to activities at the mill, the existence of the tailings management facility, and development of a work camp. These security needs will likely result in more fencing and gates than required at the Gordon site, though access will be restricted at both sites.

17.4.3.2 Mitigation

Site access at both the Gordon and MacLellan sites by traditional harvesters will be controlled post-closure as per the Conceptual Closure Plan (Chapter 23, Section 23.5.18). Alamos' ongoing engagement may result in developing alternative access to resource harvesting areas. Existing access roads and trails will be used to the extent possible; access routes will be refurbished in compliance with provisions of *The Crown Lands Act* and *The Mines and Minerals Act*.

17.4.3.3 Project Residual Effects

Gordon and MacLellan Sites

Construction and Operation

Clearing of natural vegetation or earthworks, including digging of channels or infilling of ponds, cannot be avoided during Project construction. These activities will remove one travelway from use within the MacLellan site PDA and through increased traffic, affect but not remove several travelways that cross the Gordon Lake access road. Project development will therefore have an adverse residual effect on access to resources. The project pathways for change in access and the mitigation suggested are similar for both sites. The increase in infrastructure and personnel at MacLellan site will not increase the magnitude of effects, and therefore the assessment of the residual effects for the Project are the same for both sites.

Signage and/or fencing will be installed around Project facilities to protect public safety, and the local community will be informed of the location and timing of construction activities. Indirect effects associated with the restriction of access along the Gordon site access road could occur within the LAA to traditional harvesters who have used the access road to get to lakes outside of the LAA (e.g., Ellystan Lake, Nickel Lake, White Owl Lake, and Barrington Lake).

Patterns of access to travel routes harvesting areas in the LAA may be altered by access restrictions to the PDA as indicated by Marcel Colomb First Nation. Overall, the residual effects on change in access during the construction and operation of the Project are characterized as follows:

- Direction is adverse: there will be a portion of a trail taken out of commission during site preparation at the MacLellan site and will remain inaccessible during operation. Restricted access to the Gordon site road may require alternate routes to harvesting areas beyond the LAA.
- Magnitude is low: with planning and design, the change in access is anticipated to be low, as the project is only expected to affect one trail in the PDA.
- Geographic extent is the LAA: while the direct effect of the blocked trail will occur in the PDA, the rerouting that will be required is an indirect effect and will extend to the LAA.
- Frequency is continuous: the trails will remain blocked throughout the construction phase.
- Duration is medium-term: change in direct and indirect changes to access will commence during the construction period and persist through operation.
- Change is reversible: change in access during construction and operation are reversible after the life of the Project.
- The ecological context for the PDA and LAA is disturbed: most of the RAA is relatively undisturbed.

Decommissioning/Closure

Decommissioning/closure is expected to create changes to access. The Conceptual Closure Plan (Appendix 23B) outlines access to the LAA post-closure. Barricades will prevent vehicular traffic, but off-road vehicles and snowmobiles will still be able to gain access to the trail system. Residual effects are characterized as follows:

- Direction is positive: there will be an increase or restoration of access post-closure.
- Magnitude is low: with the closure plan, historical access will be restored but not increased.
- Geographic extent is the LAA: restored access to resources will extend to the LAA due to generalized increase in accessibility into forest otherwise impenetrable by vehicular traffic.
- Frequency is continuous: change in access will endure throughout Project closure.
- Duration is long-term: change in access will be extend until the Project returns to its natural state.
- Change is reversible: change access will return to its post-development state upon closure and is then reversible once the Project returns to its natural state.
- The ecological context for the PDA and LAA is disturbed: most of the RAA is relatively undisturbed.

17.4.4 Change to Traditional Cultural and Spiritual Sites and Areas

Changes in traditional cultural and spiritual sites and areas can be affected in two ways, either by a change in the landscape in which the site or area is affected directly through the physical removal of the resource itself through land clearing and infrastructure development, or indirectly through noise, light and other emissions.

Change to sites and areas can be measured by quantifying the number of sites to be physically removed during each Project phase (i.e., construction, operation, and decommissioning/closure) in comparison with baseline conditions.

Indirect change in sites and areas (i.e., alteration) can be measured through the amount of emissions received by the site by way of noise, light, or dust emissions due to Project activities. The extent of the zone of influence of activities causing indirect effects varies depending on the Project component, pathway, and measurable parameter.

17.4.4.1 Project Pathways

Gordon Site

Construction

There are no known cultural or spiritual sites and areas in the Gordon site PDA. Vegetation clearing and dewatering are the primary pathways for a direct change to any undiscovered or not currently reported cultural and spiritual sites and areas during site preparation and water development and control activities, respectively. Site preparation activities will require the removal of vegetation throughout the PDA. Water development and control activities will include the dewatering of the existing pits and re-alignment of the existing build diversion channel which may remove further sites and areas.

Vegetation clearing and sensory disturbances (wastes and emissions) are the primary pathways for an indirect change to cultural and spiritual sites and areas during the site preparation and wastes and emissions, respectively. The vegetation clearing described above may remove visual buffers between infrastructure and sites and areas.

Project-related light, dust, and noise from most construction activities (e.g., heavy equipment operation, infrastructure construction, increased traffic volumes) have the potential to disturb and change the use of cultural and spiritual sites and areas.

Operation

Utilities, site infrastructure, and facilities in place during Project operation, such as fencing or security measures may render a site or area inaccessible, which would be a measurable change to that site or area.

Fluctuating water levels due to water management activities during operation are another pathway for a direct change in sites or areas to occur if access to the sites are blocked due to water flows or the site receives direct flow overland.

Noise is expected to be the primary pathway for indirect change to sites and areas through wastes and emissions. Project-related noise, dust, and light sources (e.g., heavy equipment operation, blasting, and increased traffic levels) will result in measurable changes to sites and areas.

Decommissioning/Closure

The pathways for change in sites and areas vary over time as mine operation transitions towards reclamation and post-closure activities. Water infilling and vegetation succession of the PDA provides an increased visual buffer and a reduction in wastes and emissions. The level of sensory disturbance due to wastes and emissions activities will be reduced in comparison to operational components. Sensory disturbance due to dust, light and noise during reclamation are expected to be greatly reduced and returned to baseline conditions post-closure.

MacLellan Site

Project pathways for change in cultural and spiritual sites and areas at MacLellan site are similar to those present at the Gordon site. The MacLellan site has a higher risk for indirect effects due to wastes and emissions during operation due to the presence of the mill infrastructure and tailings management facility.

17.4.4.2 Mitigation

The implementation of the mitigation measures will be the responsibility of Alamos and/or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards, and upon engagement with potentially affected Indigenous peoples. Alamos commits to ongoing engagement with potentially affected Indigenous peoples to discuss the efficacy of mitigation measures.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Gordon Site

Though no known cultural and spiritual sites or areas are in the PDA, Alamos' ongoing engagement program will facilitate development of mitigation measures if these are reported or discovered during construction and operation phases. Additional mitigation includes:

- Design for limitation of Project footprint (i.e., PDA) to the extent possible.
- Design for use of down-lighting, a technique of directing night lighting downward, to reduce light effects adjacent to the PDA.
- Buffers around wetlands, waterbodies, and watercourses as described in the vegetation and wetlands VC (Chapter 11, Section 11.4.3.2), which will be maintained to reduce effects to cultural and spiritual sites or areas.
- Design for restriction of unauthorized access adjacent to the PDA.
- Maintenance of vegetation cover along the boundaries of high activity areas (e.g., access roads) to reduce sensory (noise and visual) disturbance.
- Development of a Heritage and Cultural Resource Protection Plan (HCRPP; Chapter 23, Section 23.5.11), which will be implemented when previously unidentified heritage or cultural resources, or objects thought to be heritage or cultural objects, are exposed (Chapter 16).

MacLellan Site

Mitigation measures at the MacLellan site are the same as indicated for the Gordon site plus the following:

- Controlled surface collection or salvage excavation as addressed in Chapter 16, Section 16.4.2 will be implemented for any discovered heritage resource sites, or a portion thereof, that cannot be avoided.

17.4.4.3 Project Residual Effects

Gordon Site

Site preparation activities will require the disturbance of upland and wetland landscape for the PDA (Chapter 11, Section 11.4.2.3). Due to the design of the PDA to have a reduced footprint, no traditional or cultural sites or areas are known to exist within the PDA. Marcel Colomb First Nation Sacred Area 1 (Appendix 17A, Figure 4b) and Habitation 8 and 24 are located adjacent to PR 391 but should have no direct physical effects as the road is already in existence, and only traffic volumes will change with the Project. These sites may experience indirect effects from wastes and emissions due to their proximity to PR 391 and the increase in traffic.

Habitation 26 near Pump Lake, and Habitations 10 and 14 near Swede Lake (Appendix 17A, Figure 4b) may also experience sensory disturbances due to light, dust, and noise. These sites may also experience effects due to the removal of visual buffers during site clearing and exclusion or restricted access due to security, fencing or water management activities. The use of best management practices is expected to reduce the risk of changes in direct and indirect changes in sites and areas.

Overall, the residual effects on change in resource availability during the construction, operation and decommissioning/closure phases of the Project are characterized as follows:

- Direction is adverse: there will be an increase in noise, dust, and light during all phases of the Project that may affect experience of using traditional, cultural, and spiritual sites within the LAA.
- Magnitude is low: with mitigation, the change in sites and areas is anticipated to be low, as a small number of sites are affected indirectly.
- Geographic extent is the LAA: while physical removal of sites and areas would be confined to the PDA, sensory effects will extend to the LAA.
- Frequency is continuous: sensory disturbance and potential changes to site accessibility will occur throughout the all phases of the Project.
- Duration is medium-term: changes to sites and areas will persist throughout the life of the Project.
- Change is reversible: change to sites and areas related to visual buffers, wastes and emissions, utilities and site preparation are reversible after the life of the Project.
- The ecological context for the PDA and LAA is disturbed: most of the RAA is relatively undisturbed.

MacLellan Site

While the MacLellan site has a higher amount of infrastructure and will have more staff on site than the Gordon site, there are no known traditional cultural or spiritual sites or areas located adjacent to or within the PDA at the MacLellan site. The increase in infrastructure and personnel will increase the zone of influence; however, there are no receptors for these effects.

17.4.5 Change to the Environment that Affects Cultural Value or Importance Associated with Current Use

Cultural values are intangible, therefore not readily quantifiable, and relate to beliefs, perceptions, and qualitative experience. Given the subjective and conditional nature of cultural values, these potential effects are considered only when an Indigenous community has identified a related concern. Potential effects on cultural values can include changes to cultural transmission, language retention, governance systems, patterns of cultural behaviour, and the sensorial experience of traditional practices. Effects on these can be meaningfully evaluated only by individuals and communities in their cultural context; however, such effects are difficult to mitigate or quantitatively assess by an external party. These effects are not amenable to conventional residual effects characterizations developed for the assessment of objective, measurable phenomena. For example, attempting to assign a rating for magnitude, duration, or extent for effects on an experiential value such as ‘quiet enjoyment of the land’ would not be meaningful or defensible. In addition, intangible effects may not be fully mitigated in the context of an environmental assessment. While potential Project effects may be mitigated to acceptable regulatory standards, individuals may nevertheless continue to feel that unsafe conditions remain. Therefore, potential effects on cultural values have not been subject to an effects assessment using the same methodology as for the other effects discussed previously. Rather, when an Indigenous community has identified a related concern, the subjective and experiential components of Current Use that cannot be measured are here considered narratively.

Marcel Colomb First Nation described how cultural practices and teachings were traditionally transmitted between generations on the land and especially on the trapline, when families may typically go out in the autumn, return to the community at Christmas, and then go back to the trapline until Easter. Because space was limited for freighting supplies, families relied on a few essential staples while obtaining all other necessities from the land. These necessities included food and water, materials for building cabins and tents, fuel, materials for making and adorning clothing, and materials for constructing sleighs, canoes, toboggans, and snowshoes. Sharing food and supplies among families was a central cultural value on the trapline that continues today in the form of sharing country food with Elders and other family and community member.

The concept of a “sacred site”, as a specific location, does not align with the Cree worldview as explained by Mathias Colomb Cree Nation to Alamos through engagement. The land and waters are sacred, not specific portions of them.

Manitoba Metis Federation described the deep relationship that Métis citizens have with the lands, waters, and other aspects of the environment. Manitoba Metis Federation identify ecologically and culturally important areas through their relationship with and use of the land throughout the year for harvesting, recreation, ceremony, travel, and other purposes. Sharing the harvest (hunting, fishing and plant gathering) is a common cultural practice by the Manitoba Métis citizens and is one of the ways in which the exercise of harvesting rights is interwoven with cultural and social practices to maintain connections between community members and families. Trapping as a traditional activity illustrates the connection to the land and its cultural value to Métis citizens: Manitoba Metis Federation also discussed the importance of trapping in their connection to the land as well as their families as they pass these practices on to their children. Trapping and snaring therefore is part of Métis traditions and culture and many of these traplines would have been handed down from generation to generation in Métis families. The continued use of trails by Métis citizens today provides an important link to their past and the traditions of their Métis ancestors. “They literally are following in their footsteps” (SVS 2020).

Nisichawayasihk Cree Nation’s constitution states: “Kehchi Manitou, through Kehchi Othasowewin (the Great Law), granted us, as the guardians of N’tuskenan (our sacred land), the responsibility to care for, and the right to use and benefit from its resources. Aski Kanache Pumenikewin (responsibility for the land) - the conduct of a person must be in accordance with the sacred duty to protect N’tuskenan, the land, life, home and spiritual shelter entrusted to Nisichawayasi Nehethowuk by Kihche’manitou for our children michimahch’ohchi, since before the beginning of time” [Nisichawayasihk Cree Nation Othasowewin (Constitution) October 2017].

Marcel Colomb First Nation related how the experience of the land has changed in the area since mine, road, and railroad development has created year-round access to traditional areas. This brought employment in mining and mineral exploration, outfitting and guiding for sport hunting and fishing, surveying, mechanics, and commercial fishing to supplement trapping. Marcel Colomb First Nation Elders observed that overfishing has caused declines in fish populations, including whitefish and sturgeon in some lakes, and decreases in mammal populations, including moose, beaver, wolves, and other fur bearers in the RAA. Caribou have not been observed since the 1950s. Some attribute these population changes to increased pressure from non-Indigenous hunters.

An Elder from Marcel Colomb First Nation now takes children from Grades 1 to 8 (10 to 20 children at a time) to the trap line during the winter and another occasionally takes the children to camp, hunt, and catch sturgeon at Dunsheath Lake in the RAA (Appendix 17A Figure 2b: Fishing 3). One such location of cultural transmission is Mile 7 camp, the access to which is within the LAA, though no access limitations are anticipated (Appendix 17A, Figure 2b: Trapping 9).

Changes to the environment resulting from the Project that have the potential to affect cultural values associated with Current Use include those that may interfere with cultural transmission through the experience of traditional practices. Any such practices that occur in the LAA may be indirectly affected by sensory disturbances including noise, light, and dust. Change in access to Current Use areas may also contribute to effects on transmission of cultural values through increase in travel time and distance or increased inconvenience of access. Ongoing engagement with potentially affected communities may help mitigate effects to cultural values, through sharing results from monitoring and facilitating tours to verify efforts to manage effects.

17.4.6 Summary of Project Residual Environmental Effects on Current Use of Lands and Resources for Traditional Purposes

A summary of residual environmental effects on Current Use as a result of the Project are summarized in Table 17-6.

Table 17-6 Project Residual Effects on Current Use of Lands and Resources for Traditional Purposes

Residual Effect	Project Phase	Residual Effects Characterization							
		Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context
Gordon and MacLellan Sites									
Change in availability of resources currently used for traditional purposes	C, O, D	A	L	LAA	LT	A	C	R	D
Change in access to resources currently used for traditional purposes	C, O, D	A	L	LAA	LT	A	C	R	D
Change to Traditional Cultural and Spiritual Sites and Areas	C, O, D	A	L	LAA	MT	N/A	C	R	D

KEY
See Table 17-2 for detailed definitions

Project Phase
C: Construction
O: Operation
D: Decommissioning

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term;
MT: Medium-term
LT: Long-term

N/A: Not applicable

Timing:
N/A: Not Applicable
A: Applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

Project residual effects after mitigation on Current Use will be adverse through construction, operation, and decommissioning/closure. Because the PDA is within the disturbed context of existing mine sites and the LAA includes an existing road, magnitude is anticipated to be low with indirect effects, especially sensory disturbance, extending into the LAA. The effects will be long term, extending beyond the Project life until the PDA returns to its pre-Project state, except for the open pits and mine rock, which will be permanent features (Appendix 23B). While the timing of construction, operation, and decommissioning/closure may affect Current Use dependent on seasonal resources and access, effects on land-based cultural sites and areas are irrespective of season. Effects on Current Use will be reversible with decommissioning/closure, except for the open pits and mine rock, which will be permanent features.

17.5 ASSESSMENT OF CUMULATIVE ENVIRONMENTAL EFFECTS ON CURRENT USE OF LANDS AND RESOURCES FOR TRADITIONAL PURPOSES

The Project residual effects described in Section 17.4 are likely to interact cumulatively with residual environmental effects from other physical activities (past, present, and reasonably foreseeable).

The effects of past and current projects relative to conditions prior to historical mining activities contribute to baseline conditions upon which Project effects are assessed. Conditions prior to historical mining activities are generally considered to be similar to currently undisturbed areas of the RAA.

The resulting cumulative environmental effects (future scenario with the Project) are assessed. Cumulative environmental effects (the future scenario without the Project) are also described. This is followed by an analysis of the Project contribution to cumulative effects. Future projects and activities that are reasonably foreseeable are defined as those that (a) have been publicly announced with a defined Project execution period and with sufficient project details that allow for a meaningful assessment, (b) are currently undergoing an environmental assessment or (c) are in a permitting process.

The assessment of cumulative effects is initiated with the determination that two conditions exist:

- The Project has residual environmental effects on Current Use, and
- The residual effects could act cumulatively with residual effects of other past, present, or reasonably foreseeable future physical activities with the RAA.

17.5.1 Project Residual Effects Likely to Interact Cumulatively with Current Use of Lands and Resources for Traditional Purposes

Table 4D-1 in Chapter 4, Environmental Assessment Methods, presents the Project and physical activities inclusion list, which identifies other projects and physical activities that might act cumulatively with the Project. Where residual environmental effects from the Project act cumulatively with residual effects from other projects and physical activities (Table 17-7), a cumulative effects assessment is undertaken to determine their significance.

Table 17-7 Interactions with the Potential to Contribute to Cumulative Effects on Current Use of lands and Resources for Indigenous Purposes

Other Projects and Physical Activities within the RAA with Potential for Cumulative Environmental Effects	Environmental Effects		
	Change in availability of resources currently used for traditional purposes	Change in access to resources currently used for traditional purposes	Change to traditional cultural and spiritual sites and areas
Past and Present Physical Activities and Resource Use			
Mineral Development			
• "A" Mine	✓	✓	–
• EL Mine	✓	✓	–
• Fox Mine	–	–	–
• Farley Mine	✓	✓	–
• Ruttan Mine	–	–	–
• MacLellan Mine (Historical)	✓	✓	
• Burnt Timber Mine	✓	✓	–
• Farley Lake Mine	✓	✓	–
• Keystone Gold Mine	✓	✓	–
• East/West Tailings Management Areas	✓	✓	
Mineral Exploration	✓	✓	–
Water and Waste Projects (sewage plants, waste disposal grounds)	✓	–	–
Residential and Community Development (including cottage subdivisions)	✓	✓	✓
Infrastructure Development (transmission line, airport, highways, roads, rail)	✓	✓	✓
Other non-Indigenous Resource Activities (hunting, fishing, berry picking)	✓	–	–
Future Physical Activities			
Mineral Development	✓	✓	✓
Mineral Exploration	✓	✓	✓
Traditional Land Use	–	–	–
Non-Indigenous Resource Use Activities	✓	✓	✓
Recreation	✓	–	✓

NOTES:
✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with Project residual environmental effects.
– = Interactions between the residual effects of other projects and residual effects of the Project are not expected.
For a detailed description and mapped locations of Projects and Physical Activities, where applicable, see Chapter 4, Table 4D-1 and Maps 4-1 and 4-2.

Environmental effects identified in Table 17-6 as not likely to interact cumulatively with residual effects of other projects and physical activities (no check mark) are not discussed further. Past and present project/activities contribute to the existing conditions in which the Project will occur and are considered in the assessment of residual Project effects. The assessment of the cumulative environmental effects that are likely to result from the Project in combination with future projects and physical activities are discussed in subsequent sections.

17.5.2 Change in Availability of Resources Currently Used for Traditional Purposes

17.5.2.1 Cumulative Effect Pathways

The effects of future projects and activities may interact cumulatively with the residual effects of the Project by affecting resource use activities (e.g., hunting and trapping) through vegetation clearing, sensory disturbance, changes to water and air quality, and visual aesthetics. Activities that can affect resource availability include developments that involve land clearing, construction of infrastructure, waste management, and the use of heavy equipment.

17.5.2.2 Mitigation for Cumulative Effects

Implementation of the mitigation measures described in Section 17.4.2.2 will reduce effects on resource availability. As well, mitigation designed to reduce effects on fish and wildlife (including habitat) will also benefit Current Use (Chapters 10 and 12). These mitigation measures are also applicable to the effects of identified future physical activities.

17.5.2.3 Residual Cumulative Effects

The Project will affect availability of resources by an increase in the risk of wildlife mortality by vehicular collisions, human interactions, habitat loss for wildlife by vegetation clearing (<1% of the RAA) and sensory disturbance, loss of fish habitat (Minton Lake) and plants by vegetation clearing during construction. These will act cumulatively with the effects of future projects and activities that reduce availability of resources currently used for traditional purposes in the RAA, thereby further limiting choices of undisturbed resource harvesting areas.

The cumulative effects for change in availability of resources currently used for traditional purposes is considered of low magnitude, long-term in duration, continuous in frequency, and reversible.

17.5.3 Change in Access to Resources Currently Used for Traditional Purposes

17.5.3.1 Cumulative Effect Pathways

Future projects and activities may interact cumulatively with the Project by limiting access to traditional harvesting and cultural and spiritual sites and areas.

17.5.3.2 Mitigation for Cumulative Effects

Implementation of the mitigation measures described in Section 17.4.3.2 will reduce cumulative effects on access to traditionally harvested resources and cultural and spiritual sites and areas. These mitigation measures are also applicable to the effects of identified future physical activities.

17.5.3.3 Cumulative Effects

While no known future projects or activities overlap with the Project LAA for Current Use, the Project will affect access to traditionally harvested resources or cultural and spiritual sites and areas by removal of a portion of a trail at the MacLellan site that will remain inaccessible during operation as well as restricted access to the Gordon site road that may require alternate routes to harvesting areas beyond the LAA. These will act cumulatively with the effects of future projects and activities in the RAA that further limit access to traditionally harvested resources or cultural and spiritual sites and areas, thereby further limiting choices of access routes or increasing distance and effort of access.

The cumulative effects for change in availability of resources currently used for traditional purposes is considered of low magnitude, long-term in duration, continuous in frequency, and reversible.

17.5.4 Change to Traditional Cultural and Spiritual Sites and Areas

17.5.4.1 Cumulative Effect Pathways

The Project may act cumulatively with other activities to affect traditional cultural and spiritual sites and areas if future projects or physical activities interact cumulatively with the Project to remove or alter the experience of using these sites and areas.

17.5.4.2 Mitigation for Cumulative Effects

Implementation of the mitigation measures described in Section 17.4.4.2 will reduce effects on access to traditionally harvested resources and cultural and spiritual sites and areas. These mitigation measures are also applicable to the effects of identified future physical activities.

17.5.4.3 Cumulative Effects

Although the Project does not interact with known traditional, cultural, or spiritual sites or areas, there will be an increase in noise, dust and light during all phases of the Project that may affect experience of using currently unidentified traditional, cultural and spiritual sites within the RAA. These will act cumulatively with the effects of future projects and activities in the RAA that may alter the experience of using currently unknown traditional, cultural, or spiritual sites or areas, thereby further limiting choices of locations to conduct traditional practices.

The cumulative effects for change in availability of resources currently used for traditional purposes is considered of low magnitude, long-term in duration, continuous in frequency, and reversible.

17.5.5 Change to the Environment that Affects Cultural Value or Importance Associated with Current Use

Changes to the environment resulting from the Project that have the potential to affect cultural values associated with Current Use are primarily those that may interfere with cultural transmission through the experience of traditional practices. Any such practices that occur in the LAA may be indirectly affected by sensory disturbances including noise, light, and dust. Change in access to Current Use areas may also contribute to effects on transmission of cultural values through increase in travel time and distance or increased inconvenience of access. Marcel Colomb First Nation explained how the experience of the land has changed in the area since mine, road, and railroad development has created year-round access to traditional areas as described in Section 17.4.5. Project activities may be perceived by Indigenous communities to be acting cumulatively with these past activities and with future activities. Ongoing engagement with potentially affected communities may help mitigate effects to cultural values.

17.5.6 Cumulative Effects Without the Project

The future scenario without the Project is similar to baseline conditions. It is the cumulative effect less the Project contribution to reduced availability of and access to resources and lands currently used for traditional purposes. It is assumed that future physical activities that involve vegetation clearing, soil disturbance, habitat loss, changes to air or water quality, or changes to or increased competition for traditionally harvested wildlife and plant species and or changes in access to harvesting areas or culturally important spaces will adversely affect Current Use by Indigenous peoples.

17.5.7 Summary of Cumulative Effects

Table 17-8 summarizes cumulative environmental effects on Current Use of Lands and Resources for Traditional Purposes. The Project is anticipated to contribute adversely to effects on the availability of and access to traditionally used resources and to cultural and spiritual sites and areas; however, the magnitude is anticipated to be low due to the small number and widespread nature of past, present and future projects and activities and the history of disturbance in RAA. These effects extend to the RAA and will be long-term, extending beyond the life of the Project. The effects will be continuous for the Project life.

Table 17-8 Residual Cumulative Effects

Residual Cumulative Effect	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context
Residual Cumulative Change in Availability of Resources Currently Used for Traditional Purposes								
Without the Project	A	L	RAA	LT	N/A	IR	R	D
With the Project	A	L	RAA	LT	N/A	C	R	D
Contribution from the Project to the residual cumulative effect	The Project will contribute to the loss or degradation of plant and wildlife habitat due to vegetation clearance, changes in air quality and water quality from all projects in the RAA. A cumulative effect of activities past, present and future, may result in changes in distribution of some wildlife species.							
Residual Cumulative Change in Access to Resources Currently used for Traditional Purposes								
Without the Project	A	L	RAA	LT	N/A	IR	R	D
With the Project	A	L	RAA	LT	N/A	C	R	D
Contribution from the Project to the residual cumulative effect	The Project will contribute to changes in access to land and water travel routes, the addition of gated access roads and fences and firearms restrictions, adding to access restrictions already present from projects elsewhere in the RAA.							
Residual Cumulative Change to Traditional Cultural and Spiritual Sites and Area								
Without the Project	A	L	RAA	LT	N/A	IR	R	D
With the Project	A	L	RAA	MT	N/A	C	R	D
Contribution from the Project to the residual cumulative effect	Cumulative effects on cultural and spiritual sites and areas from the Project are primarily aesthetic and my act cumulatively with past, current, and future projects on the aesthetics of the cultural landscape.							

KEY

See Table 17-2 for detailed definitions

Direction:
P: Positive
A: Adverse

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term;
MT: Medium-term
LT: Long-term

N/A: Not applicable

Timing:
N/A: Not Applicable
A: Applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

17.6 EFFECTS TO FEDERAL LANDS

Federal lands within the LAA and RAA for Current Use consist of Black Sturgeon Reserve, of which 42.94 ha of the southwest-most portion of the reserve falls within the LAA.

The portion of the reserve is within 1 km of PR391 where project-related traffic may contribute to sensory disturbance to harvested wildlife species, to traditional practices, and to dust on harvested plants.These effects are anticipated to be similar to those described in Sections 17.4 and 17.5.

17.7 DETERMINATION OF SIGNIFICANCE

17.7.1 Significance of Project Residual Effects

The Project may result in a reduced access to land and availability of resources for the pursuit of traditional activities such as plant harvesting, fishing, hunting, trapping, and access to cultural or spiritual sites. The PDA is in previously disturbed areas from historical mining and the LAA is dominated by an existing highway. Current Use sites are outside of the PDA. While access through the PDA will be restricted for the lifetime of the Project, it will be largely restored after mine closure.

With mitigation, the residual environmental effects from the Project on the Current Use of Land and Resources are not significant because they do not result in the long-term loss of availability of traditional use resources or access to lands relied on for traditional use practices or the permanent loss of traditional use sites and areas in the LAA and RAA. The ability of Indigenous communities to continue traditional practices outside of the PDA will be maintained.

This determination considered the environmental effects assessments for the atmospheric environment VC (Chapter 6), noise and vibration VC (Chapter 7), groundwater VC (Chapter 8), surface water VC (Chapter 9), fish and fish habitat VC (Chapter 10), vegetation and wetlands VC (Chapter 11), wildlife and wildlife habitat VC (Chapter 12), heritage resources VC (Chapter 16), and land and resource use VC (Chapter 15), and available TLRU and TK information.

17.7.2 Significance of Cumulative Effects

With mitigation and environmental protection measures, the residual cumulative environmental effects on Current Use of Lands and Resources for Traditional Purposes are not significant as they will not result in the long-term loss of availability of traditional use resources or access to lands relied on for current use practices or current use sites and areas such that will be such that these activities will be substantially diminished or lost from the RAA.

17.7.2.1 Project Contribution to Cumulative Effects

The Project’s contribution to the cumulative effects will be small and is not expected to:

- Result in a change that disrupts continued availability of resources for Current Use within the RAA.

- Result in a change that disrupts continued access to resources for Current Use within the RAA.
- Result in a change that disrupts continued use of traditional, cultural, or spiritual sites or areas within the RAA.

It is anticipated that much of the Project's contribution to the identified cumulative effect will be low magnitude, long-term, continuous, reversible (with the exception of the permanent open pits), and within a disturbed ecological context (i.e., the LAA has been previously disturbed by human development, or human development is still present).

17.7.3 Significance of Effects on Federal Lands

Federal lands within the LAA and RAA include of Black Sturgeon Reserve, of which 42.94 ha of the southwest-most portion of the reserve falls within the LAA. Based on the results in Section 17.6, the residual environmental effects on federal lands from changes Current Use are predicted to be not significant.

17.7.4 Community Summary

The following summary organizes the Indigenous Communities by two categories: those which have expressed through engagement that there is traditional interest in the Project RAA and those which have indicated through engagement that there are no current traditional practices in the RAA. With mitigation and environmental protection measures, the residual effects and residual cumulative environmental effects on Current Use of Lands and Resources for Traditional Purposes are predicted to be not significant for the Indigenous communities considered in this assessment.

17.7.4.1 Communities with Traditional Interest

Marcel Colomb First Nation

Based on Project-specific TLRU information shared by Marcel Colomb First Nation (Appendix 17A), the Project is expected to result in the reduction of wildlife habitat due to vegetation clearing in the PDA and sensory disturbance that may extend into the LAA. Residual effects are anticipated for hunting and trapping activities in the LAA surrounding the Gordon and MacLellan sites, including the hunting/trapping trail near Mile 7. Fishing sites in the LAA may be affected, as indicated by Marcel Colomb First Nation, particularly Simpson, Swede, Ellystan and Hughes Lakes.

Overall, the Project is not expected to limit the availability of or access to traditional lands and resources within the LAA or RAA.

Mathias Colomb Cree Nation/Granville Lake Settlement

The Project is expected to result in the reduction of wildlife habitat due to vegetation clearing in the PDA and sensory disturbance that may extend into the LAA. Some residual effects to fishing may extend to the RAA, particularly at Granville Lake, which is downstream of the Project.

Overall, the Project is not expected to limit the availability of or access to traditional lands and resources within the LAA or RAA.

Peter Ballantyne Cree Nation

The Project is expected to result in the reduction of wildlife habitat due to vegetation clearing in the PDA and sensory disturbance that may extend into the LAA.

Overall, the Project is not expected to limit the availability of or access to traditional lands and traditional resources within the LAA or RAA.

Manitoba Metis Federation

The Project is expected to result in the reduction of wildlife habitat due to vegetation clearing in the PDA and sensory disturbance that may extend into the LAA. Results from the Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project indicate Manitoba Metis Federation citizens practice hunting, trapping and plant gathering activities in the LAA and RAA.

Overall, the Project is not expected to limit the availability of or access to traditional lands and resources within the LAA or RAA.

Métis Nation – Saskatchewan Eastern Region 1

The Project is expected to result in the reduction of wildlife habitat due to vegetation clearing in the PDA and sensory disturbance that may extend into the LAA. Métis Nation – Saskatchewan Eastern Region 1 is concerned with effects to woodland caribou, which are not expected to extend beyond the LAA.

Overall, the Project is not expected to limit the availability of or access to traditional lands and resources within the LAA or RAA.

17.7.4.2 Communities with No Reported Current Traditional Practices

Alamos will continue to engage the Indigenous communities considered below to monitor whether traditional interest in the RAA changes.

O-Pipon-Na-Piwin Cree Nation

Through engagement, Alamos learned that O-Pipon-Na-Piwin Cree Nation does not currently conduct traditional practices in the RAA. No Project effects are anticipated for Current Use of Lands and Resources for Traditional Purposes by O-Pipon-Na-Piwin Cree Nation.

Nisichawayasihk Cree Nation

Through engagement, Alamos learned that Nisichawayasihk Cree Nation does not currently conduct traditional practices in the RAA. No Project effects are anticipated for Current Use of Lands and Resources for Traditional Purposes by Nisichawayasihk Cree Nation.

Nisichawayasihk Cree Nation expressed concerns regarding increased traffic on PR 391 resulting in further deterioration of their main access road. They also expressed concerns that their RMA is directly adjacent to the Project resulting in traditional land and resources user issues and concerns. Other concerns mentioned were human health and terrestrial and aquatic impacts to species at risk, migratory birds, big game species, and invasive species.

Barren Lands First Nation

Through engagement, Alamos learned that Barren Lands First Nation does not currently conduct traditional practices in the RAA. No Project effects are anticipated for Current Use of Lands and Resources for Traditional Purposes by Barren Lands Nation.

Hatchet Lake First Nation

Through engagement, Alamos learned that Hatchet Lake First Nation does not currently conduct traditional practices in the RAA. No Project effects are anticipated for Current Use of Lands and Resources for Traditional Purposes by Hatchet Lake First Nation.

Northlands Denesuline First Nation

Through engagement, Alamos learned that Northlands Denesuline First Nation does not currently conduct traditional practices in the RAA. No Project effects are anticipated for Current Use of Lands and Resources for Traditional Purposes by Northlands Denesuline First Nation.

Sayisi Dene First Nation

Through engagement, Alamos learned that Sayisi Dene First Nation does not currently conduct traditional practices in the RAA. No Project effects are anticipated for Current Use of Lands and Resources for Traditional Purposes by Sayisi Dene First Nation.

Métis Nation – Saskatchewan Northern Region 1

Through engagement, Alamos learned that Métis Nation-Saskatchewan Northern Region 1 does not currently conduct traditional practices in the RAA. No Project effects are anticipated for Current Use of Lands and Resources for Traditional Purposes by Métis Nation-Saskatchewan Northern Region 1.

17.8 PREDICTION CONFIDENCE

The prediction confidence assignment reflects the Current Use information available through Project-specific TLRU studies, understanding of applicable mitigation measures, and reliance on assessments of other VCs of relevance to TLRU. While there is substantial information forming the basis of the assessment, given the qualitative and subjective nature of assessing TLRU, the views of Indigenous communities may differ from the findings of this assessment. However, communities closest to the Project and likely to be most affected have shared Project-specific TLRU information and, through engagement, Alamos has learned that some communities do not currently conduct traditional practices in the RAA. Therefore, the overall confidence in residual environmental effect and significance predictions for Current Use is high. As additional information continues to be shared through Alamos' ongoing engagement with local Indigenous communities over life of mine, relevant TLRU information will be considered against the results of the EIS and incorporated into Project planning as practical.

17.9 FOLLOW-UP AND MONITORING

Follow-up and monitoring is intended to verify the accuracy of the EA, assess the implementation and effectiveness of mitigation and the nature of the residual effects, and to manage adaptively if required. A Project-specific Environmental Protection Program will be developed wherein mitigation measures are stipulated for construction, operation, and decommissioning/closure activities. This is summarized in Chapter 23. As part of an adaptive management plan for follow-up and monitoring, these mitigation measures will be regularly reviewed and updated by Alamos to verify and enhance their effectiveness. In the event that an unexpected deterioration of the environment is observed as part of follow-up and/or monitoring, intervention mechanisms will include the adaptive management process described in Chapter 23, Section 23.2.

17.10 SUMMARY OF COMMITMENTS

The following summarizes proposed measures to mitigate Project adverse residual effects for current use of lands and resources for traditional purposes:

- Construction and operation activities will be restricted to the PDAs, as much as possible, to reduce disturbances to adjacent forest land.
- Site clearing and disturbance will be limited to the Project footprint and associated access routes.
- Existing access roads and trails will be used to the extent possible; access routes will be refurbished in compliance with provisions of The Crown Lands Act and The Mines and Minerals Act.
- Signage will be implemented around the PDAs to alert traditional harvesters of the presence of Project facilities.
- Workers will be prohibited from bringing firearms to the sites while working to limit competition for wildlife species of value to traditional harvesters.
- Workers will be prohibited from bringing fishing gear to the sites while working to limit competition for fish species of value to traditional harvesters.
- Alamos will communicate the schedule of Project activities throughout the construction, operation, and decommissioning/closure phases to potentially affected Indigenous Communities.
- Alamos will engage with potentially affected Indigenous communities to address to the extent possible the potential conflict, disturbance, or access restrictions to traditional practice and harvesting areas and resources in the PDA.

Mitigation to changes in access to lands and resources currently used for traditional purposes through; timing of Project activities, potential scheduling of construction, signage, and engagement with Indigenous communities to identify potential alternate routes of access.

Refer to Chapter 6 Atmospheric Environment, Section 6.9 regarding mitigation measures that will be implemented for the management and reduction of fugitive dust emissions from construction and mining activities at the Gordon and MacLellan sites.

Refer to Chapter 16 Heritage Resources, Section 16.9 regarding inadvertent discoveries of heritage resources. Procedures to follow for chance finds are documented in the Heritage and Cultural Resource Protection Plan.

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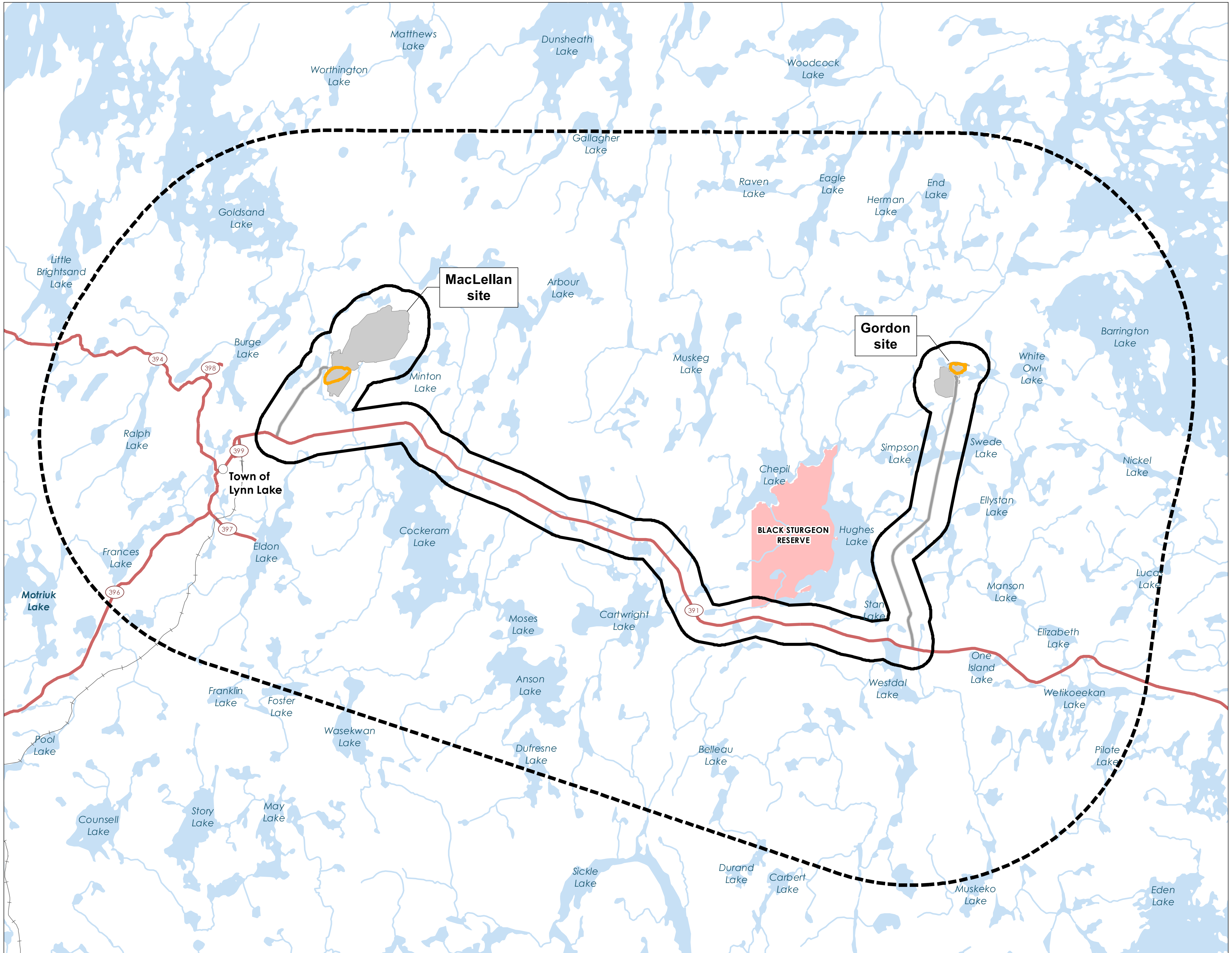

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Project Infrastructure

- Proposed Open Pit
- Project Development Area

Study Area

- Current Use of Lands and Resources for Traditional Purposes Local Assessment Area (LAA)
- Current Use of Lands and Resources for Traditional Purposes Regional Assessment Area (RAA)

Landbase

- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- First Nation Reserve

N

0 2 4 Kilometres

(At original document size of 11x17)
1:200,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake, Manitoba

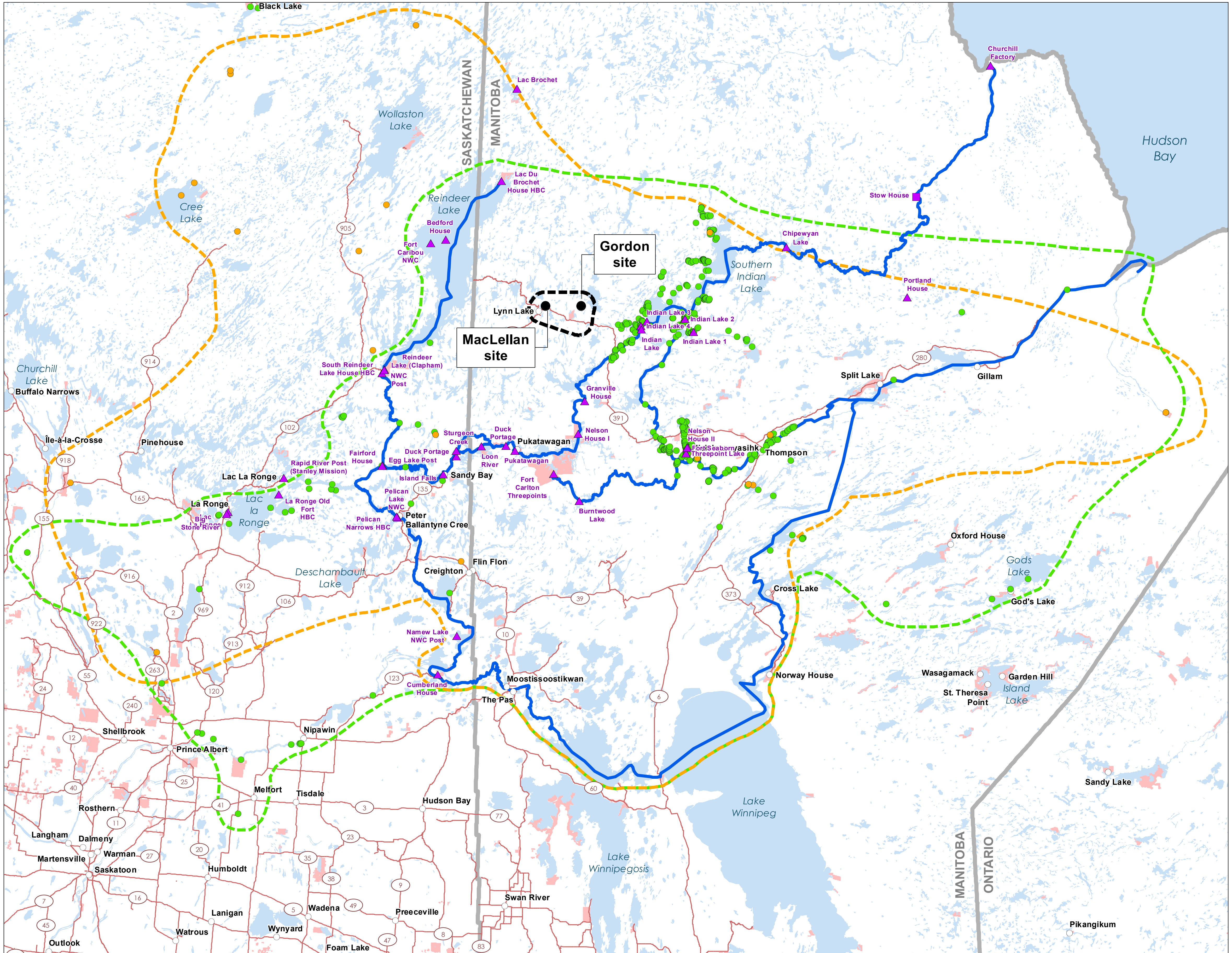
Prepared by ACampigotto on 2020-01-20
Technical Review by BAmundson on 2020-01-20
Senior GIS Review by GKroupa on 2020-01-20

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
17-1

Title
Current Use of Lands and Resources for Traditional Purposes - Spatial Boundaries



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Study Area
- Project Sites
- Current Use of Lands and Resources for Traditional Purposes Regional Assessment Area (RAA)

Precontact Features
- Talthelei Site
- Selkirk Site
- Talthelei Range
- Selkirk Range

Postcontact Features
- Fur Trade Post
- Historic House
- Canoe Route

Landbase
- Community
- Major Road
- First Nation Reserve
- Waterbody
- Provincial Border

N

0 50 100 Kilometres

(At original document size of 11x17)
1:3,500,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-01-23
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Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
17-2

Title
Historical Regional Context

Appendix 17A PROJECT-SPECIFIC TRADITIONAL LAND AND RESOURCE USE STUDIES

A Traditional Land and Resource Use Study for Marcel Colomb First Nation, Manitoba: EA/EIS Version

From Interviews with Elders and Harvesters at Black Sturgeon, Lynn Lake, Pukatawagan, Winnipeg and Regina

Prepared for: Marcel Colomb First Nation
Prepared by: Stantec

Date: January 11, 2018

Stantec

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Abbreviations

BP	Before Present as calibrated in radiocarbon years before 1950
ha	hectares
HBCA	Hudson’s Bay Company Archives
HBC	Hudson’s Bay Company
IR	Indian Reserve
MAS	Manitoba Archaeological Society
MCCN	Mathias Colomb Cree Nation
MCDC	Marcel Colomb Development Corporation
MCFN	Marcel Colomb First Nation
NWC	North West Company
PAM	Provincial Archives of Manitoba
PR	Provincial Road
TEK	Traditional Ecological Knowledge
TLRU	Traditional Land and Resource Use

Glossary

Precontact	The time before arrival of Europeans
Postcontact	The time after the arrival of Europeans
Traditional Land and Resource Use	Traditional Land and Resource Use (TLRU) refers to Indigenous peoples' use of land, water, and resources. TLRU includes activities and information regarding hunting, trapping, fishing, and plant-gathering locales; lists of harvested species; harvesting practices (such as seasonality); sites such as trails, cabins, or campsites; and sacred areas such as burials or ceremonial sites. Study participants may provide additional context related to including temporal information (e.g., when certain sites are used, or harvesting occurs, whether use occurred in the past or present) or information regarding the uses of harvested plants or animals (e.g., subsistence, medicinal, or ceremonial).
Traditional Ecological Knowledge	Traditional Ecological Knowledge (TEK) is ecological knowledge regarding a specific natural and cultural environment, accumulated through generations of living within a traditional territory or occupancy area. TEK is most frequently provided regarding animal and plant species, and it can include information such as migration patterns, habitat, population health and diversity, vegetation growth, spawning areas, or changes to any of these. TEK may also be provided regarding water or air quality, weather patterns (temperature or precipitation), soil stability, flooding, permafrost, or other environmental features.

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1 INTRODUCTION

Contained herein is a report on Traditional Land and Resource Use and Traditional Ecological Knowledge (TLRU/TEK) compiled from interviews with and map biographies of Elders and harvesters of Marcel Colomb First Nation (MCFN) and Mathias Colomb Cree Nation (MCCN). The study is a collaboration with MCFN, funded by Alamos, Inc. (Alamos) and the Province of Manitoba Resource Development Division Growth, Enterprise, and Trade (the Province), to gather and present TLRU/TEK information relevant to the proposed Lynn Lake Gold Project and the rehabilitation of Fox Mine (Figure 1). Stantec conducted interviews with 19 participants in Black Sturgeon Indian Reserve (IR), Lynn Lake, Pukatawagan and Winnipeg, Manitoba, and in Regina, Saskatchewan in October and November 2016, and May 2017. Andrew Colomb, a former Chief of MCFN, in the employ of Marcel Colomb Development Corporation (MCDC), was the community coordinator for this study in 2016. He arranged interviews, translated, and provided local logistical and transportation support. Alamos provided logistic support for the May 2017 interviews and for the review of completed interview summaries with the participants.

2 COMMUNITY AND HISTORICAL CONTEXT

2.1 MARCEL COLOMB FIRST NATION

The Cree people of MCFN initially resided throughout northeastern Saskatchewan and northwestern Manitoba. MCFN is one of the communities located in Manitoba that adhered to Treaty 6 (TRCOM 2017). MCFN's reserve, Black Sturgeon (INAC No. 09000), is located on Hughes Lake, north of Provincial Road (PR) 391. The reserve covers 2,327 hectares (ha) (INAC 2017a). Black Sturgeon is 12 km from the Gordon site and 24 km from the MacLellan site of the Lynn Lake Gold Project. It is 71 km from the former Fox Mine and Mill site. MCFN separated from MCCN in the 1990s and established a separate reserve at Hughes Lake. Andrew Colomb, then Chief of MCFN, appeared as a witness to the Standing Senate Committee on Aboriginal Peoples. The following is an excerpt from the Proceedings of May 26, 2009 in Winnipeg, Manitoba:

> We separated from Mathias Colomb in a process that began in 1972, through a resolution to the chief and council. In 1997, Minister Ron Irwin in Grand Rapids said that we would become a new First Nation if we went through a plebiscite, and if Mathias Colomb would allow us to separate to establish a new First Nation…. Well you see, in March of 1999, we were recognized as a new First Nation. We had to complete the election code by June so that we could have an election, because we are now recognized as a new First Nation. We needed an election code because we did not want the two-year term.
>
> We are a new First Nation. Perhaps a little history would be appropriate. In 1972, a resolution seeking to be a First Nation was passed by the chief and council. We had a vision of the reasons why we had to protect our lands, because mining people were coming there to destroy our lands. We had to do something to protect those lands. We had to try and become a new First Nation, so we could speak for ourselves.
>
> For about ten years, we lived in a tent village in the outskirts of Lynn Lake. We lived in plastic tents. We were supposed to go back home, but we chose not to. Our children went to residential schools and they came home to the tent village at Christmas. These are the choices we made at that time. I have always acknowledged our trail blazers time for being able to do the things that they had to do, the sacrifices that they made to be able to make something a reality.
>
> Now, in 1999, this dream became true. This vision that we had for the longest time did happen.
>
> Back in about 1980, when mining activity was declining, we were allowed to move into the residential area in Lynn Lake. Two weeks after there was a knock on the door, Child and Family Services came and told us we were not fit parents and they had to take our children away. They allowed our children to go to school but labelled them all as Fetal Alcohol Syndrome, to get more money so that the school can continue to run.
>
> These are things that happened during our journey to become recognized. In 1999, we were recognized. We are still under development as of today. We have no infrastructure and we have no housing. (Senate of Canada 2009, A. Colomb).

MCFN governance is by custom electoral system with a Chief and two councillors (INAC 2017). Elections were last held in February 2016. The total registered population of MCFN is 442 people with 43 living on reserve, 4 on other reserves, 256 on Crown Land, and 139 living off reserve (INAC 2017). MCFN is a member of Swampy Cree Tribal Council Inc. along with Chemawawin Cree Nation, Mathias Colomb Cree Nation, Misipawistik Cree Nation, Mosakahiken Cree Nation, Opaskwayak Cree Nation, Sapotaweyak Cree Nation, and Wuskwi Sipihk First Nation (INAC 2017).

Access to the town of Lynn Lake is by air and PR 391. YYL Airport Inc. Bearskin Airways operates the Lynn Lake Airport, approximately 1.5 km northwest of the town, and offers seasonal air service between Lynn Lake and Winnipeg from May to September. Lynn Lake is the starting point of the road to Kinoosao, Saskatchewan, which is on the east side of Reindeer Lake, and of the winter roads to Brochet, Lac Brochet, and Tadoule Lake. PR 391 connects Lynn Lake with Leaf Rapids, Manitoba, Thompson, Manitoba, and points south (Town of Lynn Lake 2016).

Lynn Lake provides most of the services and infrastructure for MCFN members including the Lynn Lake Hospital, West Lynn Heights School (kindergarten to Grade 12), Canada Post, Manitoba Conservation, Manitoba Health and Family Services, and the Lynn Lake Resource Centre. Businesses include several retail outlets including the Northern Store, a gas station, two motels, and a restaurant (Town of Lynn Lake 2016).

2.2 PUKATAWAGAN, MANITOBA

As described above, MCFN separated from MCCN in 1999: “Our mother band is Mathias Colomb, which is Pukatawagan” (Senate of Canada 2009, A. Colomb). As such, MCFN’s community coordinator arranged interviews with Elders residing in Pukatawagan who had harvested traditional resources in the Fox Mine and Lynn Lake Gold Project vicinities. Pukatawagan, which is on the Churchill River in western Manitoba, is the main reserve centre of MCCN (INAC 2017). Because of the historical link between MCCN and MCFN, the following background considers them as having a shared history.

2.3 PRECONTACT HISTORY OF NORTHWESTERN MANITOBA

Archaeological, archival, and oral tradition all agree that there is a long history of occupation of northwestern Manitoba, extending back thousands of years. The following sections summarize this evidence as a historical and regional context for the oral histories and map biographies presented herein.

People moved into northwestern Manitoba after Glacial Lake Agassiz began to drain at the end of the Ice Age. Archaeologists divide the record of human habitation of northwestern Manitoba into major time periods and subdivisions according to stone tools and ceramic pottery used at those times. Particularly, they use distinctive projectile points (lance, dart, and arrow tips) and ceramic pottery styles because these are durable and survive in the archaeological record. The names of archaeological cultures in the following discussion come from a tradition in archaeology of (usually) naming cultures after the modern place names of their discovery or first description. Other archaeological culture names, such as “Arctic Small Tool” are purely descriptive. These names are arbitrary and bear no cultural connection to the people who invented and used these artifacts.

Archaeologists recognize three major precontact periods in Northern Manitoba (Table 2-1). The Early Precontact Period is from approximately 9,500 to 6,500 years before present (BP); the Middle Precontact Period is from approximately 6,500 to 2,500 BP; and the Late Precontact Period begins approximately 2,500 BP and ends at contact with Europeans about 325 years ago. The Manitoba Archaeological Society (MAS 1998) provides an overview of

Manitoba's culture history as revealed by archaeological research at http://bit.ly/2AgFi8U. The website provides descriptions, timelines, maps, and illustrations of artifacts referred to in the following discussion.

Table 2-1: Culture History of Northern Manitoba Based on Technology

Archaeological Period	Technology	
	Container Type	Food Procurement
Early Precontact Period (ca. 9,500– 6,500 Before Present)	Fiber Baskets/Bags Animal Viscera/Hide	Bone Harpoons Trihedral Adzes Lanceolate Projectile Points Stemmed Points Agate Basin
Middle Precontact Period (ca. 6,500 – 2,500 Before Present)	Fiber Baskets/Bags Animal Viscera/Hide	Atlatl Bone Harpoons Nets Oxbow Points Duncan/Hanna Points Pelican Lake McKean Points Old Copper
Late Precontact Period (ca. 2,500–325 Before Present)	Clay Vessels: Selkirk (Late Woodland) Clearwater Lake Punctate Blackduck (Middle Woodland) Kame Hills Laurel (Early Woodland)	Bow & Arrow Bone Harpoons Nets Raddatz Projectile Points Besant and Larter Points Side-notched Points Eastern and Plains Triangular Points

2.3.1 Early Precontact Period (9,500–6,500 BP)

People moved into northwestern Manitoba as part of a continued northerly human expansion that followed the retreating shoreline of Lake Agassiz beginning about 9,500 years ago (Pettipas 1984). The earliest inhabitants of northern Manitoba were small bands of hunter gatherers who used bone harpoons, trihedral adzes, and stemmed projectile points. The lanceolate (leaf shaped) projectile points that characterize the Early Precontact Period were likely hafted onto thrusting spears. The Agate Basin projectile point style is diagnostic to this period and related to the Plano complex of a plains-adapted bison-hunting culture (Pettipas, 1984; Wright J. , 1981).

2.3.2 Middle Precontact Period (6,500–2,500 Before Present)

The Middle Precontact Period marks the introduction of the atlatl or spear thrower. A change from stemmed to notched projectile points in the archaeological record identifies the adoption of the atlatl. Projectile point styles that characterize this period include Duncan-Hanna, McKean, Oxbow, and Pelican Lake. While Duncan-Hanna and McKean projectile points signify the influence of people from the south, their presence in the northern Boreal Forest is sporadic in the archaeological record (Kroker 1990). Similarly, cultural evidence from the Artic Small Tool Tradition, also known as the Pre-Dorset Culture, signifies influence from the far north. Their presence in the Boreal Forest was also intermittent during this period (Pettipas 1984).

The first people thought to adapt to and live permanently in the northern Boreal Forest used what archaeologists refer to as the Shield Archaic Tradition (Kroker, 1990; Pettipas, 1984). The earliest evidence of the Shield Archaic in the area is from site GjLp-7, near Wuskwatim Lake. Radiocarbon assays of a moose antler and human bone indicate the site is about 6,390 years old (Smith 2002).

Stone tools include flaked and hafted stone knives, side-notched projectile points, large scrapers, drills, and woodworking tools. People incidentally used flakes of stone, referred to as utilized flakes, that fell to the ground during the tool manufacture for cutting and butchery and discarded them on site.

People made awls, needles, hide scrapers and personal adornment articles of bone, antler, and shell (Syms 1970). Wood working tools suggest people made and used canoes, snowshoes, and toboggans (J. Wright 1995). Unfortunately, given the fragile nature of these wooden materials, they do not survive in the archaeological record.

2.3.3 Late Precontact Period (2,500–325 Before Present)

Significant technological innovations are evident in the archaeological record of the Late Precontact Period. Pottery making distinctly marks the boundary between the Middle and Late Precontact periods. Adoption of the bow and arrow also characterizes this period. Distinctive projectile point types associated with the period include Raddatz, Besant, Larter, Side-Notched, and Eastern and Plains Triangular points.

There is evidence of a northerly influence from the Taltheilei Tradition during this period. The Taltheilei people primarily hunted barren-ground caribou and are considered by archaeologists to be the ancestors of the present Dene (Kroker, 1990; Pettipas, 1984).

Projectile points recovered from northwestern Manitoba also indicate southern influences: specifically, Besant projectile points discovered at Leaf Rapids and the western portion of Southern Indian Lake (Kroker 1990). However, the small number of points recovered indicates that the Besant Tradition was not permanently established in the Boreal Forest.

Ceramic materials further confirm southern influences. Distinctive pottery styles indicate the presence of three cultural groups in the Boreal Forest: Laurel, Blackduck, and the Selkirk Composite. Laurel sites in the area are between 1,920 to 465 years old. Blackduck sites are between 1,090 to 550 years old and Selkirk sites are between 1,190 to 360 years old (Morlan 2000). Archaeologists generally agree that the ancestors of the modern Cree produced Selkirk pottery and its associated variant styles (Kroker 1990).

2.4 FUR TRADE HISTORY OF NORTHWESTERN MANITOBA

The following summarizes information recorded from select Hudson's Bay Company (HBC) journals held on microfilm at the Hudson's Bay Company Archives (HBCA) at the Provincial Archives of Manitoba (PAM) including journals from the period of 1794 to 1941 for posts on the Churchill River in present-day Saskatchewan and Manitoba. These posts are within the region discussed in this study. The posts include:

- Granville House (1794 to 1796) (on Granville Lake)
- Fairford House (1795–1796) (on the Churchill River, 1.6 km below Reindeer River)
- Indian Lake House (1795 to 1809) (on Southern Indian Lake)
- Pukatawagan (1929 to 1941) (Pukatawagan on the Churchill River)

The early journals (Granville House, Fairford House, and Indian Lake House) contain information regarding First Nation traditional lifeways during the period between autumn and early spring when HBC operated the post. While the journal entries are primarily a daily account of life at the post, the underlying assumption of the information is that the HBC traders learned or adopted the daily activities required to survive winter from the local Indigenous people with whom they interacted. The business approach adopted by the HBC during the early years of inland trade was to operate the trading establishment from mid-September to mid-June and either close the post or leave a small contingent to operate during the summer. The remainder of the wintering party would transport the year's furs to Fort Churchill, often referred to as The Factory, and then return the following autumn.

Data from the journals include groups who traded at the posts, goods traded by both First Nations and HBC, travel patterns of the First Nations and HBC, place names either in English or phonetic Cree syllables, and climatic events such as dates of freeze up and thaw.

The early journals do not identify First Nation individuals by name. The Pukatawagan journals, however, do identify some individuals, such as members of the Colomb, Bighetty, and Sinclair families, which are among the family names of participants in this study.

David Thompson's journal covering the years he was in the northwest with either the HBC or the North West Company (NWC) was also reviewed (Thompson 1916). Several of his chapters discuss the northern Cree and traditional land use activities. This information is more general than the trade post journals but offers a compendium of Thompson's observations after having spent 28 years in the northwest.

2.5 SUMMARY OF TRADE POSTS

2.5.1 Granville House

The following is from a review of George Charles' journals during his tenure at Granville Lake from 1794 to 1795 and 1795 to 1796 (G. Charles 1794-1796). Charles entered service in the HBC in 1792 as an apprentice and spent his entire time in the Churchill River District. He died in March 1807 at Nelson House (HBCA 2016), which at that time, was on the Churchill River near Highrock, 112 km southeast of present-day Lynn Lake (Payette 2010).

Charles initially was to proceed from Fort Churchill to establish a post on Reindeer Lake. These orders changed enroute to proceed to *Lake Aw-Pis-A-Paw-Achi-Panna-Coose* (Granville Lake) at the mouth of the *Mus-Quo-Ayun* River (Laurie River). He left Fort Churchill on June 30, 1794 and arrived on Granville Lake on August 9, 1794. He established his trade post 3.2 km (2.0 miles) from the mouth of the Laurie River. On August 13, 1794 two Canadiens (NWC traders) arrived to set up a rival post approximately 90 m (100 yards) from Charles' post.

2.5.2 Fairford House

Malcolm Ross' journals cover the operation of the post, known as Fairford House, at the confluence of the Reindeer and Churchill rivers, during the winter of 1795 to 1796 (Ross 1795-1796). Ross entered service in the HBC in 1774 as a labourer and spent most of his time in the northwest interior of present-day Manitoba and Saskatchewan. He drowned at God's Falls on the Churchill River in October 1799 (HBCA 2016).

Ross arrived September 14, 1795 and laid the foundation for the trade post at the mouth of the Deer (Reindeer) River. On September 29, 1795 two Canadian canoes arrived to set up a post in opposition.

2.5.3 Indian Lake House

John Charles' journal during his tenure at present-day Southern Indian Lake is for the winter of 1805 to 1806 (J. Charles 1805-1806). John, brother to George Charles, entered HBC service in 1799 as an apprentice and spent most of his employed time in northern Manitoba and Saskatchewan. He retired to the Red River Settlement in 1834 (HBCA 2016).

Joseph Spence wintered at Southern Indian Lake between 1808 and 1811. His journal entries follow those of John Charles (Spence 1808-1809). Spence entered service in the HBC in 1790 as a labourer at Albany then transferred to the northern district in 1794. He retired to the Red River Settlement in 1823 and died there in 1856 (HBCA 2016).

Charles and three men left Nelson House Post on the Churchill River near present-day Highrock and paddled down the Churchill River. He passed through Paint Lake Rapid and noted in the journal that there was a post there before 1805. Paint Lake could have been another name for Granville Lake and the noted post may be Granville House, however it is curious that he did not identify it as the post his brother, George, had built. They constructed Indian Lake Post on a small point of land in the southern basin of Indian Lake near a former trade post of unknown affiliation.

Spence arrived at Charles' Indian Lake Post on September 27, 1808.

2.5.4 Pukatawagan

The Pukatawagan journals cover the period from 1929 to 1941 (Various 1929-1943). Several of the authors' names are not listed at the start of the annual and occasionally there were multiple authors as indicated by a change in the hand-writing style.

The post opened in 1919 and closed in 1943 for lack of HBC staff. Pukatawagan is 100 km south of Fox Mine and 125 km southwest of Lynn Lake. The post was located along the banks of the Churchill River within the present-day community. Archival maps showing the exact location could not be located but references within the journal place the post on a point of land along the river well-removed from the main community.

The HBC post at Pukatawagan dealt almost exclusively with members of MCCN, which was originally part of the Peter Ballantyne Band of Pelican Narrows in Saskatchewan. Mathias Colomb was the first chief of the reserve and served from 1910 to1932. Solomon Colomb was chief from 1933 to 1952.

2.5.5 References to Indigenous People in the Trade Post Journals

2.5.5.1 The People

The early HBC winterers referred to the local inhabitants as “Southern Indians” and “Northern Indians” but the journals do not list the distinguishing criteria. It may be a function of dialect or criteria that the First Nations themselves used and instructed the HBC. Malcolm Ross referred to the local population as “Chipewyan.” In journal entries for November 1795, Ross distinguished between Southern First Nation and Chipewyan. David Thompson echoes this distinction:

> North of the latitude of fifty-six degrees, the country is occupied by a people who call themselves "Dinnie," by the Hudson Bay Traders "Northern Indians" and by their southern neighbours "Cheepawyans.” Southward of the above latitude the country is in the possession of the Nahathaway (Thompson 1916, 78).

If the distinction is based on dialect, then the “Southern” group may refer to the present-day Swampy Cree, while the “Northern” refers to the Rock or Woodland Cree, as suggested by Brightman (Brightman 2007). Early maps of the area mark Northern Indian Lake and Southern Indian Lake on the Churchill River.

By the 1920s, the HBC managers at Pukatawagan referred to the local population either by family name, such as Colomb, or by community name, such as Highrock or Granville. There were several satellite communities that annually congregated at Pukatawagan primarily for church holidays and treaty days.

The HBC journals from 1929 to 1941 provide the best summary of daily and seasonal life for the Mathias Colomb Cree Nation people the ancestors of the future (1999) MCFN. This period coincides with early development of the railroad, air freight/travel, and early mineral exploration; an increase in trade opportunities for furs and fish; a decline in the abundance of fur-bearing animals and the consequent decline of the fur trade; and the establishment of the residential school at Sturgeon Landing, Saskatchewan.

2.5.5.2 Place Names

In 1794, George Charles records the Cree name for Granville Lake as *Aw-Pis-A-Paw-Achi-Panna-Coose* and Laurie River as *Mus-Quo-Ayun* River, translated as “Bear’s Backbone.” On his way to South Indian Lake he paddled up the Churchill River and entered Lake *Pa-Thew-A-Muty* on July 29, 1794. On August 2, 1794, he arrived at the mouth of South Indian Lake suggesting that the *Pa-Thew-A-Muty* was downriver of South Indian Lake and possibly corresponds to present-day North Indian Lake. It took Charles about a week to cross Southern Indian Lake to the mouth of the Laurie River where Granville Post was located (G. Charles 1794-1796).

Charles makes several references to “The Forks” and gives the Cree name *Nuit-A-Why-A-Ou*. The HBC and the Canadians both had houses there in the winter of 1794–1795. Charles’ 1795–1796 journal records the distance to The Forks from Granville Post as 112 km (70 miles). However, Charles does not identify whether this distance was up or downstream of Granville House. In a later journal entry, Charles mentions leaving The Forks for Duck Lake, present-day Sisipuk Lake, to set up a temporary post (G. Charles 1794-1796). Duck Portage Post was located on the Churchill River, near Pukatawagan Lake. Therefore, The Forks may have been upstream of Granville House.

John Charles' 1805–1806 journal for Indian Lake Post begins with him leaving Nelson House on October 5. At the time, Nelson House was on Highrock Lake near the present-day Prayer River. A trade post operated there from 1800 to 1827. On October 10, 1805 Charles recorded that a group of First Nations arrived from "The Rapids," but he does not identify which rapids.

On December 19, 1805, Charles travels from Indian Lake Post to Nelson House Post to spend Christmas with his brother, George. He stopped at The Graves at the end of his second day of travel. On December 22, he stopped for the night at Poplar Point, which sat below two falls. On his return trip, he left Nelson House on January 3, 1806 and was at The Graves on January 5, 1806. The following night he stopped at Paint River and was back at Indian Lake Post by 9:00 a.m. the morning of January 7, 1806.

On January 24, 1806, Charles left for a winter camp in the Trout Lake area. He arrived at the Trout River at the end of the day on January 24 and in the evening of January 25 crossed Trout Lake.

On March 30, 1806, Charles accompanied a hunter to his winter camp near Crooked Pine River. It took one day to walk there and Charles recorded that they walked through open woods.

On April 21, 1806, Charles records that a group of First Nation members had left most of their winter furs at their camp on the Seal River approximately 100 km north of Indian Lake Post (J. Charles 1805-1806).

By the early 1920s, Mathias Colomb Cree Nation, and by extension the ancestors of the future MCFN, were residing in several small communities along the Churchill River. The major communities were Highrock, Granville, Duck Lake (present-day Sisipuk Lake), Burntwood Lake and Island Falls. Other smaller communities included Pickerel Narrows, Old Man River, Trout Lake, and Loon Lake. The Churchill River was the main transportation route for the First Nation families during both the summer and winter (Various 1929-1943).

Angus Millar recorded a reference to the Lynn Lake area on March 3, 1938 when he wrote that A. Beaucage arrived at the Pukatawagan post on his way to Lynn River (Various 1929-1943). Beaucage had also set up a claim at Old Man's River in the fall of 1937. The exact location of Beaucage's claims on the Lynn or Old Man's rivers is not known.

2.5.6 References to Air Quality in the Trade Post Journals

Trade post journals usually only referenced air quality when forest fires were in the area. Several fires came close to the HBC post at Pukatawagan, particularly during the late 1930s and early 1940s. A fire in August 1940 resulted in the evacuation of the community (Various 1929-1943). The reported thick smoke probably affected the respiration of the more elderly members of the communities.

2.5.7 References to Climate and Meteorology in the Trade Post Journals

Most of the journals recorded dates of first snow fall, first frost, dates of water bodies freezing and thawing, and periods of abnormal weather. The snow falls and dates of waterways freezing and thawing were important because these conditions not only affected the modes of transport but also restricted the ability for First Nation groups to travel. Partially frozen waterways prohibited both canoe and pedestrian travel, while only a small amount of snowfall made dogsled travel difficult.

The MCFN and MCCN ancestors had an uncanny ability to leave for their wintering grounds at least two or three days before the advent of snow and sub-zero temperatures. Evidently, there were indicators of the onset of winter that the people recognized and acted upon by traveling to their winter resource areas.

During Charles' first year at Granville the lake completely froze over by November 2, 1794. It opened in May 24, 1795. He does not mention when the lake froze in the fall of 1795 but during the week May 8 to 14, 1796 he states that the lake ice was unsafe for walking (G. Charles 1794-1796).

Malcolm Ross remarked on October 22, 1795 that the river froze in front of the Fairford Post at Reindeer River and they could not access their nets. There is no mention of when the river opened but Ross departed by canoe for Churchill Factory on May 26, 1796 (Ross 1795-1796).

John Charles mentions that Southern Indian Lake nearly completely froze over by October 29, 1805. By May 19, 1806 the ice was off the lake (J. Charles 1805-1806). Joseph Spence recorded the lake completely frozen as of October 20, 1808. It reopened during the first week of May 1809 (Spence 1808-1809).

The late 1920s and early 1930s experienced several abnormal weather patterns across northern Manitoba. The HBC journal records on November 18, 1929 that the river had frozen over and this was the latest ever recorded at Pukatawagan. In 1931, the lake did not freeze until November 16 (Various 1929-1943).

John Charles recorded heavy snowfall at Southern Indian Lake during the winter of 1805 to 1806. Hunters used the accumulation to their advantage as they could mire moose in the deep snow and kill them with knives thus conserving ammunition (J. Charles 1805-1806).

The winter of 1929 to 1930 recorded one of the heaviest accumulations of snow ever witnessed at Pukatawagan. By the end of January 1930, the snow was too deep for the people to visit their trap lines. The summer of 1930 was one of the wettest on record at Pukatawagan. This caused the Churchill River to rise several metres throughout the summer (Various 1929-1943).

2.5.8 References to Fish and Fish Habitat in the Trade Post Journals

Fish were one of the main winter provisions for both First Nation and the HBC and was also the main food source for the sled dogs. During the winter of 1795 to 1796, Charles' journal indicates that the HBC winterers relied more heavily on fish for provisions. The arrivals of Cree hunters were not as frequent during the second winter at Granville as they were in the year previous (G. Charles 1794-1796). The HBC at Fairford House relied on First Nation support for provisions. During the first two weeks of November no First Nation groups came to the post and the HBC had to rely on fish returns from the nets. Fishing shortly after freeze-up was not lucrative (Ross 1795-1796). Nets were generally set under the ice and examined daily (Spence 1808-1809).

HBC winterers called the main fish species caught "guineard" or whitefish. In November 1805, Joseph Spence reported that they had four nets set at Southern Indian Lake and were obtaining 40 or 50 whitefish per day. By February 1, 1806, they had six nets set and procured about two meals per day for ten people excluding his companion and four children. By April 2, 1806, the run of whitefish had ended and the HBC was catching primarily pike, perch, and suckers (Spence 1808-1809).

Sturgeon was originally abundant in the Churchill River and formed an important component of the community's diet as well as a source of income. Sturgeon fishing was generally in the early spring, usually the latter part of May or early June, and in early fall, usually the latter part of September or the first weeks of October. In the 1920s and 1930s air freighting enabled MCCN communities to ship sturgeon to Cold Lake and The Pas. The HBC also purchased sturgeon from the communities and shipped to The Pas. For example, during September 1938 the HBC shipped nearly one ton of sturgeon to City Meat market in The Pas (Various 1929-1943).

In July 1929, the HBC journal remarks that there were very few inhabitants as the fishing was starting to fail at Pukatawagan. HBC staff went to Duck Lake to obtain a load of fish. Also in July 1929 the Churchill River was rising although there was no explanation as to the cause. In July, the river had risen about 2 m (7 feet) in one month. By September 6, 1929, the river had risen about 3 m (11 feet). The September 25, 1929 entry records that fishing was poor because of the high water (Various 1929-1943).

2.5.9 References to Water Quality in the Trade Post Journals

A Pukatawagan journal entry for September 11, 1930 states that the Churchill River Power Company at Island Falls had altered the river flow and forced the water over the banks cutting new natural channels. This resulted in stream siltation downstream at Pukatawagan and severely altered the water quality (Various 1929-1943).

2.5.10 References to Birds in the Trade Post Journals

Geese, ducks, and swans were the main birds used as a food source. First Nation hunters routinely brought migratory wildfowl to the HBC posts, when available. The migrating birds were usually along the Churchill River by the end of April and would depart in the latter part of September. Thompson (1916, p. 36) records that geese were often salted and preserved for the winter. John Charles' journal recorded that First Nation groups from Southern Indian Lake would go to Churchill Factory for spring goose hunting (J. Charles 1805-1806).

Migratory wildfowl departures helped gauge the onset of the fall season. The August 25, 1929 journal entry for Pukatawagan stated that it was an early sign of winter when the crows and ducks begin bunching on that date. One of the earliest sightings of crows returning to the area was at the Pukatawagan post on February 25, 1930 (Various 1929-1943).

2.5.11 References to Mammals in the Trade Post Journals

Mammal furs and meat were the main trade commodities throughout the history of the fur trade. Beaver was the prime fur traded during the seventeenth and eighteenth centuries. A depletion of the beaver population throughout the western interior during the early 1800s diversified the types of mammals trapped. By the late 1930s, furs acquired by the HBC at Pukatawagan included squirrel, fox, mink, weasel, marten, muskrat, wolf, otter, and lynx (Various 1929-1943).

The HBC relied heavily on the First Nation groups for provisions. The hunters would trade either dried, pounded, and green meat, as well as animal fat. Green meat probably relates to freshly killed and butchered portions of either moose or caribou. Rabbits were also snared when large game or fish were unavailable. Other meat sources were beaver and bear. Moose hides were occasionally tanned and used for tent covering.

The Pukatawagan journals record that trappers would leave Pukatawagan to access their trap lines between November and April and be away for about two weeks. They would trap grey and mixed fox, lynx, marten, weasel, and wolverine. The annual muskrat hunt usually occurred in spring. Fox and lynx were highly susceptible to cyclical fluctuations. For example, the winter of 1931 to 1932 was an exceptionally good year for fox trapping. The following year their fox returns were extremely poor. By the late 1930s, all fur-bearing species were becoming scarce and the annual hunt was producing poor returns (Various 1929-1943).

Forest fires affected the quantity and range of many mammals. After a severe fire in the Pukatawagan area in the summer of 1940 devastated a grazing area, the journal reports that by December many people were leaving the community as there were few animals nearby.

2.5.12 References to Vegetation in the Trade Post Journals

David Thompson describes several trees and plants used by the northern First Nation groups. They collected birch bark for a variety of uses including canoe and dwelling covers as well as dishes and domestic utensils. The larch, a strong elastic wood, was used for sleds. Poplar made the best fire wood for heating and for smoking meat and fish. White spruce branches made bedding and pine saplings, tent poles (Thompson 1916).

Thompson lists the following edible berries used by both the First Nation and the HBC: dry and swamp cranberry; crow and blackberry; raspberry; strawberry; cherries; red, black and white currants; gooseberry, hipberry, juniper berry, eye berry, and bear berry (Thompson 1916, 58). He described the latter as a low spreading plant that lies flat on the ground and is used for medicine. The First Nation groups also collected and dried the leaves and mixed it with tobacco. Wood from the summer berry [high bush cranberry (Clavelle 1997)] made pipe stems. Thompson also mentions the saskatoon berry as very sweet and nourishing, the favourite food of small birds and bears. The First Nation groups collected and dried them for future use and mixed the berries with dried meat. The wood made arrow shafts (Thompson 1916).

In mid-September, the Pukatawagan community partook in the annual blueberry “pic-nic,” where everyone from the community left for about seven days. The HBC journals do not indicate where berries were gathered but, given the reliance of travel along the Churchill River, it is likely that the locations would be near traditional camps such as High Rock and Granville.

2.5.13 References to Socio-Economics in the Trade Post Journals

The HBC and NWC developed a system of supplying credit to the First Nations groups throughout the western interior. The Cree would acquire goods on credit in the fall and then pay the debt either with furs or provisions obtained during the winter. Based on Charles’ journals, it would appear that the furs and provisions seldom if ever totally eradicated the debt and additional credit would be required prior to the next trapping season. The net result was that the Cree were perpetually in debt to either company (G. Charles 1794-1796) (J. Charles 1805-1806). However, as the HBC developed additional posts along the Churchill River system throughout present-day northern Manitoba and Saskatchewan, the Cree developed a practice of acquiring credit at each of the posts over several successive seasons.

When the Northern Cree came to trade at the Fairford, Granville or Indian Lake trade posts, they generally arrived in the afternoon or evening, traded the next morning, and left immediately. Furs and provisions were exchanged for either payment of debt, ammunition, clothing, tobacco, metal tools, or alcohol. Once the lakes were frozen, the Cree continued to come to the post but would inform the HBC winterers that they had provisions at their camp and men from the post would travel with the informant(s) to retrieve the provisions. Distances traveled varied from 40 to 65 km (30 to 40 miles), and a round trip of 130 km (80 miles) took approximately four days. Often several HBC staff went to live with the Cree at their winter camps. This alleviated the numbers to be fed at the post and allowed the HBC men to trade directly with the Cree at their camps thereby restricting the Cree trade relations with the NWC.

Not all the Cree were willing to trade with the HBC or NWC winterers. On April 21, 1806, John Charles recorded that many First Nation families arrived at Indian Lake Post but only traded 30 Made Beaver, a unit of barter that equated all trade goods to the value of a prime winter beaver pelt (Waiser 2016), and a few martens. Most of their winter catch was stored at their winter camp on the Seal River as they intended to go to Fort Churchill with them in the summer (J. Charles 1805-1806).

The members of MCCN had several trade partner options during the early 1930s. They could take their furs to the HBC post or the Revlon Frères store at Pukatawagan. On April 3, 1930, W. Yakosaveck arrived and established a store on Trapper's Island to compete with the HBC. Another two individuals went to Pine Cache Lake, 19 km (12 miles) from Pukatawagan, to build a store. Evidently this was another wintering community for members of MCCN. Revillon Frères Trading Company was an HBC competitor until the HBC purchased a controlling interest in the company in 1926 (Various 1929-1943).

The Pukatawagan trappers could also travel south to Cold Lake near present-day Sherridon, Manitoba, or they could patronize several independent trade posts that operated in communities including High Rock, Granville, and Burntwood Lake. The independent traders were more flexible in what they could offer for the furs whereas head office determined HBC annual prices with only some small degree of flexibility by the individual post manager. The HBC journals at Pukatawagan during the late 1930s continually reported poor annual returns because their prices were set lower than their competitors' prices. During the late 1930s, the resident Roman Catholic priest also bought furs from the various community members and would then resell the furs in Cold Lake (Various 1929-1943).

During the late 1920s and early 1930s, there were several seasonal economic options for the First Nation people living along the Churchill River. The spring and fall sturgeon catch was either sold independently or to the HBC. The produce from berry picking was sold within the community. The main economic pursuit was fur trapping that was generally between late September and late March. Community members assisted government surveyors in the late 1920s and early 1930s when several reserves along the Churchill River were being developed (Various 1929-1943).

Freighting between Pukatawagan and Cold Lake developed during the late 1920s and early 1930s. Goods were brought in either by air during the summer months or by truck or horse team during the winter. The HBC and the independent merchants depended on these goods and often ran out of supplies when deliveries failed. Air travel was dependent on clear conditions and during the late 1930s there were several forest fires, the smoke from which impeded air flights. Occasionally the transfer truck would break down or roads would become impassable and this resulted in low stock supplies at Pukatawagan (Various 1929-1943).

2.5.14 References to Traditional Land and Resource Use in the Trade Post Journals

2.5.14.1 Travel

During open water season, the main mode of transport was canoe. George Charles makes the distinction between “big” and “small” canoes. He set out from Fort Churchill with 40 pieces of trading goods, 8 staff and 2 First Nation guides in 10 big canoes. There were four small canoes used by First Nation guides and porters. Charles did not describe the First Nation canoes in any detail (G. Charles 1794-1796). However, because subsequent journal entries list Cree individuals building canoes for Charles, it is logical to assume that they would have built the HBC canoes similar to their own.

In spring, birch bark was gathered to make canoes. They would also harvest wood to construct the frame, but Charles did not identify the type of wood collected. Thompson (1916: 116) describes First Nation canoes as:

> from 10 to 16 feet in length, and breadth in proportion, during the open season, they are almost constantly in them; hunting; removing from place to place, the Rivers and numerous Lakes giving free access through the whole country.

Canoes were still the main method of water transport during the 1930s and 1940s. By this time, most of the canoes used by the HBC and the people at Pukatawagan had canvas covers that generally had to be replaced annually. Boats with outboard motors were occasionally used during this period but primarily by the HBC, government surveyors, and prospectors (Various 1929-1943).

Winter transport was by usually by foot and dog sled. Sleds were generally made of larch (Thompson 1916:117). At Southern Indian Lake, John Charles records that in November 1805 he had men collecting birch for snowshoes along a small river about 10 km (6 miles) from the post (J. Charles 1805-1806). These modes of winter travel continued into the early 1940s as many members of MCCN as well as HBC employees used dog sleds. In April 1939, W. McKinnie reported the spread of disease among the dogs at Pukatawagan and High Rock. Several dogs died and people had difficulty accessing their trap lines (Various 1929-1943).

The ancestors of MCCN and MCFN were not averse to traveling great distances. George Charles’ journal indicates that Cree from the Granville Lake area routinely traveled the Churchill River to Fort Churchill and back. During the winter, it would take approximately eight weeks to travel from Churchill Factory to Granville. In the summer, it took about six weeks to ascend the Churchill River from Churchill Factory to Granville Lake (G. Charles 1794-1796). It would probably take a First Nation family less time as Charles was traveling with a large quantity of trade goods in larger canoes and would have taken longer to portage men, goods, and canoes.

During the 1920s and early 1930s, many families would return to Pukatawagan for the summer as this was where the HBC and Revlon Frères stores and the Roman Catholic Church were located, where annual Treaty Day was held, and the departure point for the residential school at Sturgeon Landing. They would also congregate in the community for religious holidays such as All Saints’ Day, Christmas, Easter, and Ascension Sunday. People would generally arrive a day or two prior to the event and then depart a day or two afterward (Various 1929-1943).

The July 30, 1929 journal entry for Pukatawagan records that the community was extremely quiet as the people had departed for their summer vacations down the river and elsewhere. This time away was generally during the month of July. The families would begin returning in early August in anticipation of Treaty Day (Various 1929-1943).

Annual Treaty Day, usually during the second week in August, marked the time when the community was busiest. Treaty Day was a major annual event in Pukatawagan and people from the outlying communities would begin arriving a few days before the day and then depart shortly thereafter. The HBC and Revlon Frères anticipated the arrival of Treaty Day as the community members would then use the money issued to clear debts or purchase goods (Various 1929-1943).

The HBC journals for 1929 record that people from Pukatawagan conducted one last seasonal fishing trip to their camps in September. They would arrive back just before the river froze in late October or early November. Once the lake had frozen, trappers began accessing trap lines. Usually a large number would leave and return in four to five days. They would go out at least once or twice before Christmas and then at least three or four times after Christmas before the river opened (Various 1929-1943).

By the early 1940s, band members often remained in the satellite communities on the Churchill River year-round. By this time, independent traders established stores in the communities and the resident Pukatawagan priest visited the outlying communities to provide church services. The HBC at Pukatawagan counted on the various church holidays and gatherings in the community to bolster sales. However, at Christmas 1940 the journal records that very few arrived for church service: the only arrivals were the Chief and a few councilors from Granville Lake (Various 1929-1943).

2.5.14.2 Seasonal Activities

Data regarding summer activities by the northern Cree during the late 1700s and 1800s only refer to late spring and early fall. The Pukatawagan journals from the 1930s and 1940s offer a more detailed summary of seasonal activities during the onset of the decline of the fur trade industry and just before mine development in northern Manitoba.

During the summer, the Cree congregated in areas close to active fisheries. At these locations, canoes were repaired or new ones constructed. Fishing, primarily for whitefish and sturgeon, was combined with hunting and harvesting berries and plants. If access to more plentiful fisheries along the river system required travel, people would generally leave two or three times during the summer for a week to ten days (Various 1929-1943).

The late fall was a time for gathering materials for sleds and snowshoes. The Cree would then divide into smaller family units and leave for their wintering sites before freeze-up and snowfall (Various 1929-1943). The early HBC winterers do not identify where these wintering areas were but may have been the same areas such as Highrock, Granville, and Burntwood Lake used as resource bases in the 1930s and 1940s.

The HBC journals seldom mention the Cree using fish as provisions for trade during the winter. Winter activities concentrated on trapping and hunting moose and caribou. Therefore, while the HBC winterers relied heavily on fishing, the Cree relied on hunting.

3 TRADITIONAL LAND AND RESOURCE USE STUDY PURPOSE AND METHODS

3.1 INTRODUCTION

The Lynn Lake Gold Project (the Project) identified the need for TLRU and TEK information from MCFN for consideration in the Environmental Assessment. As well, the Fox Lake Rehabilitation Project (the Rehabilitation Project) identified the need for TLRU/TEK information from MCFN for consideration in the Rehabilitation Design. Because these areas overlap with the traditional territory of MCFN and with their ancestral First Nation MCCN, this TLRU/TEK study intends to inform both projects.

3.2 OVERVIEW OF TRADITIONAL LAND AND RESOURCE USE/ TRADITIONAL ECOLOGICAL KNOWLEDGE (TLRU/TEK) STUDIES

The purpose of this TLRU/TEK study is to gain an understanding of and document use of land and resources for traditional purposes by MCFN members, characterize anticipated project effects, and identify mitigation strategies. In collaboration with MCFN, Stantec supported development of the study design, implementation, reporting, quality control and tracking of all phases of the study.

3.3 STUDY PHASES/SCOPE OF WORK

3.3.1 Scope

Stantec worked with MCFN representatives to collaboratively develop a work plan and budget for the TLRU study. The objective of the scoping process was to work with MCFN to identify study phases, determine deliverables and milestones, and agree upon a format for submission of study results suitable to the community and for use in the environmental baseline, assessment, site remediation planning and other regulatory processes. Terms of use for TLRU/TEK information and an Information Sharing Agreement was discussed with MCFN. A mutually agreed-upon work plan and cost estimate was then submitted to Alamos Gold, as well as the Province for review and approval prior to commencement of work.

3.3.2 Literature Review

The literature review provides the regional and historical context for information shared as part of the TLRU/TEK study. Section 2 is a compilation of government, archival, and academic literature and data presented herein as a community and historical context from the earliest occupation of the region through the 18th to 20th century fur trade and to a profile of MCFN as it exists today.

3.3.3 Interviews and Mapping

Stantec facilitators along with MCFN's community coordinator conducted interviews with study participants selected by MCFN. Before the interviews, the community coordinator explained the purpose of the study and the review and release process. The participants gave verbal informed consent to be interviewed, recorded on video and audio devices, to allow compilation of the map data and to make notes and summarize the interviews for later review. Participants identified use areas that the Projects may affect, including travel routes, harvesting locales, habitation areas, and spiritual sites as well as important areas for wildlife, fish, and plant species, and archaeological sites. Participants also shared concerns and proposed mitigation measures. The facilitators recorded TLRU sites, locations, and areas on mark-up maps. Records of the interviews include notes, audio/video, photographs and the mark-up maps.

3.3.4 Reporting

The reporting approach agreed upon was to compile a summary of each interview from notes and recordings for review by the participants. From the approved summaries, two reports resulted. This version of the TLRU/TEK report does not include names or images of participants and organizes the TLRU/TEK information according to the categories that best inform the environmental assessment process:

- Harvesting: plant gathering, fishing, hunting and trapping
- Occupation, Trails and Travelways: residences, harvesting camps and cabins, overland and water travel routes
- Cultural Sites and Areas: spiritual and archaeological sites, gathering sites and culturally important areas
- Experience of TLRU: seasonality, sharing relationships, family connections to TLRU activities and areas, food preparation, use of resources
- Environmental Observations: comments on flora, fauna, weather and climate, and observed change in these over time

This volume presents commentary provided by study participants regarding project and cumulative effects on TLRU. The report also includes statements regarding the need for, and nature of, mitigation strategies recommended by the participants. In writing the results, participants are assigned a code number to protect their identity. This version, if released by MCFN, will be shared with the Project and Rehabilitation Project according to MCFN's terms for release. The following provides the methods and results of the TLRU/TEK.

3.3.5 Validation

Stantec facilitators held meetings with study participants to review the draft interview summaries for accuracy in May and June 2017.

After review by MCFN representatives to confirm proper protection of that any confidential or sensitive information, Stantec made required changes to the draft reports and prepared the final reports.

3.3.6 Release of the TLRU/TEK Final Reports

The final community version of the TLRU/TEK report will not be released and is for community use only to protect personal information. This version of the report is for use in the environmental assessment of the LLGP and has personal information redacted. With the approval of MCFN Chief and Council, this version of the report will be released to Alamos Gold ether directly by MCFN or by Stantec on the express authorization of MCFN. The details of this approval are included in the Information Sharing Agreement approved by MCFN Chief and Council on February 26, 2018 (Appendix C). A separate agreement for the release of this version of the report to the Province will be reviewed

3.4 CONFIDENTIALITY AND INTELLECTUAL PROPERTY COMMITMENT

Stantec is committed to maintaining the confidentiality and propriety of information shared by MCFN in all aspects of the communication of this TLRU/TEK study. Stantec acknowledges that TLRU/TEK information is proprietary and belongs to individual knowledge holders and, collectively, MCFN. Stantec is committed to following individual MCFN's protocols for the collection, validation, and use of TLRU/TEK information.

Stantec recognizes that information collected during the course of a TLRU/TEK study program is highly sensitive and requires special consideration. As such, a restricted access computer storage drive, separate from other Stantec drives, is used to house all electronic information relative to the study including all notes and tables, audio and video recordings, photographs, GIS data, reports, and any other data generated through the program. Any physical materials related to the study will be returned to MCFN upon completion. Stantec will not release any TLRU/TEK study data to Alamos Gold or to the Province without the express authorization of the MCFN.

4 TRADITIONAL LAND AND RESOURCE USE AND TRADITIONAL ECOLOGICAL KNOWLEDGE

The purpose of this volume is to inform the environmental assessment of the Lynn Lake Gold Project and Fox Mine regarding traditional land and resource use including:

- availability of traditional resources
- access to traditional resources or areas
- occupancy, cultural sites, and areas
- experience of traditional land and resource use

Traditional ecological knowledge learned from the Elders and harvesters can further be integrated into the environmental assessment to provide a better understanding of:

- Air Quality/Noise/Vibration and Light
- Fish and Fish Habitat
- Heritage Resources
- Human and Ecological Health
- Socio-economic Factors
- Community Health and Wellbeing
- Employment and Economy
- Non-Indigenous Land and Resource Use
- Soils and Terrain
- Vegetation and Wetlands
- Visual aesthetics
- Surface water
- Groundwater Quality
- Wildlife and Wildlife Habitat

Nineteen participants were interviewed for this study in Lynn Lake, Pukatawagan, Winnipeg, Manitoba and Regina, Saskatchewan.

4.1 HARVESTING

Harvesting includes hunting, trapping, plant gathering, and fishing. Country food once formed the only diet of northern Indigenous communities but through time, what is termed southern foods have been introduced. These foods are often expensive and of lesser nutritional value. Harvesting is a gender-shared process as exemplified by the participants who provided input to the TLRU/TEK study data.

Figure 2a illustrates the MCFN harvesting sites identified by the participants at the regional level.

4.1.1 Hunting

Successful hunting requires an intimate knowledge of the land, animal behaviour, weather, and technology. Hunting has been a major TLRU activity by members of MCFN and their ancestors since they first began inhabiting northern Manitoba. Artifacts found at archaeological sites, HBC journal accounts of country produce, and information supplied by Elders and harvesters underscore the importance of hunting.

Hunting while on the trap line was essential for survival. According to MC4 moose was the primary game hunted, but caribou and deer were also harvested (Figure 2b: Hunting 2 and Trapping 2, 3). While trapping, MC15 and MC16 would hunt anything they could to make sure they had enough food to survive.

MC1 recalls that moose were especially abundant around McGavock Lake (Figure 2c: Hunting 29). MC2 would hunt for fresh meat including caribou, moose, chickens, ducks, ptarmigans, and rabbits while out on the trapline near Muskeg Lake (Figure 2b: Hunting 26). MC9's favourite places to hunt were at Ghost Lake, west of Chicken Lake (Figure 2a), Dunsheath Lake (Figure 2b: Trapping 4), and areas around Cockeram (east of the Lynn Lake town site), Moses, and Anson lakes (Figure 2b: Hunting 13). When trapping, MC10 hunted moose in the bush near a camp at Cartwright Lake (Figure 2b: Hunting 5). MC12's family hunted moose in around Anson and Moses lakes, west of Huet and Carr lakes, and on the west side of Cockeram Lake (Figure 2b: Hunting 7, 8, 9, 10, 25). MC13, an active hunter, hunts moose throughout the season, but does not harvest the cows to preserve the population and promote growth. MC13 hunts primarily from roads, such as old mining trails near Eden Lake, because the moose frequent these areas to eat the salt. MC13 believes the best time to hunt moose was when it was windy because they could not hear or smell the hunter. As an alternative to using a gun, MC13 often sets snares along the moose trails and the animals could be caught "with a rope around their neck" (Figure 2b: Trapping 11). MC13 hunted from Hughes Lake to Eden Lake along the Hughes River (Figure 2b: Hunting 15). MC14 was helping with chores by age eight and recalls hunting and preparing moose. Having a source of food was essential for survival during the winter time and so MC14 and MC14's partner regularly hunted while out on the trap line (Figure 2c: Trapping 29). Though they hunted many different types of animals they ate primarily moose. MC17, MC18, and MC19 recalled that good moose hunting locations were on the shores of Moses, Mary, and Anson lakes (Figure 2b: Hunting 11). MC17, MC18, and MC19 also report moose hunting around Dunphy Lakes, east of Fox Mine (Figure 2c: Hunting 32). MC11 and three siblings would hunt moose near Eden Lake and Wetikoeekan (Sasquatch) Lake (Figure 2b: Trapping 23, Hunting 16). MC17 and MC18 also reported hunting along the railroad that goes into Pukatawagan (Figure 2b: Hunting 27). MC3 used the moose hide to make sling shots to hunt ptarmigan (Figure 2b: Hunting 18). MC4's mother used moose hide to make moccasins, mitts, and parkas. Historically, moose hides were used for tents.

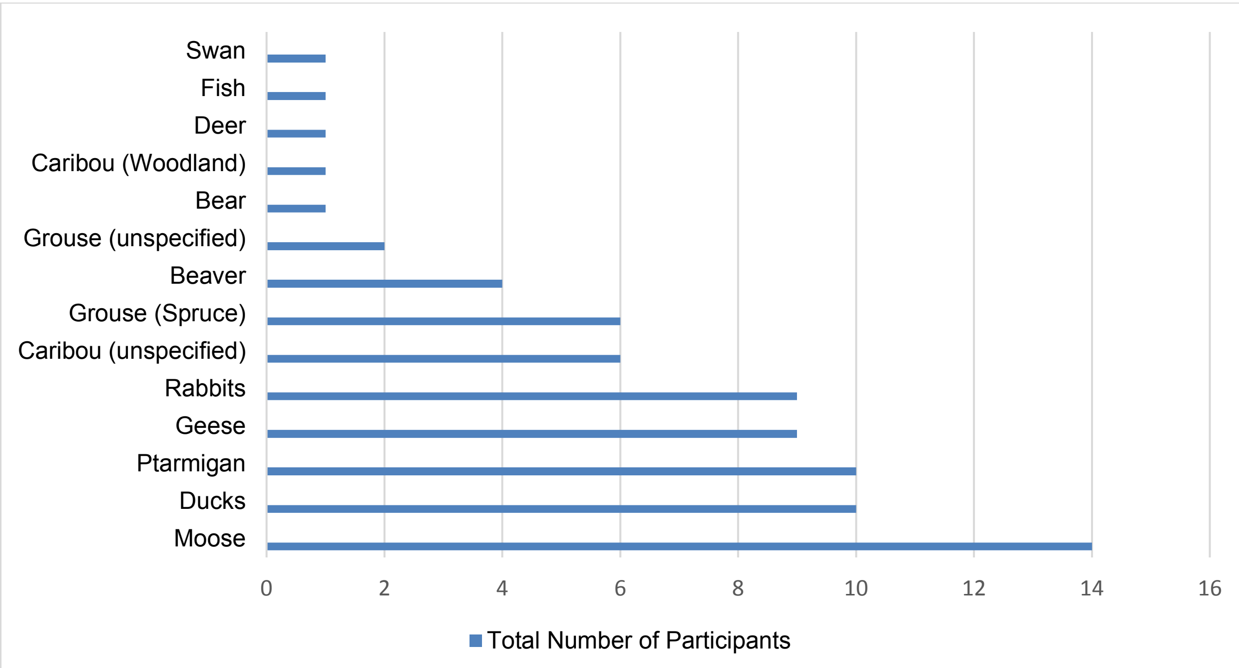
MC7 would hunt while out on the trap line around Douglas McKay, Koshelanyk, and Glasspole lakes, to south along the Laurie River (Figure 2c: Hunting 31). MC8 would hunt animals in MC8's trapping areas (Figure 2b: Hunting 19, 20, 21, 22, 23, and Trapping 22), for food and furs. MC8 hunted a variety of game including moose, beaver, rabbit, and, occasionally, bear.

MC1 often spent winters hunting and trapping with extended family in a large area northwest of Pukatawagan (Figure 2c: Hunting 28). MC1 observed large numbers of woodland caribou in this area until 1954 and hunted them as far north as the Dunphy and Gemmel lakes and around Goldsand and McVeigh lakes (Figure 2b: Hunting 1, 3 and Figure 2c: Hunting 28). Both MC6 and MC7 recalled that they no longer hunted caribou (barren ground) because they are not as numerous, even at the historical caribou hunting grounds around McGavock Lake (Figure 2c: Hunting 30). MC8 shared that the last time caribou were hunted in the region was in 1953, south of Cockeram Lake (Figure 2b: Hunting 12). MC11 and three siblings would hunt caribou near Eden Lake (Figure 2b: Trapping 23). MC4 was always on the lookout for animals to hunt while working the trap line near Goldsand Lake and Little Brightsand Lake (Figure 2b: Trapping 2). MC4 hunted and ate moose in this area as well as caribou until about 1952.

MC10 would snare rabbits during the winter (Figure 2b: Hunting 5, 6) as did MC15 and MC16 (Figure 2a). In addition to moose and caribou, MC17, MC18, and MC19 hunted beaver and rabbit. MC10 also harvested ptarmigans, chickens (spruce grouse), ducks, and geese (Figure 2b: Hunting 5, 6). MC15 and MC16 harvested chicken, ptarmigan, and duck (Figure 2a). MC3 hunted spruce grouse, ducks, and geese in the spring. Both MC6 and MC7 hunted ducks and geese while away from the trap line in the spring and summer. MC13 would hunt geese in the spring near the rapids on Hughes River. MC17, MC18, and MC19 hunted a variety of birds including geese, ducks, chickens (spruce grouse), and ptarmigans. MC18 also hunted birds at Black Sturgeon with the kids in the community (Figure 2b: Hunting 17). MC8 also hunted for different kind of birds including goose, for meat and down, as well as swans and ptarmigans. MC8 identified Pilote Lake as an area for hunting swans in the spring (Figure 2b: Hunting 14). MC4 reported that areas with flowing water were good for bird hunting. Specifically, rivers north of Goldsand Lake are excellent goose hunting locations because they do not freeze and the birds do not have to leave during the winter (Figure 2b: Trapping 2).

See Table 4-1 for a tally of participants who report hunting species.

Table 4-1: Tally of Participants Who Report Hunting Species*



*note: this is not an inventory of numbers hunted, simply an indication of how many participants report hunting a species in the oral histories

4.1.2 Trapping

The ancestral members of MCFN had been commercially trapping since the arrival of the HBC in the 1670s. Beaver was the most sought-after animal but during the early 1800s there was a major decline in the beaver population, so the range of animals trapped was expanded. Trapping is no longer a major source of revenue because of a decline in fur prices. MC4 said that some people still make a living trapping; however, MC18 observed that not too many young people are currently engaged in trapping. MC6 has noticed an increase in animal populations because fewer people are trapping.

MC1 trapped muskrat at Cockeram, Simpson, Swede, and Ellystan lakes (Figure 2b: Hunting 4 and Trapping 14), and mink at Goldsand Lake (Figure 2b: Trapping 1), whereas beaver were not plentiful. MC1 trapped in the area around the Dunphy Lakes and throughout the area east towards Black Sturgeon (Figure 2c: Trapping 28). MC2 also specialized in trapping muskrat as they were very plentiful. MC2 recounted that each trapper would have thousands of muskrat pelts. The trappers would also sell mink, weasel, and beaver pelts. MC2 trapped around Eagle Lake (Figure 2b: Trapping 5).

MC3 began trapping at the age of 20 years on a trap line at Little Britan Lake, near the Manitoba-Saskatchewan border and later trapped and hunted around Hughes Lake (Figure 2b: Trapping 18). MC3 retired from trapping 40 to 50 years ago. MC4 trapped mink, otter, muskrat, fox, and wolverines (Figure 2b: Trapping 2, 3). MC4 disliked wolverines because they are very smart and would steal animals from the traps. MC4 trapped around Cockeram

Lake. MC4 also reported that there had been a trapper with a trap line near Fox Lake Mine (Figure 2c: Trapping 30). MC10 trapped marten, lynx, fox, otter, and beaver in the winter, as well as muskrat in the spring and fall. MC10 trapped at Anson and Cartwright lakes (Figure 2b: Trapping 7, 10).

MC7 acquired a trap line from MC7's brother-in-law in 1992 and still actively works the line. The trap line is around Douglas McKay, Koshelanyk, and Glasspole lakes, and extends further south along the Laurie River (Figure 2c: Trapping 31). MC7 primarily traps beaver but also harvests marten and mink. MC6's trap line was further to the southwest and reports trapping marten, weasel, beaver, and otter.

Most of MC11's winters were spent on a trap line that spread over a large area from Chepil Lake east to Swede Lake, south to near Eden Lake, and north back to Chepil Lake (Figure 2b: Trapping 15, 16, 17, 23). Mammals trapped by MC11 included mink, lynx, beaver, muskrat, and otter.

MC12's main trapping area extended from the north end of Cockeram Lake south to Anson Lake and many small rivers, creeks, and lakes within this area (Figure 2b: Trapping 8, 25, 26). MC12's family trapped and traveled around Eden Lake and along the Numakoos River south toward Granville Lake (Figure 2b: Trapping 27). Trapping was MC12's livelihood and MC12 caught whatever was available, including beaver, fox, lynx, wolverine, otter, mink, muskrat, and wolf.

MC13 trapped from Hughes Lake to Eden Lake along the Hughes River (Figure 2b: Trapping 13). MC13's family trapped mostly beaver as well as otter, mink, and rabbits. MC13's father's generation had traditional territory around Eden Lake (Figure 2b: Trapping 12).

MC14 spent many winters on their trap line located at Rabbit Lake (Figure 2c: Trapping 29) and would trap a variety of animals including beaver and mink. They would also snare rabbits for food as well as for clothing.

The family trap line of MC15 and MC16 was located between Laurie River and Granville Lake and included the area around Rosie (northeast of Elvyn Lake), Seahorse, Trophy, and Oyster (southwest of Numapin Lake) lakes (Figure 2a). MC15 and MC16 primarily stayed in their cabin on the trap line, but would stay in a tent if they traveled too far away to return by the end of the day. The mammals they trapped included beaver, muskrat, mink, otter, rabbit, and lynx. They did not trap wolverine. MC16 related a preference for snares instead of leg traps and that occasionally bears would get into the snares. If the snared bear was still alive when they checked their trap line, they shot it and fed the meat to their dogs.

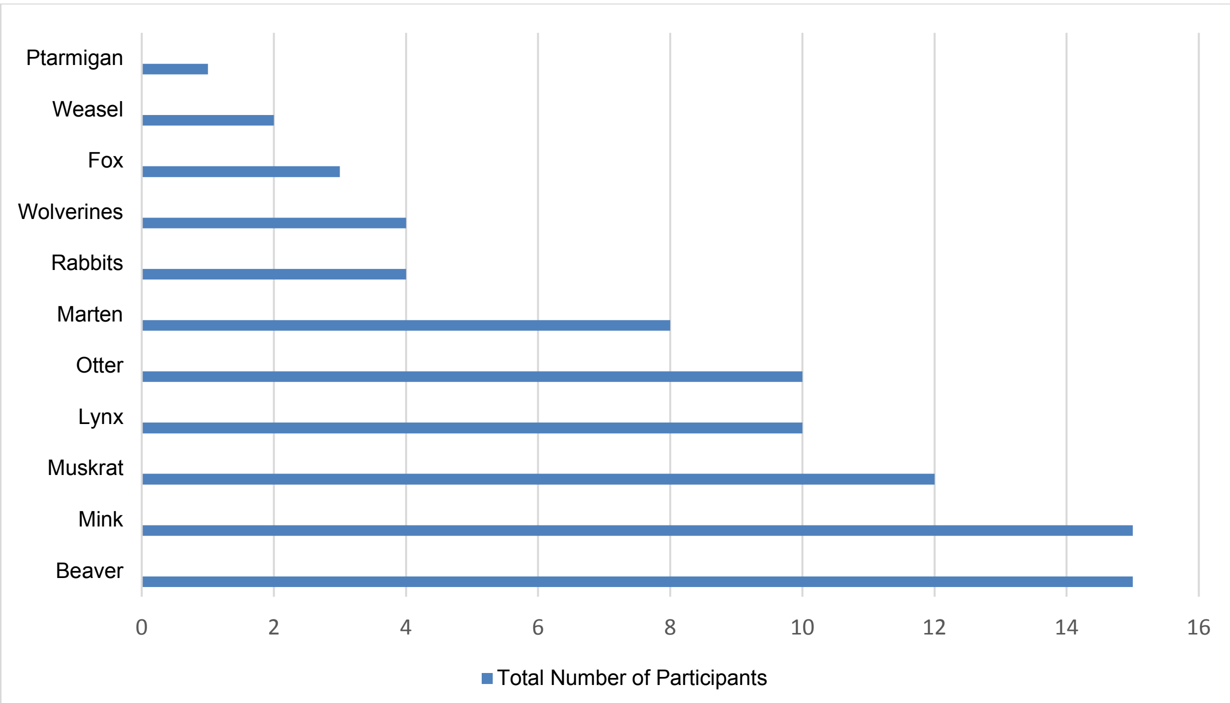
MC17, MC18, and MC19 are active trappers and have spent many winters trapping mammals that include beaver, muskrat, lynx, mink, and marten. They maintain a base camp at Mile 7 (Figure 2b: Trapping 9). MC17, MC18, and MC19 observed that fur prices are very low compared to what they used to be and it is now difficult for people to make a living trapping. Trapping is now more of an occasional activity but MC17, MC18, and MC19 agreed that more people would trap if fur prices were higher and if there was still a fur buyer in Lynn Lake.

MC8 spent most of the time living off the land by trapping, hunting, fishing, and gathering plants and berries for medicine and food. MC8's main trap line north of White Owl Lake and the Gordon site extended south around Hughes, Westdal, and Wetikoeekan (Sasquatch) lakes, then back north to White Owl Lake (Figure 2b: Trapping 19, 20, 21, 22). MC8 also had another trap line with a camp around Eden Lake and one around Sickle Lake (Figure 2b: Trapping 24 and Figure 3b: Habitation 19, 20). Mammal species that MC8 trapped included mink, lynx, beaver, otter, wolverine, muskrat, and wolf. MC8 recounted a story about the first-time s/he had trapped a marten but had not known it was a marten, because they were very rare at the time. MC8 had to take the animal to her/his father to identify it. MC8 would continue to trap many marten as their population increased.

MC9 trapped a variety of species of mammals including lynx, mink, otter, beaver, and marten. MC9 also trapped wolverines when possible, but they were tough to get because they are a very smart animal. MC9 trapped 20 miles along the river and went back to see the old trapline with his/her child, but the area is all burned.

See Table 4-2 for a tally of participants who report trapped species.

Table 4-2: Tally of Participants Who Report Trapped Species*



*note: this is not an inventory of numbers trapped, but an indication of how many participants who report trapping a species in the oral histories

4.1.3 Harvesting Plants

Plant harvesting for food, medicines, fuel, shelter, and transportation has been an integral part of MCFN culture since their ancestors first inhabited northern Manitoba. Indigenous people have gained substantial knowledge of plants and their uses that has been transmitted from generation to generation as part of oral traditions (Uprety, Yadav, Hugo Asselin, Archana Dhakal, and Nancy Julien 2012).

4.1.3.1 Food Plants

MC2 picks berries and explained that at the time of the interview (October) cranberries were abundant, but it was too late in the season for raspberries or blueberries. Muskeg Lake is an example of an area where MC2 would pick berries (Figure 2b: Plant Gather Food 4). MC3 picks berries in the summer and stated that cranberries and blueberries are usually abundant at Russel Lake, near the Fox Mine (Figure 2a). MC5 gathered berries with Elders including blueberries, saskatoons, strawberries, cranberries, raspberries, moose berries, and orange-coloured berries (possibly cloudberries). MC8 picked berries, mostly cranberries, along a canoe route with a series of portages from the Eden Lake area into Granville Lake and then by the Churchill River to Pukatawagan (Figure 2a, Figure 2b: Plant Gather Food 7). During the summer, MC9 picks blueberries, cranberries, and moss berries around Moses and Anson lakes (Figure 2b: Plant Gather Med 3) and noted that in 2016 there was an abundance of berries so one does not have to go far to find them. MC10 would pick cranberries, blueberries, and moss berries. MC10 said there is always an abundance of berries in the summer (Figure 2b: Plant Gather Food 2, 3 and Plant Gather Med 4, 5). MC11 mentioned that there are few berries around the area except for at Hughes Lake where there are blueberries and cranberries (Figure 2b: Plant Gather Food 6). MC12's family would also gather cranberries and blueberries around the edges of Cockeram Lake (Figure 2b: Plant Gather Food 1).MC13 picks raspberries and strawberries in July, collects blueberries in August, and cranberries in September. MC13 stated that the berries are abundant everywhere. MC14 also picks blueberries and cranberries in the summer. In the summer when they were home from the trap line, MC15 and MC16 would pick many different berries including blueberries, cranberries, and strawberries. They would pick saskatoons when they were on the Churchill River. MC17, MC18, and MC19 recalled that every summer, people in the area gathered blueberries, chokecherries, and cranberries. They related that berry picking is often the best in recently burned areas such as around Black Sturgeon (Figure 2b: Hunting 17) and Cockeram Lake (Figure 2b: Fishing 11).

MC5 also collects wild carrot that is usually found in the bush away from rivers or lakes.

MC5 would dry and crush orange-coloured berries to make a natural sugar. MC5 used berries in cooking and were often eaten with fish and potatoes. MC8 would eat the cranberries with dried fish. MC15 and MC16 said that their mother often made jam with the berries that they picked and served it with bannock.

Labrador tea was also collected by MC10 and prepared as a beverage.

MC5 also harvested birch and poplar sap. Birch sap had to be collected in May because the sap is gone by late May or June. Birch sap was mixed with muskrat or beaver tail to make a laundry soap. Poplar syrup is taken from underneath the bark and tastes like pineapple. MC5 stated that now there is less sap flowing in the birch trees.

MC15 and MC16 did not gather any plant foods nor did they harvest or use traditional medicines.

4.1.3.2 Medicinal Plants

Many participants collect medicinal plants during the summer. MC2 mentioned that there were a lot of medicines, but that people "don't know how to use them anymore." Muskeg Lake is an example of an area where medicinal plants can be gathered (Figure 2b: Plant Gather Med 6). MC8 spends time in the summer gathering plants for medicines and picking berries for food. MC8 told us that many varieties of medicines could be collected between Hughes and Eden lakes (Figure 2b: Plant Gather Food 5, 7 and Plant Gather Med 7, 8, 9). Medicines collected included beaver pineapple (*waskatamiw*, probably small yellow pond lily), rat root, seneca root, mint, and chaga fungus from birch trees. MC17, MC18, and MC19 gather medicines in the summer, including spruce gum (for sores and cuts), seneca root, rat root, herbs, chaga (birch fungus), and a variety of herbs.

MC2 collects rat root (*Acorus calamus* Photo 1), which is chewed for energy and to treat colds. *Wîhkês*, (pronounced "weekees"), the Cree word for rat root, is used by MC3 to treat colds. Rat root is purple, smells minty, and is found along shorelines. MC3 stated that rat root occasionally burns the tongue when chewed. MC5 has found that traditionally harvested plants in the area were previously more abundant. MC5 uses rat root to make a tea to treat colds. Both MC6 and MC7 gather medicines in the spring and summer when away from the trap line. They collect rat root from the Churchill and Laurie rivers (Figure 2c: Plant Gather Food 8) and from Jackson Lake (Figure 2c: Plant Gather Med 12) where there is an abundance of medicinal plants. MC9 gathered rat root west of Lynn Lake at the north end of Frances Lake (Figure 2b: Plant Gather Med 11). MC9 would gather the rat root when the water level was low because one must wade in about 0.5 m of water to pick the root where it grows on the bottom of the lake or river. MC11 uses the summer months to gather country foods and medicines and gathers rat root, pineapple root, and mint (Figure 2b: Plant Gather Food 6). These plants were often collected near rapids and prepared to treat ailments such as colds and headaches. MC12's family collected rat root along the smaller rivers and lakes in the Cockeram Lake area (Figure 2b: Plant Gather Med 1, 2). MC14 gathers rat root and spruce gum in the summer.

Photo 1: Rat Root at Home of MC2

There were several medicines in MC2's home at the time of the interview, including the tip of the sprig of a young spruce tree used for cuts and wounds to prevent infection and scarring. MC2 also had spruce gum used to treat headaches, migraines, and eczema. MC4 has a scar on his/her wrist that was healed with spruce gum and recounted that young birch tree roots can be used to treat infections and heal vital organs.

MC10 related that the fungus on birch, also known as chaga mushroom or true tinder fungus (*Inonotus obliquus)*, can be used for treating cancer and pneumonia. MC10 has also used chaga in a tea mixed with salt for headaches or cold chills. The medicine was particularly beneficial when consumed after a long walk. MC8 stated the fungus was used to treat serious ailments including cancer and pneumonia. MC17, MC18, and MC19 identified Goldsand Lake as a medicine gathering location (Figure 2b: Plant Gather Med 10).

MC3 also collects mint, which grows on shorelines and in boggy areas, and uses the leaves to make tea. MC4 recalled that a traditional healer used bear root, a very powerful medicine that can be collected in the area, to prevent the spread of the flu.

MC17 stated that there is a green substance underneath poplar tree bark that can be chewed or boiled in water to make tea for a cold remedy. MC17 joked that is why "beavers don't get pneumonia."

MC2 also collected frog's ears, a type of moss.

MC13 does not pick traditional medicines but, in return for an offering, acquires medicinal plants or plant preparations from people who collect medicine.

4.1.3.3 Construction and Fuel Plants

MC2 recalled that their cabins were built with whatever wood was available at the site, but they preferred to use jack pine because the logs were straighter. Moss was used to chink the walls and birch bark was collected for roofing. A layer of sand was placed on top of the bark to act as a sealant to keep MC2's family dry and warm. MC2 had a wood fireplace inside the cabin for cooking and heating. MC13 constructed a wooden smoke house to preserve beaver, moose, or fish and would use dry shrubs like willows to smoke.

MC7 stated that s/he cut wood for the stove near Cockeram Lake in the spring and let it dry during the summer. MC7 also gathered winter firewood in the summer so that there was time for it to dry and cure. MC12's family collected wood near their camps to fuel their woodstoves for heat, cooking, and boiling water. MC17, MC18, and MC19's camps also had woodstoves. They gathered standing dead wood or cut and dried wood near their camp for stove fuel.

MC10 spoke about using fungus collected from birch trees to light fires and referred to historical role of fire keepers. There were usually three fire keepers and they were responsible for transporting the fire from camp to camp and used the fungus as tinder.

MC11 cut and dried pine, spruce, or birch for tent poles.

MC4 recalled using birch wood to make toboggans. MC2 made snowshoes using young birch for the frame and caribou hide webbing. Toboggans were also made from green birch. MC2 would boil water and soak half-metre

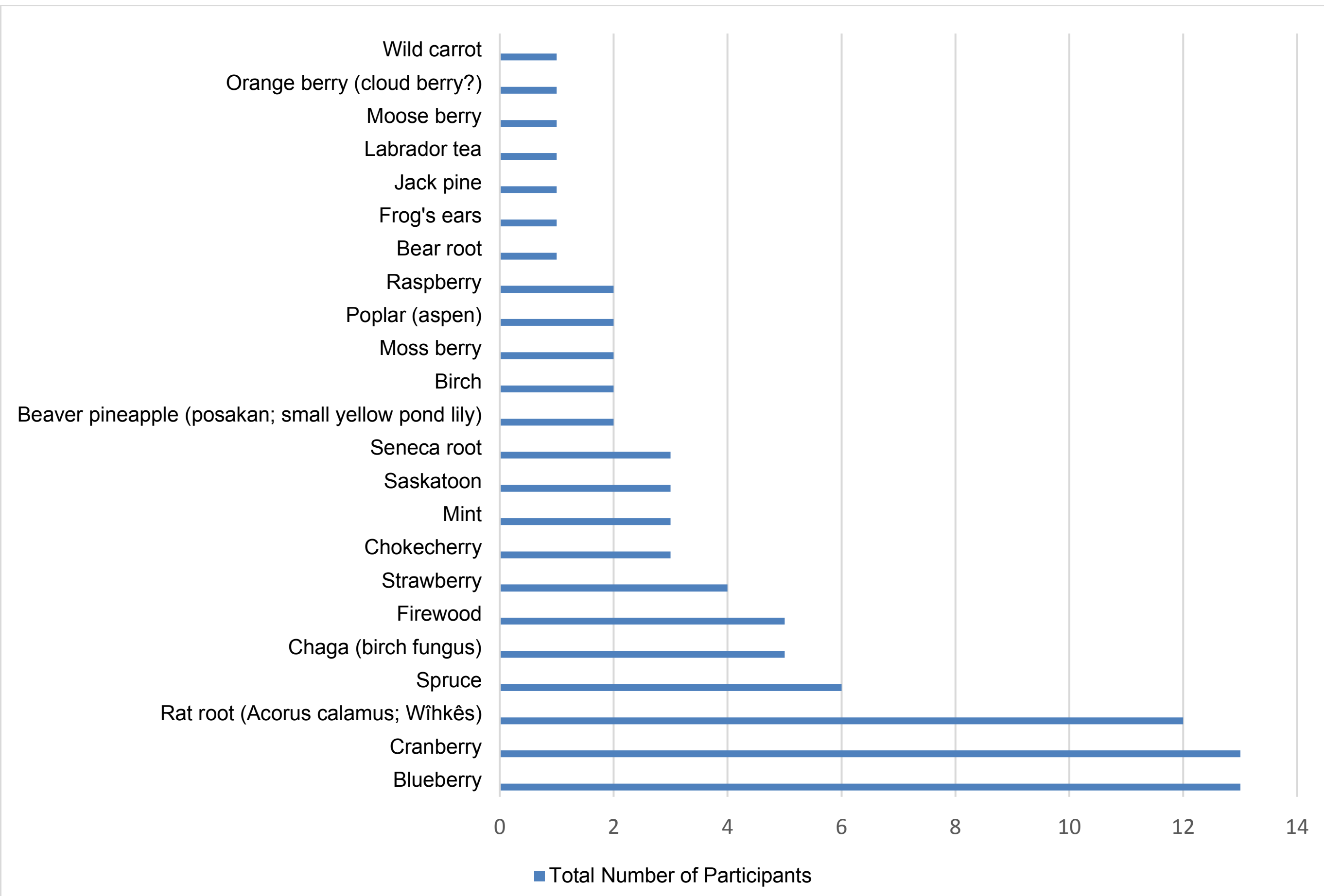
(1½-foot) lengths of birch in the water for a few days until the wood was pliable and bendable. This generally produced a toboggan or sled that was 0.6 m (2 feet) wide.

MC13 stated that birch bark canoes used to be made but the skill of building canoes was lost when manufactured canoes became available. MC13 used birch to make one ski and would find the tallest hill and ski down the slope on the one ski.

MC14 stated that his/her partner used to make snowshoes with birch and moose hide.

See Table 4-3 for a tall of participants who report harvesting plant species.

Table 4-3: Tally of Participants Who Report Harvesting Plant Species*



*note: this is not an inventory of numbers of plants harvested, but an indication of how many participants report harvesting a plant species in the oral histories

4.1.4 Fishing

Fishing is an important food source for all participants in this study. Historically, the summer and fall fisheries areas were gathering places as these were reliable harvesting locations. The dog teams essential to winter trapping and hunting were fed almost exclusively fish. The commercial fishery is also important to the wage-based economy.

MC1 stated that spring was the best fishing time. This was when most fish species spawned, and they were plentiful in areas of moving water such as the Keewatin and Lynn Rivers. MC1 fished for northern pike, whitefish, and walleye for food, not sale, at Cockeram Lake (Figure 2b: Fishing 8) and remembered large numbers of spawning sturgeon in Chepil Lake (Figure 5b: Environ Obs 1) and in Hughes Lake, where, in the 1950s, there was a large population (Figure 2b: Fishing 15 and Figure 5b: Environ Obs 2). MC1 identified Simpson, Swede, and Ellystan lakes as fishing areas that were abundant in whitefish (Figure 2b: Fishing 24). MC1 spoke of jumbo whitefish at Simpson Lake whose population was “totally depleted” after the Farley Lake Mine opened. MC2 and a sibling fished with nets and once they set the nets, it would only take a few hours before they would be filled with sturgeon and whitefish (Figure 2b: Fishing 14). MC17 camps on the west shore of Eden Lake during the summer and stated that there is good walleye and northern pike fishing in that lake. MC17, MC18, and MC19 said that Eden Lake (Figure 2a) has good walleye and northern pike fishing; Cockeram Lake (Figure 2b: Fishing 10, 11) is a good place for northern pike; and Hughes River and Hughes and Chepil lakes are good sturgeon fisheries (Figure 2b: Fishing 17, 18, 19).

MC3 fished while trapping in the winter and in the spring and caught mainly walleye using nets. MC3 fished at Hughes Lake (Figure 2b: Fishing 20). Russel Lake was the best lake MC3 ever fished, especially at Big Sand point. MC3 would eat the fish and use them to feed the dogs. MC4 also caught fish to feed the dogs. MC4 shared that Narrows Lake (the traditional name for Goldsand Lake) is a good lake for fishing, especially near the narrows (Figure 2b: Fishing 1). MC5 shared that fish taste different depending on the lake from which they are caught. MC5 stated that fish caught in lakes with stagnant water do not taste as good as those obtained in lakes with flowing water or in rivers. MC6 and MC7 also fish for food while working on their trap lines. They catch walleye, sturgeon, goldeye, lake trout, whitefish (tullibee), and northern pike in areas including Flatrock, Hughes, and Glasspole lakes, as well as on the Churchill and Laurie rivers (Figure 2b: Fishing 21 and Figure 2c: Fishing 45, 47). They stated that fish spawn in rivers and creeks, especially where there are rapids. MC8 would set nets in lakes to catch whitefish, walleye, northern pike, tullibee, and sturgeon when hunting and trapping in the winter fish at Wetikoeekan (Sasquatch), Swede, Simpson, and Ellystan lakes (Figure 2b: Fishing 29, 30, 31, 32). “Where there’s fish, that is where we would set our nets,” MC8 added that Ellystan Lake was a good location to catch jumbo whitefish. MC8 would often snare fish in the spring when they were spawning in the rivers and rapids (Figure 2b: Fishing 32). A good place to snare sturgeon was between Hughes and Chepil lakes (Figure 2b: Fishing 22). MC10 primarily fished at Cartwright and Anson lakes (Figure 2b: Fishing 13 and Hunting 6) but moved to other lakes when there seemed to be fewer fish. MC10 would catch walleye, northern pike, and suckers. MC10’s favourite fish to eat are walleye and northern pike. MC11 would usually catch a variety of fish including whitefish, walleye, northern pike, and lake trout. MC11’s favourite fish to eat are northern pike and walleye. MC11 believes that the best place to fish was Wetikoeekan (Sasquatch) Lake (Figure 2b: Fishing 25). MC12 fished at Cockeram, Moses, and Anson lakes (Figure 2b: Fishing 9) and along the Keewatin River (Figure 2b: Fishing 41, 42).

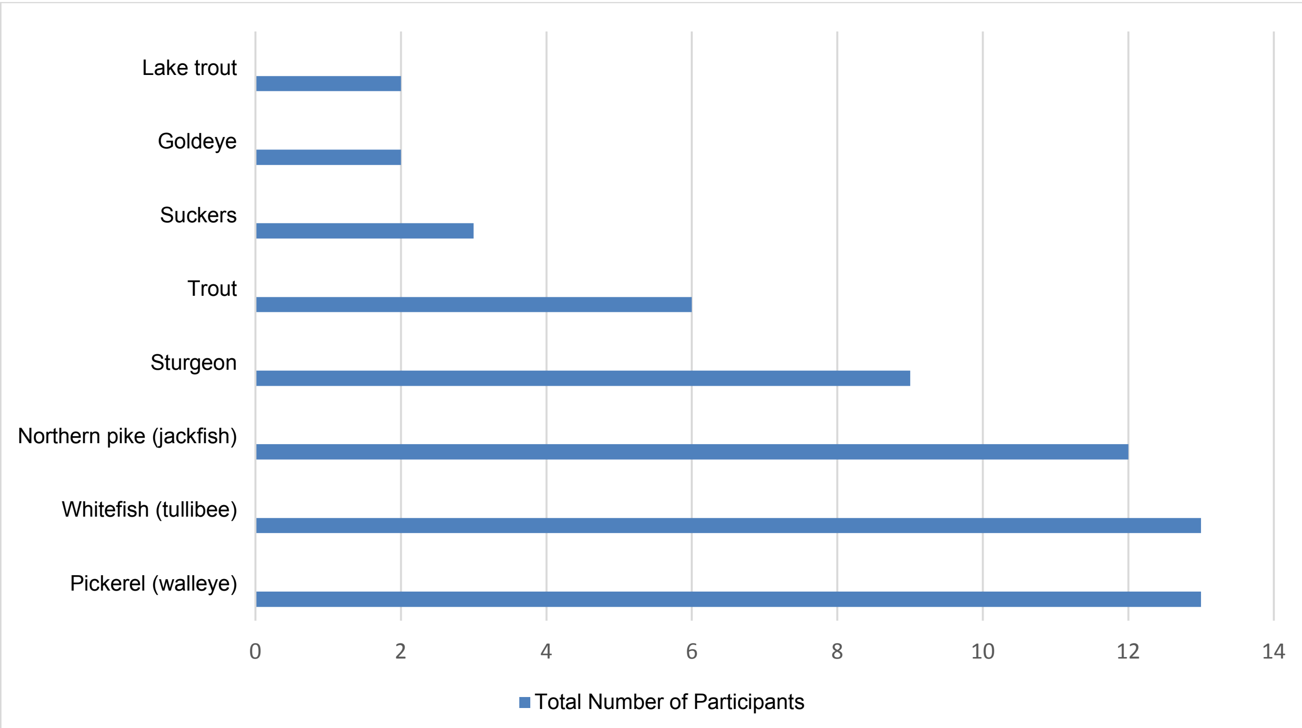
When younger, MC13 would net fish in both the winter and spring at the Hughes camp (Figure 2b: Fishing 26, Fishing 28). MC13’s family would fish for jumbo whitefish at Swede Lake, black sturgeon at Chapel Lake, and walleye by the mouth of the Eagle River on Hughes Lake (Figure 2b: Fishing 16, 26). MC13 would fish along the Hughes River from Hughes Lake to Eden Lake (Figure 2b: Fishing 27). People who lived at Granville Lake would trap and commercial fish in a large area between Granville and Sickle lakes (Figure 2a). Currently, MC13 primarily fishes at Eden Lake using rod and reel or netting and catches northern pike, walleye, and whitefish (Figure 2b: Fishing 40). MC11 also mentioned fishing for whitefish, pickerel, and northern trout at Eden Lake (Figure 2b: Fishing 39). While out trapping, MC14 would chop holes through the lake ice to collect drinking water and would also use the holes to catch lake trout. They would also catch trout in the summer. MC14 had no preference for what season they were caught, as it was their favourite fish to eat, especially when smoked. MC14 said that trout are more abundant in the lakes to the west around McGavock Lake and become less abundant to the east around Lynn Lake.

MC15 and MC16 would regularly catch northern pike, whitefish, suckers, and walleye, which was their favourite fish to eat.

MC17, MC18, and MC19 fish commercially and for food. MC17 said, “I’ve been in nearly every lake in here,” while pointing at the topographic map of the Gordon and MacLellan areas. Specifically, MC17, MC18, and MC19 recounted commercial fishing for walleye, northern pike, and whitefish at Dunsheath Lake (Figure 2b: Fishing 5). When fishing at this lake, nets were checked daily and the caught fish were shipped by plane every second day. The fish were sold to the Co-op in Leaf Rapids and the fish market in Winnipeg. MC17, MC18, and MC19 said that there were regulations in place for the slot sizes of the nets used for catching certain species of fish. Whitefish and trout have a larger slot size than species such as northern pike and walleye. These regulations are in place to sustain the fish populations. MC17, MC18, and MC19 can use any net slot size to catch the fish for personal consumption. MC9 reported that there was very good fishing at Laurie, McGavock, and Edgar lakes (Figure 2c: Habitation 30). MC9 commercial fished at Galligher, Goldsand, Wells, Barrington, Swede, Simpson, Ellystan, and Dunsheath lakes (Figure 2b: Fishing 2, 3, 4, 6, 7, 34, 35, 36). Some lakes were noted for more of a certain fish species than other lakes. For example, MC9 would catch a large quantity of lake trout near the camp at the north end of Barrington Lake (Figure 2b: Fishing 7 and Figure 3b: Habitation 6), but found that jumbo whitefish were more plentiful in Swede, Simpson, and Ellystan lakes (Figure 2b: Fishing 34, 35, 36).

MC9 would mainly guide for American fishermen who wanted to catch northern pike and walleye.

Table 4-4: Tally of Participants Who Reported Catching Fish Species*



*note: this is not an inventory of numbers of fish harvested, but an indication of how many participants report harvesting a fish species in the oral histories

4.2 OCCUPANCY, TRAILS AND TRAVELWAYS

Successful land occupancy is dependent on adequate trails and travelways. Historically, as today, travel was seasonally restricted because lakes and rivers needed to be solidly frozen and there needed to be adequate snow cover to permit dog team, and later bombardier and snow mobile, and pedestrian travel. Conversely, lakes and rivers needed to adequately thaw to allow boat transport. All participants have lived in cabins and/or camps and traveled extensively throughout the region over land and on water using long established trails and routes.

When hunting and trapping, MC1's family regularly moved to different areas to build camps around Dunphy, McGavock, Simpson, and Goldsand lakes and along the Hughes River (Figure 3b: Habitation 3, 8, 26 and Travel 1; Figure 3c: Habitation 27 and Travel 34). MC1 used several travel routes to access areas in northern Saskatchewan and Manitoba. One travel route connected the Churchill River to Vandekerckhove Lake. When traveling along this route, MC1 would pass through Cockeram and Goldsand lakes (Figure 3b: Travel 7). A second route went from Reindeer Lake in northern Saskatchewan to the Churchill River and extended through Chepil and Hughes lakes (Figure 3b: Travel 8). The camps were located wherever food was abundant because it "is like finding gold—you know you're going to survive." MC1 spoke about access to Simpson, Swede, and Ellyston lakes and how it used to be seasonal access with canoe and dog team (Figure 3b: Travel 1).

MC2 and an older sibling trapped in an area around Muskeg and Eagle lakes and had four cabins along the trap line (Figure 2b: Trapping 6; Figure 3b: Habitation 22 and Travel 5, 6; and Figure 4b: Trad Activities 1). MC2 is the third generation of their family to trap in this area. MC2 traveled north by canoe from the Churchill River through many lakes including Granville, Sickle, and Hughes and Chepil to access their trap line. MC2 recalled leaving Granville Lake in a canoe in August of 1949 and arriving at Muskeg Lake in September (Figure 3b: Travel 21).

MC3 has lived in a cabin near the mouth of the Hughes River while trapping and on the Churchill River near the community of Highrock (Figure 3b: Habitation 12).

MC4 worked on her/his father's trap line until ca. 1953 then traveled north by canoe to an area around Narrows Lake (the traditional name for Goldsand Lake) and Little Brightsand Lake and lived in a cabin on an island in Goldsand Lake (Figure 3a and 3b: Habitation 1, 2 and Travel 22). MC4 reported that there had been a trapper with cabins near Fox Lake Mine (Figure 3c: Habitation 28). When the trapper refused to sell the trap line, MC4 said the cabins were destroyed.

MC7 had a cabin at Glasspole Lake (Figure 3c: Habitation 29). MC7 was a fishing guide at a fly in fishing lodge on McGavock Lake (Figure 2c: Fishing 46) and used the travel route from the lodge to Jackson Lake (Figure 3c: Travel 36). MC6 was born in Pukatawagan and, except for a short period in the teen years, has always lived there.

MC8 indicated several travel routes used while hunting and trapping; particularly, a north to south winter road to White Owl Lake, located east of the Gordon site, that connects with an east to west Bombardier trail from Westdal Lake, situated south of Black Sturgeon (Figure 3b: Travel 25). MC8 also identified a road to a boat launch on Hughes Lake (Figure 3b: Travel 23).

MC8 also identified a travel route from Elizabeth Lake to Manson Lake to Ellystan Lake (Figure 3b: Travel 24). The first time MC8 and her/his siblings traveled that route they used a team of four dogs and a sled (Figure 3b: Travel 24). Later MC8 used a snowmobile to travel this route. MC8 pointed out a portage from an unnamed lake to Swede Lake in this trapping area (Figure 3b: Travel 26) and also two winter portages from Hughes to Chepil Lake (Figure 3b: Travel 17 and 27). MC1 highlighted that the areas around Black Sturgeon are connected by river or winter portage (Figure 3c: Travel 34). MC8 knew of a winter road from Muskeko Lake to Ospawakun Lake, one from Swede Lake to Eden Lake, and also one from Swede Lake to White Owl Lake (Figure 3b: Travel 30, 31). In the summer MC8's family would travel by canoe back to Pukatawagan using a variety of routes. One of the canoe routes with a series of portages identified by MC8 was from the Eden Lake area into Granville Lake and then by the Churchill River to Pukatawagan (Figure 3b: Travel 28, 29). MC8 identied a camp on Eden Lake (Figure 3b: Habitation 20).

MC9's first trap line was located near Reindeer Lake but MC9 also trapped near Granville and Dunsheath lakes, and areas near Black Sturgeon and Hughes Lake (Figure 3b: Habitation 4, 6). MC9 also identified a travel route that connects Sickle Lake with Willis Lake (Figure 3b: Travel 32).

MC10 worked with another trapper near Cartwright Lake, where they had neighbouring cabins (Figure 2b: Trapping 10). MC10's cabin is pictured in Photo 2. MC10 eventually abandoned the trapping cabin as it became old and unlivable.

Photo 2: MC10's Cabin

MC11 and their siblings had cabins at Swede, Elizabeth, and Wetikoeekan (Sasquatch) lakes, and on an island at Eden Lake (Figure 3b: Habitation 9, 14, 15, 16, 17). They traveled between these cabins along the Hughes River (Figure 3b: Travel 9).

MC12 was a trapper and hunter with camps at Cockeram Lake and on the Keewatin River (Figure 3b: Travel 2). Typically, MC12's family would live in camps year-round and continued to stay in a camp while trapping even after MC12's father built a house by the road (Figure 3b: Travel 3) following construction of the local highway. MC12 identified numerous travel routes, including to the town of Lynn Lake and trapping areas (Figure 3b: Travel 10, 11, 12).

When MC13's grandfather was a child, he sailed across James Bay from Quebec with his father, MC13's great grandfather. MC13's family first settled near One Mile portage by Burnwood Lake, southeast of Pukatawagan (Figure 3b: Travel 13). Their travel routes passed throughout their traditional territory as the Churchill River could be used to access Granville and Highrock lakes and then Pukatawagan. The Churchill River could also be traveled west of Pukatawagan to reach Sisipuk Lake. From One Mile portage the Churchill River could be traveled northeast into Granville, Opachunau and Southern Indian lakes to access the Barrington, Melvin, Eden, and Big Sand Lake areas (Figure 3b: Travel 13). MC13's grandfather spent most of his time on the Churchill River frequently moving to new areas where there was an abundance of food. In the winter, the family settled in the South Indian Lake area. The Dene were living in the area at that time, but they and the Cree made an agreement about hunting territories and erected a pole north of Big Sand Lake to mark the boundary between the Cree and Dene territories. MC13's mother was born on Eden Lake (Figure 3b: Trad Loc 1) and, although unsure of the exact location, MC13's father was either born in Pukatawagan or along the Churchill River. MC13's father's family lived near the mouth of the Hughes River on Eden Lake. It was during MC13's parents' generation that trapping blocks were established and they trapped in Block 32 (Figure 3b: Trad Loc 2).

MC13 reported that Prairie River near Highrock on the Churchill River was supposed to be the main reserve, but the people chose to live at Pukatawagan, which means "good fishing place," and a reserve was later established at that location (Figure 3a). The land at Prairie River for the Mathias Colomb Reserve was surveyed in 1928. However, due to many disagreements regarding the survey and the identified land, the survey was never completed after the 1930s *Natural Resources Transfer Act*.

In the winter, MC13 would travel by train to Lynn Lake to get supplies and travel by dog team along a Bombardier trail. The Bombardier trail went from the community of Lynn Lake to the community of South Indian Lake (Figure 3b: Travel 15). MC13's late sibling's cabin still stands at South Indian Lake (Figure 3b: Habitation 24). They also have cabins on Wetikoeekan (Sasquatch) Lake and Hughes River (Figure 3b: Habitation 23, 25).

As a child, MC14 traveled with parents and siblings through the Eden Lake area (Figure 3b: Travel 16). MC14's spouse maintained a trap line on Rabbit Lake northwest of McGavock Lake and south of the Fox Mine and would fly to Rabbit Lake from Pukatawagan. They also had a camp on Eager Lake near the dam. They would travel by train from Pukatawagan to the Drybrough siding then travel by canoe along the Laurie River into McGavock Lake and then into Eager Lake. They would go to the trap line in the late fall and return to Pukatawagan in the early spring. MC14 stopped going to the trap line in the mid-1950s.

MC15 and MC16 traveled from Pukatawagan through Highrock, Granville and Wheatcroft lakes to access their trap line (Figure 3a). Travel by snowmobile is possible between Pukatawagan and Lynn Lake following the railway right-of-way (Figure 3b: Travel 33).

MC17 and MC18 use the railway right-of-way as a travel route for hunting (Figure 3a). MC17 and MC18 identified a water route from Black Sturgeon to Dunsheath Lake along the Hughes River (Figure 3b: Travel 19) and a portage at the north end of Hughes Lake that leads to Chepil Lake (Figure 3b: Travel 4). MC17, MC18, and MC19 also stated that the Keewatin River is commonly used for travel by boat (Figure 3b: Travel 18). MC17, MC18, and MC19 identified the Bombardier road as a travel route from Mile 14 on Provincial Road 391 to Barrington Lake (Figure 3b: Travel 20). MC17 identified a travel route between McGavock and Dunphy lakes (Figure 3c: Travel 35). MC17 and MC18 also know of a cabin and camp on Swede Lake south of the Gordon site (Figure 3b: Habitation 10) and another near a trail by the turn off from the highway close to Black Sturgeon (Figure 3b: Habitation 11).

Table 4-5: Residences, Harvesting Camps and Cabins Mentioned by Participants

Residence
Black Sturgeon (n = 3)
Brochet (n = 1)
Cockeram Lake (n = 2)
Granville Lake (n = 3)
Laurie River (n = 2)
Lynn Lake (n = 3)
Nelson House (n = 1)
Pukatawagan (n = 14)
South End (n = 1)
Sturgeon Landing (n = 1)
Harvesting Cabin/Camp
Barrington Lake (n = 1)
Cartwright Lake (n = 1)
Cockeram Lake (n = 1)
Dunphy Lake (n = 2)
Dunsheath Lake (n = 4)
Eagle Lake (n = 1)
Eden Lake (n = 3)
Elizabeth Lake (n = 1)
Glasspole Lake (n = 1)
Goldsand (Narrow) Lake (n = 2)
Highrock (n = 1)
Hughes Lake/River (n = 3)
Keewatin River (n = 1)
McGavock Lake (n = 2)
Muskeg Lake (n = 1)
Rabbit Lake (n = 1)
Wetikoeekan (Sasquatch) Lake (n = 3)
Sickle Lake (n = 1)
South Indian Lake (n = 1)
Swede Lake (n = 5)

4.3 CULTURAL SITES AND AREAS

MC4 indicated that the narrows on Goldsand Lake is a place of cultural importance as people used to live there and because there are possible burial sites in that area (Figure 4b: Burial Site 1). MC13 recalled an island in Eden Lake where one could visit the grave of a man named Francois (Figure 4b: Burial Site 2). A visitor would offer tobacco provided by an Elder and this would bring luck. It was important while traveling not to camp in certain places to avoid disturbing the spirits of people who had died there. MC4 also reported that there are graves "here and there" near where they camped (Figure 4c: Burial Site 3). MC4's spouse spoke of a baby that passed away at the narrows during the 1919 Spanish flu epidemic. MC17, MC18, and MC19 knew of a burial site on an island at the north end of Hughes Lake (Figure 4b: Sacred Area 2). MC18 and MC19 also reported a burial on an island in Eden Lake (Figure 4a). They also believed that there are numerous burial sites throughout the region as people would be buried "where they fall" (MC17). MC17, MC18, and MC19 reported a sweat lodge at Swede Lake southwest of the Gordon site (Figure 4b: Sacred Area 1).

4.4 EXPERIENCE OF TRADITIONAL LAND AND RESOURCE USE

The following relates to the experiential aspects of traditional land and resource use that participants in the study shared. Apart from species and places, the participants related how harvesting is practiced and what it means to them, their culture, their link to the past and their hopes for future generations.

MC1 began hunting, trapping, and fishing in the 1950s and recognizes a cycle of six seasons: winter, early spring (snow melt), late spring (when everything comes alive), summer, early fall, and late fall (when everything freezes). MC1 typically traveled by canoe in the spring, summer, and fall, and by dog sled team after the first winter snowfall. Trapping was a winter activity so MC4 traveled by dog sled and snowshoes to travel faster in the snow. When traveling between cabins MC2 used snowshoes, dog sleds, and toboggans that they made themselves out of birch and caribou and moose sinew. MC14's spouse made snowshoes with birch and moose hide, but they purchased the sleds and dog harness. MC14 would use a dog team to cut and haul wood in the winter and in the spring they would run along the shore as they paddled. In the winter, MC11 would travel using snowshoes made by their father or by dog team and sled. MC16 used commercially made snowshoes. MC3 also used snowshoes purchased from people who made them in Pukatawagan and recalled having to break trail to reach camp or destinations on the trap line. In the winter time MC13 uses snowshoes to track moose. MC2 would often follow caribou trails; however, MC2 warned that "you have to know where you're going, or else you're in trouble" because of dangers such as rapids. MC3 stated that "nothing was easy" and after one week of trapping one would have to come back just to rest.

MC1 trapped during the late fall and winter and returned to Pukatawagan from late spring until early fall. MC3 typically left Pukatawagan for the trap line in the fall, returned home for Christmas, then went back to the trap line until spring, traveling by dog team and sled, snowmobile, or train depending on the travel conditions. When traveling by dog team everything was packed in the sled. MC8 and siblings used a team of four dogs and a sled the first time they traveled from Elizabeth Lake to Manson Lake and on to Ellystan Lake (Figure 3b: Travel 24). After that, MC8 used a snowmobile. MC11 used a variety of transportation modes depending on the season. MC11 would only travel home in the winter at Christmas and Easter. MC2 began trapping with an older sibling in 1945 at 10 years of age and carried on the tradition of trapping in the area like her/his father and grandfather. Typically, MC2 left Pukatawagan for the trap line in the late summer or early fall, would only make one trip home at Christmas, and would not return to

Pukatawagan again until the early summer. MC5 began going to the trap line with a sibling at a very young age in the 1940s. After marriage, time on the trap line was as a parent. Typically, travel to the trap line was in March by dog team and return home to Pukatawagan by canoe in June. MC13 grew up trapping with the family. MC13's siblings and father would prepare for the trapping season and then MC13 and her/his mother would travel to the trap line (Figure 3b: Travel 14). Typically, in October MC15 and MC16 would travel from Pukatawagan to the trap line either by canoe or dog team and would only return once during the winter for Christmas. When traveling to the trap line, MC15 and MC16 had very little space for supplies so they would only bring the essentials that included flour, salt, baking powder, tea, coffee, and lard. They used dog teams until the mid-1970s and then switched to snowmobiles. They stated that "it's a lot of work to keep a dog team; snowmobiles were easier and faster." Unlike snowmobiles, there were no headlights when traveling by dog teams, so if travelling at night they could only see by the light of the moon. MC8 returned to Pukatawagan when the trapping and fish-spawning season ended. MC14 and family would travel to the trap line in early fall and would return in the late spring.

During the summer months, MC11 would travel by canoe. MC13 would hunt from a boat along the shoreline of the lakes (Figure 2b: Hunting 24). They stayed at Swede Lake until spring and then paddled home to Pukatawagan in June. MC8 typically traveled to and from the trap line by canoe; however, sometimes her/his spouse would either fly to the trap line from Pukatawagan or travel partway by train. As MC14 paddled home each spring, the dogs ran along the shore.

MC13's grandmother was Dene and on treaty days would travel by canoe with her children from Pukatawagan (Figure 3a) to Pelican Narrows, Saskatchewan to collect her treaty money from the Indian Agent. MC13 said that "she was best known as the woman sailing along the shoreline." She bought her canoe from the trading post as the skill of building birch bark canoes was lost once manufactured canoes were available. She would put a sail on the canoe so that they could sail from lake to lake. MC13 still remembers sailing across the lake in a canoe with her/his father. Regarding MC13's grandparents and their teachings, MC13 (2016) stated:

> They talked about their hardships, but not in a negative way, nor would they ask for pity … the way they lived was never a hardship because this is their way of living and they enjoyed their way of living, right. It was like a challenge between an animal, a bird, or whatever. They got away when they got away. You know, it was part of a game of fun at the same time. If the animal is better than you, then you get laughed at.

All-season access came when the mines were developed, and the railway constructed. MC1 spoke about how the experience of the land has changed in the area since mine, road, and railroad development has created year-round access to traditional areas.

MC2 used a .30-30 rifle because it was lighter than other types of rifles, which made traveling through the bush easier. MC2 would be "lucky to have one box of shells" to take trapping and that meant that every shot counted; one could not waste any shots. MC2 also used a shotgun for hunting. MC10 would occasionally hunt ptarmigans and chickens with nets to conserve ammunition. MC15 and MC16 used a .30-30 rifle for hunting animals because it was lighter than other rifles. They used a shot gun for hunting birds. MC17 joked about hunting grouse with MC18, MC19 using slingshots because "rocks are free" and said that the grouse "close their eyes so they don't see you" and believe that if they can't see you, you can't see them. MC8 stated that they would often set nets in the bush to catch ptarmigans to save the bullets for larger animals and birds.

Returning to their cabin after a day of trapping, MC2's family ate their meals in the evening and then, by candle light, skinned the animals they had trapped that day. They would work late into the night, sleep for a few hours, then wake up and go back out to work the trap line. On the weekends, they prepared the hides but limited their work on Sundays to chopping wood because many of the trappers held Christian beliefs. MC2 told us that working the trap line was hard work but always found it enjoyable. MC13's mother prepared the moose hides by soaking them for a long time to loosen the hair, stretching the hide between four poles, and then leaving it to dry for a week or so. She would then scrape the hide on both sides using three different tools handmade from animal bone. The tanned hides were used for wrap-arounds, coats, and mukluks. MC4 remembered her/his mother used moose hides to make moccasins. MC14 used moose hide for making gloves, moccasins, mitts, and for snowshoe webbing. MC6 and MC7 used porcupine quills to decorate moccasins. MC11 used rabbit fur to insulate boots and moccasins. MC15 and MC16's family used as much of a harvested animal as they could. For example, they would eat moose tongue. They also ate many of the animals trapped for furs, including lynx, which was good to eat when the hind quarter meat was sliced and fried with lard. They used duck feathers to fill quilts and pillows, rabbit fur to make blankets, and moose hide was used to make mukluks, gloves, and jackets. Their mother decorated the clothing made from hides with beadwork. When MC8 hunted rabbits, the fur would be used to insulate boots and moccasins. MC14 continued to work on the trap line until the children were in school. Although MC14 stopped going to the trap line, s/he continued to help by skinning the animal furs that were harvested and brought home.

MC2 disliked trapping beaver because the pelts were difficult to prepare and difficult to transport, especially on the small travel trails, because they were heavy and bulky. They usually sold prepared furs to the North West Company in Pukatawagan but MC2 would occasionally sell furs to a trader at Granville Lake. MC12 would occasionally sell their furs to buyers in Lynn Lake. They would also sell furs in Leaf Rapids and in Pukatawagan, where the prices were the highest. MC14 traded the prepared furs for supplies or sold them to the owner of the Northern Store.

MC5 now takes children from Grades 1 to 8 (10 to 20 children at a time) to the trap line during the winter. MC9 would occasionally take the children to camp, hunt, and catch sturgeon at Dunsheath Lake (Figure 2b: Fishing 3).

MC13 does not remember being cold during the winter because of activities with friends to make winter fun. They would go mushing with dogs, sledding, and downhill skiing using only one ski made of birch.

While trapping, MC8 would only have one camp for each trap line (Figure 3b: Habitation 13, 18, 19, 20) and when trapping away from the camp MC8 would sleep in the open in a goose down and flannel sleeping bag handmade by her/his mother. MC11 and three siblings used tents as outpost camps when they traveled between their cabins. They cut tent poles from dry birch, pine, or spruce trees at each outpost camp and would leave the poles behind for reuse when they returned. MC14 would stay at their cabin when trapping, but occasionally it would be necessary to be away for short periods to check traps, hunt, or fish. They lived with their extended family, including a mother-in-law, so there were up to seven people at the camp. When this occurred, they would stay in a tent and everyone had a job to do and would pitch in when it came time to move. MC15 and MC16 observed that people tended not to gather in large groups and that the nearest community to their camp was at Granville Lake. MC4 found it helpful to have other people nearby when trapping as they could trade supplies when needed. When MC12's family needed supplies, they would travel to Lynn Lake.

MC11 and his/her siblings would take a portable stove with them to heat the cabins and the tents. The stove would be used to keep them warm, to thaw the frozen animals from the trap line, boil water, and to cook food. MC15 and MC16 heated their cabin with a cook stove purchased in Lynn Lake or Pukatawagan and fueled it with available wood. MC14 would cut wood for their stove and hauled it to camp with a dog sled.

MC2 chinked the walls of his/her cabin with moss, laid birch bark on the roof, and covered this with a layer of sand. This sealed the walls and roof to keep the occupants dry and warm. Inside the cabins, they had fireplaces for heat and to cook bannock and various kinds of meat.

Hunting for fresh meat was essential for survival on the trap line however, MC2 told us that they would only harvest what they needed. MC10 shared moose meat with family members who lived in Black Sturgeon. MC5 has 12 children who all speak Cree. They were raised eating country foods that were harvested from the land. MC12's family ate what was available from the land including beaver, muskrat, fish, and moose. Meat was often fried, boiled, or cooked in a stew. Moose meat would be dried so that it would last longer. MC14 extracted grease from the moose bones and used the grease for cooking. Most of MC11's food was taken from the land, by hunting, fishing, or gathering however, they would have to buy supplies such as flour, sugar, lard, and tea. MC1 remembers the family having large amounts of meat from hunting, especially around Christmas time. When MC8 harvested a moose, it could feed two people for up to six months. When they harvested a moose, MC14 helped carry it back to camp. They would prepare the meat and the hide and use as much of the animal as possible; little was wasted. MC12 used bear grease to keep their hair healthy.

MC18 and MC19 said that MC17 makes the best bannock. The recipe is flour, baking powder, salt or sugar mixed into a dough with lukewarm water. The bannock is fried in a pan or roasted on a stick over the coals of the fire. They often eat bannock with homemade jam when staying in camp for fishing or trapping. One of the delicacies that MC14's mother-in-law made was bannock prepared with marrow and served with moose meat.

When in Pukatawagan for the summer, MC5 spent time harvesting traditional foods and medicines, as well as camping and hunting with the family. MC2 is thankful for the medicines that the earth provides and talks to the medicine during preparation and when using them as they carry her/his grandmother's and grandfather's spirits. MC6 and MC7 said that skunks could be used to make important medicine for treating pneumonia. MC13 has personal experience with the use of traditional medicines. As a youngster MC13 fell from a tree near High Rock and fractured a leg bone. MC13's father asked a traditional healer for help and ten days later, MC13 was up and moving around. MC13 never had a cast and was only given plant-based traditional medicine. Twelve years later, MC13 sprained an ankle and went to the hospital for some x-rays. The doctor noticed MC13's old injury and commented that the leg must have been in a cast for six to eight weeks. The doctor would not believe that the traditional healer treated him and that MC13 did not have a cast. MC14 recounted a story about when they were traveling to the trap line one year in the fall and MC14's father-in-law broke through the ice and fell into the water. He soon became hypothermic and was given spruce gum to chew on, which cured him. MC14 has heard about many different medicines but believes that rat root and spruce gum can cure most ailments.

MC3 observed that fish are very abundant in many rivers in the spring time, but warned that one must be careful where one fishes now because of government regulations. There never used to be regulations and people could fish wherever they wanted.

MC13 recalls that just before the lake froze they would take two poles and put them in the water and string a line between them. Then they could use the line to string a net from one pole to the other. MC17, MC18, and MC19 fish for food primarily in summer by angling but also jig through the ice in winter. MC15 and MC16 often fished near their cabin at Laurie River. However, fishing was difficult because of the dam construction that flooded the area and left partially submerged logs in the water (Figure 5c: Environ Obs 26). They had to be very careful about setting nets because the logs could become snared and destroy the nets. MC11 and his/her three siblings fished at many of the lakes within the area (Figure 2b: Fishing 25, 39). They would travel to the lakes during the day and would typically set up camp late in the evening when they arrived. The following morning, they would set one net near the camp using a jigger to walk the net under the ice. Nets would typically be checked every second day. MC9 set nets on the edge of weed beds as this was often the best place to catch fish. If they did not have a jigger they would set the net's lines before the lakes froze and weight it down in the middle so that it would not freeze into the ice. MC8 said, "Where there's fish, that is where we would set our nets." While trapping, MC3 ate the harvested fish and fed it to the dogs too. MC11 used the fish to feed their team of four dogs. MC2 observed that the sled dogs would not eat fish.

MC17, MC18, and MC19 shared details about how they preserve and prepare fish. A preferred portion is the butterfly meat beneath the front fins of walleye (often referred to as walleye wings). Cleaned and roasted fish guts are also a favourite and are chewy. White fish are often smoked at camp for preservation. MC19 shared a technique to preserve fish that was learned from her/his father that involved digging a hole in the muskeg, inserting the fish, then filling the hole. The cold temperature of the muskeg due to the permafrost keeps the fish fresh, just like a cooler. MC13 would prepare the fish they caught and then either eat them fresh, freeze some for later, or smoke them. MC13 prefers to fry walleye and northern pike and either dry, roast, or boil whitefish and serve them with fresh berries. MC13 eats the fish cheeks, liver, and roe. Red suckers (sturgeon suckers) must be fileted a certain way and then smoked. MC15 and MC16 ate as much of the fish as possible including the fillets, cheeks, and livers. Any remaining fish parts were used for bait so that very little was wasted. MC2 stored harvested fish on a pole with the fish hanging tail side up and could usually string 10 on a pole if the first fish was placed about 25 cm (1 foot) from the ground. The fish were left on the pole until they were ready to eat. They were usually fried in caribou or moose fat.

MC1 told us that if one throws a sturgeon carcass into a lake during spawning season, the other sturgeon would leave to find new spawning grounds. After year-round road access came to the area, many people who did not understand how these things worked came to harvest the sturgeon eggs and tossed the sturgeon carcasses back into the water. This depleted the traditional sturgeon fishing areas. MC1 believes that people should not just take what they want from an animal and leave the rest: the whole animal should be used.

MC14 recalls the water being very clear and they drank from the lake. While out trapping, they would chop holes through the ice of lakes to collect drinking water and would also use the holes to catch lake trout. MC8 had information about several natural springs in the area that were used as traditional drinking water sources. These springs were located near Eden Lake, Hughes Lake, and at Michaluck Bay near Westdal Lake (Figure 5b: Environ Obs 10, 11, 12, 13, 14).

MC11's father used to have a camp on Wetikoeekan (Sasquatch) Lake and was the person that named the lake. MC17, MC18, and MC19 said that though many of the lakes have Cree names, they use the English names. MC19's father still uses the Cree names, however.

4.5 ENVIRONMENTAL OBSERVATIONS

The participants shared ecological observations regarding plants and animals, weather and climate, and changes in these they may have witnessed or learned from their Elders.

4.5.1 Flora

MC2 observed that the medicines harvested in the area are not as potent as before. Generally, MC5 has found that traditionally important plants used to be more abundant in the region. There also seems to be less sap in the trees.

4.5.2 Fauna

4.5.2.1 Moose

MC1 indicated that the moose population around McVeigh Lake, where MC1 hunts, began to increase in the 1970s (Figure 2b: Hunting 3). MC2 also observed that moose used to be more plentiful in the area. When asked about the moose populations, MC6 told us that they are very unpredictable because they move around a lot. MC12 said that the moose near Cockeram Lake moved away when the MacLellan site was operating. However, MC12 noticed that the moose have started to move back into this area now that the mine has closed. MC8 witnessed a decrease in moose population following the opening of the Farley mine in the 1990s (Figure 2b: Hunting 21) while living in the camp at Swede Lake (Figure 3b: Habitation 13). Although MC15 and MC16 have noticed decreases in the populations of some species, they have not observed a considerable change in the moose population. MC9 noted a decrease in moose populations due to increased traditional harvesting and recreational hunting pressure.

4.5.2.2 Caribou

Barren ground caribou once traveled south into the area, and usually arrived in October. They were plentiful in the late 1940's; however, by 1960, there were so few left that it was "difficult to track one." Also, MC3 does not recall seeing caribou while out trapping; however, remembers them being abundant when s/he was young. MC4 recalled that the southern range of caribou was once near the south end of Sickle Lake (Figure 5b). MC11 recalled that the southern limit of the caribou was at the south end of Eden Lake (Figure 5a). MC13 reported that caribou were once found as far south as Pukatawagan, but their southern limit has slowly moved north towards Horseshoe Lake. According to MC6's grandfather, caribou populations began to decline around the 1940s and 1950s. MC7 agreed with this and added that this was around the same time that mines began operating in the area. MC18 reports that hunting pressure has affected the caribou range and reported observing a caribou antler shed at Anson Lake many years ago, but has not seen any caribou signs since (Figure 5b: Environ Obs 7). MC17, MC18, and MC19 observed that there is more pressure on the animals from hunting due to increased access to the area. People are unable to hunt close to Winnipeg and choose to come north to hunt. These hunters also come with boats so they have more opportunities to see animals.

4.5.2.3 Wolves

MC2 recalled a large pack of timber wolves in his/her trapping area, but did not trap them (Figure 2b: Trapping 6). MC2 reported that when southerners began trapping in the area, some used poison instead of traps, and then discarded the skinned carcasses into the water thereby introducing the poison to the water. Some of the trappers' dogs were also poisoned. MC8 attributes the population decreases to the increased access to traditional areas that has allowed more people to hunt. Also, the Manitoba Department of Natural Resources may have caused the decrease in wolves because they set up poisoning stations to kill them. MC8 recalled one such station at the mouth of the Hughes River after 1964 (Figure 2b: Hunting 22). MC3 would sometimes find hibernating bears in the winter, but did not bother them and encountered wolves but observed that they were just as scared of the humans as the humans were of them. There could be 50 wolves, but they would not bother people unless people bothered them. MC6 and MC7 have also noticed that wolf populations have increased over time. MC13 said there were wolves in the area so one had to be careful not to bother them. However, MC13 does not hunt near Lynn Lake because of the tailings contamination.

4.5.2.4 General Wildlife

Over the courses of their lives, both MC6 and MC7 observed that animal populations including frogs, porcupines, skunks, ducks, geese, and caribou have declined. These species were sources of food and harvested for traditional purposes. MC15 and MC16 observed that most animals are less abundant now, including muskrats, beaver, and otter, and attributed the decline to displacement by flood waters from dam construction at Eager Lake (Figure 5c: Environ Obs 26). MC8 has seen decreased populations of moose, beaver, porcupine, sturgeon, and wolves. MC4 has noticed porcupines, skunks, ground hogs, and arctic loons seem to have disappeared. MC4 also observed that coyote populations have decreased. MC5 also observed that there are no longer any ground hogs, porcupines, or skunks. MC10 noted that beaver and marten were plentiful in the 1970s. MC10 also stated that there was once an abundance of porcupine in the area but that the population began to decline in the late 1970s and now have completely disappeared. MC17, MC8, and MC19 also observed that there used to more porcupines but since the mid-1970s they have completely disappeared. MC19 reports his/her last sighting of a porcupine was at Mile 16 of Highway 391 many years ago (Figure 5b: Environ Obs 8). MC8's last sighting of a porcupine was at Sickle Lake in 1975.

MC9 noted that the Lynn Lake area is not a good area for beaver. While guiding at Sickle Lake, MC9 observed a beaver in a tree from the boat. MC9 recalled the porcupines disappeared very quickly by 1954 but thought the species may be returning because MC9 saw one near Leaf Rapids. MC9 believes that beavers are very smart animals. It takes a long time for them to build a lodge because they must find a place with enough food for the winter. Beavers eat roots of lilies in the lakes and rivers and move to a different area after a forest fire. MC19 noticed a recent decline in beavers and muskrats. However, MC18 disagreed and believed there has been an increase in beavers. They explained that the rise in beaver population is because people no longer hunt or trap them as frequently as before.

MC6 and MC7 also have observed that some animal populations have increased, which they believe, is because fewer people trap in the area now. MC17, MC18, and MC19 have noticed an increase in the bear population, particularly near the Harriott River by Pukatawagan.

MC19 reported seeing a snake "in my younger days" at Muskeg Lake (Figure 5b: Environ Obs 9).

4.5.2.5 Birds

MC5 thought that animals used to be more abundant in the area and specifically observed that there are fewer ducks and ptarmigans. MC4 noted that goose populations have increased over time. MC17, MC18, and MC19 noticed that swans arrive in the late summer before they migrate; they have also observed sandhill cranes passing overhead. Peregrine falcons, which are new arrivals to the area, nest at the Fox Mine (Figure 5c: Environ Obs 25) and near MC19's cabin (Figure 3b: Habitation 7 and Figure 5b: Environ Obs 4). They have also seen several bald eagle nests at Mile 4 along the Keewatin River (Figure 5a) and at the McGavock Lake camp (Figure 5c: Environ Obs 23). They also reported osprey nests on hydro poles.

4.5.2.6 Fish

MC3 observed that there have been changes to the animal populations over time. Specifically, fish are not as plentiful, and muskrats seem to have disappeared, perhaps due to the construction and operation of the Island Falls Dam at Sandy Bay that killed a lot of fish and muskrats. MC1 has observed a decline in whitefish population, beginning in the 1950s, in Simpson, Swede, Ellystan lakes (Figure 2b: Fishing 24). MC6 and MC7 have also noticed declines in some fish populations because of overfishing at Hughes and Glasspole lakes, and on the Laurie River. MC9 noted a decrease in fish populations due to increased fishing pressure. MC9 specified that Cockeram Lake was really great fishing prior to the mine, but tailings contamination has affected the fish population and now the "fish are no good" (Figure 2b: Fishing 12).

MC13 mentioned several areas that are known as fish spawning areas. There is a creek that runs from Swede Lake to Hughes River where walleye and whitefish spawn (Figure 5b: Enviro Obs 21). MC13 also noted that the Hughes River is a fish spawning river (Figure 2b: Fishing 40). MC8 identified an area on Chepil Lake and along the river that joins Chepil, Hughes and Eden lakes as a spawning area for sturgeon (Figure 2b: Fishing 22, 23, 33). MC11 said that whitefish in Wetikoeekan (Sasquatch) Lake used to have worms inside but now they do not seem to have them anymore. MC17, MC18, and MC19 said that fish spawn in many of the rivers throughout the area, including the Keewatin River (Figure 3b: Environ Obs 5, 16), the Hughes River at Dunsheath Lake (Figure 5b: Environ Obs 15), and the Lynn River (Figure 5b: Environ Obs 6). They said that the fish would be moving to their spawning grounds at the time of the interview (May 1, 2017) and one can watch the suckers and walleye spawning in the Lynn River from the bridge in Lynn Lake. MC12 also mentioned the Keewatin River and the river to Lynn Lake as fish spawning areas (Figure 2b: Fishing 41, 42).

4.5.3 Weather and Climate

4.5.3.1 Changing Seasons

MC4 stated that spring now usually starts in early May, when before it arrived in late May or early June. The thaw also seems to happen faster, causing the winter roads to quickly deteriorate. MC6 and MC7 also observed that spring break up is earlier, starting in April rather than May. Spring break up has become less predictable according to MC17, MC18, and MC19.

MC9 observed that the weather seems to be a lot warmer now and that the snow comes earlier. MC9 also reported that the water in lakes is lower because there have not been as many big rains. However, MC1 stated that the water levels are high right now and so fish can travel between the lakes. MC13 stated that the berry-harvesting season was early in 2016: saskatoons that are usually harvested in July were ready in June.

It was colder and there was more snow when MC13 was a child. Also, the cold does not last for as many days as it once did. MC15 and MC16 have noticed changes to the environment around Laurie River and Pukatawagan. They said that there seems to be less snow in the winter than before, especially when compared to the 1970s and 1980s, when the snow was deeper. According to MC17, MC18, and MC19, freeze up seems to be later in the autumn. They were able to use a boat on Hughes Lake in November of 2016. MC8 noticed that there seems to be less snow and that the winters are not as cold as they were before.

4.5.3.2 Extreme Weather Events

MC6 and MC7 have observed that there is more extreme weather and storms now, including plough winds that will knock over large areas of trees. Plough winds are a newer phenomenon, but MC17, MC18, and MC19 reported that there was a tornado in the region in the early part of this century. MC8 also reported a tornado that knocked down all the trees around Wetikoeekan (Sasquatch) Lake and that tornados never used to occur in the area (Figure 3b: Habitation 18).

Forest fires and their frequency are influenced by lightning, but none of MC17, MC18, or MC19 have noticed a change in frequency. Burns were noted to make good moose habitat by MC17, MC18, and MC19. There has recently been more smoke from fires west in Saskatchewan. People with respiratory problems are sometimes evacuated to Thompson when it gets smoky.

MC17 noted that there was a meteorite strike on McGavock Lake (Figure 5c: Environ Obs 24).

4.6 COMMENTS AND CONCERNS

The participants shared their thoughts regarding the proposed Projects. These are grouped below as economic factors, general comments, and concerns.

4.6.1 Economic Factors

MC3 supports the reopening the Gordon and MacLellan sites and full-time operation of the railroad. MC3 believes that the mine will provide increased employment opportunities that will benefit the community. MC6 and MC7 explained there are positive effects for reopening the two sites. The positive effects that they mentioned included opportunities for employment either through the mines or through spinoff projects such as hydro lines and railroads.

Participants often worked other jobs for wages at different times during their lives or seasonally, i.e., when not on their trap lines. For example, MC8 started working in 1963 for a company that was conducting nickel exploration activities and joined an older sibling who was already living in the camp at White Owl Lake (Figure 5b: Historic Mining 1). MC8 worked with the team that built the road used for exploration drilling activities. MC6 worked for two winters as a line cutter for prospecting in the Snow Lake area. MC7 worked on the survey crew for the Fox Mine, and worked as a mechanic at the Ruttan Mine. MC4 worked in several different mines throughout the region when not trapping.

Several participants used their local knowledge to work in the recreational hunting and fishing industries. MC7 worked as a sport fishing guide for a fly-in lodge on McGavock Lake (Figure 2c: Fishing 46). MC9 worked as a sport fishing guide for the Golden Eagle Lodge at Sickle Lake for eight summers (Figure 2a). While working for the lodge, MC9 also guided from its outpost camps on the north end of Sickle Lake and on Willis and Lasthope lakes (Figure 2a and Figure 2b: Habitation 21). MC9 worked as a hunting guide. MC8 spent several summers working as a sport-fishing guide for the Golden Eagle Lodge (now Sickle Lake Lodge) at Sickle Lake and at the lodge's outpost camps (Figure 2b: Fishing 38). MC10 was a guide at Arctic Lodges on Reindeer Lake. During the summers of the mid-1970s to 1980s, MC11 was a sport-fishing guide at the Golden Eagle Lodge on Sickle Lake (Figure 2a). MC17, MC18, and MC19 often worked as sport-fishing and hunting guides to earn additional wages when not trapping. MC17 has guided on the Laurie River and at McGavock Lake (Figure 2c: Fishing 44). MC18 was a guide at Vandekerckhove Lake for Wolverine Lodge and for a camp at the south end of Sickle Lake (Figure 2b: Fishing 37). MC19 has also guided at Sickle Lake and recalled that most of the lodge guests were American hunters that would come to hunt bear in the spring, moose in the fall, or to fish for walleye, and northern pike.

In addition, some participants worked in the commercial fishing industry. MC9 worked for wages as a commercial fisher in the summer; the season would start in June when the ice was off the lakes and MC9 found it made a good living. They would fish at a lake until they had their limit before moving to another lake. The annual limit was typically about 2,273 kg (5,000 lbs.) of fish per lake. MC17, MC18, and MC19 would fly in to Dunsheath Lake and take a boat up to the creek to the Wells Lake camp where they worked as commercial fishers for walleye, northern pike, and whitefish (Figure 2b: Habitation 5).

Moreover, the participants were involved in various other ways working within their community. MC9 was also a sled-dog breeder and trainer. MC17, MC18, and MC19 have had other jobs and volunteer in the community when needed. For example, MC18 has worked as the undertaker at the Black Sturgeon cemetery for over 30 years and MC17 often assists MC18 with his/her duties. MC18 still digs all the graves by hand, even in winter when the ground is frozen. To thaw the ground, MC18 burns wood on the grave site, a technique learned from a mentor.

4.6.2 Recommendations

One development that MC6 would like to see in the future is a permanent travel route between Lynn Lake and Pukatawagan to connect the communities and build more opportunities for the people.

MC4 stated that there is traditional territory all around the MacLellan site and that it would be good to see people take back their country.

MC14 spoke of mineral exploration in the area in the 1950s, the opening of the Fox mine in the 1960s, and said of the exploration companies: "They were rich, so they were wasteful." MC14 would salvage discarded barrels to make stoves, for instance. MC8 is concerned about contamination in the area and would like to see money put aside at the beginning of projects for subsequent clean-up. MC8 believes that companies should have to take away all their garbage instead of leaving it, which has happened in the past (Figure 5b: Historic Mining 2).

4.6.3 Concerns

MC1 stated that environmental damage had been done by mines in the past.

MC5 is concerned about contamination from the mines and that it will spoil the medicines and harm plants, animals, water, and fish. MC5 mentioned that mine pollution contaminates the air and water and is worried about eating anything from the land or even melting snow to make water because it is contaminated from the mine. Both MC6 and MC7 have concerns about contamination from developments in the area. Construction and operation of developments such as the mines and railways are of concern because of the potential for contamination. They stated that water contamination is their biggest worry; however, air quality also concerns them.

MC7 showed us a potential contamination pathway from the Fox Mine through several lakes to McGavock Lake (Figure 5c: Environ Obs 22). MC7 said that this is a concern because contamination from the waste rock and tailings piles can get into the water and travel down the creeks, streams, and lakes; therefore, MC7 would like to see the tailings pile secured. MC9 is concerned about contamination from the mines and tailings (Figure 5b: Environ Obs 19). MC9 said that the water from McLellan site flows into Eldon Lake and the tailings can enter the Keewatin River that flows to Sickle Lake (Figure 5b: Environ Obs 18). MC11 worries about potential contamination from the Gordon site because water will flow downstream and past the cabin at Swede Lake (Figure 5b: Environ Concern 1). MC19 identified a flood/overflow event in about 1967 that created a contaminant pathway to Sickle Lake through the Keewatin River, because it runs through Cockeram, Moses, Mary, and Anson lakes and into Granville Lake (Figure 5b: Environ Obs 20). MC19 reported effects on shore plants and on fish, particularly walleye and suckers, which were observed while MC19 was guiding on Sickle Lake.

Several participants had concerns regarding the consumption of contaminated country foods, making them sick. MC9 has seen the effects that the mines have had on the fish. Specifically, Cockeram Lake used to be a great fishery; however, mine tailings have affected the fish and they are not safe to eat anymore (Figure 2b: Fishing 12). About 10 years ago, Manitoba government officials advised people to stop eating fish from the lake because of contamination. They also advised people to stop fishing in Laurie Lake because of high mercury levels. MC10 attributes contamination of traditional land where country foods are harvested to sources for illnesses in the area. MC17, MC18, and MC19 are concerned about contamination and the effects it can have on plants, animals, and fish. For example, MC17 and MC18 recounted a story about a moose harvested at the Dunphy Lakes, near the Fox Mine (Figure 2c: Hunting 32). MC17 and MC18 observed that the moose was discoloured inside. Though they ate the meat, they did not eat the liver. MC17 and MC18 wondered if the moose had “gotten into something” at Fox Mine. MC19 also shared a story about guiding at Sickle Lake and observing chemical sludge in the water. MC7 observed contamination from developments such as the railway and mines in the past. Specifically, they believe that herbicides sprayed on the railway (Figure 5b: Environ Obs 17) affected and killed animals such as rabbits, martens, and moose, and that the chemicals moved up the food chain. MC10 was dismayed to find garbage from historic mining activities that had never been cleaned up and explained that the rabbits would eat the garbage making them unsafe to eat.

MC12 has concerns about spills and contamination from the mine. MC12 knew of a spill that happened in the 1970s; it caused the muskrats to disappear and fish to die, leaving dead fish floating in the Keewatin River. MC12 also recalls a truck that spilled chemicals near the bridge at Mile 3 near the town of Lynn Lake in the 1980s (Figure 5b: Environ Obs 3). MC12 believes that chemicals from the McLellan site and the highway make their way into the Keewatin River and Cockeram Lake.

MC10’s concern is that the mines will scare away the animals from this area. If this happens, the people in the area will lose their livelihood on the trap lines.

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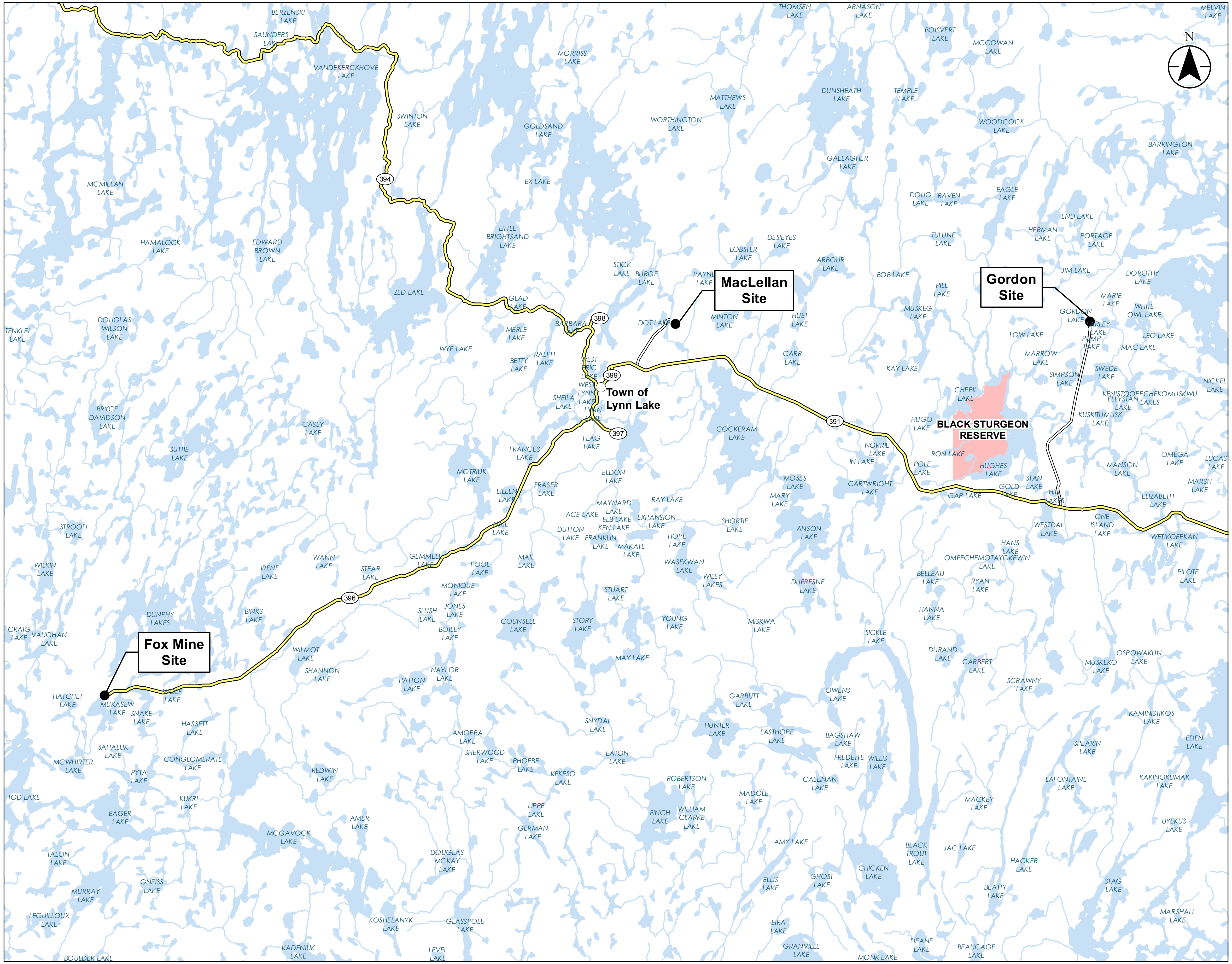
APPENDICES

APPENDIX A: FIGURES



Stantec

Landbase

- Access Road
- Provincial Road
- Watercourse
- Waterbody
- First Nation Reserve

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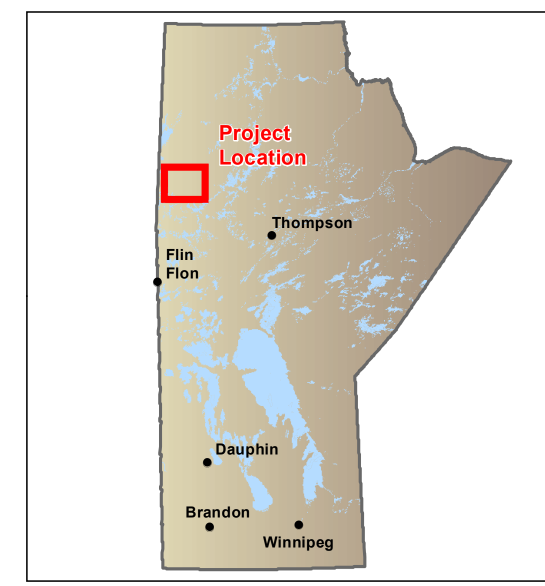
Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features provided by the Government of Manitoba and the Government of Canada.



Project Location 111473000
MacLellan and Gordon Site
Lynn Lake, Manitoba

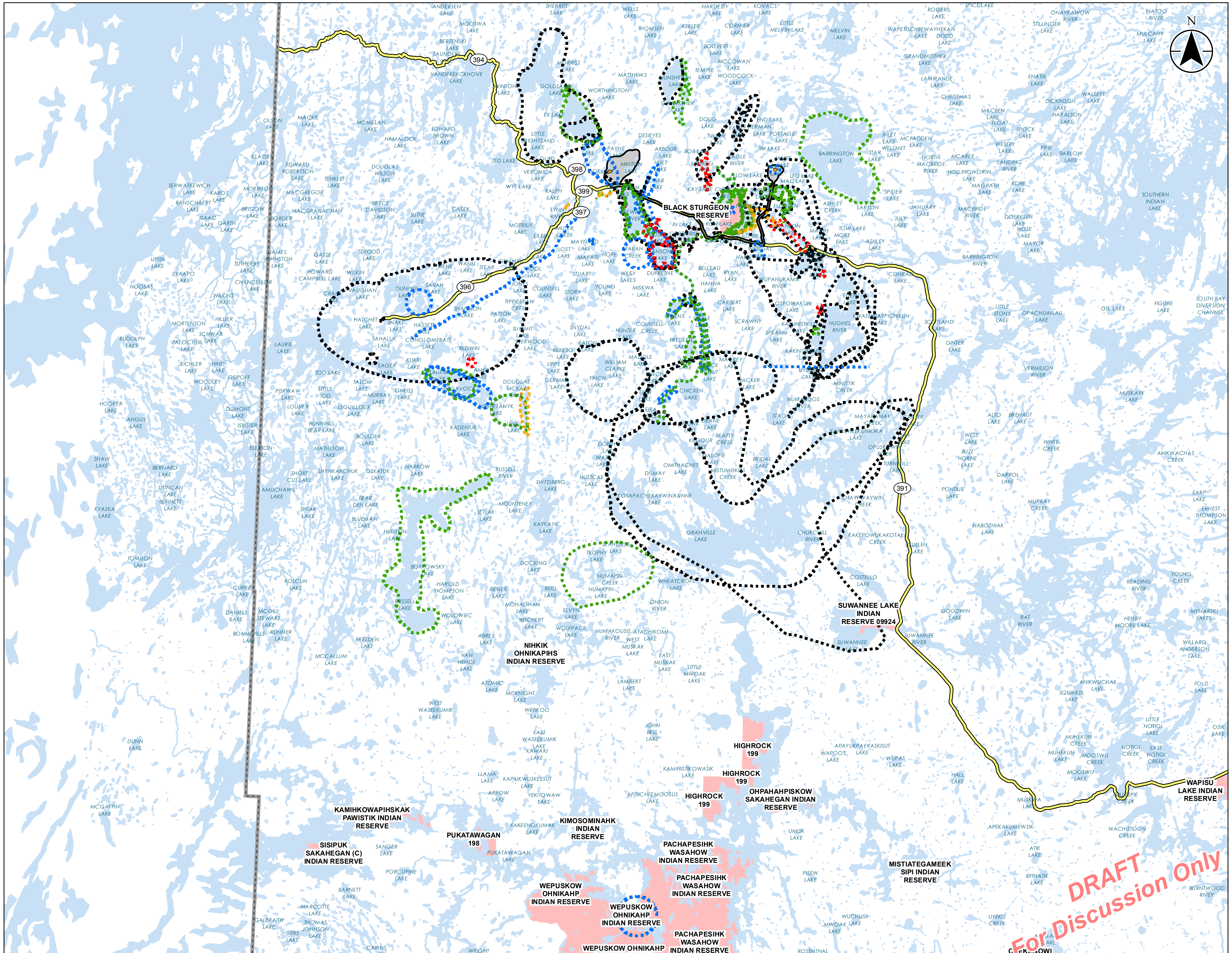
Prepared by AC on 2018-01-09
Technical Review by BA on 2018-01-09

Client/Project

LYNN LAKE GOLD PROJECT
ENVIRONMENTAL BASELINE STUDIES

Map No.
1

Title
General Project Area



Stantec

Project Infrastructure

- Proposed Open Pit
- Potential Project Development Area

Survey Locations

- <all other values>
- Fishing Area
- Hunting Area
- Plant Gathering (food)
- Plant Gathering (medicine)
- Trapping Area

Landbase

- Provincial Road
- Waterbody
- First Nation Reserve

0 20 40 Kilometres

1:750,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features provided by the Government of Manitoba and the Government of Canada.

Project Location 111473000
MacLellan and Gordon
Lynn Lake, Manitoba

Prepared by AC on 2018-01-18
Technical Review by GK on 2017-XX-XX

Client/Project

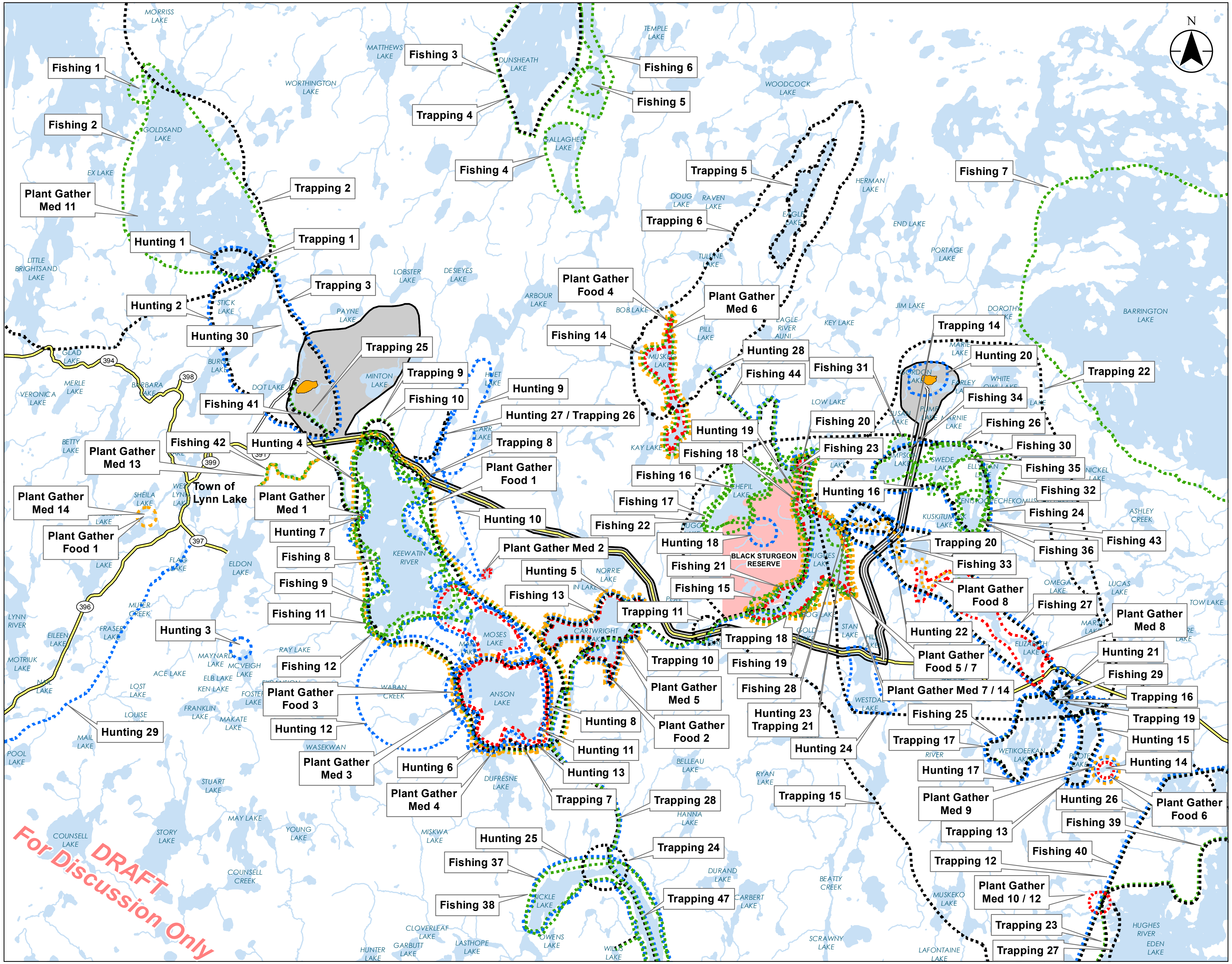
LYNN LAKE GOLD PROJECT
ENVIRONMENTAL BASELINE STUDIES

Map No.

2a

Title

MCFN Harvesting Sites – Regional



Stantec

Project Infrastructure

- Proposed Open Pit
- Potential Project Development Area

Survey Locations

- Fishing Area
- Hunting Area
- Plant Gathering (food)
- Plant Gathering (medicine)
- Trapping Area

Landbase

- Existing Access Road
- Provincial Road
- Watercourse
- Waterbody
- First Nation Reserve

0 4 8 Kilometres

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Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features provided by the Government of Manitoba and the Government of Canada.

Project Location: MacLellan and Gordon, Lynn Lake, Manitoba

111473000

Prepared by AC on 2018-02-05
Technical Review by LS on 2018-02-05

Client/Project

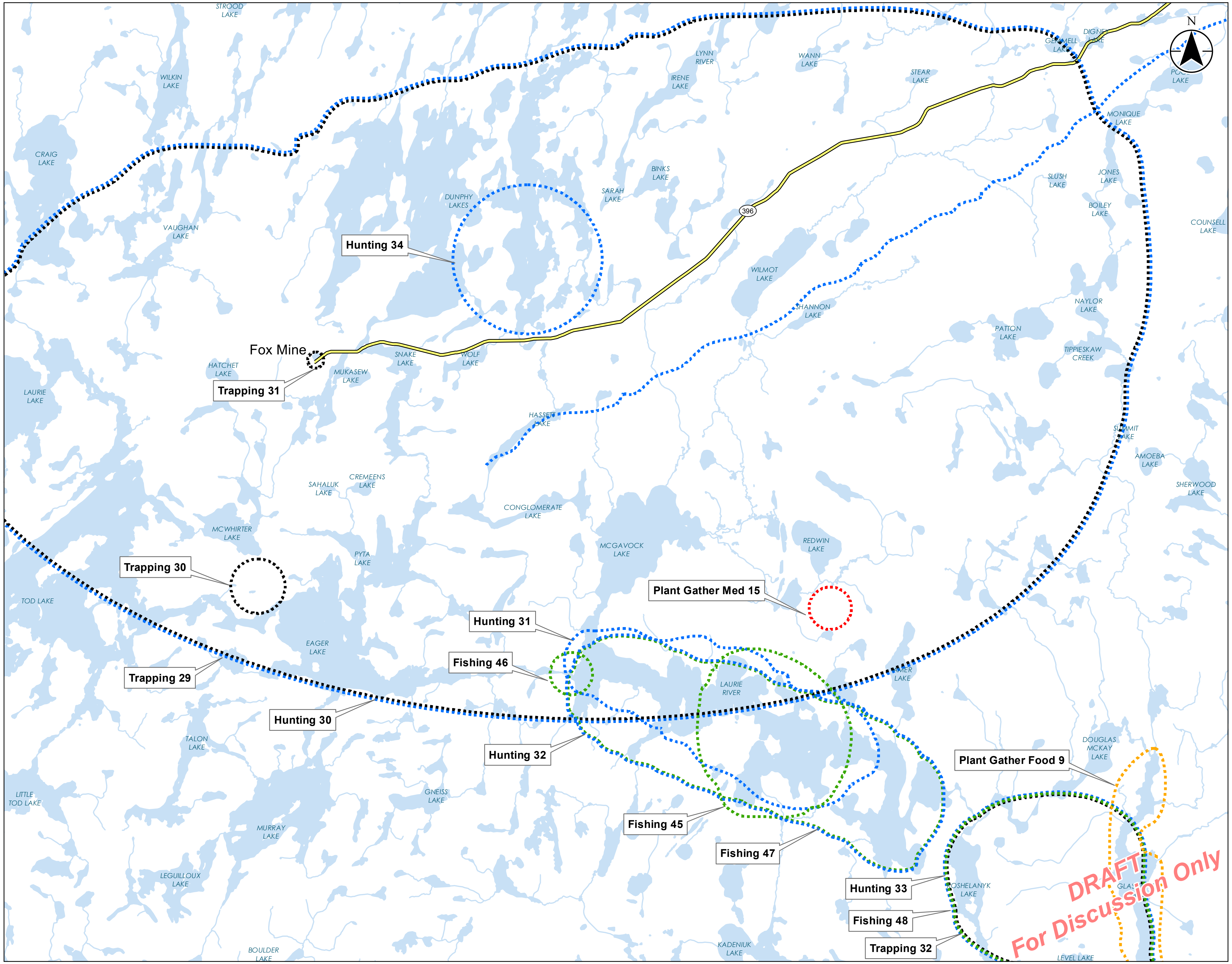
LYNN LAKE GOLD PROJECT
ENVIRONMENTAL BASELINE STUDIES

Map No.

2b

Title

MCFN Harvesting Sites – LLGP Local Assessment Area



Stantec

Survey Locations

- Fishing Area
- Hunting Area
- Plant Gathering (food)
- Plant Gathering (medicine)
- Trapping Area

Landbase

- Provincial Road
- Watercourse
- Waterbody

0 2.5 5 Kilometres

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Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features provided by the Government of Manitoba and the Government of Canada.

Project Location 111473000

MacLellan and Gordon
Lynn Lake, Manitoba

Prepared by AC on 2018-02-05
Technical Review by LS on 2018-02-05

Client/Project

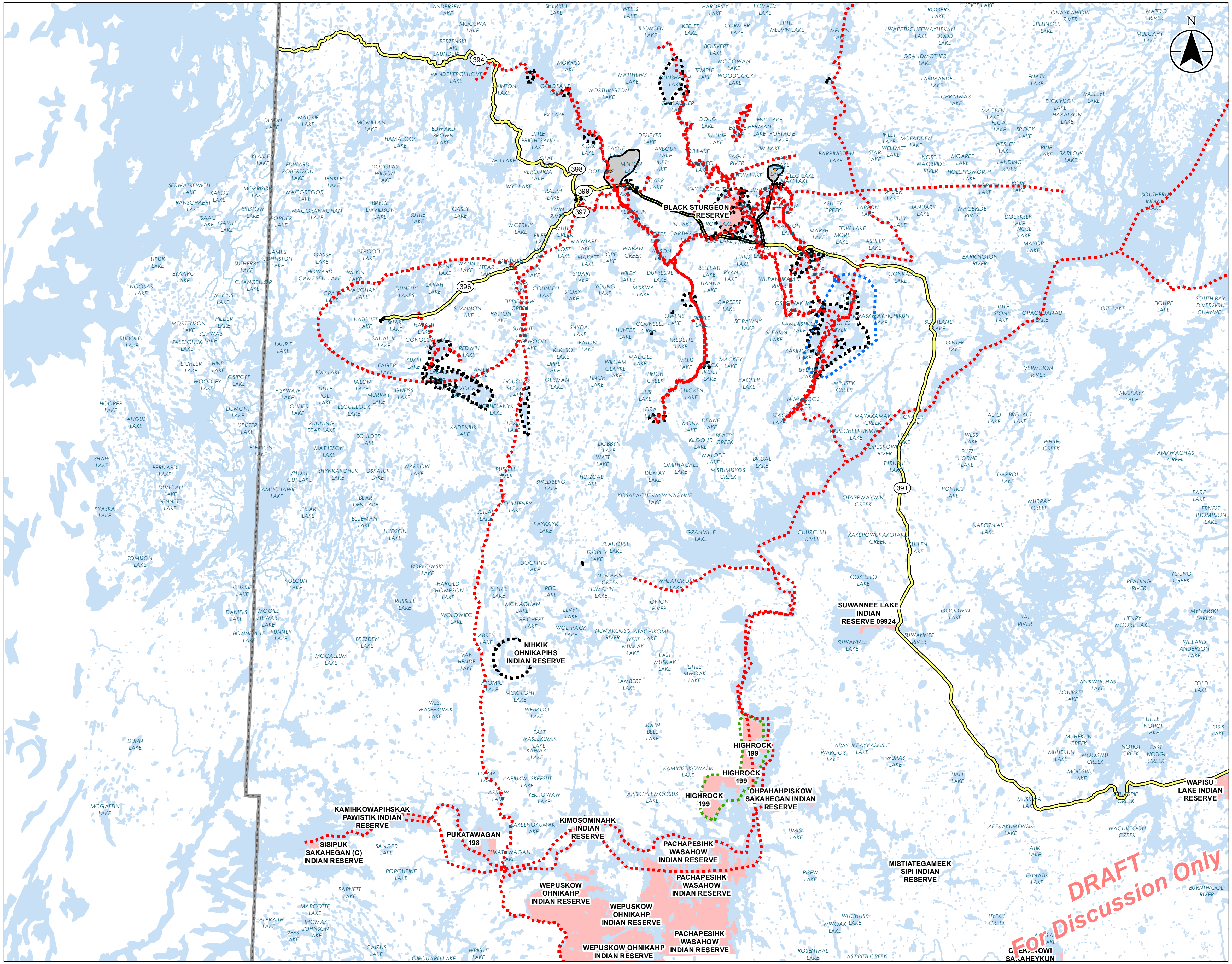
LYNN LAKE GOLD PROJECT
ENVIRONMENTAL BASELINE STUDIES

Map No.

2c

Title

MCFN Harvesting Sites – Fox Mine Local Assessment Area



Stantec

Project Infrastructure

- Proposed Open Pit
- Potential Project Development Area

Survey Locations

<all other values>

- Habitation Area
- Settlement
- Traditional Location
- Travel Route

Landbase

- Provincial Road
- Waterbody
- First Nation Reserve

0 20 40 Kilometres

1:750,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features provided by the Government of Manitoba and the Government of Canada.

Project Location 111473000
MacLellan and Gordon
Lynn Lake, Manitoba

Prepared by AC on 2018-01-18
Technical Review by GK on 2017-XX-XX

Client/Project

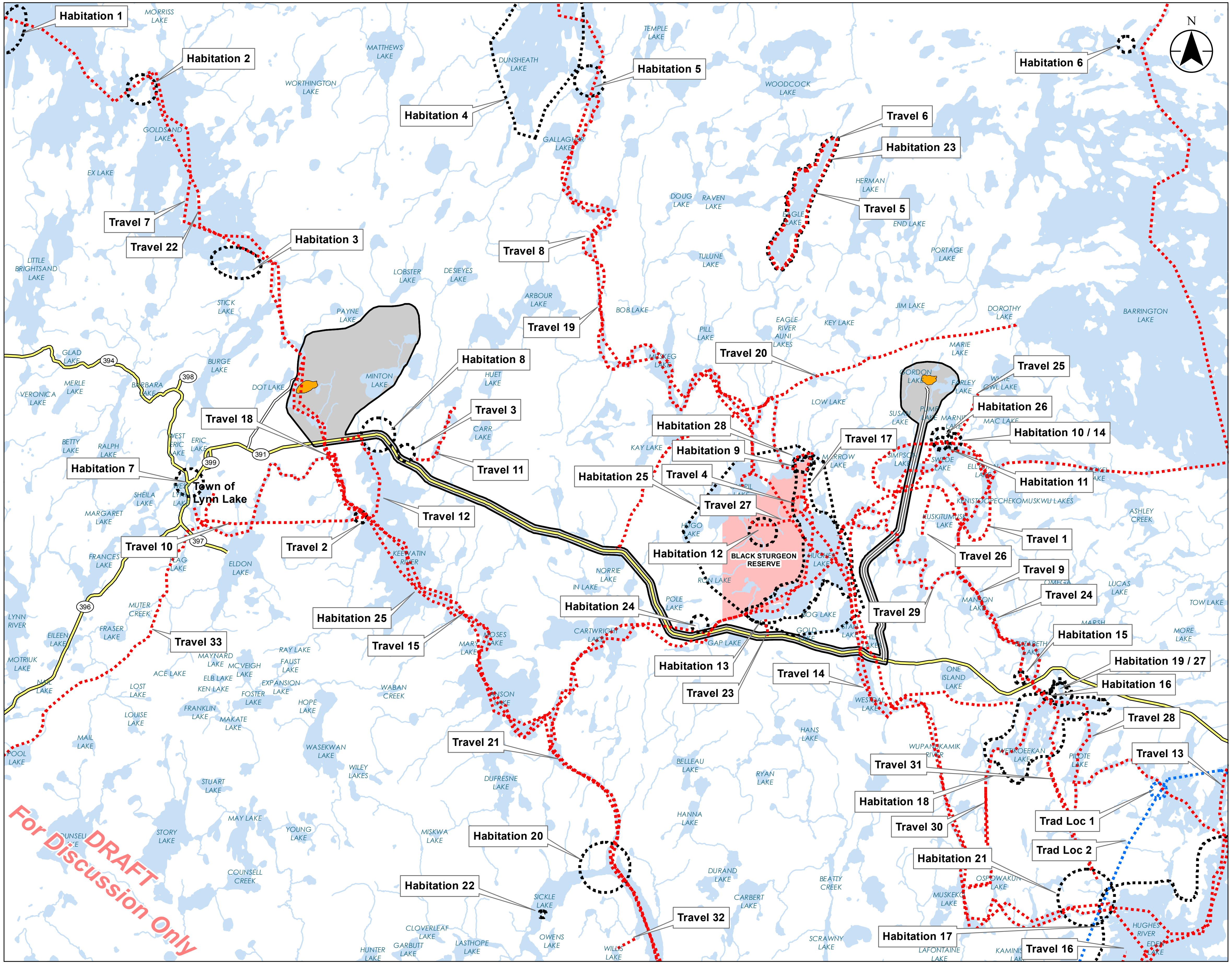
LYNN LAKE GOLD PROJECT
ENVIRONMENTAL BASELINE STUDIES

Map No.

3a

Title

MCFN Occupancy, Trails and Travelways – Regional



Stantec

Project Infrastructure

- Proposed Open Pit
- Potential Project Development Area

Survey Locations

- Habitation Area
- Settlement
- Traditional Location
- Travel Route

Landbase

- Existing Access Road
- Provincial Road
- Watercourse
- Waterbody
- First Nation Reserve

0 4 8 Kilometres

1:200,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features provided by the Government of Manitoba and the Government of Canada.

Project Location 111473000
MacLellan and Gordon
Lynn Lake, Manitoba

Prepared by AC on 2018-02-05
Technical Review by LS on 2018-02-05

Client/Project

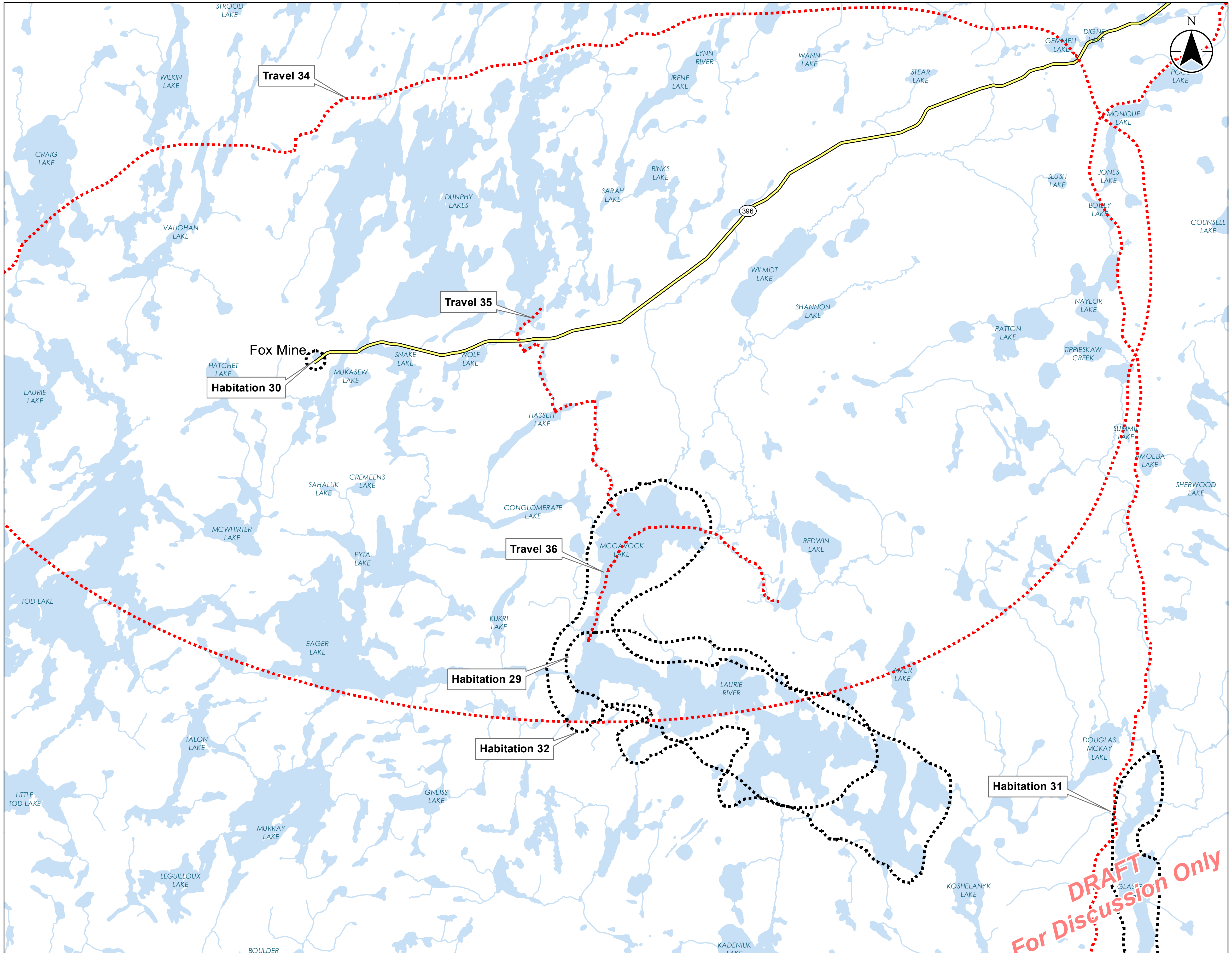
LYNN LAKE GOLD PROJECT
ENVIRONMENTAL BASELINE STUDIES

Map No.

3b

Title

MCFN Occupancy, Trails and Travelways – LLGP LAA



Stantec

Survey Locations

- Habitation Area
- Settlement
- Traditional Location
- Travel Route

Landbase

- Provincial Road
- Watercourse
- Waterbody

0 2.5 5 Kilometres

1:130,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features provided by the Government of Manitoba and the Government of Canada.

Project Location 111473000

MacLellan and Gordon
Lynn Lake, Manitoba

Prepared by AC on 2018-02-05
Technical Review by LS on 2018-02-05

Client/Project

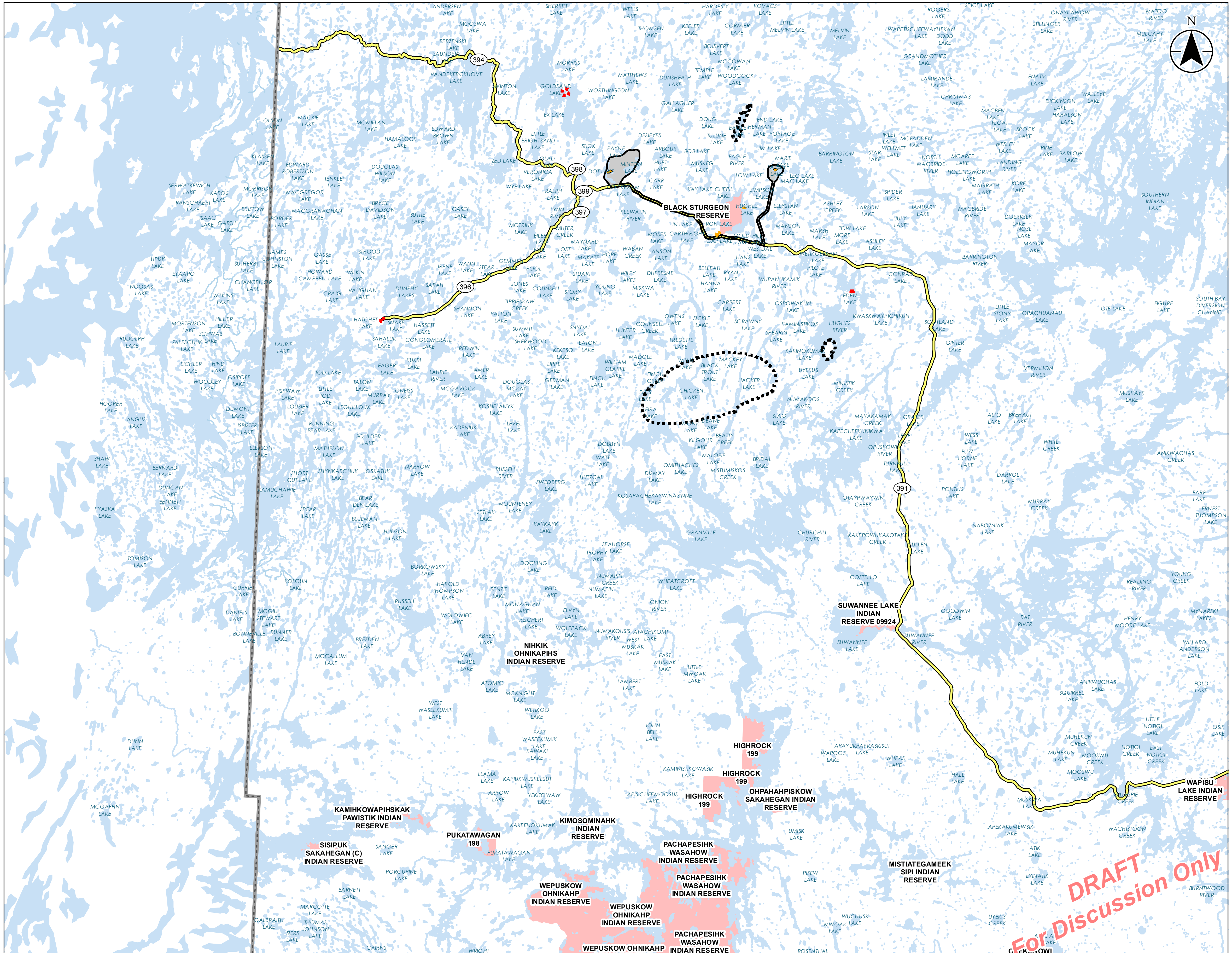
LYNN LAKE GOLD PROJECT
ENVIRONMENTAL BASELINE STUDIES

Map No.

3c

Title

MCFN Occupancy, Trails and Travelways – Fox Mine LAA



Stantec

Project Infrastructure

- Proposed Open Pit
- Potential Project Development Area

Survey Locations

- Burial Site
- Traditional Activities
- Sacred Area

Landbase

- Provincial Road
- Waterbody
- First Nation Reserve

0 20 40 Kilometres

1:750,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features provided by the Government of Manitoba and the Government of Canada.

Project Location 111473000
MacLellan and Gordon
Lynn Lake, Manitoba

Prepared by AC on 2018-01-18
Technical Review by GK on 2017-XX-XX

Client/Project

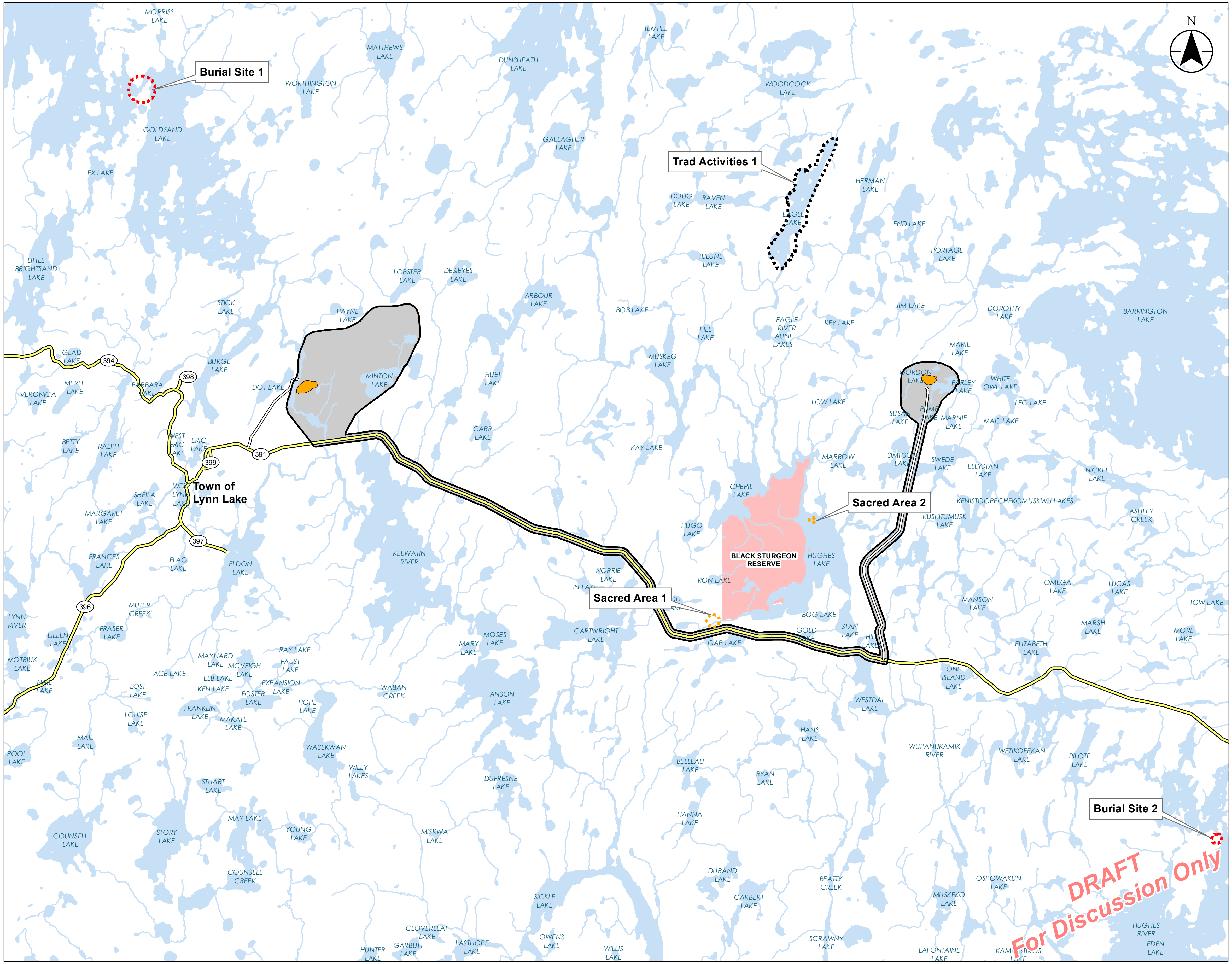
LYNN LAKE GOLD PROJECT
ENVIRONMENTAL BASELINE STUDIES

Map No.

4a

Title

MCFN Cultural and Spiritual Sites – Regional



Stantec

Project Infrastructure

- Proposed Open Pit
- Potential Project Development Area

Survey Locations

- Burial Site
- Traditional Activities
- Sacred Area

Landbase

- Existing Access Road
- Provincial Road
- Watercourse
- Waterbody
- First Nation Reserve

0 4 8 Kilometres

1:200,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features provided by the Government of Manitoba and the Government of Canada.

Project Location 111473000

MacLellan and Gordon
Lynn Lake, Manitoba

Prepared by AC on 2018-01-18
Technical Review by GK on 2017-XX-XX

Client/Project

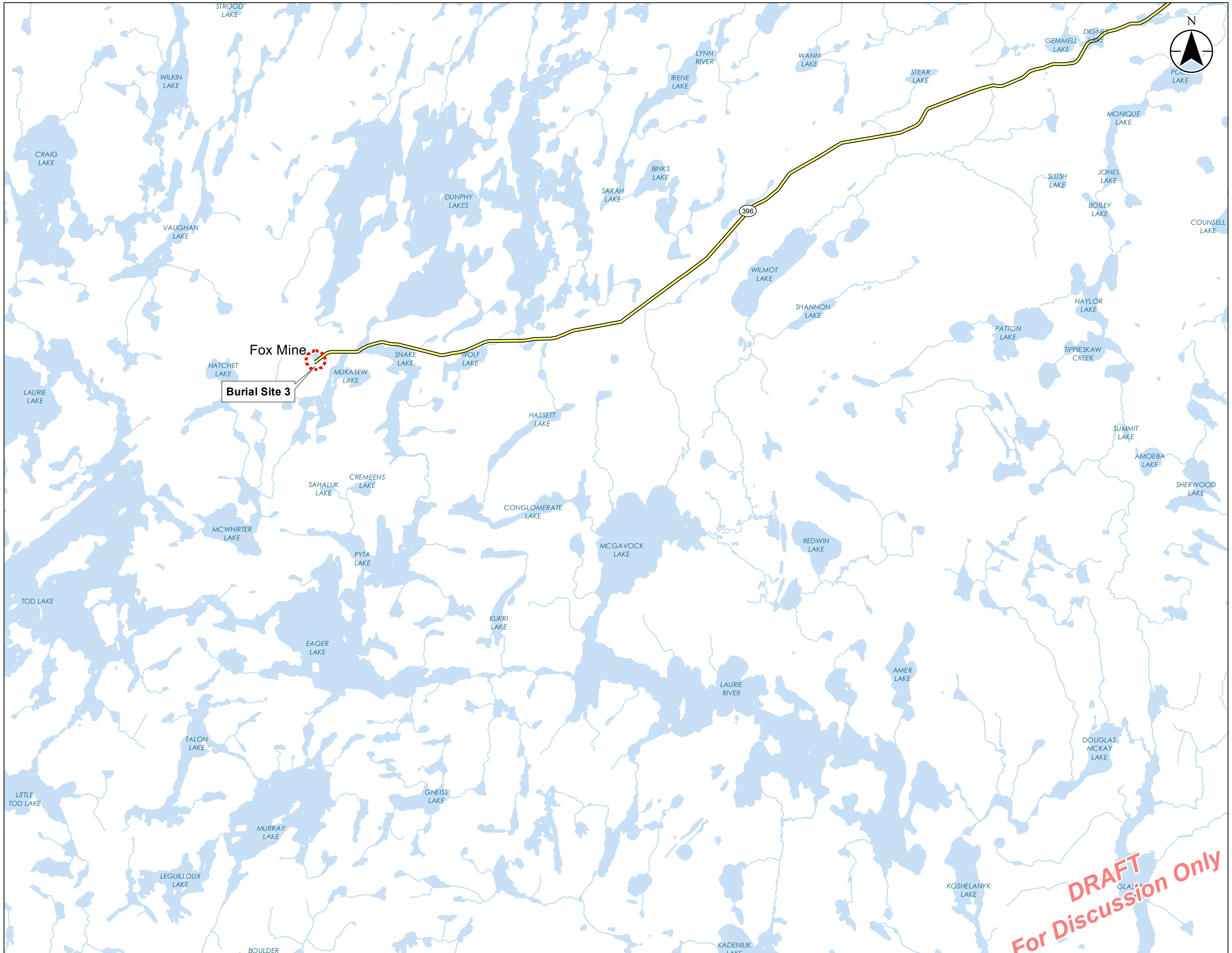
LYNN LAKE GOLD PROJECT
ENVIRONMENTAL BASELINE STUDIES

Map No.

4b

Title

MCFN Cultural and Spiritual Sites – LLGP LAA



Stantec

Survey Locations

- Burial Site
- Traditional Activities
- Sacred Area

Landbase

- Provincial Road
- Watercourse
- Waterbody

0 2.5 5 Kilometres

1:130,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features provided by the Government of Manitoba and the Government of Canada.

Project Location
MacLellan and Gordon
Lynn Lake, Manitoba

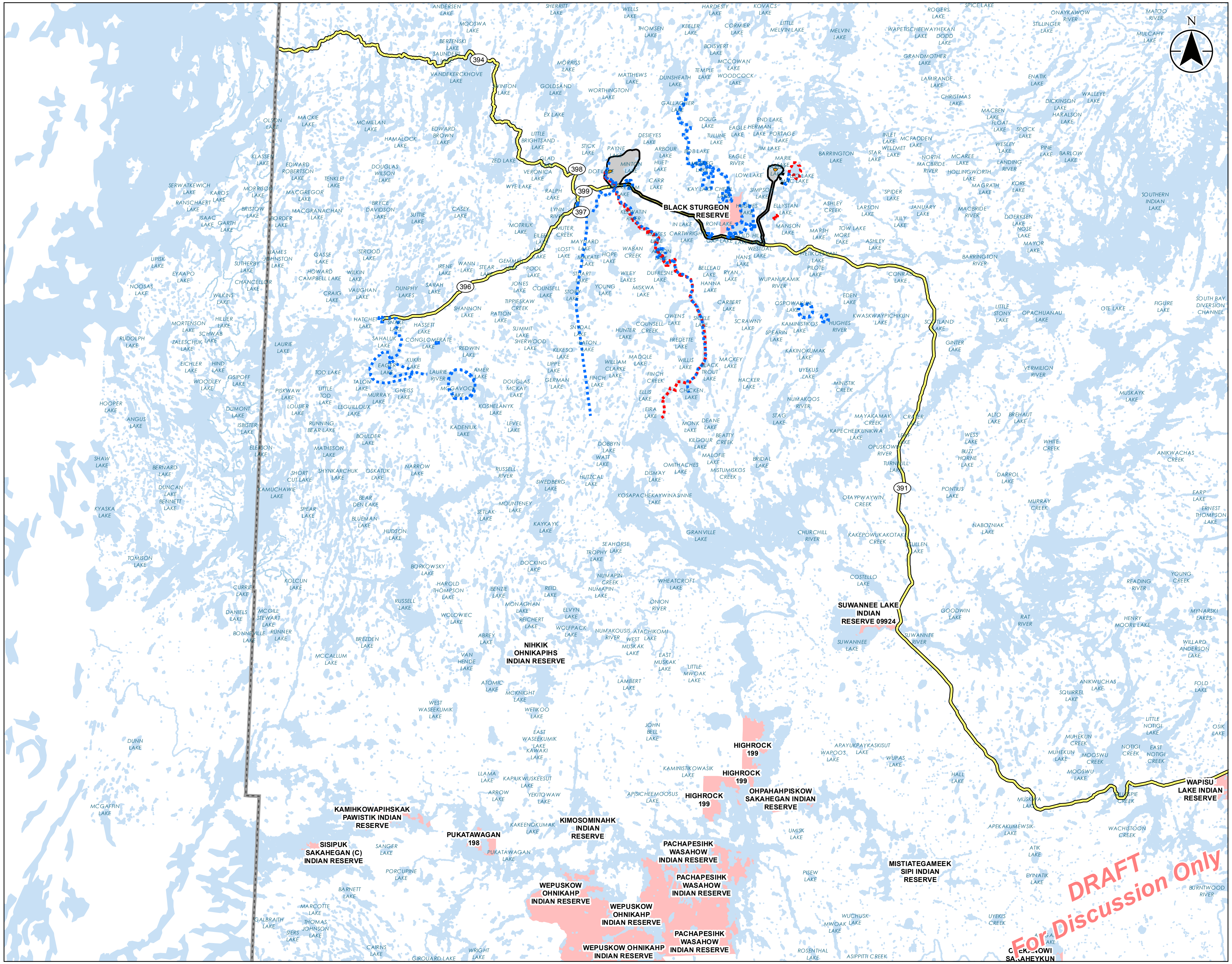
111473000

Prepared by AC on 2018-01-18
Technical Review by GK on 2017-XX-XX

Client/Project
LYNN LAKE GOLD PROJECT
ENVIRONMENTAL BASELINE STUDIES

Map No.
4c

Title
MCFN Cultural and Spiritual Sites – Fox Mine LAA



Stantec

Project Infrastructure

- Proposed Open Pit
- Potential Project Development Area

Survey Locations

- Environmental Observation
- Historical Mining Activities
- Environmental Concern

Landbase

- Provincial Road
- Waterbody
- First Nation Reserve

0 20 40 Kilometres

1:750,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features provided by the Government of Manitoba and the Government of Canada.

Project Location
MacLellan and Gordon
Lynn Lake, Manitoba

111473000

Prepared by AC on 2018-01-18
Technical Review by GK on 2017-XX-XX

Client/Project

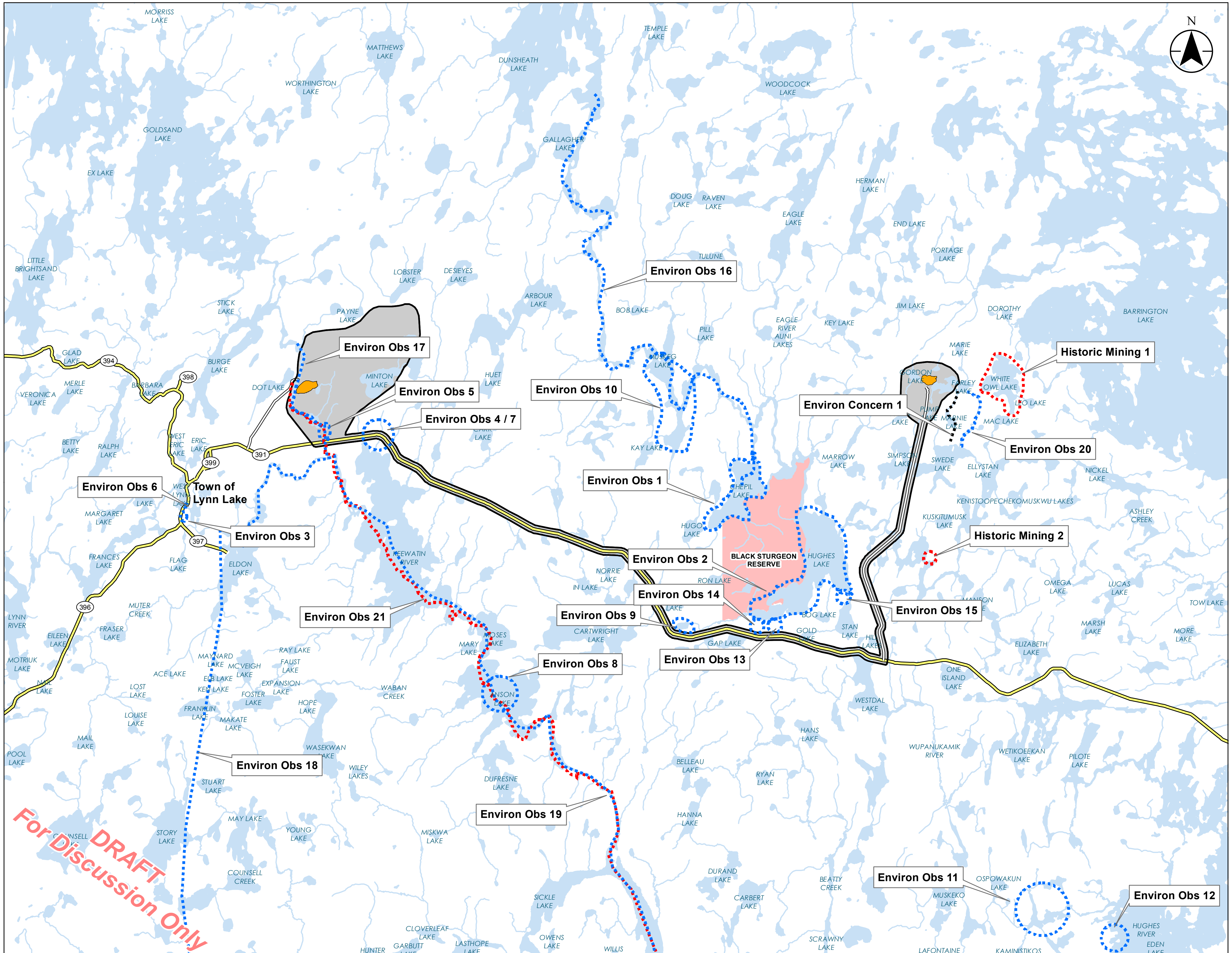
LYNN LAKE GOLD PROJECT
ENVIRONMENTAL BASELINE STUDIES

Map No.

5a

Title

MCFN Environmental Observations – Regional



Stantec

Project Infrastructure

- Proposed Open Pit
- Potential Project Development Area

Survey Locations

- Environmental Observation
- Historical Mining Activities
- Environmental Concern

Landbase

- Existing Access Road
- Provincial Road
- Watercourse
- Waterbody
- First Nation Reserve

0 4 8 Kilometres

1:200,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features provided by the Government of Manitoba and the Government of Canada.

Project Location 111473000
MacLellan and Gordon
Lynn Lake, Manitoba

Prepared by AC on 2018-02-05
Technical Review by LS on 2018-02-05

Client/Project

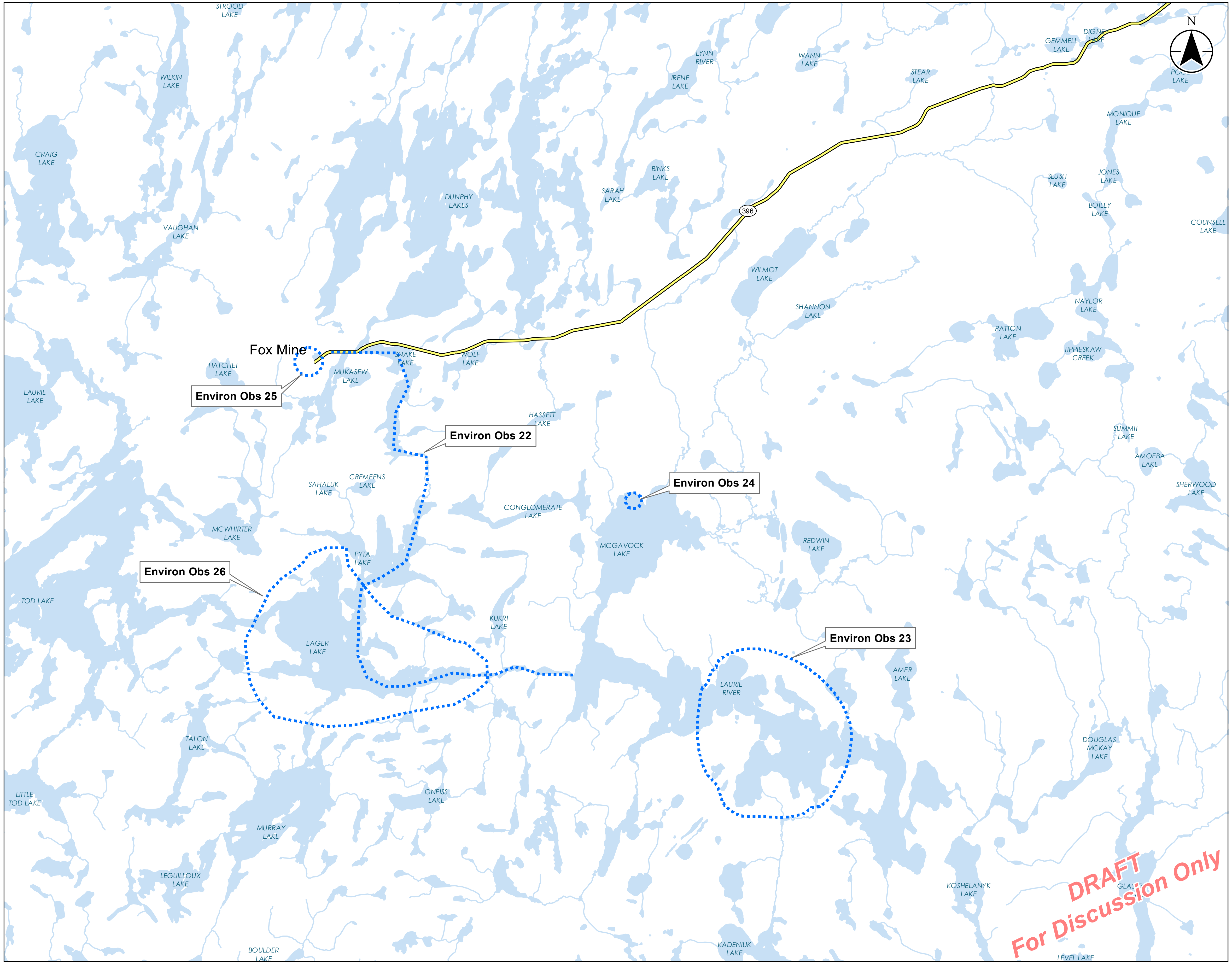
LYNN LAKE GOLD PROJECT
ENVIRONMENTAL BASELINE STUDIES

Map No.

5b

Title

MCFN Environmental Observations – LLGP LAA



Stantec

Survey Locations
Environmental Observation
Historical Mining Activities
Environmental Concern

Landbase
Provincial Road
Watercourse
Waterbody

0 2.5 5 Kilometres
1:130,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base features provided by the Government of Manitoba and the Government of Canada.

Project Location
MacLellan and Gordon
Lynn Lake, Manitoba

111473000

Prepared by AC on 2018-02-05
Technical Review by LS on 2018-02-05

Client/Project
LYNN LAKE GOLD PROJECT
ENVIRONMENTAL BASELINE STUDIES

Map No.
5c

Title
MCFN Environmental Observations – Fox Mine LAA

APPENDIX B: INTERVIEW GUIDE

Marcel Colomb First Nation Traditional Land Use and Occupancy Study

****If using video or audio recording device, start recording with statement including:**

- Date, time and location of interview
- Names of interviewees and/or observers

Residences/Trails/Travelways

1. **Permanent Residence (Home):**
   a. *How long have you been living at your current home?*
2. **Seasonal Residence (Cabin, camp, etc.):**
3. **Trace trail systems in past or current use:**
   a. *Are there trails that cross rivers or lakes?*
   b. *How do people get around within the community, between communities and when out hunting or harvesting?*
   c. *How are road conditions?*
4. **Water routes and portages:**
   a. *Did people use the Keewatin River for traveling by boat?*
   b. *Did people use the Hughes River for traveling by boat?*
   c. *Has anything changed in these rivers that effects travel on by boat?*
5. **Cabins either currently in use or available for use (i.e., still structurally intact) with names of occupants:**
6. **Cabins in ruins or cabin sites with names of former occupants:**

Spiritual/Cultural/Burial Sites/Archaeological Sites

7. **Burial sites, individual graves and graveyards:**
8. **Sites or areas of spiritual significance to community members:**
9. **Special woman's areas (e.g., retreats, spiritual renewal camps):**
10. **Archaeological (precontact and post-contact) sites:**

Hunting/Trapping/Wildlife Habitat (Mammals and Birds)

11. **Registered trapline areas:**
12. **General wildlife/birds:**
    a. *What is the status of moose populations in the region (stable, decreasing, increasing)?*
    b. *What is the status of bear populations in the region (stable, decreasing, increasing)?*
    c. *What is the status of wolf populations in the region (stable, decreasing, increasing)?*

d. *What is the status of beaver populations in the region? Are there cyclical population trends – is it high or low now?*
e. *Have you seen any unusual wildlife (e.g., Skunks, turkey vultures, snakes, turtles, salamanders in the region)? If so where?*
f. *Are there species of wildlife you used to see but don't anymore?*
g. *Do Ptarmigan breed in the area or are they typically only present during the winter*
h. *Are sharp-tailed grouse in the region? Any particular area they are observed in?*
i. *Do swans breed in the region? Any lakes or wetlands known to support breeding swans?*

13. Observations (past and present) of wolf behavior:

14. Fur-bearing animal habitat/harvest locations:

15. Moose, deer, elk and caribou habitat/harvest locations:

16. Salt licks:

17. Waterfowl habitat/harvest locations:

18. Upland bird habitat/harvest locations:

19. Raptor nesting sites:

Fishing/Fish Habitat

20. Fish spawning areas in creeks, rivers and lakes:

a. *What fish use the Keewatin River for spawning?*
b. *What fish use the Lynn River for spawning?*
c. *What time of year do they spawn?*
d. *Are there, or did there used to be, lake sturgeon that used the Keewatin River or Lynn River for spawning?*
e. *If there are (were), where did most of the spawning occur?*
f. *Is there lake sturgeon that spawn in the Hughes River? If so, where?*
g. *Are there fish that only spawn in lakes?*
h. *If so, what type of places do they spawn in?*
i. *Are there fish that move between lakes or places in the rivers, for instance between winter and summer or to spawn?*

21. Fish habitat/harvest locations:

a. *What lakes do or did you fish in?*
b. *Why are these lakes good to fish?*
c. *Do people still fish in these lakes now? If not, why?*
d. *What fish did/do people want to catch from these lakes?*

e. *What other fish did/do people catch from these lakes?*
f. *How did people catch the fish (e.g., gillnets, traps, weirs)?*
g. *Did people fish in the winter or just when the ice is gone?*
h. *Were there parts of these fish that people most liked to eat (e.g., cheeks, livers) or just the flesh? How did people prepare the fish before eating it (e.g., smoked, boiled, salted)?*
i. *Were there certain types of fish that people fed to their dogs?*
j. *Did people fish in the Keewatin or Lynn rivers? If so, what time of year was best?*
k. *Do people still fish in the Keewatin and Lynn rivers? If not, why?*
l. *What type of fish were people trying to catch in the Keewatin or Lynn rivers?*
m. *How did they catch them?*
n. *Where in the Keewatin or Lynn rivers was fishing best?*
o. *Did people fish in the Hughes River? If so, what time of year was best?*
p. *What type of fish were people trying to catch in the Hughes River?*
q. *Where in the Hughes River was fishing best?*
r. *Have you noticed any difference in the populations or quality of fish when fishing?*
s. *If there have been changes, what do you think the reason is?*
t. *Is there, or was there, any commercial fisheries that people of Marcel Colomb First Nation are/were involved in? What lakes were fished? What type of fish were caught for sale?*
u. *How long did this commercial fishery last? What years was it in?*
v. *How many people participated in the commercial fishery?*
w. *Are there people from Marcel Colomb First Nation that work as guides in the recreational fisheries in the area? If so, about how many people and in which lodges/lakes do they work? About how long each year do they work?*
x. *Have you seen northern leopard frog in the region? If so where? And when approximately (few years ago, decades ago)?*

22. Dry fish preparation areas/camps:

Plant Harvesting/Berry Picking/Harvesting Earth Materials

23. Berry patches (blueberries, saskatoons, chokecherries, pin cherries, gooseberries cranberries, etc.):

24. Rat root, seneca, sweet grass and traditional medicine gathering sites:

25. Farming, market gardening, and grazing areas:

26. Hay meadows:

27. Woodlots for firewood and building materials:

28. Stone quarries (chimney/foundation stones, sweat lodge stones etc.):

Environmental Observations/Atmosphere/Water

29. Traditional place names:

a. *What are the traditional names of the lakes around the project areas?*

b. *What are the traditional names of the rivers and streams around the project areas?*

30. Typical time of ice break up on rivers and lakes?

31. Artesian wells/spring sites:

32. Atmosphere:

a. *Are there traditional areas that have been subject to forest fire damage and forest fire smoke?*

b. *Is open burning practiced in any of the traditional land use areas? If so where and why?*

c. *Have there been extreme weather events that have affected traditional land use or the harvest of traditional foods?*

d. *Has there been poor air quality events that have negatively affected traditional land use or traditional foods? If so what was the cause of the poor air quality?*

e. *Have dusty conditions ever negatively affected traditional land use or the collection of traditional foods (e.g. especially the berry picking areas along unpaved public roads)?*

Concerns/Mitigations

APPENDIX C: INFORMATION SHARING AGREEMENT

INFORMATION SHARING AGREEMENT

This Agreement is made the ______ day of ______________________, 2018 by and between:

Stantec Consulting Ltd. ("Stantec")

100-75 24th Street East; Saskatoon, SK; S7K 0K3

and

Marcel Colomb First Nation ("MCFN")

P.O. Box 1150; Lynn Lake, MB; R0B 0W0

WHEREAS:

1. The parties wish to clarify and formalize the framework for sharing traditional land and resource use information and traditional ecological knowledge, in the form of the regulatory version of the report entitled *A Traditional Land and Resource Use Study for Marcel Colomb First Nation, Manitoba: EA/EIS Version*, for the environmental assessment and regulatory application of the Lynn Lake Gold Project ("the Project");
2. Stantec wishes to work collaboratively with MCFN to collect and use traditional knowledge to support and enhance a regulatory application for the Project and to aid in the planning, design, evaluation, assessment, development, construction, operation and maintenance of the Project (the "Purpose"); and
3. The parties are dedicated to working together in the spirit of mutual respect and understanding.

NOW THEREFORE, in consideration of the mutual promises and agreements contained herein, the Parties hereby agree as follows:

1.0 Principles of the Agreement

1.1 MCFN is the sole owner of the intellectual property rights in the traditional land and resource use information and traditional ecological knowledge they share with Stantec.

1.2 Stantec shall not use or distribute the traditional knowledge shared by study participants and MCFN with Stantec for the Project except for the Purpose and as otherwise agreed to by MCFN

1.3 This Agreement is not intended to limit the private sharing, teaching or use of information by any members of MCFN. This Agreement is intended to be consistent with the principles of sharing information in the maintenance of the environment and the well-being of MCFN.

1.4 Study participants can rescind consent to use the traditional ecological knowledge they have provided, with the understanding that information that has been distributed or made public cannot be retrieved.

2.0 Stantec agrees:

2.1 that traditional land and resource use information and traditional ecological knowledge is the intellectual property of MCFN and that MCFN is entitled to take steps to ensure its integrity, protection and preservation;

2.2 to use traditional land and resource use information and traditional ecological knowledge shared by study participants and MCFN only for the Purpose;

2.3 to follow MCFN guidelines, principles, protocols and restrictions relating to the collection, use and distribution of traditional land and resource use information and traditional ecological knowledge as identified and communicated to Stantec by MCFN study participants and community representatives;

2.4 to ensure that its employees and/or agents are aware of the provisions of this Agreement;

2.5 when applicable, to return all original traditional knowledge materials (including notes, annotated maps, be it in tape, transcribed or electronic form) to MCFN upon completion of the Project;

2.6 to recognize that traditional land and resource use information and traditional ecological knowledge is a valuable body of wisdom which can help protect, conserve, and restore the environment and traditional lands;

2.7 to respect and present the traditional land and resource use information and traditional ecological knowledge provided by study participants as accurately as possible in any interpretations and analyses; and,

2.8 to provide resources sufficient to meet the conditions of this Agreement.

3.0 MCFN agrees:

3.1 to identify and authorize community representatives to act on behalf of MCFN for the purposes of this Agreement;

3.2 to provide to Stantec the guidelines, principles, protocols and restrictions for the sharing and use of traditional land and resource use information and traditional ecological knowledge;

3.3 to determine what elements of traditional land and resource use information and traditional ecological knowledge can be included in Stantec prepared documents that will be distributed to Stantec's client and applicable government or regulatory bodies;

3.4 to provide resources sufficient to meet the conditions of this Agreement; and

3.5 that Stantec cannot control the use and distribution of the traditional land and resource use information and traditional ecological knowledge once it has been distributed to Stantec's client or applicable government or regulatory bodies.

Please circle appropriate option:

3.6 that the *A Traditional Land and Resource Use Study for Marcel Colomb First Nation, Manitoba: EA/EIS Version* report can be appended to the Environmental Impact Statement for the LLGP, thereby becoming a publicly accessible document.

3.7 that the *A Traditional Land and Resource Use Study for Marcel Colomb First Nation, Manitoba: EA/EIS Version* report can NOT be appended to the Environmental Impact Statement for the LLGP and must be kept confidential by the regulator(s).

4.0 This Agreement shall be governed in accordance with the laws of the jurisdiction where the majority of the Services are provided.

This Agreement is made as of the date written above.

Marcel Colomb First Nation

Signature: ______________________________ Date: ______________________

Name: ____________________________ Title: _______________________

Stantec Consulting Ltd.

Signature: ______________________________ Date: ______________________

Name: ____________________________ Title: _______________________

Design with
community in mind

Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project

Final Report

Prepared for:
Manitoba Metis Federation

February 2020

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Definition of Terms

Country Foods: Foods from wild animals or plants, also called wild foods, on which the citizens of the Manitoba Métis Community rely for subsistence.

Land Use: Defined generally as hunting, fishing, and gathering, and the use of sites and resources for cultural and ceremonial purposes by the Manitoba Métis Community.

Map Biography: The methodology for this TKLUS is based on the best practice map biography technique pioneered by Terry Tobias in his manual *Living Proof: The Essential Data-Collection Guide for Indigenous Use and Occupancy Map Surveys* (2009). The map biography is the standard data collection method for land use and occupancy studies. A map biography is an interview process in which a person provides an account of their life on the land and water, including places they have travelled, stayed, and gathered resources. In some cases, as with some of the TEK data provided in this TKLUS, participants indicate places that they have not used personally, but about which they have knowledge from family or other members of the community (Tobias, 2009).

Métis Knowledge or Métis Traditional Knowledge (MK or MTK): The body of knowledge and information shared by the Manitoba Métis Community, as a part of the Métis Nation, and held by and transmitted between Métis people, which supports traditional land use for the benefit and well-being of Métis peoples. Métis Traditional Knowledge can be considered a distinct type of Traditional Knowledge.

Occupancy: Defined generally as the settlements, movements, and sites associated with a distinct group of peoples, in this context with the Manitoba Métis Community.

Oral History: For the purposes of this Study, Oral History refers to the participant's qualitative land use and occupancy knowledge about a particular area or activity. It could include details about the social, economic, cultural, or environmental importance of a location, species, or land-based activity, as well as legends and stories that have been passed down. Oral History is used to bring depth to land use and occupancy research and increase shared understanding about the values of the participants. It is commonly collected as complementary material to a map biography as it doesn't lend itself as well to being recorded on a map.

Métis Ecological Knowledge (MEK): The knowledge and information by which people come to understand the ecology of their surrounding environment through years of firsthand experience and inherent cultural understanding of the relationships between humans, animals, lands, and waters. People also come to understand the ecology of their environment through teachings that have been passed down through relations or within a community.

Study Area: The Study Area refers to the 100 km area around the two Project Sites.

Project Sites: The Project Sites are the two project footprint areas of the proposed mine sites.

1.0 Introduction of the Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project

1.1 Background and Context

The Manitoba Metis Federation (MMF) hired Shared Value Solutions (SVS) to support us in providing evidence of land use and occupancy by the Métis Nation's Manitoba Métis Community (MMC) within proximity to the two mine sites being proposed by Alamos Gold near Lynn Lake, Manitoba. Alamos Gold Inc. provided the funding to complete this study.

The information provided in this report includes sensitive information shared with the MMF by members of the Métis Nation's Manitoba Métis Community (also known as Métis Citizens) with the understanding that it would be kept confidential, individuals would not be specifically identified, and the information would not be disclosed other than by the MMF. Métis Citizens have entrusted the MMF, as their democratically elected Métis Government, to safeguard and appropriately use this information on their behalf. The information provided in this report is the property of the MMF and cannot be duplicated or distributed without the MMF's prior written consent.

The Lynn Lake Gold Project is an open-pit gold mine and new metal mill located near Lynn Lake, Manitoba. Alamos Gold Inc. owns the mine. There are two locations that hold gold and silver deposits that Alamos is proposing to re-construct: the Gordon site and the MacLellan site. The proposed work would include the construction (re-development of the old mines), operation, and closure of the mines at both old Gordon and MacLellan mine sites.

1.2 Study Objectives

The Manitoba Métis Traditional Knowledge and Land Use Study (the Study) documents where and how harvesters of the MMC use the lands and waters within a 100 km Study Area around the proposed Lynn Lake Gold mines. For the purposes of the Study, participating harvesters were asked to focus on the 100-km Study Area around the Lynn Lake Gold Project sites (herein called the Project). The mapped data in this report is only reflective of a small number of Métis harvesters. Documented land use and occupancy has only been provided for the Study Area.

There were five main objectives of the Study:

1. Document evidentiary information that shows where and how Métis harvesters use the lands and waters around the Project sites and provide this data to the MMF in a format that is useful in their negotiations and discussions with Alamos Gold Inc., including information identifying the following:

- Locations for hunting, trapping, fishing, and gathering plants or natural materials;
- locations that are culturally significant to the MMC;
- locations of overnight stays on the land;
- access routes and trails;
- areas of ecological importance, and/or
- areas of demographic importance (e.g., locations of current or past residences, birthplaces, and burial sites).

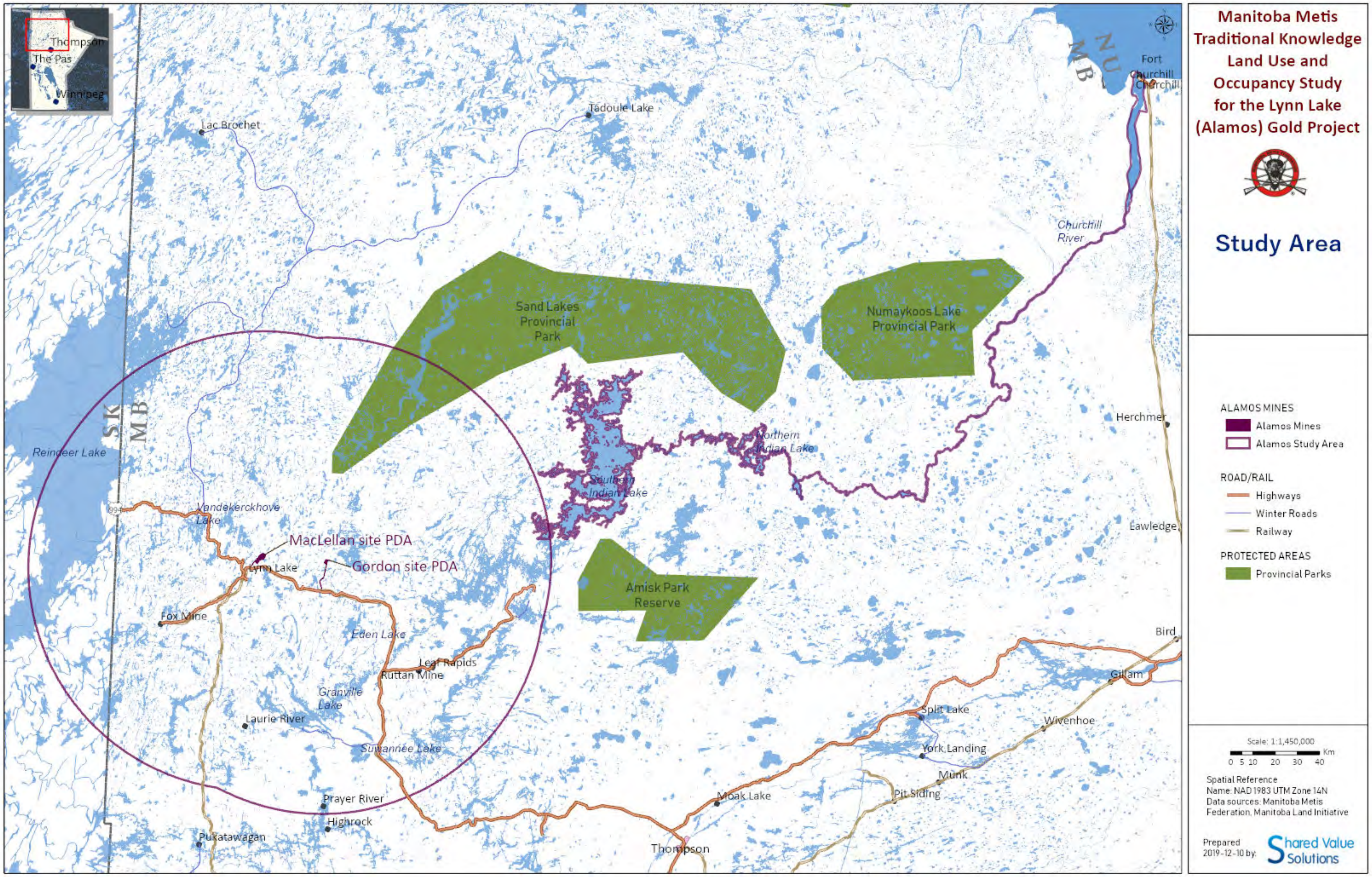
2. Collect information from harvesters on the frequency of wild food consumption including food that is harvested within the Study Area.
3. Collect information in a format that is consistent with the current Manitoba Métis Land Use and Occupancy catalogue data.
4. Understand participants' thoughts and perceptions of the Project.
5. Document evidentiary information that shows where and how Métis harvesters have used the lands and waters outside of the Manitoba Métis Resource Harvesting Zone to exercise their Métis rights.

1.3 Geographic and Temporal Scope of the Study

Geographic Scope

There were two geographic scopes used for this Study. The first Study Area included the areas within 100 km of the Project sites. The second Study Area included the Churchill River watershed from South Indian Lake downstream to Hudson Bay. Figure 1 displays the Study Areas. These two geographic scopes were chosen based on assumptions about the areas mostly likely impacted by the Project (e.g., in the immediate vicinity and downstream).

Figure 1. Study Area Map



Temporal Scope

Researchers followed land use and occupancy study best practices. This includes the use of two temporal scopes. The first is current use, which includes anything that happened within the participant's lifetime. The second is historic use of sites that the participants know about through teaching or knowledge transfer from past generations, including Oral History or Traditional Knowledge about Métis harvesting and gathering practices and sites of cultural or other significance. For current use, researchers asked participants whether a certain activity happened within the last 10 years, prior to the last 10 years, or if it was an ongoing activity both within and prior to the last 10 years.

1.4 Interpreting the Maps and Tables

The MMF has conducted multiple map biography and Oral History interviews for various projects or studies. The data presented in this report includes all data collected by the MMF, including the data collected specifically for this Project, as well as information from other projects or reports relevant to this Study. Our researchers combined this data and provided analysis of the land use and occupancy sites within 100 km of the Project sites.

SVS worked with three datasets to develop the maps for this report. The first was collected between 2003 and 2009. This data has been included on the maps, but attribute data was not available in a form that allowed for categorization. This data has been included to add to the information of where citizens of the Manitoba Métis Community have identified land use and occupancy sites. The second dataset is from 2009 onward and includes the land use and occupancy data that has been collected for other Manitoba Métis Community knowledge studies and is referred to as the MMF Data Catalogue. The third dataset is from interviews conducted specifically for this Project. The second and third datasets have been combined and are displayed on the maps and in the tables as specific land use and occupancy categories. These datasets contain in-depth attribute data, including species, season, activity, and the time period in which the activity happened. The MMF Data Catalogue includes data collected from an additional 114 Manitoba Métis harvesters.

2.0 The Manitoba Métis Community

2.1 History and Identity

The Métis Nation—as a distinct Indigenous people—evolved out of relations between European men and First Nations women who were brought together as a result of the early fur trade in the Northwest. In the eighteenth century, both the Hudson Bay Company and the Northwest Company created a series of trading posts that stretched across the upper Great Lakes, through the western plains, and into the northern boreal forest. These posts and fur trade activities brought European and Indigenous peoples into contact. Inevitably, unions between European men—explorers, fur traders, and pioneers—and Indigenous women were consummated. The children of these families developed their own collective identity and political community so that "[w]thin a few generations, the descendants of these unions developed a culture distinct from their European and Indian forebears" and the Métis Nation was born—a new people, indigenous to the western territories *(Alberta (Aboriginal Affairs and Northern Development) v. Cunningham*, [2011] 2 SCR 670 at para. 5; 2008 MBPC *R. v. Goodon*, 59 at para. 25; *Manitoba Metis Federation Inc. v. Canada (Attorney General)*, [2013] 1 SCR 623 at para. 2).

The Métis led a mixed way of life. "In early times, the Métis were mostly nomadic. Later, they established permanent settlements centered on hunting, trading and agriculture" (*Alberta v. Cunningham*, at para. 5). The Métis were employed by both of the fur trades' major players, the Hudson's Bay and Northwest companies. By the early 19th century, they had become a major component of both firms' workforces. At the same time, however, the Métis became extensively involved in the buffalo hunt. As a people, their economy was diverse; combining as it did, living off the land in the Aboriginal fashion with wage labour (*MMF Inc. v. Canada*, at para. 29).

It was on the Red River, in reaction to a new wave of European immigration, that the Métis Nation first came into its own. Since the early 1800s, the Manitoba Métis Community—as a part of the larger Métis Nation—has asserted itself as a distinct Indigenous collective with rights and interests in its Homeland. The Manitoba Métis Community shares a language (Michif), national symbols (infinity flags), culture (i.e., music, dance, dress, crafts), as well as a special relationship with its territory that is centered in Manitoba and extends beyond the present-day provincial boundaries.

The Manitoba Métis Community has been recognized by the courts as being a distinctive Indigenous community, with rights that are protected in section 35 of the *Constitution Act, 1982*. In *Goodon*, the Manitoba courts held that:

> *The Métis community of Western Canada has its own distinctive identity […] the Métis created a large inter-related community that included numerous settlements located in present-day southwestern Manitoba, into Saskatchewan and including the northern Midwest United States. This area was one community […] The Métis community today in Manitoba is a well-organized and vibrant community (paras. 46-47; 52).*

This proud independent Métis population constituted a historic rights-bearing community in present day Manitoba and beyond, which encompassed "all of the area within the present boundaries of southern Manitoba from the present-day City of Winnipeg and extending south to the United States" (*R. v. Goodon*, at para. 48).

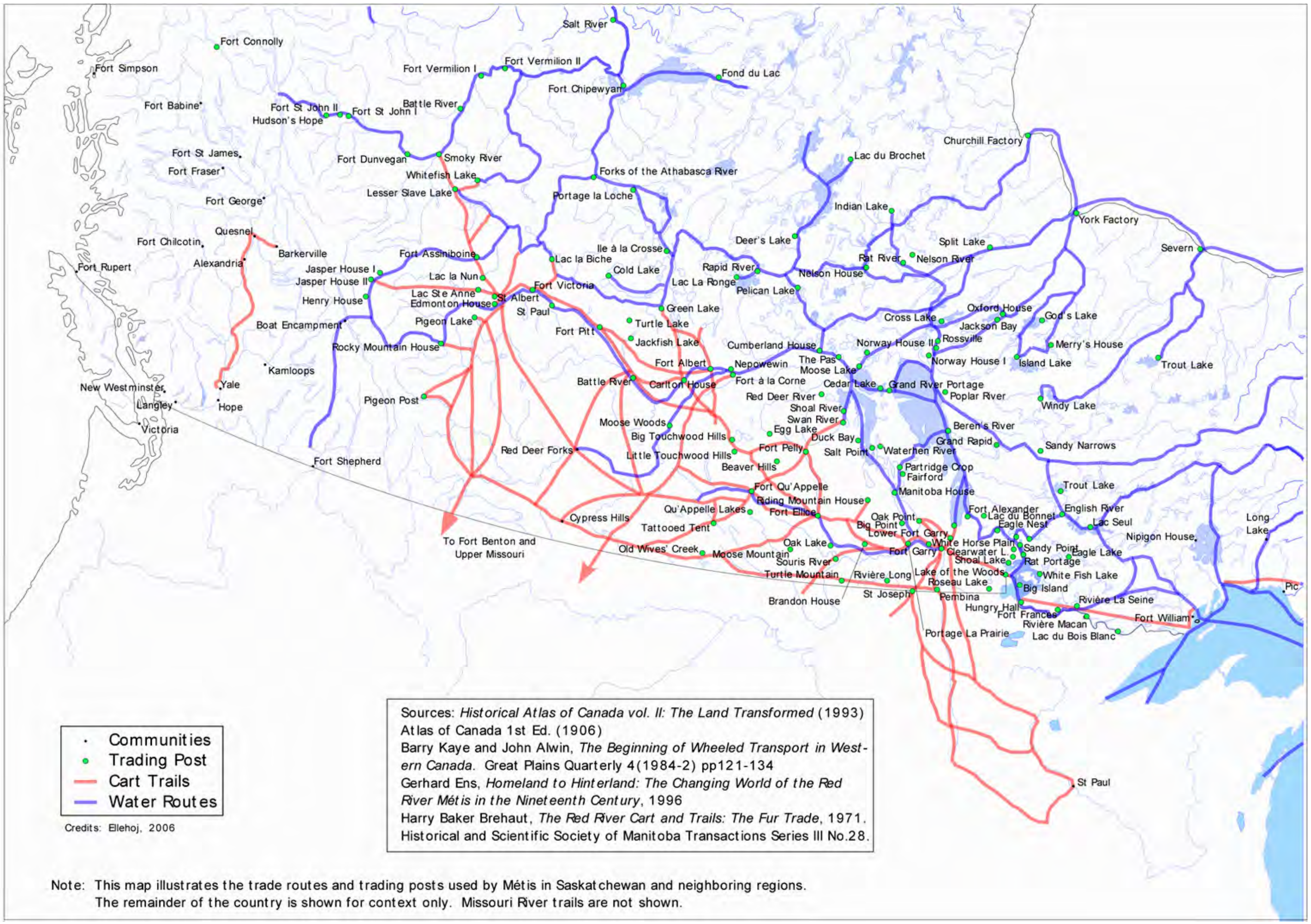
The heart of the historic rights-bearing Métis community in southern Manitoba was the Red River Settlement; however, the Manitoba Métis Community also developed other settlements and relied on various locations along strategic fur trade routes. During the early part of the 19th century, these included various posts of varying size and scale spanning the Northwest Company and the Hudson Bay Company collection and distribution networks.

More specifically, in relation to the emergence of the Métis—as a distinct Aboriginal group in Manitoba—the Supreme Court of Canada wrote the following in the *MMF Inc. v. Canada* case:

> *[21] The story begins with the Aboriginal peoples who inhabited what is now the province of Manitoba—the Cree and other less populous nations. In the late 17th century, European adventurers and explorers passed through. The lands were claimed nominally by England which granted the Hudson's Bay Company, a company of fur traders' operation of out London, control over a vast territory called Rupert's Land, which included modern Manitoba. Aboriginal peoples continued to occupy the territory. In addition to the original First Nations, a new Aboriginal group, the Métis, arose—people descended from early unions between European adventurers and traders, and Aboriginal women. In the early days, the descendants of English-speaking parents were referred to as half-breeds, while those with French roots were called Métis.*
>
> *[22] A large—by the standards of the time—settlement developed at the forks of the Red and Assiniboine Rivers on land granted to Lord Selkirk by the Hudson's Bay Company in 1811. By 1869, the settlement consisted of 12,000 people, under the governance of Hudson's Bay Company.*
>
> *[23] In 1869, the Red River Settlement was a vibrant community, with a free enterprise system and established judicial and civic institutions, centred on the retail stores, hotels, trading undertakings and saloons of what is now downtown Winnipeg. The Métis were the dominant demographic group in the Settlement, comprising around 85 percent of the population [approximately 10,000 Métis], and held leadership positions in business, church and government.*

The fur trade was vital to the ethnogenesis of the Métis and was active in Manitoba from at least the late 1770s, and numerous posts and outposts were established along cart trails and waterways throughout the province. These trails and waterways were crucial transportation networks for the fur trade (Jones 2014; Figure 2) and were the foundation of the Manitoba Métis Community's extensive use of the lands and waters throughout the province. In the early 20th century, the Manitoba Métis Community continued to significantly participate in the commercial fisheries and in trapping activities, which is well documented in Provincial government record.

Figure 2. The Fur Trade Network: Routes and Posts Prior to 1870



2.2 Manitoba Metis Federation

The MMF is the democratically elected government of the Métis Nation's Manitoba Métis Community (Manitoba Métis Community). The MMF is duly authorized by the Citizens of the Manitoba Métis Community for the purposes of dealing with their collective Métis rights, claims, and interests, including conducting consultations and negotiating accommodations (as per MMF Resolution No. 8). While the MMF was initially formed in 1967, its origins lie in the 18th century with the birth of the Manitoba Métis Community and in the legal and political structures that developed with it. Since the birth of the Métis people in the Red River Valley, the Manitoba Métis Community—as a part of the larger Métis Nation—has asserted and exercised its inherent right of self-government. The expression of this self-government right has changed over time to continue to meet the needs of the Manitoba Métis Community. For the last 50 years, the MMF has represented the Manitoba Métis Community at the provincial and national levels.

During this same period, the MMF has built a sophisticated, democratic, and effective Métis governance structure that represents the Manitoba Métis Community at the local, regional, and provincial levels throughout Manitoba. The MMF was created to be the self-government representative of the Manitoba Métis Community—as reflected in the Preamble of the MMF's Bylaws (also known as the MMF Constitution), which are agreed to by its members as a part of registering with the MMF:

> *WHEREAS, the Manitoba Metis Federation Inc. has been created to be the democratic and self-governing representative body of the Manitoba Métis Community.*

In addition, the purpose "to provide responsible and accountable governance on behalf of the Manitoba Métis Community using the constitutional authorities delegated by its citizens" is embedded within the MMF's objectives, as set out in the MMF Constitution as follows:

I. To promote and instill pride in the history and culture of the Métis people.

II. To educate members with respect to their legal, political, social and other rights.

III. To promote the participation and representation of the Métis people in key political and economic bodies and organizations.

IV. To promote the political, legal, social and economic interests and rights of its citizens.

V. To provide responsible and accountable governance on behalf of the Manitoba Métis community using the constitutional authorities delegated by its members.

The MMF is organized and operated based on centralized democratic principles, some key aspects of which are described below.

President: The President is the Chief Executive Officer, leader, and spokesperson of the MMF. The President is elected in a province-wide ballot-box election every four years and is responsible for overseeing the day-to-day operations of the MMF.

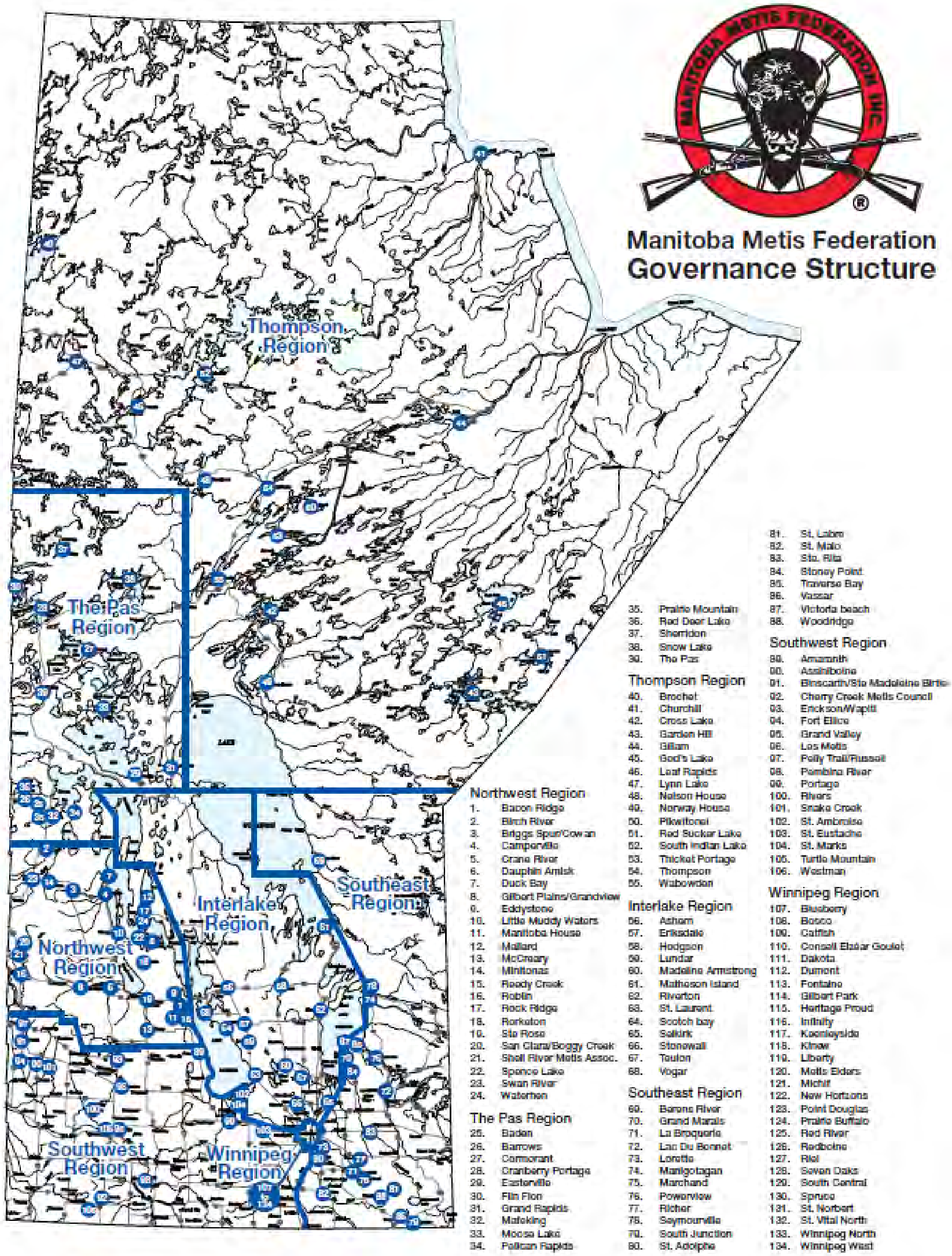
Board of Directors: The MMF Board of Directors, or MMF Cabinet leads, manages, and guides the policies, objectives, and strategic direction of the MMF and its subsidiaries. All 23 individuals are democratically elected by the citizens.

Regions: The MMF is organized into seven regional associations or "Regions" throughout the province (Figure 3): The Southeast Region, the Winnipeg Region, the Southwest Region, the Interlake Region, the Northwest Region, the Pas Region, and the Thompson Region. Each Region is administered by a Vice-President and two executive officers, all of whom sit on the MMF's Cabinet. Each Region has an office which delivers programs and services to their specific geographic area.

Locals: Within each Region are various area-specific "Locals" which are administered by a chairperson, a vice-chairperson and a secretary-treasurer. Locals must have at least nine members and meet at least four times a year to remain active. There are approximately 140 MMF Locals across Manitoba.

While the MMF has created an effective governance structure to represent the Manitoba Métis Community at the local, regional, and provincial levels, it is important to bear in mind that there is only one large, geographically dispersed, Manitoba Métis Community. Citizens of Manitoba Métis Community live, work and exercise their s. 35 rights throughout and beyond the province of Manitoba.

Figure 3. Manitoba Metis Federation (MMF) Regions



2.3 MMF Resolution No. 8

Among its many responsibilities, the MMF is authorized to protect the Aboriginal rights, claims, and interests of the Métis Nation's Manitoba Métis Community, including as related to harvesting, traditional culture, and economic development, among others.

In 2007, the MMF Annual General Assembly unanimously adopted Resolution No. 8 that sets out the framework for engagement, consultation, and accommodation to be followed by Federal and Provincial governments, industry, and others when making decisions and developing plans and projects that may impact the Manitoba Métis Community. Under MMF Resolution No. 8, direction has been provided by the Manitoba Métis Community for the MMF Home Office to take the lead and be the main contact on all consultation undertaken with Manitoba Métis Community. Resolution No. 8 reads, in part that:

> *…this assembly continue[s] to give the direction to the Provincial Home Office to take the lead and be the main contact on all consultations affecting the Métis community and to work closely with the Regions and Locals to ensure governments and industry abide by environmental and constitutional obligations to the Métis…*

The MMF Home Office works closely with the Regions and Locals to ensure the rights, interests, and perspective of the Manitoba Métis Community are effectively represented in matters related to consultation and accommodation.

Resolution No. 8 has five phases:

- Phase 1: Notice and Response
- Phase 2: Funding and Capacity
- Phase 3: Engagement or Consultation
- Phase 4: Partnership and Accommodation
- Phase 5: Implementation

Each phase is an integral part of the Resolution No. 8 framework and proceeds logically through the stages of consultation.

2.4 Manitoba Métis Community Rights, Claims, and Interests

The Manitoba Métis Community possesses Aboriginal rights, including pre-existing Aboriginal collective rights and interests in lands protected by section 35 of the *Constitution Act, 1982*, throughout Manitoba. Indeed, Manitoba courts recognized these pre-existing, collectively held Métis rights in *R. v. Goodon* (at paras. 58; 72):

> *I conclude that there remains a contemporary community in southwest Manitoba that continues many of the traditional practices and customs of the Métis people.*
>
> *I have determined that the rights-bearing community is an area of southwestern Manitoba that includes the City of Winnipeg south to the U.S. border and west to the Saskatchewan border.*

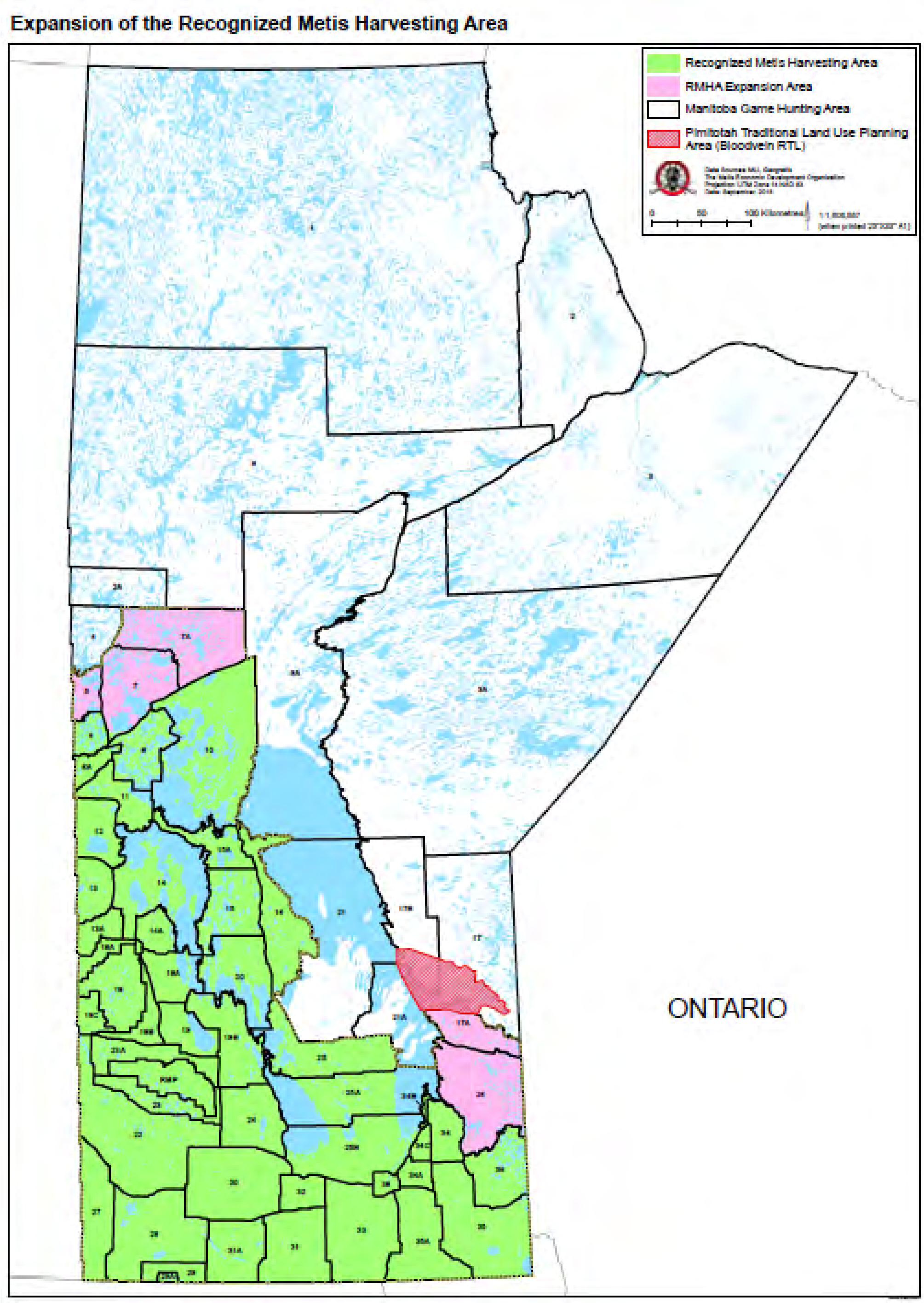
As affirmed by the Supreme Court of Canada, such rights are "recognize[d] as part of the special aboriginal relationship to the land" (*R. v. Powley,* 2003 SCC 43, at para. 50) and are grounded on a "communal Aboriginal interest in the land that is integral to the nature of the Métis distinctive community and their relationship to the land" (*MMF Inc. v. Canada*, at para. 5). Importantly, courts have also recognized that Métis harvesting rights may not be limited to Unoccupied Crown Lands (*R. v. Kelley*, 2007 ABQB 41, para. 65).

The Crown, as represented by the Manitoba government, has recognized some aspects of the Manitoba Métis Community's rights through a negotiated agreement: The *MMF-Manitoba Points of Agreement on Métis Harvesting* (2012) (the *MMF-Manitoba Harvesting Agreement*). This Agreement was signed at the MMF's 44th Annual General Assembly and "recognizes that collectively-held Métis Harvesting Rights, within the meaning of s. 35 of the *Constitution Act, 1982*, exist within the [Recognized Métis Harvesting Zone], and that these rights may be exercised by Métis Rights Holders consistent with Métis customs, practices and traditions…" (*MMF-Manitoba Harvesting Agreement*, section 1). In particular, the *MMF-Manitoba Harvesting Agreement* recognizes that Métis rights include "hunting, trapping, fishing and gathering for food and domestic use, including for social and ceremonial purposes and for greater certainty, Métis harvesting includes the harvest of timber for domestic purposes" throughout an area spanning approximately 169,584 km^2 (the "Métis Recognized Harvesting Area") (*MMF-Manitoba Harvesting Agreement*, section 2; Figure 4 below). The MMF further asserts rights and interests beyond this area, which require consultation and accommodation as well.

Beyond those rights already established through litigation and recognized by agreements, the Manitoba Métis Community claims commercial and trade-related rights. Courts have noted that Métis claims to commercial rights remain outstanding (*R. v. Kelley* at para. 65). These claims are strong and well-founded in the historical record and the customs, practices, and traditions of the Manitoba Métis Community, and it is incumbent on the Crown and Proponents to take them seriously.

As noted above, the Manitoba Métis Community has its roots in the western fur trade (*R. v. Blais*, 2003 SCC 44 at para. 9 [*Blais*]; *R. v. Goodon* at para. 25). The Métis in Manitoba are descendants of early unions between Aboriginal women and European traders (*MMF Inc. v. Canada* at para. 21). As a distinct Métis culture developed, the Métis took up trade as a key aspect of their way of life (*R. v. Powley* at para. 10). Many Métis became independent traders, acting as middlemen between First Nations and Europeans (*R. v. Goodon* at para. 30). Others ensured their subsistence and prosperity by trading resources they themselves hunted and gathered (*R. v. Goodon* at para. 31, 33, & 71). By the mid-19th century, the Métis in Manitoba had developed the collective feeling that "the soil, the trade and the Government of the country [were] their birth rights." (*R. v. Goodon* at para. 69(f)). Commerce and trade are, and always have been, integral to the distinctive culture of the Manitoba Métis Community. Today, the Manitoba Métis have an Aboriginal, constitutionally protected right to continue this trading tradition in modern ways to ensure that their distinct community will not only survive, but also flourish.

Figure 4. MMF-Manitoba Harvesting Agreement Recognized Manitoba Métis Harvesting Zones (Green and Pink)



Unlike First Nations in Manitoba, whose commercial rights were converted and modified by treaties and the *Natural Resources Transfer Agreement* (*NRTA)* (*R. v. Horseman*, [1990] 1 SCR 901), the Métis' pre-existing customs, practices, and traditions—including as they relate to commerce and trade—were not affected by the *NRTA* (*R. v. Blais*) and continue to exist and be protected as Aboriginal rights. First Nations' treaty rights in Manitoba are, for example, inherently limited by the Crown's power to take up lands (*Mikisew Cree First Nation v Canada* (*Minister of Canadian Heritage*), [2005] 3 SCR 388 at para 56). Métis rights, in contrast, are not tempered by the "taking up" clauses found in historic treaties with First Nations. Métis rights must be respected as they are, distinct from First Nations' rights and unmodified by legislation or agreements.

In addition to the abovementioned rights to land use that preserve the Métis culture and way of life, the MMF has other outstanding land related claims and interests with respect to lands. Specifically, these claims relate to the federal Crown's constitutional promise to all Aboriginal peoples, including Manitoba Métis, as set out in the Order of Her Majesty in Council Admitting Rupert's Land and the North-Western Territory into the Union (the "1870 Order") which provides

> *that, upon the transference of the territories in question to the Canadian Government, the claims of the Indian tribes to compensation for lands required for purposes of settlement will be considered and settled in conformity with the equitable principles which have uniformly governed the British Crown in its dealings with the aborigines.*

The manner in which the federal Crown implemented this constitutional promise owing to the Manitoba Métis—through the *Dominion Lands Act* and the resulting Métis scrip system—effectively defeated the purpose of the commitment. Accordingly, the MMF claims these federal Crown actions constituted a breach of the honour of the Crown, which demand negotiations and just settlement outside of the 'old postage stamp province' within Manitoba as well.

The MMF also claims that the *Dominion Lands Act* and the resulting Métis scrip system were incapable of extinguishing collectively held Métis title in specific locations where the Manitoba Métis Community is able to meet the legal test for Aboriginal title as set out by the Supreme Court of Canada. These areas in the province, which the Manitoba Métis exclusively occupied—as an Indigenous people—prior to the assertion of sovereignty, establish a pre-existing Métis ownership interest in these lands.

The MMF also has an outstanding legal claim within what was the 'old postage stamp province' of Manitoba relating to the 1.4 million acres of land promised to the children of the Métis living in the Red River Valley, as enshrined in s. 31 of the *Manitoba Act, 1870* (*MMF Inc. v. Canada* at para 154).

This land promised was a nation-building, constitutional compact that was meant to secure a "lasting place in the new province [of Manitoba]" for future generations of the Métis people (*MMF Inc. v. Canada* at para 5). This "lasting place" was to have been achieved by providing the Manitoba Métis Community a "head start" in securing lands in the heart of the new province (*MMF Inc. v. Canada* at paras 5-6).

Instead, the federal Crown was not diligent in its implementation of s. 31, which effectively defeated the purpose of the constitutional compact.

In March 2013, the Supreme Court of Canada found that the federal Crown failed to diligently and purposefully implement the Métis land grand provision set out in s. 31 of the *Manitoba Act, 1870* (*MMF Inc. v. Canada* at para 154). This constituted a breach of the honour of the Crown. In arriving at this legal conclusion, the Court wrote:

> *What is at issue is a constitutional grievance going back almost a century and a half. So long as the issue remains outstanding, the goal of reconciliation and constitutional harmony, recognized in s. 35 of the Constitution Act, 1982 and underlying s. 31 of the Manitoba Act, remains unachieved. The ongoing rift in the national fabric that s. 31 was adopted to cure remains unremedied. The unfinished business of reconciliation of the Métis people with Canadian sovereignty is a matter of national and constitutional import.* (*MMF Inc. v. Canada* at para 140)

This constitutional breach is an outstanding Métis claim flowing from a judicially recognized common law obligation which burdens the federal Crown (*MMF Inc. v. Canada* at paras 156; 212). It can only be resolved through good faith negotiations and a just settlement with the MMF (see for example: *R v Sparrow*, [1990] 1 SCR 1075 at paras 51–53; *R v Van der Peet*, [1996] 2 SCR 507 at paras 229, 253; *Haida* at para 20; *Carrier Sekani* at para 32). Lands both within the 'old postage stamp province' as well as in other parts of Manitoba—since little Crown lands remain within the 'old postage stamp province'—may need to be considered as part of any future negotiations and settlement in fulfillment of the promise of 1.4 million acres.

On November 15, 2016, the MMF and Canada concluded a *Framework Agreement for Advancing Reconciliation* (the "Framework Agreement"). The Framework Agreement established a negotiation process aimed, among other things, finding a shared solution regarding the Supreme Court of Canada's decision in *MMF Inc. v. Canada* and advancing the process of reconciliation between the Crown and the Manitoba Métis Community. It provides for negotiations on various topics including, but not limited to, the "quantum, selection and management of potential settlement lands." Negotiations under the Framework Agreement are active and ongoing.

3.0 Map Biography and Oral History

The focus of the map biography and Oral History interviews was on the collection of the following information:

- Current and childhood residences, and Métis ancestry;
- Traditional Ecological Knowledge, including locations of fish spawning areas, seasonal mammal habitat and migration routes, bird habitat, reptile and amphibian habitat, salt or mineral licks, plant habitat, species at risk, spring water locations, and other important ecological features or habitat;

- Hunting and trapping sites, including species and temporal scope of hunting and trapping activity;
- Fishing locations, including species and temporal scope of fishing activity;
- Gathering of plants and other natural materials for food, medicine, crafts or other purposes, including type of plant collected and temporal scope of gathering activity;
- Commercial fishing, trapping, and other land uses for income;
- Cultural and heritage areas including burial sites, sacred or ceremonial sites, historical village sites, trails, and significant locations, contemporary gathering places, recreation areas, and other culturally significant locations;
- Locations of overnight sites including cabins, other types of structures, and campsites;
- Land and water access routes;
- Any observed changes to the environment or any of the above items; and
- Perspectives on being Métis in Manitoba, thoughts and perceptions of the Lynn Lake Gold Mine, and cumulative effects from industry and development.

3.1 Participants

Participants were identified through phone calls by the MMF to harvesters who live in or harvest near the Study Area.

Participants were also required to:

- Be Métis Citizens based on the current definition of Métis Citizens in the MMF Constitution;
- Have historic and/or current connection to the Study Area;
- Be hunters, fishers, trappers, plant harvesters, and other land users (e.g., for education, personal employment, sustenance, etc.); and
- Be from a variety of age groups and genders.

The MMF scheduled all interviews, which took place in the Regional offices in Thompson and the Pas. A total of 13 individuals took part in map biography and Oral History interviews between November 12, 2019 and January 26, 2020. In total, there were 10 males and three females who participated in the Study. Three participants had completed map biography interviews for past studies. In these instances, they were given the same PIN that was used for their data in previous studies, and all their collected land use and occupancy data has been included in this Study. To supplement the data collected from these interviews, information from the MMF Data Catalogue was also drawn on. The MMF Data Catalogue includes data collected from an additional 114 Manitoba Métis harvesters.

3.2 Procedure

The methodology for the map biography and Oral History interviews was adapted by SVS from the work of Terry Tobias (2009) and was informed by discussions with MMF staff about the specific needs for this Study.

Map biography interviews were completed with one individual at a time, but in some instances the participant brought a family member or friend with them to observe. At the beginning of each interview, the Study team briefed the participant on the Lynn Lake Gold Mine, the Study's objectives, and how the data would be used. The Study team then reviewed the permission form with the participants and, if the participant agreed, invited them to provide their written consent to being recorded on audio and video and to allow their information to be used for the purposes of this Study.

Interview teams consisted of SVS staff members. The interviewers followed an interview guide to maintain consistency in the map biography process with each participant.

During the map biography, one interviewer would mark locations of features (points, lines, and polygons) identified by participants on the map directly into a computer using Esri Arc GIS Pro Online (Geographical Information System software). Enlarged wall maps were also hung on the walls of the interview room for reference. The second interviewer entered descriptive data for each feature (point, line, or polygon) into a customized Microsoft Access database that was developed for this Study. The GIS computer screen was video recorded to allow for post-interview verification and a back-up copy of the interview. If the participant consented, the interview was audio recorded so that it could be transcribed.

The Study team also asked Oral History questions related to Métis identity, family stories of land use, relationship to the land and waters, perceptions of current harvesting areas, and perspectives on cumulative effects of development and changes to the environment and land use activities. This portion of the interview also allowed participants time to provide their thoughts on the Lynn Lake gold mine and hopes for the future of the Métis in Manitoba in relation to the proposed gold mine.

All participants received a $150 honorarium and travel reimbursement if they were travelling outside of their home area to participate in the interview.

SVS team members took measures during data gathering, back-up, and analysis to assure proper quality. Team members followed best practices in social science research methodology and SVS' methodological approach for gathering data during the map biography and Oral History. SVS staff conducted quality assurance on collected data from each interview section to ensure there were no missing data or errors in recording descriptions. Senior SVS staff reviewed all research tools and deliverables.

Geographic data was processed to create maps that depict the land use and knowledge of the participants. These maps have been used throughout the report. Raw data and information used remains the property of the MMF and will be returned to the MMF.

3.2.1 Tools for Map Biography and Oral History Interviews

The data collection toolkit included the following components:

- A project overview description
- A permission form
- An interview record form
- A map biography interview guide

Other tools included: two laptops that were used for digital mapping on ArcGIS software and recording descriptive data on a Microsoft Access database; video cameras and audio recorders for data backup; a large-scale map of the Study Areas that was placed on the wall to help participants orient themselves; and notepads, paper, and pens.

3.3 Country Foods Study: Food Frequency Questionnaire

At the beginning of their interview, each of the nine participants completed a food frequency questionnaire that asked them about the frequency, quantity, and type of country or wild foods they consumed within the last year, and whether or not any of that came from the 100 km area around each of the gold mine sites near Lynn Lake. The different types of foods included mammals, birds, fish, and plants.

3.4 Confidentiality and Informed Consent

To ensure confidentiality and informed consent of the participants, SVS researchers took all reasonable measures to safeguard personal and confidential information. Some of these measures included not communicating to other MMF Citizens the identity of participants who were being interviewed for the Study, using PIN numbers to represent participants instead of names, and storing data in a safe and secure location. Confidentiality and informed consent were communicated to the Study participants in writing through the permission forms and verbally by researchers prior to each interview. No names, identifiers, or other forms of personal information are used in this report.

3.5 Data Management

The research team used multiple means to protect the data. These included GIS files, Microsoft Access database entries, video recordings of the GIS screen and the participant, and audio recordings of each session.

To achieve the safe storage of data throughout the research process, the team developed and followed a data management and storage protocol while in the field and back in the office. At the end of each day, audio recordings, GIS files, and Access files were collected and backed up to an external hard drive. A copy of all files was backed up to a second external hard drive. Audio files were also uploaded to a cloud storage host as an additional backup measure. Information collected on the interview record form (name, PIN, SD card number, first and last data entry number, deviations from standard procedure, interview date and location) were recorded on a master data management Excel sheet and updated daily. Paper copies of interview record forms, permission forms, and food frequency questionnaires were digitized and kept on a cloud storage host.

3.6 Study Limitations

3.6.1 Sample Size

There were 13 Métis citizens who took part in interviews for this Study with a focus on citizens who have used the lands and waters around the Study Area. This is a relatively small sample size and cannot be taken to reflect the total Métis population that has used and occupied the land in this area.

Due to the limited scope and short duration of the Study, participants were strategically identified by the MMF to provide a cross-section of the Métis population that has specifically used and/or lived in the Study's geographic area. Despite these limitations, the MMF and SVS believe that the Study provides a snapshot of the MMC's patterns of land use and occupancy within the Study Area.

The Study is not, however, a statistically representative sample of the population of Métis land users across the Province of Manitoba or within the Study Areas and cannot be relied upon as such.

3.6.2 Mapping and Data Collection Consistency Issues

SVS researchers displayed maps on laptop computers using GIS software called ArcMap (v. 10.5). Participants looked at the computer with the interviewer and identified the location(s) of land use and occupancy sites related to each interview question. Most of the participants were able to recall specific locations, direct the interviewer to those locations on the map, and verify that the interviewer recorded the location correctly.

One participant had difficulty reading the maps and verifying locations using the computer-based maps due to difficulty understanding and/or relating to the maps spatially. In this case, the interviewer assisted the participant in finding landmarks on the map as points of reference. This created some measure of difficulty in identifying specific locations at times, but the participant was still able to pinpoint specific sites and locations once they were found.

3.6.3 Interviewer, Participant, and Study Biases

Both interviewers and participants have inherent biases that can affect a research study. This is true for all studies and interviews conducted, no matter the context or circumstance. Interview bias can stem from the social setting of the interview, perceived power imbalances between the interviewer and participant, comfort levels of the interviewer or participant, or the physical location of the interview. SVS and MMF took the following steps to decrease interviewer and participant bias and mitigate the effects that it may have had on the Study:

- MMF staff conducted interview scheduling and explained Study objectives to MMF Citizens in advance;
- Informed participants of the interview process again at the beginning of the interview;
- Provided opportunity for questions to be asked and answered;
- Made conscious choices to use plain language in the wording questions and used a standard interview methodology and questionnaire;
- Limited the use of leading questions or statements;
- Where possible, interviews were conducted in MMF community spaces to offer a familiar setting; and
- Took breaks when needed to ensure interviewer and interviewee stayed alert and focused.

In addition to the strategies above, SVS also applied the methodologies of Terry Tobias (2009). An important aspect of the Tobias approach relevant to study bias is the Data Diamond. The Data Diamond is a mapping approach that ensures the map biography survey focuses on facts. To ensure that mapping data is as accurate as possible, a total of four use-and-occupancy facts need to be collected for the areas mapped (Tobias, 2009, p. 47). These facts are:

1. By a participant and/or others (Who);
2. Engaged in an activity (What);
3. At some point in time (When); and
4. At a specific location (Where).

The Data Diamond can be used to improve map accuracy by helping participants recall as many details as possible. SVS used detailed maps to help participants orient themselves, be more accurate with their mapping data, and to support participant recall.

3.6.4 Limitations of the Food Frequency Questionnaire

Participant recall is also a limitation of the food frequency questionnaire. To mitigate this limitation, we asked participants to only report on foods they consumed in the last year. Other limitations may be that a participant may have consumed wild foods two years ago but didn't this year for reasons associated with access or health. It may be that participants didn't consume foods from the Study Area this year but intend to in the coming years. The data reported on the frequency of food consumed from the Study Area should be indicative of frequency. To gather precise information on the frequency of consumption of wild food from the Study Area, a fulsome country foods study needs to take place in real time over a one-year period.

It is important to note that a limited number of Métis harvesters were available to take part in interviews due to the Study starting during a key harvesting season. The results of the Study therefore can be indicative of the Manitoba Métis Community's land use and reliance but should not be considered to fully capture or represent all Métis use or information.

3.6.5 Data Validation

The Study team sat down with six participants and provided each of them with a copy of their personal transcript and map of the features they provided during their interview. Beyond a few place name spelling corrections, there were no changes made to the documents. There were three participants who were not available for data validation. Four participants who were interviewed in January 2020 have not had a chance to review their transcript or map.

3.6.6 Thompson Regional Community Meeting

Researchers were invited by the MMF to a Regional Meeting in Thompson on January 25th, 2020. There were 53 Métis citizens in attendance. Researchers provided a brief overview of the Project followed by the results of the interim report. Those who attended were asked to participate in a discussion and were asked the following questions:

1. Did you ever interact with the Gordon or MacLellan mines while they were in operation? Please describe.
    a. If so, have you noticed any effects from these old mines?
2. Based on the information we provided today and your past knowledge, what are your thoughts about the new developments of the Lynn Lake gold mine?

a. Is there anything positive you could see coming from it or that you would like to see?

b. Is there anything negative you think could come from it?

c. Are there ways to enhance or mitigate positive or negative effects?

3. Do you think the proposed mine could impact some Métis people differently than others? For example, could it impact Elders, youth, or women differently?

4. Have you been impacted by other resource development activities?

5. other mining developments or hydro developments)?

6. What role would you like to see the Métis in Manitoba playing in the mine? What would you like to see the MMF do to make this happen?

7. If the mine is approved, are there any benefits you would like to see the Proponent giving to the local Métis community?

8. Do you have any unanswered questions that you would like to raise?

The results of the community meeting are discussed further in the next section.

4.0 Results of Métis Land Use Within the Project Study Area

Study results indicate that Manitoba Métis harvesters have used, and continue to use, the lands and waters in the Study Area for various purposes including subsistence harvesting and cultural and traditional uses. This section of the report provides an overview of these results.

4.1 Land Use and Occupancy Data Located in the 100 km Study Area

The MMF Catalogue Data[1] identifies 440 locations of land use and occupancy within the 100 km Study Area around both the Gordon and McLellan mine sites, referred to throughout this report together as the Project sites.

Non-commercial fishing sites were the most mapped land use sites within the Study Area, followed by locations of ecological significance and hunting kill sites. The sites of ecological significance identified are reflective of the deep relationship that the Manitoba Métis have with the lands, waters, and other

[1] Note that the MMF Catalogue Data includes all Métis Land Use and Occupancy data collected since 2013. This catalogue includes all data from interviews conducted for this Study.

aspects of the environment throughout the area. Participants acquired this knowledge through their relationship with and use of the land throughout the year for a variety of purposes, including harvesting, recreation, and ceremony.

The data presented in Table 1 provide evidence that clearly indicates the presence of Manitoba Métis harvesters using the lands and waters around the Project sites to exercise their s. 35 Aboriginal and Treaty Rights[2]. Additionally, this data shows other areas of significance and connection to Métis culture and traditions.

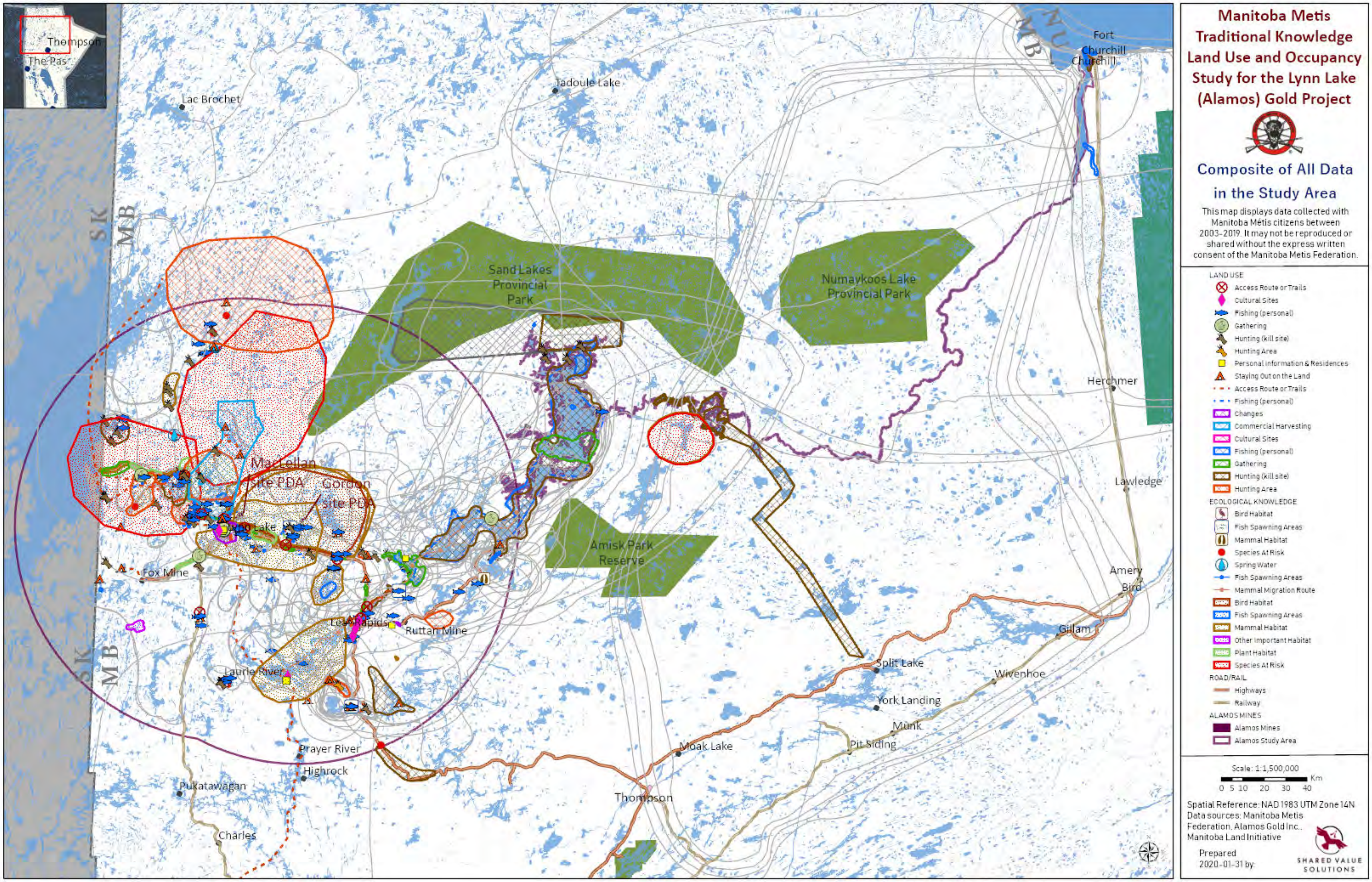
Table 1 Features Mapped Within 100 km of the Project Sites

Land Use and Occupancy Category	Total Features Mapped Within the Study Area
Personal fishing (non-commercial)	141
Ecological Knowledge	87
Hunting (kill site)	56
Access route or trails	39
Gathering	38
Overnight locations	27
Hunting areas	19
Occupancy	18
Cultural sites	9
Non-commercial trapping and snaring	2
Changes	2
Commercial harvesting (trapping and guiding)	2
Total in the Study Area	**440**

Interview participants emphasized the importance of the lands and waters they use for harvesting, gathering natural materials, recreation, ceremony, and other purposes. Figure 5 displays all mapped data within the Study Area. Any impact to the Manitoba Métis Community's ability to harvest or otherwise use the land as a result of the proposed Project must be acknowledged and addressed with appropriate mitigation and accommodation measures.

[2] S.35 of the Constitution Act, 1982 recognizes and protects the Aboriginal and Treaty Rights of the Aboriginal peoples of Canada. The "aboriginal peoples of Canada" are defined in section 35(2) as including the "Indian, Inuit, and Metis peoples." The courts have found that Aboriginal and Treaty Rights are collectively held rights and therefore consultation and accommodation regarding those rights need to be with the rights-holding collective.

Figure 5. All Mapped Data Within the Study Area



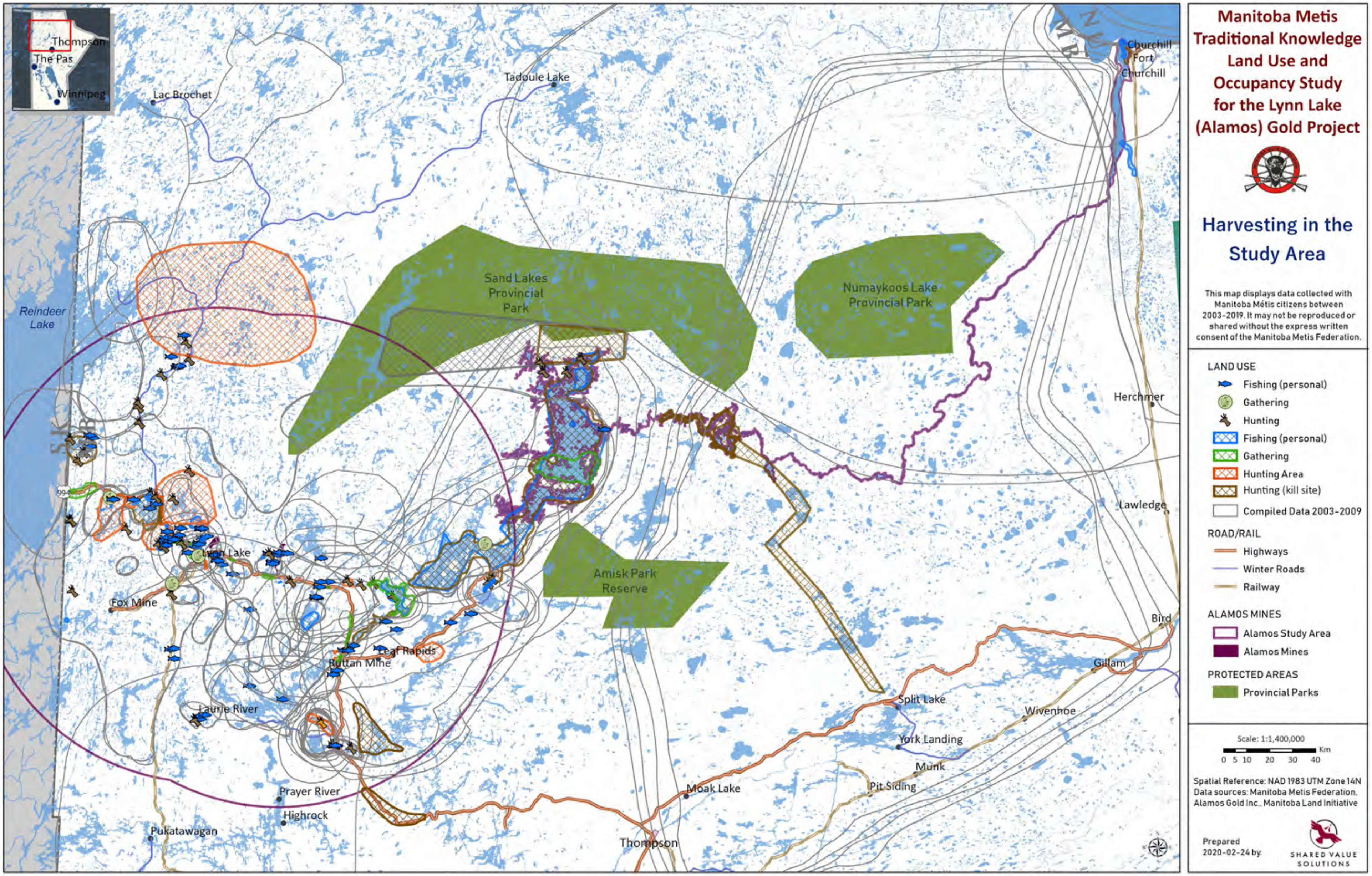
4.1.1.1 Harvesting Within the Study Area

Figure 6 displays all harvesting locations mapped by Métis harvesters and land users within the Study Area. Harvesting activities include fishing, hunting, trapping and snaring, and gathering plants and other natural materials. As detailed in section 2.4, the Manitoba Métis Community possesses Aboriginal Rights, including pre-existing Aboriginal collective Rights and interests in lands protected by section 35 of the *Constitution Act, 1982*, throughout Manitoba.

Additional harvesting maps and attribute tables can be found Appendix A. These maps include numbered leaders on each mapped feature; the corresponding information to each of these features (including species and season) can be found in the attribute tables.

More details on the harvesting activities mapped in Figure 6 are provided below.

Figure 6. All Harvesting Activities Mapped Within the Study Area



Fishing

Fishing was the most frequently mapped harvesting activity in the Project Area. The MMF data catalogue identified 141 personal fishing sites within the Study Area. Interview participants identified and mapped fishing spots (non-commercial) from which they kept fish to eat, mostly targeting pickerel/walleye, yellow perch, and various species of trout. Participants also reported harvesting pike/jackfish and lake whitefish.

Participants identified fishing sites on Simpson Lake and Swede Lake just south of the Gordon Site. They also identified fishing sites on Hughes Lake, Hughes River, and Chepil Lake. Closer to the MacLellan Site, participants mapped fishing sites at West Lynn Lake, Cockeram Lake, and Burge Lake.

Though interview participants discussed their recent experiences fishing in the Study Area, several interviewees described growing up in Lynn Lake and harvesting from these lakes year-round. For example, one participant described fishing around Lynn Lake in their childhood, which included acquiring knowledge about spawning areas and times.

> *"We fished these lakes [around Lynn Lake] continuously and extensively [growing up]. Primarily summer, but some in the winter as well. Every river where the fish ran during the spawn, you knew where it was, you knew where to go. To fish the actual lakes themselves, the spawning grounds, you never really ever had to, because of the plentifulness of the fish—the rivers they're running and that. But you still knew certain areas."*

When describing use of the lakes close to or within the Study Area, one participant simply explained that the number and availability of fish in the area due to its more remote nature made for excellent fishing locations.

> ***Interviewer:*** *"And so, what makes this area like a good spot to fish? Can you tell us a little bit more about why you like to go there?"*
> ***Interviewee:*** *"Numbers! […] They're abundant fish, so I mean in an hour you can limit out. So, you go other places you can fish for a day and come up empty. So, yeah, they're good size fish, good fighting, very colourful beautiful fish. They're a little off the beaten path, so usually you've got the place to yourself. And, there's action, they're biting."*

Though almost all participants who fished described having their favourite locations, interviewees also expressed that they rarely stick to one location throughout the year and instead move through the lakes and rivers based on the season and what the fish are doing during that time, whether it be running, spawning, or using general year-round habitat.

> *"Well, I mean in the spring, we'll go up the river and fish several spots, then we'll go down the river and fish several spots, and then even in the summer. Like in the spring when the fish are running, we'll fish [...] at the falls, and then we'll go down and fish [...] a little bit below the second set of falls, just in the rapids where the fish are running. During the summer, this stretch*

right in here, [we go] trolling in there…it's a deep channel, and all summer you'll keep getting fish in there, and then again in the fall [...], when the whitefish are running, you'll still get pickerel here, and you'll get them back in here again."

Interviewees also noted several changes to the fish populations they have observed in the area. For example, at a spot which several people have nicknamed 'The Burn,' participants reported seeing new species such as blue pickerel or sturgeon moving into the area.

"Last year was the first time I ever noticed blue pickerel up at The Burn. I was like okay I've been fishing here for thirty years and I've never seen blue pickerel."

"[The MMF] had done a sturgeon study and I said you know, [...] twenty- five [years] of fishing up at the Oar Creek slash up at The Burn, I'd never caught a sturgeon. And all of a sudden, I caught three in one year. What's changed? And then all of a sudden, my buddies are telling me, yeah, we caught a sturgeon, all catch and release, but it was just like, we've been here for how many years?"

This data demonstrates the importance of fishing to the Manitoba Métis Community for several purposes including harvesting species like walleye, trout, or whitefish as a food source as well as using the area for recreation, to connect with their families and community members, and to connect with their own culture. The data collected from participants demonstrates that fishing activities in and around the Study Area are extensive and ongoing, and that Métis harvesters have acquired in-depth knowledge of the fish, their environments, and patterns throughout their life-cycle as well as changes that have occurred over time. Changes to the waters in this area from current or future development would have an impact on Manitoba Métis rights and interests and could harm the generational teaching and knowledge transfer that happens when families harvest together. Additionally, any changes to fish quality or population would impact subsistence harvesting by Métis harvesters, and could impact personal economy and social networks.

Hunting

Interviewees also emphasized the importance of being able to exercise their harvesting rights by hunting on the land. The extent of this land-use is demonstrated by the total of 56 animal kill sites identified and mapped in the Study Area. In addition to these sites where participants reported making a kill and harvesting an animal, participants also identified 19 hunting areas, which are areas where participants reported going to hunt but either did not make or could not pinpoint a specific kill site.

The closest hunting location to the Gordon Mine site that was mapped is just west of the access road along the Hughes River. Closer to the MacLellan Mine site, just south of Glad Lake, participants identified locations where they hunted ptarmigan.

Interviewees explained that they primarily hunt large mammals such as caribou, moose, and deer, as well as bird species including ducks, geese, ptarmigan, and grouse. Many of these species provide a source of country or wild foods for the participants, but interviewees also described hunting as an important community activity and part of Métis culture. For example, one participant spoke about how people follow the migratory patterns of caribou based on freeze-up cycles in the winter months.

> "*They [the caribou] come down in the winter, they start moving in the winter. So, by the time freeze-up happens—of course, it freezes for the north faster, so as the freeze occurs, before we start getting too much snow, they've started to move down. I haven't done it myself, but I know people have gone hunting as soon as they can get in a snow machine. And they'll leave Lynn Lake. They'll go up to Goldsand, Wells, and into Lac Brochet by snow machine. There's a well-groomed trail. And then they'll go caribou-hunting into this area. And I know they'll go usually just after Christmas, and the caribou are already there."*

In some cases, participants said that they use the meat from their hunts to share with their families, communities, or others who may not be able to hunt for themselves. This tradition of sharing the harvest is a common cultural practice by the Manitoba Métis Community and is one of the ways in which harvesting rights are interwoven with cultural and social practices to maintain connections between community members and families. It is a critical part of Métis culture that must be considered when there are potential impacts on Métis harvesting in this area.

> *"[…] There's a group of people from Lynn Lake that have, had a little cabin there and they've been hunting caribou for years and never been, this is the first time I went out. I was lucky enough to get a caribou. And I brought it back to camp just to, kind of boast about it! And we caught moose also and that. That first year, we, we were quite lucky. I got a caribou and a moose, but we share, we share, I brought it here and it was too much meat and shared it with some of the people here in the night."*

> *"They had a small, an access road to Vandekerckhove which went to Fox Mine and up through that area to get to it and we went on a boat. We had a boat, an access to a boat and I'd already purchased the license for moose and caribou, but the caribou, the intent of that was, was to bring caribou meat back from to Tadoule Lake which…. There's lots of caribou out there, but we were hunting moose and we saw the caribou out on the lake, about six of them swimming on the lake and we followed them and they come up on land and waited and I shot one."*

Though the caribou hunt in northern Manitoba continues to be an important activity, harvesters also noted changes they have witnessed over the years in the caribou migration patterns and how far north or south they seem to be travelling.

> *"So as far as caribou goes there's a small sliver of land in here that you can hunt for caribou, and they haven't come that far south in several years."*

One interview participant speculated that this could be a result of repeated harvesting in the same area, a natural phenomenon, or development.

“So, I hunt caribou and I mean I’ve been hunting them for quite a few years. They seem to be not coming as far South as they once did. And I know that they re-routed the, the winter road up into Brochet, Lac Brochet and Tadoule. Whether or not it’s just years of harvesting off there that made them avoid it or whether it’s just a natural occasion I don’t know. But that would be some development that changed some, some patterns.”

Similarly, other interview participants described a decline in the moose population over the last 10 to 15 years. Interviewees described areas where moose used to be plentiful but have since been in decline, speculating that this is possibly as a result of increased numbers of non-Indigenous hunters coming to northern Manitoba to hunt moose as there are currently moose hunting bans in southern Manitoba..

“When I start noticing is, oh gosh, for Lynn Lake I’d say 19, I’d say about 1992 we started noticing around that area. Cause I was still, I was living in Leaf [Rapids] till 2002, but I was, like I said, I was back and forth ‘cause my mom and dad lived near Lynn Lake. And I noticed, maybe even longer then that, maybe 1989, cause my dad, even he wasn’t getting anything then. I’d say about, like a decline of hunting. “

Interviewee: “*There used to be lots of moose just on that stretch of road. Like south, driving up towards the Lynn Lake, and Leaf Rapids area.”*
Interviewer: *“You’d see them on the side of the highway, kind of? [...] And you said used to? Have you noticed a change?”*
Interviewee: *“Yeah, I find that the populations aren’t as high as they used to be, like ten, fifteen years ago. I just think the lack of, or the closures that are happening in southern Manitoba drawing a lot more people up to the north here for moose hunting.”*

The identification of these hunting areas is significant because use of the area for harvesting engages the s. 35 constitutional Aboriginal Rights of the Manitoba Métis Community. It is important to note that a person does not have to be successful to be exercising their Aboriginal Rights to hunt. In fact, lack of success especially in areas where harvesters have been returning for a number of years could indicate that the area is already under pressure or facing resource challenge that would make it more difficult for the Métis to exercise their rights, indicating a higher degree of consultation and accommodation may be required.

The evidence here demonstrates the importance of hunting to the Manitoba Métis Community for several reasons. For example, interview participants harvested large mammals and birds as a source of food for both themselves and to share with their families and communities. Hunting can be an important land-based activity that provides a connection between harvesters and their Métis culture. The data and quotations presented above also indicate that Manitoba Métis harvesters have acquired, through hunting on the land, in-depth knowledge of species including, but not limited to, caribou and moose. It will be essential for this Métis Ecological Knowledge to be adequately and accurately incorporated into the Environmental Assessment of the Project.

Trapping for Non-Commercial Purposes

Participants mapped two non-commercial trapping and snaring locations in the Study Area. Non-commercial trapping and snaring include locations for personal use as opposed to commercial traplines. For example, one participant discussed how trapping provided a connection to the land for themselves and their families as they pass these practices through generations.

> *"Yeah, I've been connected to the land since I was a child. Obviously trapping with my father. It means a lot to me, and I've said it a few times today I really want to make sure that it's protected, and not overharvested. And that it's there for my kids, and their kids to enjoy as well, right. That's what it means to me. Making sure it's maintained, and like not abused. There it is."*

Trapping and snaring are important land-based activities that have historically been, and continue to be, undertaken by the Manitoba Métis community. Impacts on trapping activities, including the cultural component of these activities, must be considered as part of the potential impacts to Métis harvesting in this area.

Gathering

There are 38 locations of gathering in the Study Area where Métis land users harvested plants and natural materials for food, medicine, and other purposes. Primarily, interview participants described gathering berries to eat seasonally and store or preserve for consumption throughout the year. Most commonly, participants described harvesting blueberries, raspberries, and strawberries. One participant who had lived most of their life in Lynn Lake spoke about harvesting berries all over the Study Area. These locations can be seen on the maps provided in this report.

One interview participant explained that different species of berries only occur under specific environmental conditions, like along eskers or in muskeg, which is why they are sometimes concentrated into identified gathering areas. This interview participant explained that while they gather berries sometimes for themselves, they also remembered gathering with their mother when they were a child.

> *"Cranberries, the esker areas with the pine are natural production for cranberries as well. But cranberries tend to ripen very late. I can remember going with my mom late in September picking cranberries. Your cloudberries, they're in your muskeg-y places."*

Similarly, a participant described areas for pin cherries and raspberries along roadsides, as well as finding that blueberry growth is promoted in areas that have experienced a burn.

> *"Once a burn goes through, you'll probably still have at least pin cherries and raspberries immediately alongside the road being produced, because it's open, it's still gravelly, and they'll recover faster. Back off the road you're going to get the blueberries happening, whereas in the other areas where you don't have burn, the blueberries—you'll have the odd one, but they*

haven't really taken off. Your burns promote blueberry growth. It thins out the area. Whatever it does to the soil, blueberries will naturally occur, and blossom."

Participants also described several medicinal plants they use, such as muskrat root or Labrador tea. Depending on the plant or species, gathering may take place year-round or seasonally.

The gathered plants, berries, and foods are often shared with other Métis community members and are relied on by Métis Citizens for subsistence and medicinal purposes. Gathering plants and other natural materials is another way in which harvesters exercise their Aboriginal Rights throughout the area and provide a cultural connection to the land, as well as a channel through which knowledge can be transferred through generations or families.

4.1.1.2 Routes, Occupancy, Cultural Sites, Commercial Harvesting and Observed Changes Within the Study Area

Routes, Occupancy and Cultural Sites

In addition to land- and water-based harvesting activities such as fishing, hunting, trapping, and gathering, as described in section 4.1.1.1, interview participants explained the importance of several access routes, occupancy, and cultural sites that they use in the Study Area. There were 39 access routes or trails mapped by Métis land users. These trails identified as snow machine or Ski-doo routes, boat launches or routes, canoe routes and portages, as well as walking trails and trails used by other vehicles. Some of these routes include the Hughes River and Cockeram Lake.

Routes and trails are crucial for allowing harvesters to travel to important harvesting areas by land, water, ice, or snow but can also have historic or cultural significance. Some interview participants spoke of how they currently use trails, either over land or water, that were used historically by their Métis ancestors, providing an important cultural connection and piece of history, as well as a contemporary access route. Specifically, one interview participant described the historic Grass River Canoe Route and the value this holds for them and their family and friends they travel alongside as they explore the places that people used hundreds of years ago.

Interviewee: *"[Referencing the Grass River Canoe Route] I mean there are so many different routes, you can go all the way up to Elbow Lake. Whichever way you go. Just keep following that little part of the river. Actually, we did this trip two years ago […] Depending on the group, usually it's a seven-day backcountry trip that we do. […] It goes all the way to Wekusko Falls. Actually, Grass River, I don't know the historical road how far it really goes, but the Grass River goes all the way through Thompson. [...] You're going to basically follow wherever the river flows out of the big lake here".*
Interviewer: *"So, seven days in, then somebody picks you up at the other end?"*
Interviewee: *"Yup. [...] We had our base camp on, I think it was the Iskwasum. [...] I don't know how much further without reading or going through the history, but that's the basic Grass River canoe route. I know that's got a certain value. and I'm sure there's places in there that were old*

campsites, like hundreds of years ago that people would use. I know there are pictograms on Trapping Lake."

The continued use of these trails by Métis Citizens today provides an important link to their past and the traditions of their Métis ancestors. In some instances, they are literally following in their footsteps. Where so much of the Manitoba Métis Community's Traditional Territory and cultural sites have already been taken up by development and urbanization, especially in southern Manitoba, these remaining cultural sites and connections become even more important.

Interviewees also mapped a total of 27 overnight locations on the land. Identifying overnight locations is important for several reasons. First, many interview participants expressed that they use these locations when they are out harvesting. Several interview participants described using either temporary structures like tents or more permanent structures like cabins while they are out on the land hunting or participating in other land-based activities.

> *"No, I don't have any structures, but pop up tents obviously. The entire trapline basically. Like sometimes when we're moose hunting, we'll stay at the north end, in a spot right here, and camp here."*

> *"Because when you go there you just, somebody had must have built just a, you know, just plywood. It was really, every time we went there it was always something wrong with it, we'd fix it up again. Just a piece of wood where we could find whatever. But no, it wasn't a cabin, it was just like a, maybe it was to somebody it might've been a cabin. They built it obviously, so it had to be for some reason, when they're hunting, you'd have some place to stop."*

Additionally, participants identified spending time out on the land as a way to share knowledge or spend time with their families and other community members. For example, one interview participant described the importance of their family canoe and camping trip to passing knowledge on to their children.

> ***Interviewee:*** *"[…] A few times we used to do a family canoe trip. Every summer we would go out with a group or as a family. So, we'd go do back country canoe trips. we do a lot of camping and stuff like that. and then the last couple of years, my boys are just getting old enough to be hunting. So, taking him on hunting trips and stuff like that."*
> ***Interviewer:*** *"So, you are kind of self-taught but are passing your knowledge onto your children?"*
> ***Interviewee:*** *"Trying to, yes."*
> ***Interviewer:*** *"Is that important to you?"*
> ***Interviewee:*** *"I think so, yeah definitely."*

Participants mapped nine cultural sites in the Study Area. These sites were identified as being used for cultural, ceremonial, spiritual, traditional, or other purposes. These sites could also include areas that have been identified as holding other historical or cultural significance. For example, one participant spoke about the Métis local of Leaf Rapids that used to host Métis cultural events on Turnbull Lake, including canoe races in the summer and dog-races in the winter.

> ***Interviewee:*** *"Turnbull Lake, I used to work at the MMF, and I used to, not work, we used to run the local. Actually, we were probably one of the richest locals there for a while. Did a lot of swimming there, fishing there, little bit of blueberry picking, not as much as further, like a little further down."*
> ***Interviewer:*** *"[…] so the Métis local would take everybody down there."*
> ***Interviewee:*** *"Yeah, we used to have our Métis canoe races there. […] I used to go on those canoe races with my mom and my dad. If I went with my dad, I would be touching the water, it was, my mom we'd be just. Oh, it was fun in those days. So, they had a lot of Métis events there. [...] So Turnbull, for the Métis though, is a big thing, like. Like, when I lived there, 22 years we used to have, as I say, the canoe races, dog races. I forget the trails of the dog races because I wasn't into that. I would use to just go watch. But for canoe racing and that, like, I was just totally involved with that."*

Participants also explained that there are sites on the land that are historically or culturally significant to the Manitoba Métis, one such example being cemeteries or burial sites. One interview participant described a cemetery with a large Métis presence near Lynn Lake.

> *"Lynn Lake there's a cemetery there, there's a lot of Métis people there. Which I didn't know they were Métis until later in life. Cause they wouldn't admit that they were Métis, you know, like, or any kind of native in them at all. I started working at the MMF, I'm going through and hmmm…I didn't know […] that, you know, they were."*

These results demonstrate that the Manitoba Métis Community actively uses the lands and waters throughout the Study Area. This evidence is important as routes and occupancy sites are crucial to providing passage to harvesting areas and connection to Métis culture and history. Additionally, the identification of nine culturally significant sites within the Study Area from this small sample size alone indicates a high need for the MMF and Alamos Gold to assess the potential for impacts to the Manitoba Métis.

Commercial Harvesting

There were two locations of commercial harvesting mapped by Métis land users. The first was a commercial trapping location and the second was a place where one participant did some guiding for a fishing outfitter. It should be noted that the number of people interviewed for this Study may not be the total number of Métis people who use this area for commercial purposes. It can be assumed that there are other commercial harvesting areas in the Study Area.

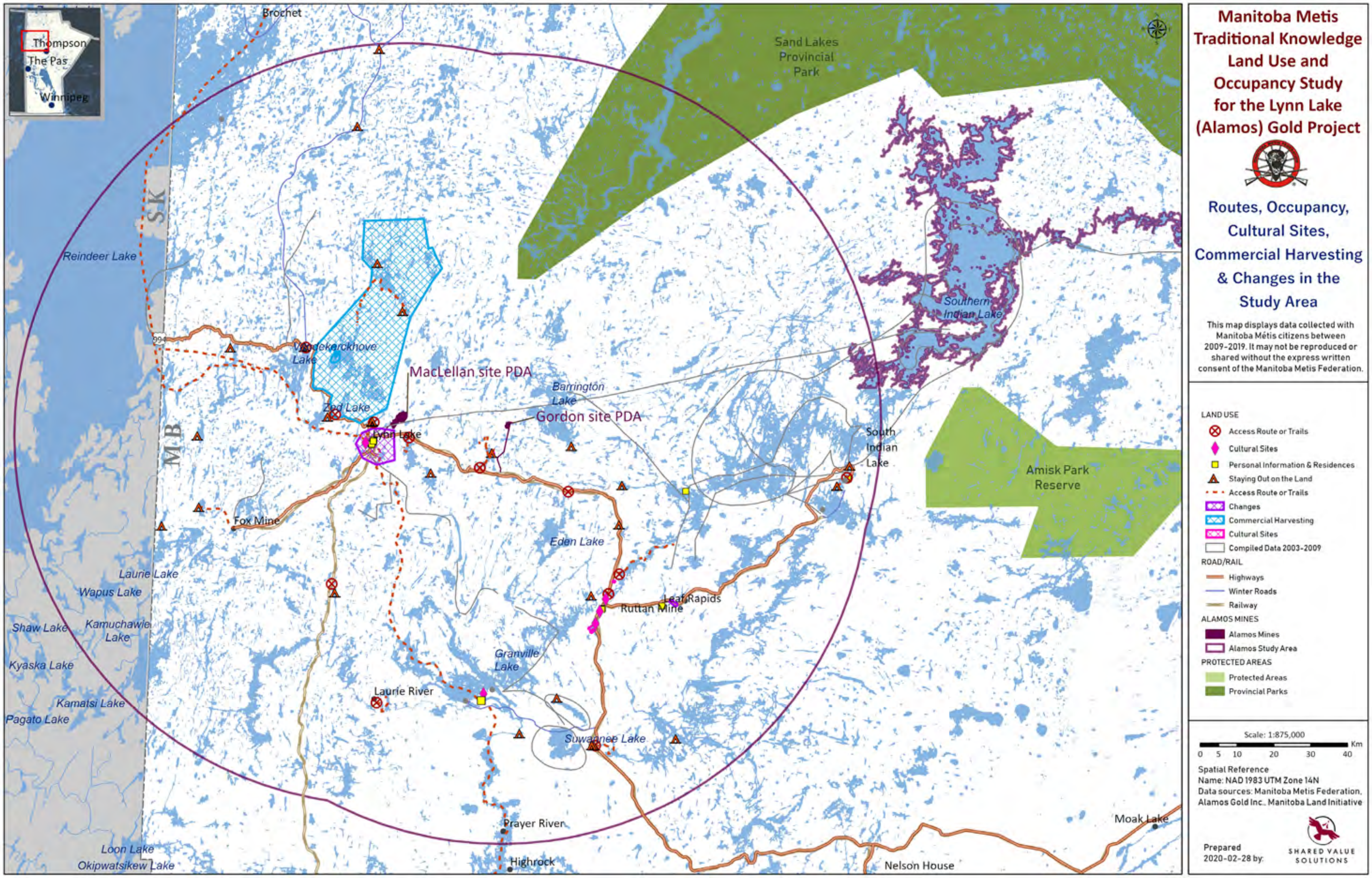
As described in section 2.1, the Manitoba Métis Community played a significant role in the fur trade. Trapping and snaring is, therefore, part of Métis tradition and culture. One interviewee described the various species they trap, explaining that they've been doing so throughout their lifetime.

Interviewer: *"What species are you trapping in there?*
Interviewee*: "Marten […], lynx, fox, wolf, beaver, muskrat, wolverine. I think that might be all I've ever caught. [...] It's a big area, eh?" [...]*
Interviewer: *"Have you ever caught mink, muskrat, wolf, or otter?"*
Interviewee: *"Yes. I will go off trail after otters, because they eat a lot of fish. […]"*
Interviewer: *"And how long have you been going there?"*
Interviewee: *"I've been a helper on the line since I was twelve."*
Interviewer: *"And that's just in the wintertime you go?"*
Interviewee: *"Yes."*

Moving forward, Alamos needs to consider the potential for the loss of formal wages that the project may have on those who depend on the lands and waters for their livelihood. Where necessary, the MMF and individual harvesters need to be compensated for a loss of access to the lands and waters, for both personal and commercial harvesting.

All routes, occupancy sites, cultural sites, commercial harvesting, and changes are displayed on Figure 7.

Figure 7 Routes, Occupancy Sites, Cultural Sites, Commercial Harvesting, and Changes mapped within the Study Area



Métis Ecological Knowledge

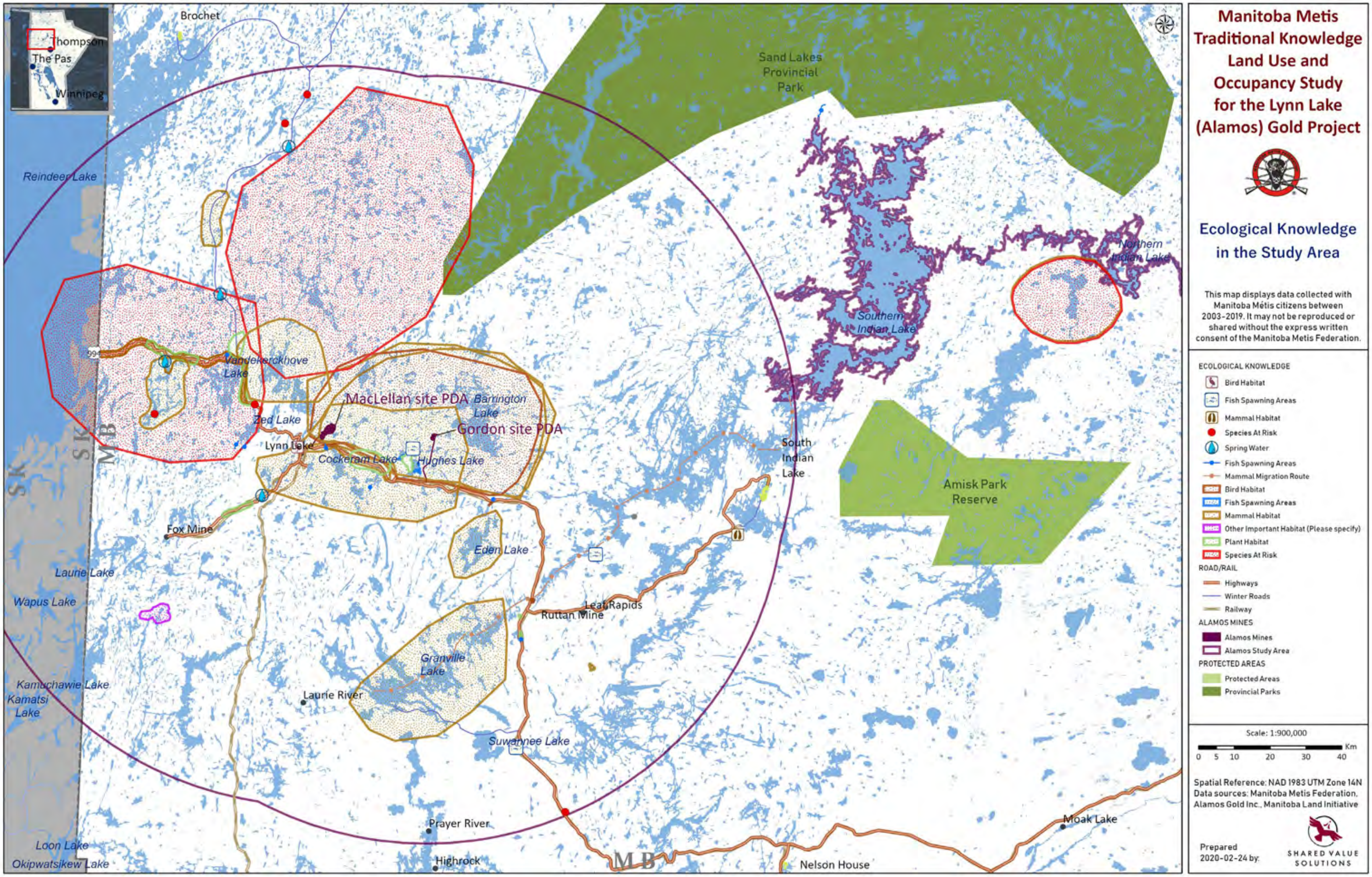
Métis Ecological Knowledge refers to areas or sites where Manitoba Métis Citizens hold unique and specialized knowledge of the land, waters, wildlife, and other aspects of the environment as a result of their distinct Métis culture and relationship to and presence on the land throughout the seasons. This knowledge can also be gathered and shared between Métis Citizens over generations through their families or the Manitoba Métis Community more broadly. Interview participants identified and mapped a significant number of Métis Traditional Knowledge locations.

Sites of Métis Ecological Knowledge mapped within the Study Area include fish spawning areas, important wildlife habitat, migration routes, and species at risk among other sites identified by participants. In total, interviewees identified and mapped 87 ecological knowledge sites within the Study Area. This is significant, as it demonstrates that Métis harvesters are uniquely connected to the landscape and understand it in a way that is not possible for those who are not living on and using the land so intimately. It will be crucial to adequately and accurately consider Métis Ecological Knowledge as equal to the baseline data that the Proponent is collecting as part of their Environmental Assessment.

Most commonly, participants mapped fish spawning areas. Concentrations of fish spawning sites were mapped by participants at the mouth of Hughes Lake leading into the Hughes River just west of the Gordon Site access road. Another fish spawning area was mapped by participants along the Keewatin River just south-east of the MacLellan site. In addition to fish spawning, participants also identified the areas around both Projects sites as important habitat for valued species to the Métis such as moose, bear, lynx, fox, marten, otter, fisher, rabbit, weasel, squirrels, beaver, muskrat, mink, and blueberries.

All features of Métis Ecological Knowledge mapped by participants within the Study Area are displayed on Figure 8.

Figure 8. Ecological Knowledge Mapped Within the Study Area



Interviewees also detailed specific species of which they hold knowledge. Of interest in northern Manitoba are barren-ground and woodland caribou, which are known to migrate through the Study Area and have also been identified as species at risk. While both barren-ground and woodland caribou were mapped within the Study Area, barren-ground caribou travelling in large herds were the most often discussed in terms of their migratory patterns and presence on the land.

As several interview participants described, the caribou come across the ice as it freezes up and travel in different herds across the province.

> ***Interviewee:*** *"Yeah, [the caribou] come across the ice, but they come down through that side then the map on that one. The ones they come down through somehow through Red Sucker Lake and Oxford House and that. Right down in through Foot Lake. That's the St James herd. And then they got the, the coastal herd that comes in from Hudson Bay that's a cross breed between the woodland and the barren land."*

> *"As far as the caribou's territory I would say you know they might get a big burn through there. And then they'll eat, paw through on the swamps and eat kind of the, I guess it would be kind of like a moss or a lichen or [...] We got floating bogs, so there's, there's no grass up there so they'll paw through and eat that. And if a fire goes through, they might kind of follow the out tracks or avoid it, but in a few years they're back into there. So, most of Northern Manitoba is caribou. The herd, it it's fairly widespread I've seen them across the whole board."*

In addition to having knowledge of their migratory patterns, one interview participant also described being able to differentiate between the different ecotypes based on their colouring.

> *"The woodland [caribou] has got one colour. The mixed breeds got another colour. The barren land, some of the barren land you can see them, when you see them coming you can see that white on them from a long way because they're, it's so shiny actually."*

Several participants also detailed their firsthand experiences seeing caribou migrate during their time on the land, often in large herds of hundreds or even thousands of animals.

> *"And on Shannon Lake [...] we could see the caribou way in the distance, and we stopped, waiting for everybody to catch up. [...] And we just pulled over to the side, we shut off our machines, and we were just waiting, sitting still. And the caribou are milling around, you could smell them [...]. And grunting—they make that kind of a sound. One came, and then a couple more came, and then a few more would follow. And they'd walk, and they'd look at you, and they'd stop. Finally, they got moving, and we sat there while that whole herd went through. And at one point in time--I don't know how many there would be wide, but lots—they're walking, and their antlers are clicking, because they're touching each other. And they'd stop, and they'd look at you, and they'd go. It was an experience that you can't even describe. We're talking hundreds of animals here, not ten or 20 or 30—hundreds of animals. Maybe 1000, I don't know."*

"I've seen them all over. That big herd that I talked about, about 10,000, would have been probably just off from there. But routinely that area, I'll, I'll see something. I have seen the, the North around the Seal River, the very far North of the province, kind of even just North of Churchill, I've seen a big group of caribou one year, too. And then it's very common to see pockets of six, eight, you know, maybe even 30 or 40, but couple of times I've seen where, like ants, like you, you, you couldn't even get a head count, there's no way you could count that high."

Participants also expressed concern around changes to the caribou's migration patterns and behaviour in recent years. Specifically, participants expressed that the caribou are not travelling as far south as they used to or are staying further south for longer periods of time. One interview participant speculated that perhaps these changes were a result of increased human presence in the area or warmer temperatures.

"The last few years [caribou] still come down to this area, but every other year, they'll be further west, or they'll be further east. It could be weather-driven, snow amounts, but I think the activity on the road is probably also contributing to it to some degree. [...] And I know the pilots that fly the area would say they've seen little bits and pieces of caribou everywhere, where they didn't make it back. Did they not make it back because they were late and the break-up caught them, or are they just choosing to stay south? [...] Like all these areas are outposts for a lot of the lodges, different out camps, commercial fishing lakes et cetera, fly-in lakes. And they're seeing these caribou in the summertime. So, my personal opinion is I don't think they all got ambushed by the warm weather and got stuck. I think by choice they're there. Maybe I'm wrong, but the frequency of seeing them is too much, too often. And they're not woodland."

It is evident from the results provided here that species at risk, specifically caribou, are present within the Study Area and that the Manitoba Métis Community holds knowledge of their presence, migration routes, behaviour, and recent changes to these animals.

In addition to caribou, interview participants also had specific knowledge of other species in the Study Area including moose, bears, wolves, lynx, foxes, and various species of plants and fish. One interview participant described their knowledge of walleye in the area and how their patterns indicate when the time to go fishing is right.

"So, walleye will all, across the whole North, will spawn kind of spring after the ice is off. Our spring's a lot later than Southern [Manitoba] so it would almost end up being early summer before the ice is off and the temperatures are right."

Another interview participant described knowing the environmental conditions needed for various species of plants including pine, pin cherries, raspberries, and blueberries.

"So, this is all esker, nice sand, the sand, gravel ridges, the roads built right on the top of them, beautiful pine. The pine grows kind of hand in hand with your eskers, so alongside the road,

> *that's where you get your pin cherries naturally occurring, your raspberries naturally occurring. In the areas where they've been burnt off due to the fires, you will get your blueberries happening."*

In summary, the data collected in the Study Area demonstrates that the Manitoba Métis possess and are using Métis Traditional Knowledge of the land and waters in the Study Area and have for many generations. The Métis Traditional Knowledge presented here demonstrates that the Manitoba Métis should be both consulted on any potential impacts of the project and involved in ongoing monitoring efforts connected to the project. As such, it is crucial that the Manitoba Métis Community, through the duly elected authority of the MMF, is consulted about any potential impacts of the Project and that mitigation and accommodation measures are developed for any impacts on Métis harvesting, cultural, and other rights.

4.2 Results of the Food Frequency Questionnaire

As part of the Study, interview participants were asked to complete a food frequency questionnaire. The goal of this questionnaire was to find out how often participants consume country foods and whether any of it is harvested from within the Study Area. Although the land use data summarized in section 4.0. explores the lifetime of a participant's land use, the food frequency questionnaire focused on country foods that had been consumed by a participant and their family within the last year to provide an indication of what foods the Manitoba Métis Community may be harvesting and eating from the Study Area.

A total of twelve participants completed the food frequency questionnaire; 83% of participants reported providing food for their families from the Study Area. On average, participants had four other family members who consume the foods they harvest.

The food frequency questionnaire identified 64 country or wild foods that participants consumed from their harvesting areas in the last year, including various species of mammals, fish, birds, and plants as well as other natural materials such as spring water, birch water, or syrups. More specifically, participants identified 35 wild foods they have consumed from within the Study Area.

These foods include

- Birch water
- Black bear fat
- Blueberries
- Brown trout
- Burbot
- Grouse (general)
- Grouse (Spruce)
- Labrador tea
- Lake trout
- Lake whitefish
- Pin cherries
- Ptarmigan
- Rabbit
- Rainbow trout
- Raspberries

- Caribou meat
- Caribou tongue
- Chaga
- Cranberries
- Duck (Mallard)
- Goose (Canada)
- Goose (General)
- Moose heart
- Moose liver
- Moose meat
- Moose tongue
- Muskrat root
- Northern pike
- Pickerel/walleye
- Saskatoon berries
- Sauger
- Spring water
- Strawberries
- Suckers
- Wild mint

The results of the survey indicated that the highest percentage of participants harvested and consumed pickerel or walleye (58% of participants), blueberries (50% of participants), northern pike or jackfish (42% of participants), and moose meat (33% of participants) from the Study Area. The data presented here are only reflective of those foods that were harvested in the Study Area. A list of all the foods that participants reported harvesting, not limited to the Study Area, can be found in Appendix B.

Participants were also asked to estimate how frequently they eat the foods they harvest per season. In other words, if a participant identified that they harvest and consume pickerel from the Study Area, they were asked how many times per season they eat pickerel in the spring, summer, fall, and winter. Table 2 shows how often participants reported eating the country foods harvested from the Study Area by season. These values were summed to show the frequency of consumption year-round.

Table 2. Consumption frequency of country foods from the Study Area

Food Harvested	Sum of Frequency (Spring)	Sum of Frequency (Summer)	Sum of Frequency (Fall)	Sum of Frequency (Winter)	Total Frequency of Consumption (Year-round)
Birch Water		48			**48**
Black Bear Fat		12			**12**
Blueberries	6	34	33	6	**79**
Brown Trout	1				**1**
Burbot	3			4	**7**
Caribou Meat	39	39	39	39	**156**
Caribou Tongue				1	**1**
Chaga	6	7	6	7	**26**
Cranberries	3	3	5	3	**14**

Food Harvested	Sum of Frequency (Spring)	Sum of Frequency (Summer)	Sum of Frequency (Fall)	Sum of Frequency (Winter)	Total Frequency of Consumption (Year-round)
Duck (Mallard)	27		6		**33**
Goose (Canada)	3		3		**6**
Goose (General)	24				**24**
Grouse (General)			24		**24**
Grouse (Spruce)			15	18	**33**
Labrador Tea		1			**1**
Lake Trout	5	3	5	3	**16**
Lake Whitefish	3	3	2	2	**10**
Moose Heart	1		3		**4**
Moose Liver			1	1	**2**
Moose Meat	108	108	120	108	**444**
Moose Tongue			1		**1**
Muskrat Root		1		1	**2**
Northern Pike	9	3	4	5	**21**
Pickerel/Walleye	78	76	76	76	**306**
Pin Cherries		1			**1**
Ptarmigan				24	**24**
Rabbit				5	**5**
Rainbow Trout	13	24	12	12	**61**
Raspberries		90	12		**102**
Saskatoon Berries		1			**1**
Sauger	4	4	4	4	**16**
Spring Water	360	360	360		**1080**
Strawberries		90			**90**
Suckers			1		**1**
Wild Mint		3	3		**6**
Frequency of Country Food Consumption per Season:	**693**	**911**	**735**	**319**	

Of the foods harvested within the Study Area, spring water is most frequently consumed, followed by moose meat, pickerel, caribou meat, and raspberries. Strawberries, blueberries and rainbow trout are also consumed frequently by participants.

In combination with the harvesting and land-use data collected for this study and detailed in Section 4.1.1.1, this data provides evidence of Métis harvesting and consumption of wild and country foods within the Study Area and indicates that Métis harvesters use country and wild foods harvesting from the Study Area for subsistence purposes year-round. Further, study participants expressed that these foods are not only for personal consumption but are shared with their families and sometimes community members.

Given the frequency and extent of the consumption of wild or country foods, it is evident that further discussions between the MMF and Alamos Gold regarding potential contamination from the Project and is necessary. These discussions will be essential to ensure appropriate mitigation, accommodation, or compensation measures are put into place to protect the rights and interests of the Manitoba Métis Community.

4.3 Perspectives on the Lynn Lake Gold Mine Project

During each interview, participants were asked questions about their perspectives on the Lynn Lake Gold Mine Project, including past experiences with development and any concerns related to this project specifically. This section will explore the effects that participants have felt from past developments throughout the Lynn Lake area, which is important when considering the cumulative effects related to the project or how potential impacts from the project could augment or otherwise be combined with the effects already being felt from other developments.

While several of the effects described by participants were a result of development projects in general, it is important to emphasize that a significant number of interview participants described how they were impacted as a result of the mines that previously operated around Lynn Lake in the 1980s through to the late 1990s and are proposed to become the Gordon and McLellan sites. Many of these impacts are still relevant and ongoing. Participants voiced many concerns with the proposed Project. With this direct connection, the information presented in this section provides a unique opportunity to Alamos Gold Inc. to consider these potential effects and ongoing impacts in their planning and operation of the Gordon and McLellan mine sites.

4.3.1 Past Development and Cumulative Effects

Interview participants were asked questions about their perspectives on past developments and cumulative effects they have experienced or observed on the land. For the purpose of this Study, cumulative effects were environmental, socio-cultural, or economic changes that are caused by a combination of natural or human activities. The term 'cumulative effects' most often refers to those effects accumulated through industrial development such as logging, mining, or other activities that cause changes impacting the land and people who rely upon it.

Several interview participants expressed concerns about development projects disrupting the environment and creating changes including weather patterns, wind, and the species present on the land, among others. One participant explained that changes come as a result of any type of development. Importantly, this participant also explained how the effects of changes are experienced through various parts of the environment.

> *"Wherever there is any type of a development, there is always a changing. Your vegetation, your plants, even your trees. It also affects the wildlife. And not only wildlife but the birds, the fur bearing animals and everything. They all have to move because of a disturbance to the environment. For the land. And I've noticed that lots."*

Several participants described changes to their harvesting areas as a result of the Bipole 3 transmission line project and from forestry, most notably with logging or cutting causing an increase in wind. This has forced some interviewees to spend less time in spots where they had been harvesting for years.

> *"I know since that Bipole project came through on Paint Lake, my God, you can never get a calm day on the lake. I remember be-being a kid and we'd go out there, it'd always be calm water. Now, you get out there and you've got one-foot rollers and things like that, and I don't know if it's directly to do with the Bipole project but man, we get a lot more wind up here. They've got to cut down on the logging."*

> ***Interviewee:*** *"[…] When I was a kid, you'd go on Paint Lake, eight for ten times we'll say the water was calm. It was like, maybe not like glass but, I mean, you could go out there, anchor down and sit flat in your boat. Now you go out there and there's rock and you're thrashing around. It, it always seems to be so windy out there. […]"*
> ***Interviewer:*** *"And what impact does that have on you, in terms of how you are able to use the land or the water?"*
> ***Interviewee:*** *"Well, you, you can't stand fishing there nearly as long when, when you're getting thrashed around. I mean, the body isn't meant to sit there like this all day, you know, so it cuts down on the time you can go out fishing."*

Participants noted that the effects stemming from past mining developments near Lynn Lake are still being felt today. Just as effects from development may accumulate from different projects on the land, social and economic effects can also accumulate over time as old projects close and new ones move in.

One prevalent theme that interview participants raised in discussing previous mining activities around Lynn Lake was the quality of the water in the surrounding lakes and the town's water system. One participant described the boil water advisory the community has been subject to for a number of years.

> ***Interviewee:*** *"[...] we've had a boil water advisory for so long in Lynn Lake. So long."*
> ***Interviewer:*** *"How long?"*
> ***Interviewee:*** *" Long as I've been back. Ten, 12, 15 years, something like that. Our intake is not deep enough, so all that crap is coming in. The water's yellow, you can't drink it, you gotta boil it. You won't soap your clothes in it, they come out yellow right? Like we're, and our water just went up. We're, we're just, whole Lynn Lake is in an uproar right now because they just put our water up and you can't drink it, you can't do nothing with it. [...] Oh just boil it for five minutes,*

sure. Soak your clothes in it for an hour, half an hour. Whatever it is you soak your clothes for. They're gonna be falling apart and they're gonna come out yellow."

Several interview participants described growing up with 'tea-coloured' water that they didn't realize was of poor quality until much later in life. Some of them felt that there was a connection between the poor water quality and the mine tailings being stored in the area.

Interviewer: *"[…] Is there any locations where you collect spring water?"*
Interviewee: *"No. I don't trust the water up [near Lynn Lake]."*
Interviewer: *"Why's that?"*
Interviewee:" *I just, I don't know. Like all of our town waters, both in Lynn [Lake] and in Leaf [Rapids] are just so colored that I've never, never trusted to grab it off the lakes. I don't, you know, it's not clear in most places. Even though they say you can drink it out of our Churchill river, I still wouldn't trust it."*
Interviewer: *"Do you have any idea what would cause that colour?"*
Interviewee: *"I know up in Lynn [Lake] it was the tailings doing that. And I know that from just living there as long as I did. Our water was more of a tea color."*
Interviewer: *"Like out of the tap?"*
Interviewee: *"Yup. It always looked like a tea light tea color. You know, as a young kid we didn't know any better, but as you got older it was kind of, okay, this isn't normal. You know? Especially after I moved out of there. It was, this isn't normal to see it this color."*
Interviewer: *"What was it like growing up [in Lynn Lake]?"*
Interviewee: *"It was alright. Like I said, once you got older you realized your sand wasn't the same color as everybody else's. And the water when, as far as back as I remember always looked kind of yellowish like a tea. But then back then it was normal to us."*
Interviewer: *"Do you know why it was like that?"*
Interviewee: *"I didn't find out until I was much older that a lot of our sand is due to the tailings that were around blowing in and stuff. So. But growing up it was just normal to us."*

Interview participants described this same issue with water quality happening in Lynn Lake today but instead of tea, they described the water as 'coffee' and 'apple juice' even after running the taps for a while.

"I stay in Lynn Lake. Their water comes running through the taps, it looks like coffee. Like it's…disgusting. For, my understanding is they put a water treatment plant in…. whatever costs a few million bucks, but as soon as they hit the trigger all the lines started to pop underground cause it was pressurized, where it's normally gravity flow. […] But yeah, you go there to take a shower, and you think maybe there's rust in the lines, so you kind of bleed the lines for an hour, it's still coming out the same colour. You know a glass [of water] looks like tea."

"[I]brought my daughter here, and you know, she's asking you know, who's apple juice are those on the counter, you know, could she have a sip of who's ever apple juice and I said…apple juice? And I looked and I said sweetheart that's…that's my water."

In addition to the issue with both water in the environment and access to drinking water, participants described other pathways through which they noticed tailings making their way into the environment. Another common thread during interviews was the presence of 'yellow snow' around Lynn Lake. One participant even described noticing a decline in the number of ptarmigans in the area as this snow impacted their habitat.

> *"I remember that when I used to live up in Lynn Lake. There would be some years, there would be lots of ptarmigan. And then all of the sudden when the snow would look kind of yellow from the tailings off the old mine site in Lynn Lake. Where they had the mine site there was the big tailings up and back and when the wind was blowing, it would blow that tailings. The dust of them tailings around, and the snow would be yellow. And the habitat that used to be around there just sort of disappeared."*

> *"That yellow snow was, was from the tailings. The old tailings pond behind where the mine used to be in Lynn Lake. […] And what was happening is when the wind would come and start blowing, anything that was loose, it would blow it. And it would settle on top of snow and the snow would look yellow or it would be yellow. […] I can't remember what it was, but you could smell it."*

Another interviewee expressed concern about yellow dust, or mine tailings and other chemicals more generally, making their way into the environment and bioaccumulating through the food chain to impact other species.

> *"Where that dust [from the mine] is and with the [grouse] as one, they'll eat that. That's, I don't know, for them to digest their food better or whatever. And then you take your foxes or your wolves and they're killing [grouse] and eating them. So, what have they got? Same thing. They're eating them and the [grouse] they eat that. So that's one very heavy concern on that."*

Several participants pointed to a lack of proper closure with the mines in Lynn Lake as a source of some of these issues and hoped that the proposed project would do a better job of ensuring the sites weren't left to contaminate the surrounding environment.

> *"So, but, as to what is gonna happen with the new mine, I think [Alamos] could do a bit better job than [the other mining company] did before, because basically they, they opened up the area and never cleaned up behind themselves."*

Even more specifically, one participant described the still ongoing reclamation and tailings management work contributing to negative environmental conditions around Lynn Lake, re-emphasizing the negative impacts that were felt as a result of an inadequate closure plan and procedures that left remnants of the operation and mine tailings to sit in the area for many years.

> *"My concern is going to be for this [Lynn Lake] area, and what impact the open pit mine and further underground development are going to impact this immediate area. We still have—since*

1950 right through to 1989—all the remnants of the tailings here, and even thereafter with the gold production. You've got all the tailings and the reclamation work is still ongoing. You've got reclamation work at the Fox Mine, which is still ongoing. So, you would hope, environmentally speaking, it's not going to get any worse than what it is, and hopefully we can bring the area back. But it's always going to be some level of a disaster. Tailings are tailings are tailings, and it just is what it is with the leaching and the various acidic issues related to it. Gold, by far, is the worst."

In addition to the environmental concerns associated with an abrupt closure and lack of proper management and reclamation work, participants also described devastating economic and socio-cultural impacts the town of Lynn Lake experienced seemingly overnight. Participants described Lynn Lake as a town in which the main industry was mining, at both the Farley and McLellan sites. When these mines closed, much of the town's population and economic opportunity went with them.

Participants explained that people had to sell their homes, hand over their keys, and leave town. These effects and the resulting impacts to the community, though they began years ago, are still being felt today. This, in addition to the ongoing environmental issues associated with the mines, is especially important to consider in the realm of cumulative effects related to the proposed project as interview participants described economic devastation that Lynn Lake has still not recovered from.

"When the mines in town finished, and all we had was the MacLellan Mine…when that shut down in '89, the following year we dropped down to probably around 850 people. When you're already downsized that much, […] 200 residents is significant. And with no real mining or other economic base—even the tourism base being minimal—the town had just continued to deteriorate. Those downsizings, and the adjustments you had to make as a community as those projects came to an end, in my opinion is what has really impacted the town the most."

"At that time, my wife worked in the [name removed] bank at the time. And it was unbelievable. People walking in and just handing their keys in and basically, you know, it was sad. There were some nice houses in town and because the RCMP detachment at that time [started] to buy houses […] the government paid a fair dollar, but most homes were going for just pennies. […] An average house, for a really good house was $20 -25,000 when the mine closed."

***Interviewer**: "So you were there, you were living there and working there with the RCMP when the mine closed down. What did that do in the community?"*
***Interviewee:** "They, they had to bring in mental health workers and all this. Families were devastated, like they were making big money and overnight that, they were closing and stores […] started reducing their inventory, closing half their store down because they didn't have the business anymore. The break and enters and the vandalism increased because, you know, a lot of people, people moved into town that thought they could get into houses for nothing. […] As matter of fact we generated and started up, what you call citizens on patrol. A system just to have people driving all night long to protect properties and making people feel safe."*

“People basically dropped their keys off at the bank and, and financing, a lot of people, a typical mining town, when you make big dollars, you spend big dollars. So, overnight a lot of people, a lot of reprocessing, you know. The boats and the toys and that, people basically sold a lot of their stuff […] for next to nothing. People lost a lot of money, out of pocket. It was very unstable, but, you know, it’s like any other community that was a one industry town. If that industry goes by the wayside, you know, it’s, you know, it’s just what happens. That’s what happened at Lynn Lake, at that time. And it never recovered.”

Interviewer: *“Yeah, what was it like when the mines closed down? How old were you? You would have been young, eh?”*
Interviewee: *“Yeah ten or eleven years old.”*
Interviewer: *“What do you remember about that time?”*
Interviewee: *“That it was like a light switch. Everybody was gone. Everything from the school, to the hospital. Everything completely scaled down. There was less teachers, less doctors, less nurses. It was a pretty big shock to the system. "*

As interview participants explained, the closure of the mines around Lynn Lake caused a sudden displacement of the population in the town. Several interviewees who grew up or lived in Lynn Lake for a time described leaving and coming back to find the town in a state of deterioration. Participants explained that the sudden change resulting from the closure had deteriorated the economy, population, and infrastructure, creating a stark contrast to the Lynn Lake in which they used to live.

Interviewer: *“What kinds of things did you notice when you went back [to Lynn Lake]?”*
Interviewee: *“Deterioration of the town. When you first went into town, there was older, already older buildings and structure. […] Then those are the houses that were left, and they basically fell apart and […] the squatters came in and took over some of the houses and they basically deteriorated […].”*

“It’s sad and depressing, and that’s one of the reasons I don’t go back as well…just sad, for what that town used to be in its heyday when I was a kid growing up in high school for example.

“The infrastructure [in Lynn Lake] has deteriorated to such a point that unless they’re going to rebuild the town, they can’t band-aid it anymore. The economic base, the tax base, isn’t there to rebuild the town. […] You could take everybody and put them in one quarter of the corner of the township. That’s how spread out the town used to be, and that’s how many people you actually have living in town right now.”

“[…] We were lucky we got to sell [our house in Lynn Lake], but not for much, $10,000. You know, you buy it at $30,000 at that time. Yeah. And it was just sad to see all that going, everything slowly going downhill. People were leaving. And the one thing about it though, I still keep in touch with the Facebook, you know. You always hear people are either dying or they’re getting married, you know, or they’re sick or something. But yeah, it’s, same with Lynn Lake, it was a nice community, you hear about people, now there’s not too many left up in Lynn Lake, old-

timers, I can only think of two now. And same with Lynn, Leaf Rapids is very little, few people left that I know now, the old-timers I call them."

Given the experiences interview participants described with the previously operating mine sites in Lynn Lake, it is evident that the Manitoba Métis were impacted by these developments in several different ways. First, interview participants described the impact of these mines on the environment from which they harvest and use for cultural purposes, including yellow snow, tea-coloured water, and discoloured sand as a result of tailings or other chemicals from the mines. Alongside these environmental effects was the economic devastation of the town following the mine closures. Participants detailed their community members losing their homes, money, and other belongings in a short period of time following the closure, which also resulted in a significant population decline. Today, as a result of these impacts, the town of Lynn Lake was described by participants as still struggling with the deterioration and social issues that emerged with the mine closures.

Aside from the impacts that participants have experienced, and in some cases continue to experience, in Lynn Lake, they also described the effects that other development projects throughout northern Manitoba have had on their harvesting or other practices. Most prevalently, interview participants explained that clearing the bush to make way for development projects has resulted in changes to the wind, which has impacted their ability to harvest throughout the lands and waters they have visited throughout their lifetime, in some cases dating back to their childhoods.

The environmental, economic, and social impacts that were described by participants as a result of developments throughout northern Manitoba are crucial to considering how the proposed project may impact the Manitoba Métis. These stories and accounts demonstrate the importance of ongoing communication and engagement with the Manitoba Metis Federation to ensure that the impacts are mitigated or appropriate compensation and accommodation measures are put in place to avoid further compounding effects to Métis rights and interests.

4.3.2 Concerns Related to the Lynn Lake Gold Mine

In addition to being asked about their previous experiences with development projects in the region, interview participants were also asked about any specific concerns they had pertaining to the proposed project. Interviewees expressed concerns related to the environment and the social impacts that could be felt as a result of the project. Many of the concerns that participants expressed are rooted in their past experiences with development and provide an important opportunity for Alamos Gold Inc. to look ahead and see where impacts to the Manitoba Métis may arise.

Several interview participants expressed concerns about the environment around the proposed mines and the changes to that environment that could come as a result of the project. One interview participant expressed concern that the chemicals used, and tailings areas, will impact wildlife and waterways in the region.

“Those new developments of those new mines are going to have an effect on any wildlife, birds, fur bearing animals. There’s gonna be, because of their, when they’re refining that ore, there is going to be a lot of chemicals being used which is going to be dumped into a tailing pond or whatever. Water will seep into the ground and end up in the rivers, the streams, which is going to affect everything.”

One participant emphasized that even with reclamation efforts, development projects bring about changes that are impossible to reverse. Another expressed concern specifically around the “natural” activities that are associated with mining, including high nitrogen runoffs that are associated with open-pit mining, as well as the ongoing trucking activity that will be necessary.

“I mean, from what I’ve learned with my experience from contracting through my own business, through working for contractors, through working for mining companies, you know, once you disturb something it’s never the same again. I mean, try all you want, you can backfill with all the topsoil and grass seed but it’s never going to be the same. It’s not what it was, you’ve moved it, and it’s changed.”

“Anyway, the mining here is going to have some level of impact on the area, just for the fact that you’re going to have again the high nitrogen runoffs from the open-pit mining, and you’re going to have all the trucking activity. So those natural activities associated with a mine will have an impact on the animal life in the area.”

The risk of negative impacts to wildlife, plants, water, and air are especially significant to the Manitoba Métis Community as they use the lands and waters to exercise their s. 35 Aboriginal Rights. As demonstrated by the results of the food frequency questionnaire in Section 4.2 of this report, interview participants reported frequently harvesting plants and animals for consumption in the Lynn Lake area. Because of this, several interview participants expressed concerns that wildlife could interact with mine tailings. One interviewee described watching fish die as they come into contact with mine tailings, alongside birds and other small fur bearers.

“[...] I know for the company I work for, we have tailings ponds and they are tied to a contract for life to keep, you know, hauling lime out there to reduce the acidity, so it’s, it’s gnarly, nasty stuff. I see what it does to, to animals, like tailings itself. It’s brutal. You’ll see fish come swimming up in clear water and into the tailings ponds and they’ll hit where the line is and all of a sudden, they’re belly up. And then a seagull flies by and eats it and I don’t know how those damn things can survive but they can seem to eat anything, but there’s birds that end up in there. Muskrats, you know, and they die from these tailings.”

Another interviewee expressed similar concerns, describing how humans can become sick from eating wild or country foods off the land that have come in contact with mine tailings. This participant explained that, despite best efforts, they have seen wildlife make it past the barriers, interact with these chemicals, and die.

"Well, you don't want to be eating anything that interacts with tailings, tell you that. […] Say it's one of those one-off chances it does, and you go and eat it, you get sick. Absolutely you get sick. I have seen when I worked in the refinery at this mine […] I've seen muskrats, you know, like get into the buildings and [the company] can't stop them all but they do try. All doors are closed and things like that, but they, but they sneak in and you'd see them come swimming out from our sump area. They make it about ten feet out and their bodies start shutting down, so you know, you feel sorry for it, you kill it with a shovel instead of watching it slowly die."

This interviewee also went on to describe the potential impact to hunters and trappers eating food off the land that may have interacted with dangerous chemicals related to mining activities. They understood that measures are put into place to avoid these interactions but explained that the risk for harvesters and land users getting sick exists, nonetheless.

"So, I mean, if one of those things were to get out and go and heal up but it's sick, and you're trapping – and some people do eat muskrat – and they end up eating that, I couldn't imagine the health effects. It'd be terrible. And I know birds, geese, they go and they land in the tailings ponds and the companies [...] have [...] a propane canon, and it'll let out a loud bang to, to deter wildlife from coming again and it works 99 percent of the time. But that one percent is all it takes to get one person sick and one person is one too many."

In looking at the big picture around the project, one participant suggested that there could be a fair trade-off between the potential effects of the project and the economic gain for the area. This is significant, especially given the economic deterioration of Lynn Lake described by participants in section 4.4.1. This trade-off, however, is also a source of concern for interviewees. As several participants described, the possibility of having a mining camp environment and bringing in non-local people to work in the mines in effort to make the project more economically feasible would severely interfere with any economic benefit to Lynn Lake or the Manitoba Métis Community in the area.

"Can we argue there'll be a fair trade-off in terms of economic gain for the area, and our people and the other Indigenous peoples, and the other residents of the area? I'd like to be able to argue that. But […] they may have a camp and a come-and-go crew, where it then lessens the economic input, in this case to Lynn Lake. And I know damn well that that's going to be their goal, because that's the most economical way to approach it. And the other aspect of it is reliability—you can't rely on people all the time to come and go, but you bring people in for two weeks at a time, or whatever shift schedule you're going to run. They're there for two weeks, they work their asses off, they go home. Level of productivity is higher with a camp environment where you're controlling everything, versus in this case people from Lynn Lake driving out to the mine and everything else."

"[the mine workers] should come into Lynn Lake. I think they should be in town. There's lots of houses, they might need work, or whatever you know, like they should be putting into the community. Don't just have them in the camp and fly them home and mine there, the, the town's gotta benefit somehow, right? I don't think they should be putting a camp."

One participant also noted crime rate rises in northern communities, like Thompson, when transient workers are present in the area because they are not invested in the communities they visit. This interviewee was a woman and described feeling nervous about what the presence of transient workers would mean for her.

> *"We get a lot of transient [workers]. So, our population will go up, they're not invested in this community, crime rate goes up as well. They come out of these dams, they come out of these mines, they go to the Thompson, which is the local hub in the north, party it up, break a few laws. I hate to say it, use and abuse locals, and go home. And does the money stay here? No. Are the jobs long term? Not really. [...] It will affect us. And as a single, and I hate to say this, but it is a reality, as a single woman in this community, crime rate goes up towards women, and it makes me nervous, personally."*

On top of not feeling safe in a community with transient workers travelling in and out, the woman quoted above also mentioned that having a transient workforce results in no positive economic benefit to the communities or the Manitoba Métis that live there. Another participant echoed this sentiment and described the "double whammy" this could have on the community of Lynn Lake due to its vulnerable economic state and ongoing social issues.

> *"[The mine will] probably [have] a camp environment. So, they'll draw from Lynn Lake what they can. […] You have all the social problems that you do. [...] So, the same is going to apply here, but you've got the double whammy with just the economic state of [Lynn Lake] and everything else…no, it'll be a camp environment. It'll be an 80-man operation biweekly. They'll fly in, fly out, or drive in, drive out probably."*

Similar to other participants who expressed issues related to the workforce not being invested in the places they travel through; this interviewee described the impact this could have on their harvesting areas and other popular places to visit on the land.

> *"The environmental side of it, I can tell you right now. When you have an influx of people that have no ownership to the area, and it's their job, you're gonna have a lot of litter in the bush, you are gonna have a lot of people that go out and wanna go fishing at the weekends and stuff, and we used to have, find piles of litter, because it was basically, people that had no ownership to the land. No pride for the land so there's a lot of debris in the water. There's a lot of, you know, a lot of garbage and that. That's something that is, that's gonna come with an influx of population. There's no doubt about it."*

In general, participants expressed concern about being able to trust the mining companies in ensuring concerns, effects, and impacts are addressed, mitigated, or appropriate compensation and accommodation measures are provided. One interview participant succinctly expressed the sentiment connecting all of these concerns:

> *"What mining companies say and what mining companies do are usually two different things."*

Given the rights and interests of the Manitoba Métis in the project Study Area, alongside their previous experiences with similar mine development projects around Lynn Lake in the past, it is evident that ongoing communication and engagement with the Manitoba Metis Federation is crucial in ensuring that these concerns do not come to fruition and the negative impacts of the past mining operations do not repeat themselves with the proposed project.

5.0 Thompson Regional Community Meeting

As discussed in section 3.6.6, the Thompson Community Regional Meeting provided Métis citizens with an overview of the proposed Project and the results of the interim report. The 53 Métis citizens were asked to provide their comments on the discussion questions listed in section 3.6.6.

There were six main themes that continually came up during the discussion and from written feedback from attendees.

1. **Conduct a Métis-specific impact assessment** - Métis citizens have been and continue to be impacted in several ways by current or closed mining practices and other resource developments throughout the province. Previous mine closures in the Lynn Lake area have had devastating impacts on those who lived and worked in the area. There is a need to plan for both impacts to the environment as well as the social, economic, and physical health of Métis in the area.

2. **Ensure best practice is followed** - All aspects of construction, operation, and closure need to use best practices for environmental management and restoration.

3. **Employ Métis monitors** - Métis citizens need to be involved in monitoring programs.

4. **Métis employee retention program** - Retention of Métis employees at the proposed Lynn Lake Gold Mine is essential and opportunities for training and education need to go alongside employment opportunities.

5. **Set-asides for Métis businesses** -Contract work that goes out for tender needs to prioritize Métis-owned businesses.

6. **Strong closure plan** - A clear closure plan needs to be put in place to ensure detrimental social, economic, and environmental impacts from the mine closure are avoided.

6.0 Recommendations for the Project

Those who participated in the Study as well as those who attended the Regional meeting in Thompson had recommendations that they felt needed to be included in any negotiations or plans that are made going forward.

A detailed and explicit closure plan that identifies how Alamos Gold Inc. is going to mitigate social and economic issues after the mines close was very important to Métis citizens who've experienced mining closures in the past. For example, one participant said they felt that people shouldn't have to lose their homes when the mine closes. Another expressed fear for what would happen to Lynn Lake or other communities after the mine closed.

> *"I would just like to see it, something happens, but people don't have to lose their homes. A lot of them are just boarded up going in to, molding, and stuff like that. And I don't know, there's lots of possibilities, if we just think of them."*

> *"But the negative part of it, just, the negative part of it for me would be the, after the closure. What's going to happen to the town again. One of the biggest things that I always think of, it's the negative part of it, what's going to become of people again, again they're all going to move, probably die. Cause, it's a good career, like a mining, you get, being up in the north, because everything's more expensive to ship up, it's, at least you make good money."*

The opportunity for employment as a potential economic benefit was discussed by many participants and was also raised at the Regional community meeting in Thompson. Not only was hiring Métis people for job opportunities important, but also retaining Métis people and providing capacity support for them to be successful on the job. For example, one participant said that it was important for people to have a stable work environment, another said that there needed to be training opportunities for those who wanted to work in the mine but who don't currently have the required skills. Overall, people felt that there was a desire for local Métis people to have meaningful and secure jobs in the area. This will be especially important for maintaining community and family connections amongst Métis citizens in the area.

> *"I think a good way to affect Métis people if you're hiring them, which I hope they, I really hope they do, give them a stable environment to work, don't talk to them like they're, you know, less than or 'you're only here because we, we need the statistic to say that we hired, you know, 80 of you, you know. Don't treat them like that."*

> *"As long as they have a fair hiring process and they're hiring, you know, local people, and even if they're not qualified for say what you're hired for, well, qualify them. Train them. If your employees shouldn't be a liability, they should be an asset. The more you train somebody, the better you treat them. They are the face of your business, right? Like, if they're out there, they're happy because you've invested time and showing you have confidence in them because you helped them get, you know, get them to a position where if they leave, they leave with more than they showed up with. And I'm not just talking money, I'm talking education because education's huge, right? So, for positive impact on Métis people, be it men or women, both, children, kids, I don't know, train them. Hire them."*

> *"Training. I mean, we're just as good as anybody else. Let, let's train our people. Let's have those smart people. Let's see how, so when they see a job posting, you know, for a class one engineer,*

you know, hey look at that, we've got three people up to Class 1-A engineer levels now. Let's talk to them to see if they're interested in this, you know. Training, training, education. I mean, I've been trained by the MMF. I went to school for heavy equipment operator and from there I opened a business and now from there, I'm becoming a journeyman heavy duty mechanic, you know. […] And they were really good to, to us because they let us know that they had stiff expectations. Like, they said there was no reason you should fail this. You need help studying? No problem. You need better books? No problem. You need to eat? No problem. You know, they, they set us up so the only factor at failing was literally you not paying attention."

"We've got smart, smart people. We have a lot of people with unlocked talent, you know, that they don't even know what they'd be good at yet but you get them into these job fairs and you know, things like that, put them in simulators, put them in a job placement for a week, you know, and maybe it's like, 'I kind of like this way of wood work. Maybe I'll be a carpenter' [...] Training, education – huge. Support. Follow through."

"Give them a fair shot [...] People have been up here for a long time who have invested their lives up here, you know. Like, we should be not necessarily taking advantage in a bad way but we should be taking advantage of that knowledge and, you know, getting them into the sectors in say this mining project that, where, you know, they've been there for 40 years already, they know what it looked like 40 years before, how it got to this state. [...] Use them. Nobody works for you harder than Métis people, you know. We do, we shoot for that higher target."

"If you want to make a good investment, invest in Métis people. Not only will you get your dollar back in work, but you'll get more. They will do the best job that you possibly could imagine. Believe in us. Try us out. We will impress you."

As discussed, there is a growing concern of the transient work population that often comes with mining camps. Métis citizens who already had experience with transient mining communities were concerned about these issues continuing. At the Regional meeting, people discussed issues with drugs, alcohol, and violence against women. One participant suggested that Alamos Gold Inc. should hire and retain local people, who are already engaged and embedded in the local community. There was one participant who felt that crime rates would not increase if most mine workers lived in and were connected to the local community.

"Start training people here so we don't have as many of the transients. People that are invested, that are going to be here long term […] is one of the ways I could see that being helped to keep the crime rate down. Invest in the community long term. Less transients. […] One of the things I see is hire local. Make sure they're at the table when you're looking at training, whenever the jobs come. And don't do it the day you're going to start the job, do it now!"

Many interview participants, and those in attendance at the Regional community meeting in Thompson, expressed a concern for how the environment was going to be impacted by the development. There was a strong feeling of needing to protect and care for the environment for future generations. For example, one participant expressed their desire for clean water, and that water is life. They also expressed the need to ensure that what they are harvesting in the area is safe to eat, noting that they had already had arsenic poisoning once.

> ***Interviewee: "****As long as they are actually putting in a legitimate effort into, you know, cleaning it up when they're done and are at least making it usable, you know, for the next generation to be able to use – maybe not for mining – but hell, just for living, you know. That's a big factor, cleaning up after yourselves."*
> ***Interviewer: "****When you talk about making sure it's usable for the next generation, what are those qualities that you want?"*
> ***Interviewee:*** *"You want clean water. I mean, water is life. Pretty sure everybody knows that if you don't got water, you got nothing. So, there's waterways and, you know, ground water feeds everything. It feeds your trees, it feeds your plants, it feeds your berries. Guys like me picking, you know, I don't want to get any pickings if they're full of arsenic. I've had arsenic poisoning and it is not fun."*

A country foods monitoring program of the foods identified in this report will need to be established to ensure that Métis citizens are not being exposed to harmful contaminants from the activities of the Project.

In both the interviews and at the Regional community meeting in Thompson, Métis citizens expressed the desire to have Métis environmental monitors who would be able to identify changes and raise the flag if they saw issues happening in the environment. The reason for having local Métis citizens take on this role, they said, was because they already had experience in this geographic area and would be familiar enough to identify changes.

> *"I think it's very important, while they're operating as that, they have what you call traditional trappers that live in that area and hunters. Especially the elders, one's going out there now before they start and check, and take pictures and record game, signs of game and caribou and moose and that, what the signs are and the site that they are at before they start disturbing the earth. And then, do a study once in a while, maybe once every month or two months to see just how there's any tracks, there are any lynx tracks or any marten tracks, is there anything, you know, to see whether or not, it's effected the population of wildlife there. I think they should do that, because they never did that before."*

> *"[Get] the hunters, the harvesters to take a look at it and say, 'this is what it is today'. And then, take a look at it, a month later, two months later and say 'there's no moose in the area anymore. There's no, they'll be the fur, we no longer can trap in that area', or 'they're dumping their, dumping their, their tailings or […] their overburden is going into the river'. […] You know, I think things like that might be advantageous going forward and how that impacts on the land and hunting and everything harvesting. But I think they gotta rely on local sources to do that. Local people."*

Some participants felt that the MMF has not been adequately consulted on past resource development projects but that Métis citizens are still heavily impacted by these developments. Participants felt that the MMF will need to be at the table to ensure appropriate mitigation and accommodation measures are in place to ensure that negative impact are mitigated, and any potential positive impacts are enhanced.

> *"I also know from past experience, people that come up here and open up mines, even the dam, and other agreements with the First Nations, and MMF hardly ever gets invited to that table so the Métis really don't get included."*

> *"I'd like to see MMF at the table and the jobs being discussed. What's the future going to hold? What are the jobs needed? How are we going to be affected long term? [...] What's going to be released into the air? Will the land be put back to the way it was before? Those are the questions I think MMF should be asking."*

7.0 Conclusions and Expectations of the MMF

The results of the Métis Traditional Knowledge and Land Use Study has given the MMF the information required to make meaningful recommendations to Alamos Gold Inc. The evidence that we have presented above shows that there is indeed significant land use by Métis citizens in the area, and any impacts to the environment have reasonable potential to impact Métis citizens. Furthermore, based on past experiences it is likely that Métis citizens' social, economic, and physical health may be impacted through direct or indirect effects of the project. All of the issues raised above need to be accurately and adequately included in the Environmental Assessment process or resolved through additional mitigation or accommodation measures jointly agreed upon with the MMF. In this report we have provided Alamos Gold Inc. with some indicative baseline data of where and how Métis citizens use the lands and waters and in which they hold Aboriginal rights under s.35 of the Constitution. This baseline data should not be considered a comprehensive or exhaustive record of current use of lands and resources for traditional purposes by the Manitoba Métis Community, as the scope of data collection was constrained by funding and timelines dictated by Alamos Gold Inc.

The following are how we expect to be engaged in this Project moving forward:

- Alamos Gold Inc. must meaningfully engage the MMF at any level where key strategic project decisions are being made. We expect adequate time to review these decisions and capacity support to engage with and respond to these decisions to ensure all Métis Traditional Knowledge and Land Use information has been considered in these decisions. Such decisions may include but are not limited to material changes to the site layout, project description, closure plans, mine plans, and permitting plans.

- Alamos Gold Inc. must formally and functionally acknowledge MMF jurisdiction, sovereignty, governance, and rights, claims, and interests and the related requirements for consultation and engagement moving forward. This must be done within Alamos' environmental assessment documentation and any related environmental permitting applications to the Crown, in particular.

- In the spirit of respect, we expect and require Alamos Gold Inc. to include the information presented in the report above in the upcoming release of the Environmental Assessment. This includes:

    - Demonstration that the information in this report was incorporated into all relevant aspects of the Environmental Assessment. That is, we expect to see this information applied in an integrated fashion to all relevant chapters and technical supporting documents of the Environmental Assessment, not just summarized in an MMF specific chapter. In particular, this is relevant to EA content (baseline environment, effects assessment, mitigation, determination of significance of adverse effects, follow-up programs) associated with relevant components of the environment such as terrestrial and aquatic ecology, fish, wildlife, species-at-risk, cultural and archaeological heritage, human health, socioeconomic conditions, water resources, air quality and the like, where adverse effects on these components may have secondary effects on Métis traditional use, socioeconomic conditions, health, or archaeological and cultural heritage.

    - That the Métis Ecological Knowledge and land use data provided in this report is treated and conveyed as being equally valid and legitimate in comparison to other baseline data for the Environmental Assessment.

    - That there is transparency and traceability in how the information in this report was used to determine mitigation, and the significance of adverse effects on Métis rights, current uses of lands and resources for traditional purposes, socioeconomic conditions, health, or archaeological and cultural heritage.

- We request that Alamos Gold Inc. include in an Environmental Assessment section on Sustainability or similar, how and where they will ensure socioeconomic benefits for the Manitoba Métis Community, including planning for capacity development and the retention of Métis employees, and for Métis economic and business participation.

- We expect that, where appropriate mitigation measures cannot be put into place, that Alamos Gold Inc. will provide accommodation and long-term relationship measures that ensure the lowest feasible impact to the Manitoba Métis Community's rights and interests. For example, these accommodations could include equity ownership of the Project, revenue sharing, direct involvement in progressive and full close-out rehabilitation and environmental monitoring, financial compensation for impacts that cannot be avoided or where residual impacts remain following mitigation measures, and ensuring long-term economic and social benefits to the Manitoba Métis Community.

- Given the evidence provided in the report, we expect that ongoing engagement and consultation will be required. A fulsome socio-economic study and management plan as well as an environmental and cultural management and protection plan that is designed to protect the sensitive Métis values described in the report are expected as part of this ongoing engagement.

Appendix A: Additional Maps and Corresponding Attribute Tables

Figure 9 Métis Harvesting within the Study Area (Map 1 of 7)

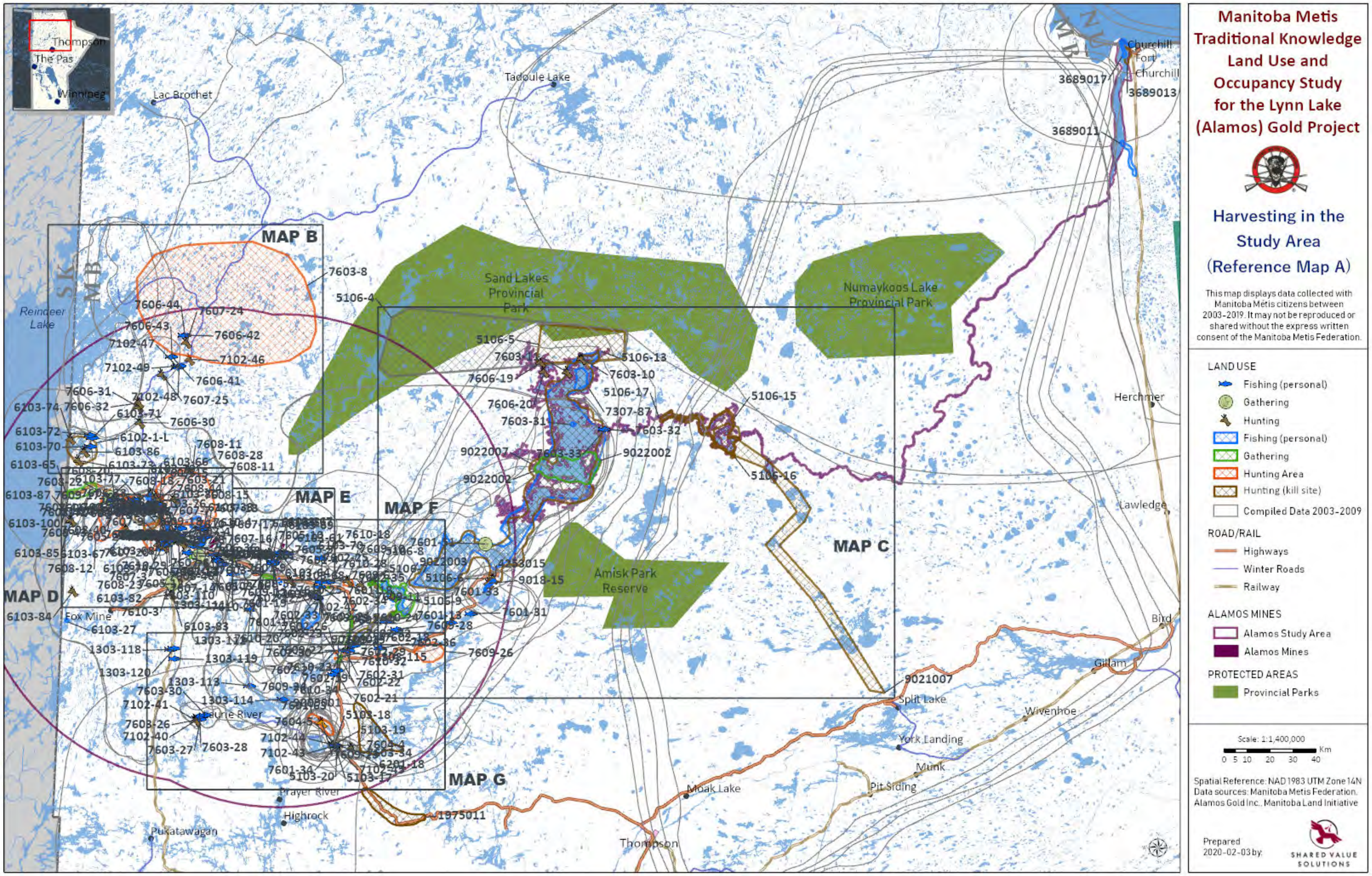


Figure 10 Métis Harvesting within the Study Area (Map 2 of 7)

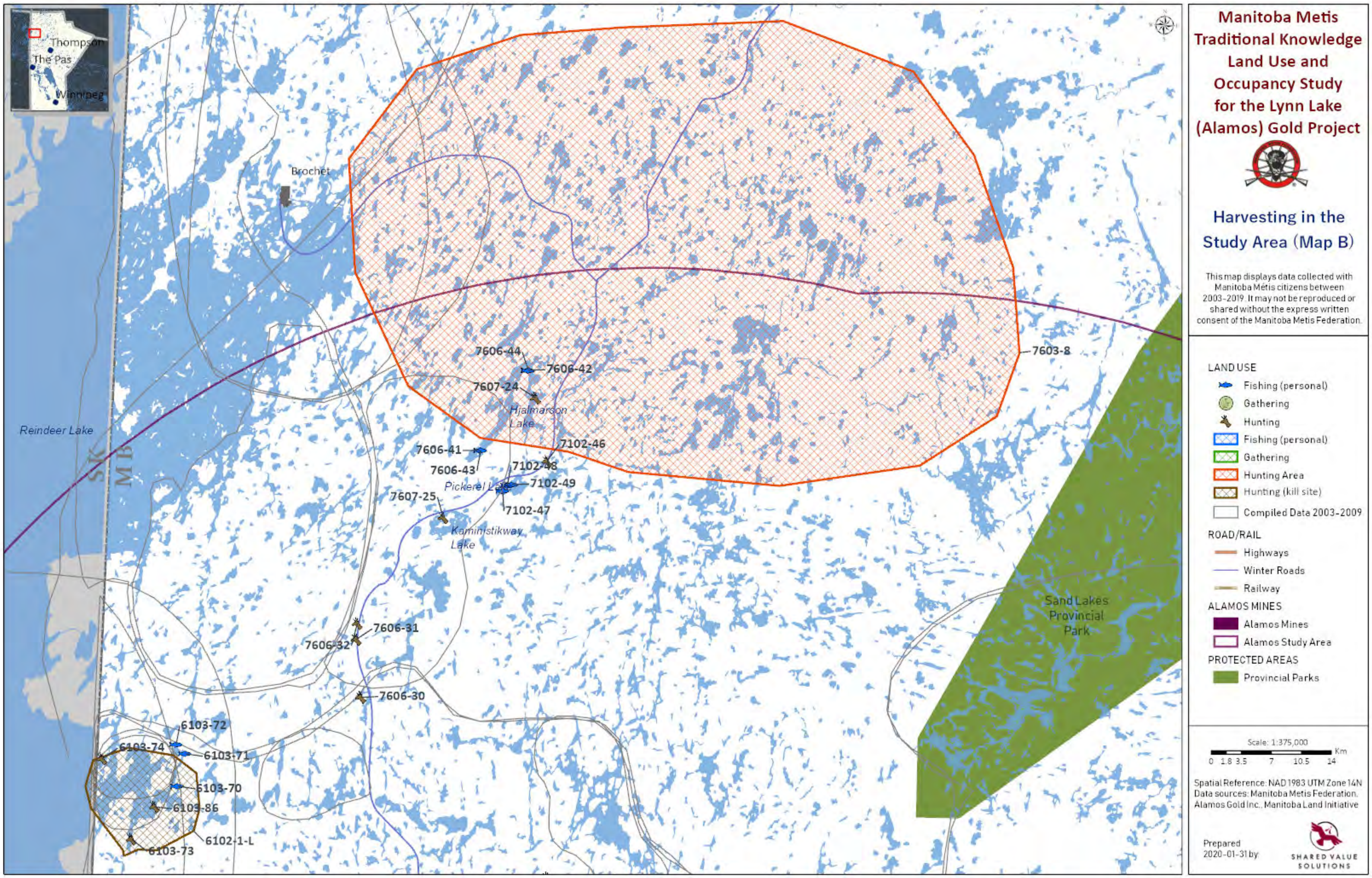


Figure 11 Métis Harvesting within the Study Area (Map 3 of 7)

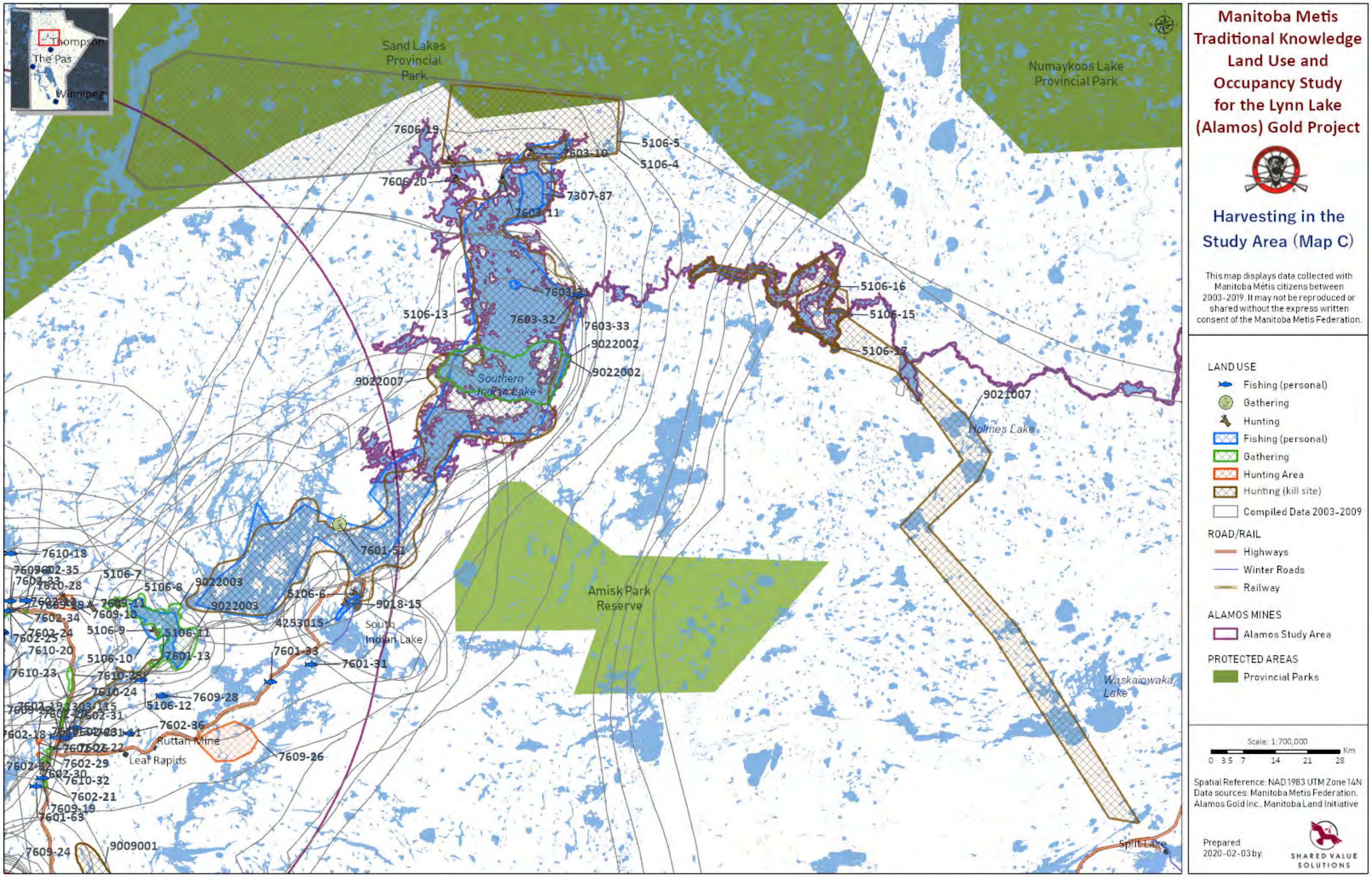


Figure 12 Métis Harvesting within the Study Area (Map 4 of 7)

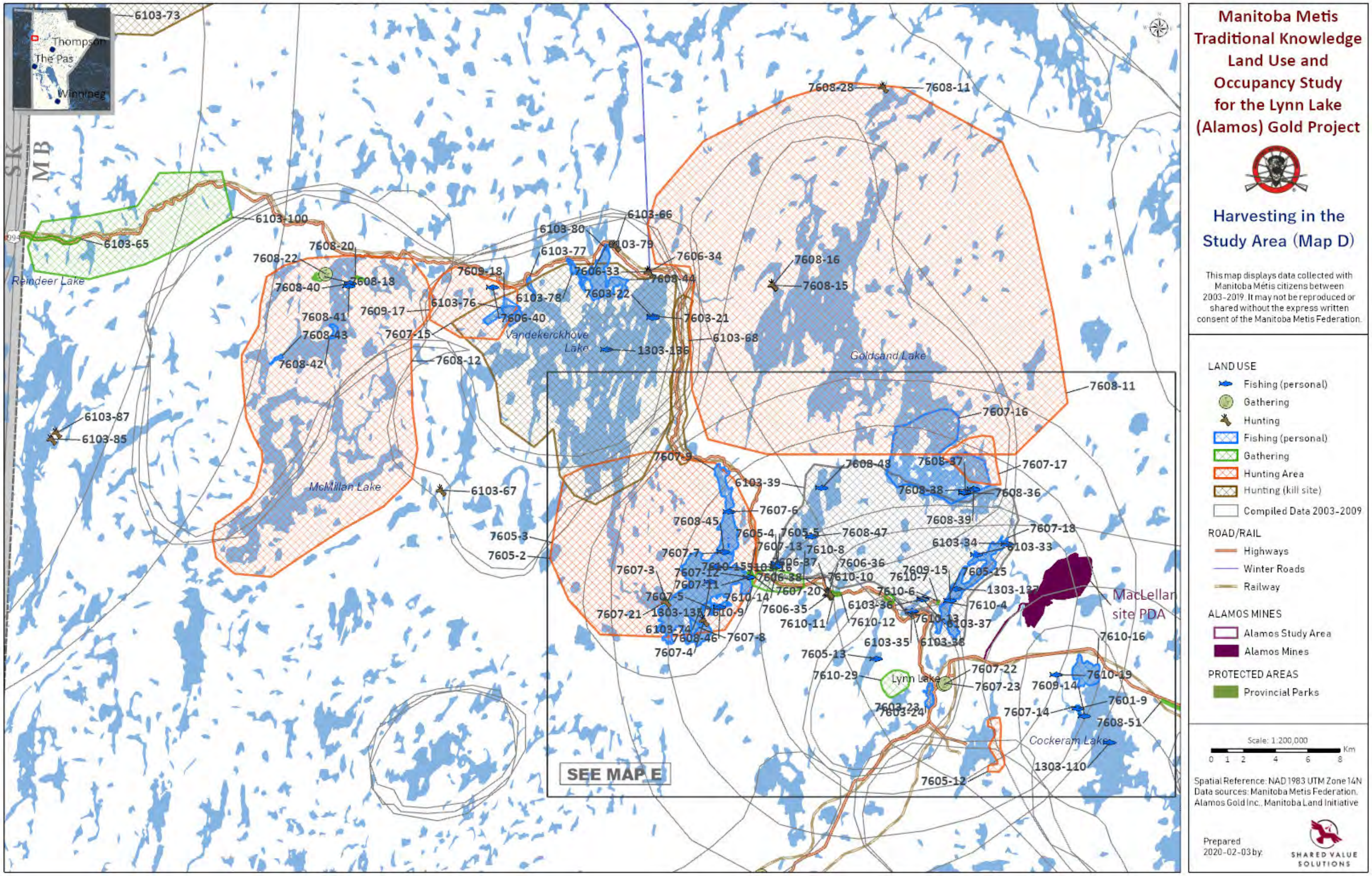


Figure 13 Métis Harvesting within the Study Area (Map 5 of 7)

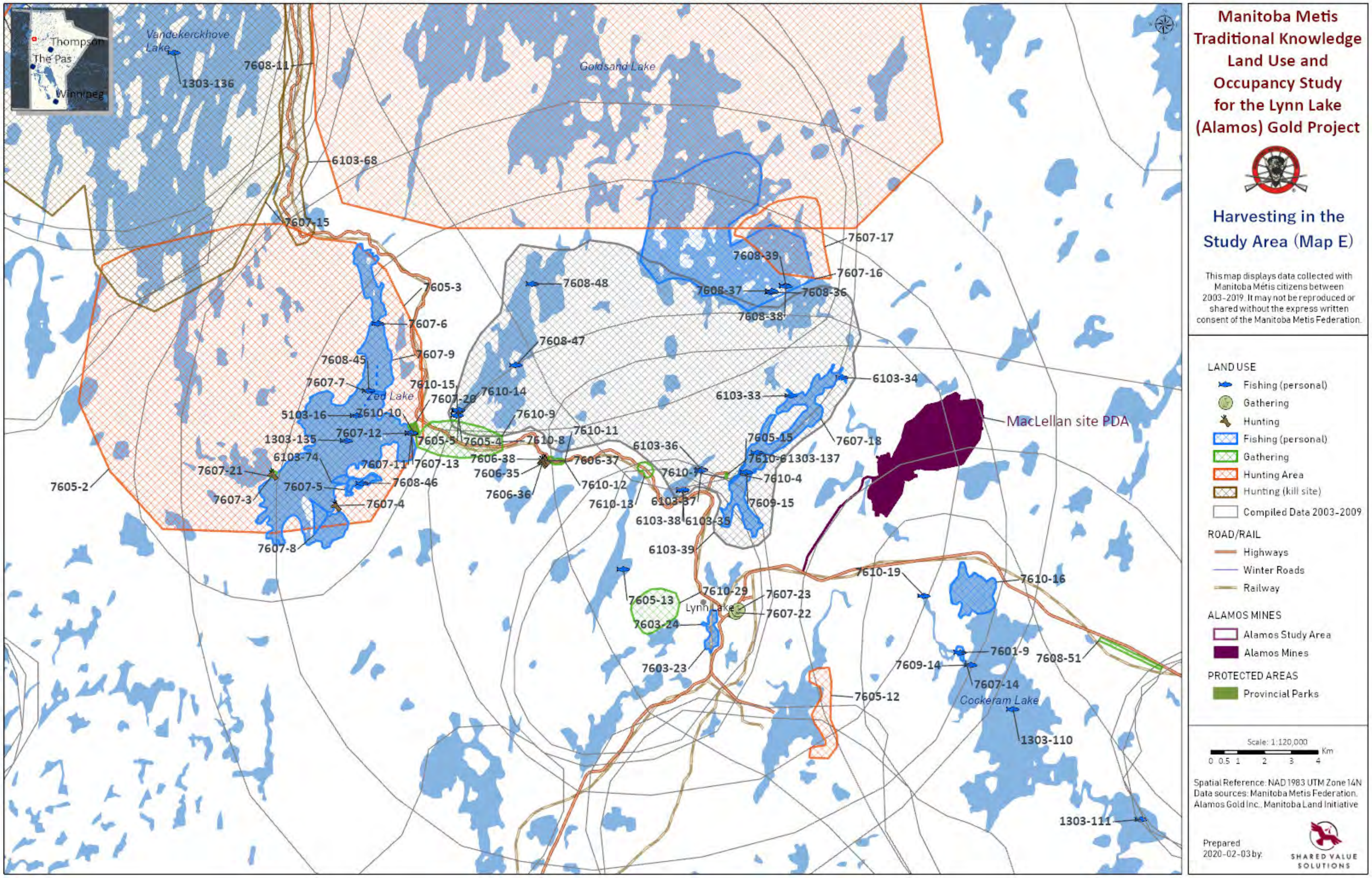


Figure 14 Métis Harvesting within the Study Area (Map 6 of 7)

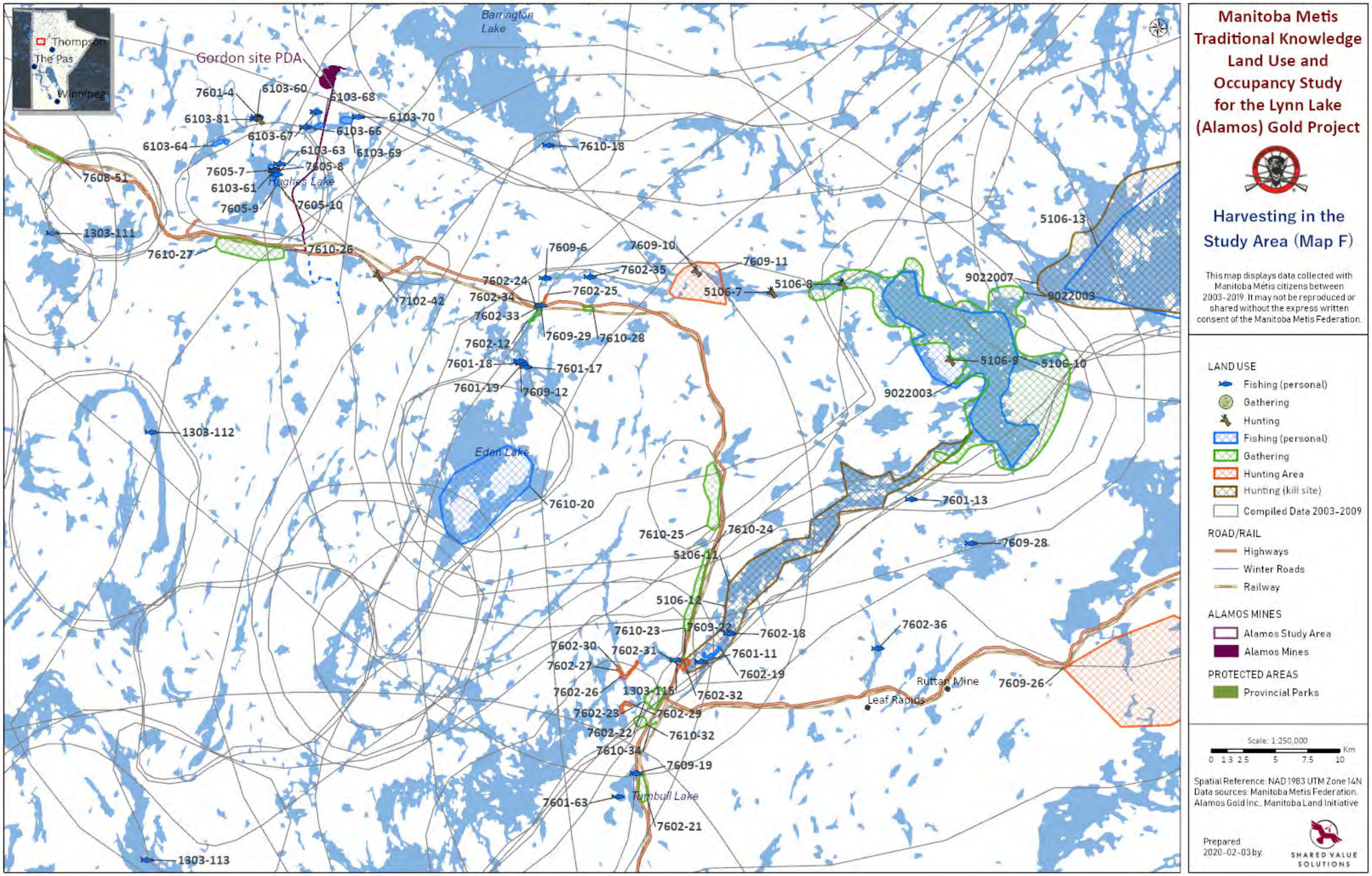


Figure 15 Métis Harvesting within the Study Area (Map 7 of 7)

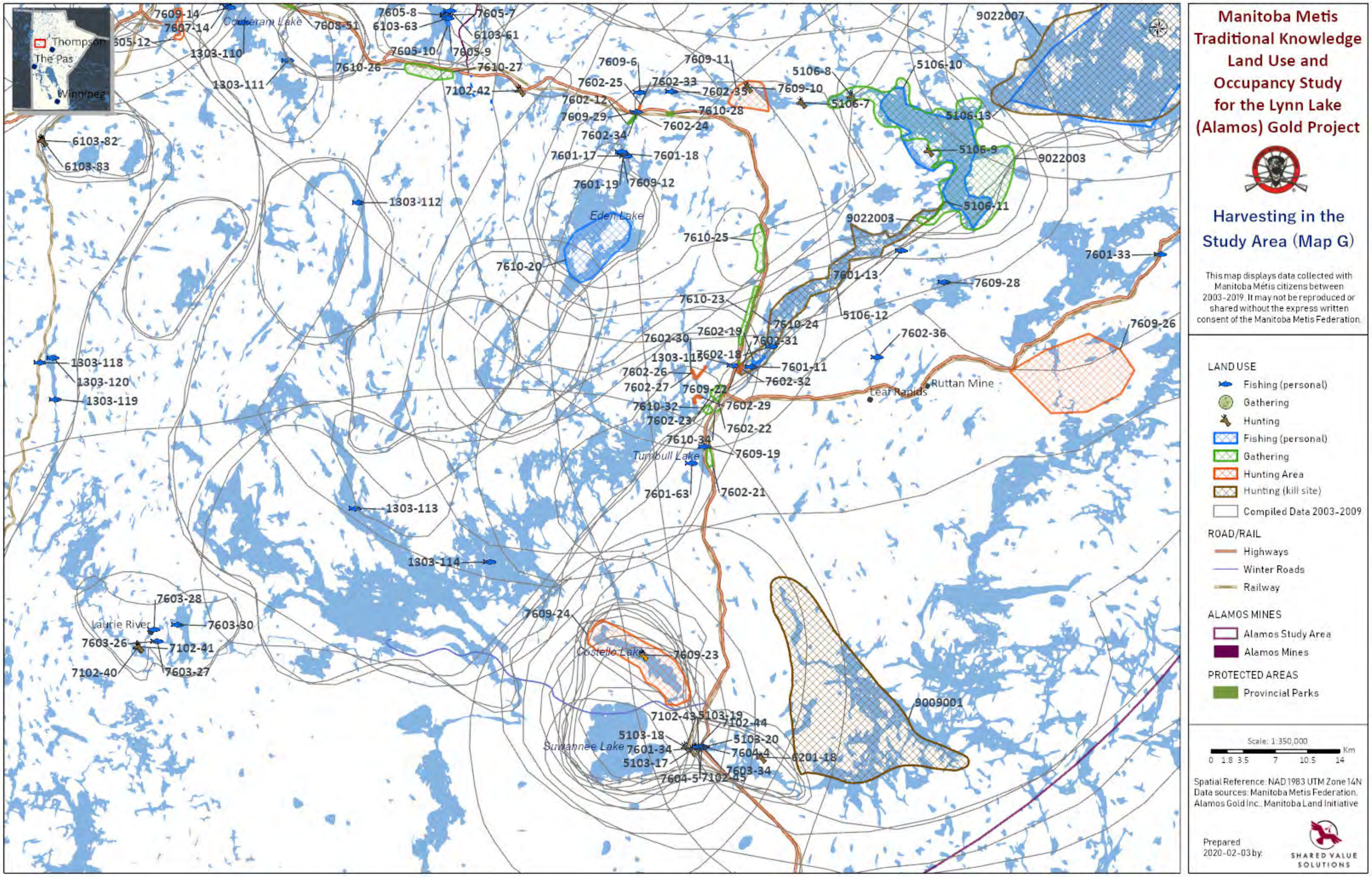


Table 3 Métis Harvesting Within the Study Area - Attribute Tables Corresponding to Harvesting maps 1-7

PIN-GISID	Category	Type	Subtype	Spring	Summer	Fall	Winter
1303-110	Fishing (personal)		Jackfish/Northern Pike, Lake Sturgeon, Pickerel/Walleye, Yellow Perch				X
1303-111	Fishing (personal)		Jackfish/Northern Pike, Lake Sturgeon, Pickerel/Walleye, Yellow Perch				X
1303-112	Fishing (personal)		Jackfish/Northern Pike, Lake Sturgeon, Pickerel/Walleye, Yellow Perch				X
1303-113	Fishing (personal)		Jackfish/Northern Pike, Lake Sturgeon, Pickerel/Walleye, Yellow Perch				X
1303-114	Fishing (personal)		Jackfish/Northern Pike, Lake Sturgeon, Pickerel/Walleye, Yellow Perch				X
1303-115	Fishing (personal)		Jackfish/Northern Pike, Lake Sturgeon, Pickerel/Walleye, Yellow Perch				X
1303-118	Fishing (personal)		Jackfish/Northern Pike, Pickerel/Walleye, Yellow Perch				X
1303-119	Fishing (personal)		Jackfish/Northern Pike, Pickerel/Walleye, Yellow Perch				X
1303-120	Fishing (personal)		Jackfish/Northern Pike, Pickerel/Walleye, Yellow Perch				X
1303-135	Fishing (personal)		Jackfish/Northern Pike, Pickerel/Walleye				X
1303-136	Fishing (personal)		Jackfish/Northern Pike, Pickerel/Walleye				X
1303-137	Fishing (personal)		Jackfish/Northern Pike, Pickerel/Walleye				X
1975011	Hunting	Mammals	Moose				
3689011	Fishing (personal)	Fish	Whitefish, Jackfish, Sturgeon	X	X	X	
3689013	Hunting	Birds	Ducks, Geese	X			

PIN-GISID	Category	Type	Subtype	Spring	Summer	Fall	Winter
3689017	Fishing (personal)	Fish	Whitefish, Arctic Char, Cisco	X	X	X	
4253015	Fishing (personal)	Fish	Pickerel				
5103-16	Fishing (personal)		Pickerel	X			
5103-17	Hunting		Duck			X	
5103-18	Hunting		Duck			X	
5103-19	Hunting		Duck			X	
5103-20	Fishing (personal)		Pickerel			X	
5106-4	Trapping						X
5106-5	Hunting		Woodland Caribou			X	X
5106-6	Hunting		Woodland Caribou			X	X
5106-7	Hunting		Moose		X	X	
5106-8	Hunting		Moose		X	X	
5106-9	Hunting		Moose		X	X	
5106-10	Fishing (personal)		Jackfish/Northern Pike, Lake Whitefish, Pickerel/Walleye	X	X	X	X
5106-11	Fishing (personal)		Jackfish/Northern Pike, Lake Whitefish, Pickerel/Walleye, Sucker			X	
5106-12	Hunting				X		
5106-13	Fishing (personal)		Goldeye, Jackfish/Pike, Lake Whitefish, Pickerel/Walleye		X		X
5106-15	Fishing (personal)		Jackfish/Pike, Lake Whitefish, Pickerel/Walleye				X
5106-16	Hunting						X
5106-17	Hunting						X
6102-1-L	Hunting	Mammals, Vegetation, Fish	Moose, Deer, Bear, Berries, Blueberries, Fish			X	X

PIN-GISID	Category	Type	Subtype	Spring	Summer	Fall	Winter
6103-27	Fishing (personal)		Trout		X		
6103-33	Fishing (personal)		Pickerel/Walleye		X		
6103-34	Fishing (personal)		Pickerel/Walleye		X		
6103-35	Fishing (personal)		Pickerel/Walleye		X		
6103-36	Fishing (personal)		Pickerel/Walleye		X		
6103-37	Fishing (personal)		Pickerel/Walleye		X		
6103-38	Fishing (personal)		Pickerel/Walleye		X		
6103-39	Trapping						X
6103-59	Fishing (personal)		Lake Whitefish			X	
6103-60	Fishing (personal)		Pickerel/Walleye	X		X	
6103-61	Fishing (personal)		Pickerel/Walleye	X		X	
6103-62	Fishing (personal)		Pickerel/Walleye		X		
6103-63	Fishing (personal)		Pickerel/Walleye	X			X
6103-64	Fishing (personal)		Pickerel/Walleye	X			X
6103-65	Gathering	Vegetation	Blueberries, Pin Cherries		X		
6103-66	Fishing (personal)		Pickerel/Walleye				X
6103-66	Hunting	Mammals	Moose			X	
6103-67	Fishing (personal)		Pickerel/Walleye				X
6103-67	Hunting	Mammals	Moose			X	

PIN-GISID	Category	Type	Subtype	Spring	Summer	Fall	Winter
6103-68	Fishing (personal)		Pickerel/Walleye			X	
6103-68	Hunting	Birds	Grouse, Chickens			X	X
6103-69	Fishing (personal)		Lake Whitefish			X	
6103-70	Fishing (personal)		Lake Whitefish				X
6103-70	Fishing	Fish	Pickerel		X		
6103-71	Fishing	Fish	Pickerel		X		
6103-72	Fishing	Fish	Pickerel		X		
6103-73	Hunting	Mammals	Moose			X	
6103-74	Fishing (personal)		Pickerel/Walleye	X	X		
6103-74	Hunting	Mammals	Moose			X	
6103-75	Fishing (personal)		Lake Trout		X		
6103-76	Fishing (personal)		Pickerel/Walleye	X	X		
6103-77	Fishing (personal)		Pickerel/Walleye	X	X		
6103-78	Fishing (personal)		Pickerel/Walleye	X	X		
6103-79	Fishing (personal)		Pickerel/Walleye	X	X		
6103-80	Fishing (personal)		Pickerel/Walleye	X	X		
6103-81	Hunting (kill site)	Large Mammals	Moose			X	
6103-82	Hunting (kill site)	Large Mammals	Moose			X	
6103-83	Hunting (kill site)	Large Mammals	Moose			X	
6103-84	Hunting (kill site)	Large Mammals	Moose				X

PIN-GISID	Category	Type	Subtype	Spring	Summer	Fall	Winter
6103-85	Hunting (kill site)	Large Mammals	Moose			X	
6103-86	Hunting (kill site)	Large Mammals	Moose			X	
6103-87	Hunting (kill site)	Large Mammals	Bear			X	
6103-100	Gathering	Food	Blueberries		X		
6201-18	Hunting	Mammals	Moose			X	
7102-40	Hunting (kill site)	Large Mammals	Moose			X	
7102-41	Hunting (kill site)	Large Mammals	Moose			X	
7102-42	Hunting (kill site)	Large Mammals	Moose			X	
7102-43	Fishing (personal)		Jackfish/Northern Pike	X			
7102-44	Fishing (personal)		Pickerel/Walleye	X			
7102-45	Fishing (personal)		Sucker (Longnose & White)	X			
7102-46	Hunting		Moose				X
7102-47	Fishing (personal)		Jackfish/Northern Pike, Pickerel/Walleye				X
7102-48	Fishing (personal)		Jackfish/Northern Pike, Pickerel/Walleye				X
7102-49	Fishing (personal)		Jackfish/Northern Pike, Pickerel/Walleye				X
7601-4	Fishing (personal)		Pickerel/Walleye		X		
7601-9	Fishing (personal)		Pickerel/Walleye		X		
7601-11	Fishing (personal)		Pickerel/Walleye		X		

PIN-GISID	Category	Type	Subtype	Spring	Summer	Fall	Winter
7601-13	Fishing (personal)		Pickerel/Walleye		X		
7601-17	Fishing (personal)		Lake Whitefish		X		
7601-18	Fishing (personal)		Pickerel/Walleye		X		
7601-19	Fishing (personal)		Jackfish/Northern Pike		X		
7601-31	Fishing (personal)		Pickerel/Walleye			X	
7601-33	Fishing (personal)		Pickerel/Walleye		X		
7601-34	Fishing (personal)		Pickerel/Walleye		X		
7601-51	Gathering	Food	Blueberries		X		
7601-63	Fishing (personal)		Yellow Perch	X			
7602-12	Fishing (personal)		Pickerel/Walleye		X		
7602-18	Fishing (personal)		Pickerel/Walleye		X		X
7602-19	Fishing (personal)		Pickerel/Walleye		X		X
7602-21	Gathering	Food	Strawberries		X		
7602-22	Gathering	Food	Blueberries			X	
7602-23	Gathering	Food	Cranberries			X	
7602-24	Gathering	Medicinal or Ceremonial Plants	Mint			X	
7602-25	Gathering	Medicinal or Ceremonial Plants	Mint			X	
7602-26	Gathering	Medicinal or Ceremonial Plants	Mint			X	

PIN-GISID	Category	Type	Subtype	Spring	Summer	Fall	Winter
7602-27	Fishing (personal)		Pickerel/Walleye		X		
7602-29	Hunting Area	Large Mammals	Moose			X	
7602-30	Hunting Area	Large Mammals	Moose			X	
7602-31	Hunting Area	Birds	Duck	X			
7602-32	Hunting Area	Birds	Goose	X			
7602-33	Hunting Area	Birds	Duck	X			
7602-34	Hunting Area	Birds	Goose	X			
7602-35	Fishing (personal)		Pickerel/Walleye				X
7602-36	Fishing (personal)		Pickerel/Walleye	X			X
7603-8	Hunting Area	Large Mammals	Barren Ground Caribou				X
7603-10	Hunting (kill site)	Large Mammals	Barren Ground Caribou				X
7603-11	Hunting (kill site)	Large Mammals	Barren Ground Caribou				X
7603-21	Fishing (personal)		Pickerel/Walleye			X	
7603-22	Fishing (personal)		Jackfish/Northern Pike			X	
7603-23	Fishing (personal)		Pickerel/Walleye			X	
7603-24	Fishing (personal)		Jackfish/Northern Pike			X	
7603-26	Fishing (personal)		Pickerel/Walleye		X		

PIN-GISID	Category	Type	Subtype	Spring	Summer	Fall	Winter
7603-27	Fishing (personal)		Jackfish/Northern Pike		X		
7603-28	Fishing (personal)		Pickerel/Walleye		X		
7603-30	Fishing (personal)		Pickerel/Walleye		X		
7603-31	Fishing (personal)					X	
7603-32	Fishing (personal)		Pickerel/Walleye		X	X	
7603-33	Fishing (personal)		Jackfish/Northern Pike		X	X	
7603-34	Fishing (personal)		Pickerel/Walleye	X	X		
7604-4	Fishing (personal)		Pickerel/Walleye	X			
7604-5	Fishing (personal)		Pickerel/Walleye	X			
7605-2	Hunting Area	Large Mammals	Caribou (Woodland)			X	
7605-3	Hunting Area	Large Mammals	Moose			X	
7605-4	Fishing (personal)		Jackfish/Northern Pike	X		X	
7605-5	Fishing (personal)		Pickerel/Walleye	X		X	
7605-7	Fishing (personal)		Pickerel/Walleye		X	X	
7605-8	Fishing (personal)		Jackfish/Northern Pike		X	X	
7605-9	Fishing (personal)		Pickerel/Walleye		X	X	
7605-10	Fishing (personal)		Jackfish/Northern Pike		X	X	

PIN-GISID	Category	Type	Subtype	Spring	Summer	Fall	Winter
7605-12	Hunting Area	Large Mammals	Moose			X	
7605-13	Fishing (personal)		Lake Trout				X
7605-15	Fishing (personal)		Rainbow Trout		X	X	
7606-19	Hunting (kill site)	Large Mammals	Barren Ground Caribou				X
7606-20	Hunting (kill site)	Large Mammals	Barren Ground Caribou				X
7606-30	Hunting (kill site)	Large Mammals	Moose				X
7606-31	Hunting (kill site)	Large Mammals	Moose				X
7606-32	Hunting (kill site)	Large Mammals	Moose				X
7606-33	Hunting (kill site)	Small Furbearers	Rabbit				X
7606-34	Hunting (kill site)	Birds	Ptarmigan				X
7606-35	Hunting Area	Birds	Ptarmigan				X
7606-36	Hunting (kill site)	Birds	Ptarmigan				X
7606-37	Hunting (kill site)	Birds	Ptarmigan				X
7606-38	Hunting (kill site)	Birds	Ptarmigan				X
7606-40	Fishing (personal)		Pickerel/Walleye				X
7606-41	Fishing (personal)		Jackfish/Northern Pike				X
7606-42	Fishing (personal)		Jackfish/Northern Pike				X

PIN-GISID	Category	Type	Subtype	Spring	Summer	Fall	Winter
7606-43	Fishing (personal)		Lake Trout				X
7606-44	Fishing (personal)		Jackfish/Northern Pike				X
7607-3	Hunting (kill site)	Large Mammals	Moose			X	
7607-4	Hunting (kill site)	Large Mammals	Moose			X	
7607-5	Fishing (personal)		Pickerel/Walleye		X		
7607-6	Fishing (personal)		Pickerel/Walleye		X		
7607-7	Fishing (personal)		Lake Trout		X		
7607-8	Fishing (personal)		Lake Trout		X		
7607-9	Fishing (personal)		Jackfish/Northern Pike				X
7607-11	Fishing (personal)		Burbot (Ling Cod)				X
7607-12	Fishing (personal)		Lake Whitefish		X		
7607-13	Fishing (personal)		Pickerel/Walleye		X		
7607-14	Fishing (personal)		Pickerel/Walleye		X		
7607-15	Hunting (kill site)	Large Mammals	Moose			X	
7607-16	Fishing (personal)		Pickerel/Walleye				X
7607-17	Hunting Area	Large Mammals	Moose			X	
7607-18	Fishing (personal)		Pickerel/Walleye		X		
7607-20	Gathering	Food	Blueberries		X		

PIN-GISID	Category	Type	Subtype	Spring	Summer	Fall	Winter
7607-21	Gathering	Food	Cranberries			X	
7607-22	Gathering	Food	Birch water		X		
7607-23	Gathering	Food	Birch water		X		X
7607-24	Hunting (kill site)	Large Mammals	Caribou (other)				X
7607-25	Hunting (kill site)	Large Mammals	Caribou (other)				X
7608-11	Hunting Area	Large Mammals	Moose			X	
7608-12	Hunting Area	Large Mammals	Moose			X	
7608-15	Hunting (kill site)	Birds	Goose			X	
7608-16	Hunting (kill site)	Birds	Duck			X	
7608-18	Gathering	Food	Blueberries		X	X	
7608-20	Gathering	Medicinal or Ceremonial Plants	Chaga			X	
7608-22	Gathering	Drinking Water	NA	X		X	X
7608-23	Gathering	Drinking Water	NA	X		X	X
7608-28	Hunting (kill site)	Large Mammals	Moose			X	
7608-36	Fishing (personal)		Pickerel/Walleye				X
7608-37	Fishing (personal)		Jackfish/Northern Pike				X
7608-38	Fishing (personal)		Pickerel/Walleye				X
7608-39	Fishing (personal)		Jackfish/Northern Pike				X
7608-40	Fishing (personal)		Pickerel/Walleye	X	X	X	X

PIN-GISID	Category	Type	Subtype	Spring	Summer	Fall	Winter
7608-41	Fishing (personal)		Lake Trout	X	X	X	X
7608-42	Fishing (personal)		Lake Trout	X	X	X	X
7608-43	Fishing (personal)		Pickerel/Walleye		X		
7608-44	Fishing (personal)		Pickerel/Walleye		X		
7608-45	Fishing (personal)		Lake Trout		X		X
7608-46	Fishing (personal)		Pickerel/Walleye	X			
7608-47	Fishing (personal)		Pickerel/Walleye	X	X		
7608-48	Fishing (personal)		Pickerel/Walleye	X	X		
7608-51	Gathering	Food	Cranberries			X	
7609-6	Fishing (personal)		Pickerel/Walleye	X			
7609-10	Hunting (kill site)	Large Mammals	Moose			X	
7609-11	Hunting Area	Large Mammals	Moose			X	
7609-12	Fishing (personal)		Pickerel/Walleye	X	X		
7609-14	Fishing (personal)		Pickerel/Walleye			X	
7609-15	Fishing (personal)		Pickerel/Walleye		X		
7609-17	Hunting Area	Large Mammals	Moose			X	
7609-18	Fishing (personal)		Pickerel/Walleye			X	
7609-19	Fishing (personal)		Pickerel/Walleye	X			

PIN-GISID	Category	Type	Subtype	Spring	Summer	Fall	Winter
7609-22	Gathering	Food	Blueberries		X		
7609-23	Hunting Area	Birds	Duck			X	
7609-24	Hunting Area	Large Mammals	Moose			X	
7609-26	Hunting Area	Large Mammals	Moose			X	
7609-28	Fishing (personal)		Pickerel/Walleye	X			
7609-29	Fishing (personal)		Pickerel/Walleye		X		
7610-3	Fishing (personal)		Pickerel/Walleye	X	X	X	
7610-4	Fishing (personal)		Pickerel/Walleye		X		
7610-6	Gathering	Food	Blueberries		X		
7610-7	Gathering	Food	Cranberries		X		
7610-8	Gathering	Food	Raspberries		X		
7610-9	Gathering	Food	Blueberries		X		
7610-10	Gathering	Food	Cranberries		X		
7610-11	Gathering	Food	Blueberries		X		
7610-12	Gathering	Food	Raspberries		X		
7610-13	Gathering	Food	Raspberries		X		
7610-14	Fishing (personal)		Jackfish/Northern Pike		X		
7610-15	Fishing (personal)		Pickerel/Walleye		X		
7610-16	Fishing (personal)		Pickerel/Walleye		X		
7610-18	Fishing (personal)		Jackfish/Northern Pike			X	
7610-19	Fishing (personal)		Pickerel/Walleye		X		

PIN-GISID	Category	Type	Subtype	Spring	Summer	Fall	Winter
7610-20	Fishing (personal)		Pickerel/Walleye		X		
7610-21	Fishing (personal)		Pickerel/Walleye		X		
7610-23	Gathering	Food	Blueberries		X		
7610-24	Gathering	Food	Cranberries		X		
7610-25	Gathering	Food	Blueberries		X		
7610-26	Gathering	Food	Blueberries		X		
7610-27	Gathering	Food	Cranberries		X		
7610-28	Gathering	Food	NA		X		
7610-29	Gathering	Food	Blueberries		X		
7610-32	Gathering	Food	Blueberries		X		
7610-34	Gathering	Food	Blueberries		X		
9009001	Hunting	Mammals	Moose				
9018-15	Hunting		Goose	X			
9021007	Hunting	Mammals	Moose			X	
9022002	Fishing (personal)	Fish	Whitefish, Jackfish, Pickerel		X	X	
9022003	Gathering	Berries, Medicines	Labrador Tea, Wild Mint	X		X	
9022007	Hunting	Mammals, Birds	Moose, Barren Land Caribou, Woodland Caribou, Black Bear, Rabbit, Geese, Duck, Beaver, Upland Birds	X	X	X	X

Figure 16 Métis Access, Occupancy, Cultural Sites, Commercial Harvesting, and Observed Changes in the Study Area (Map 1 of 2)

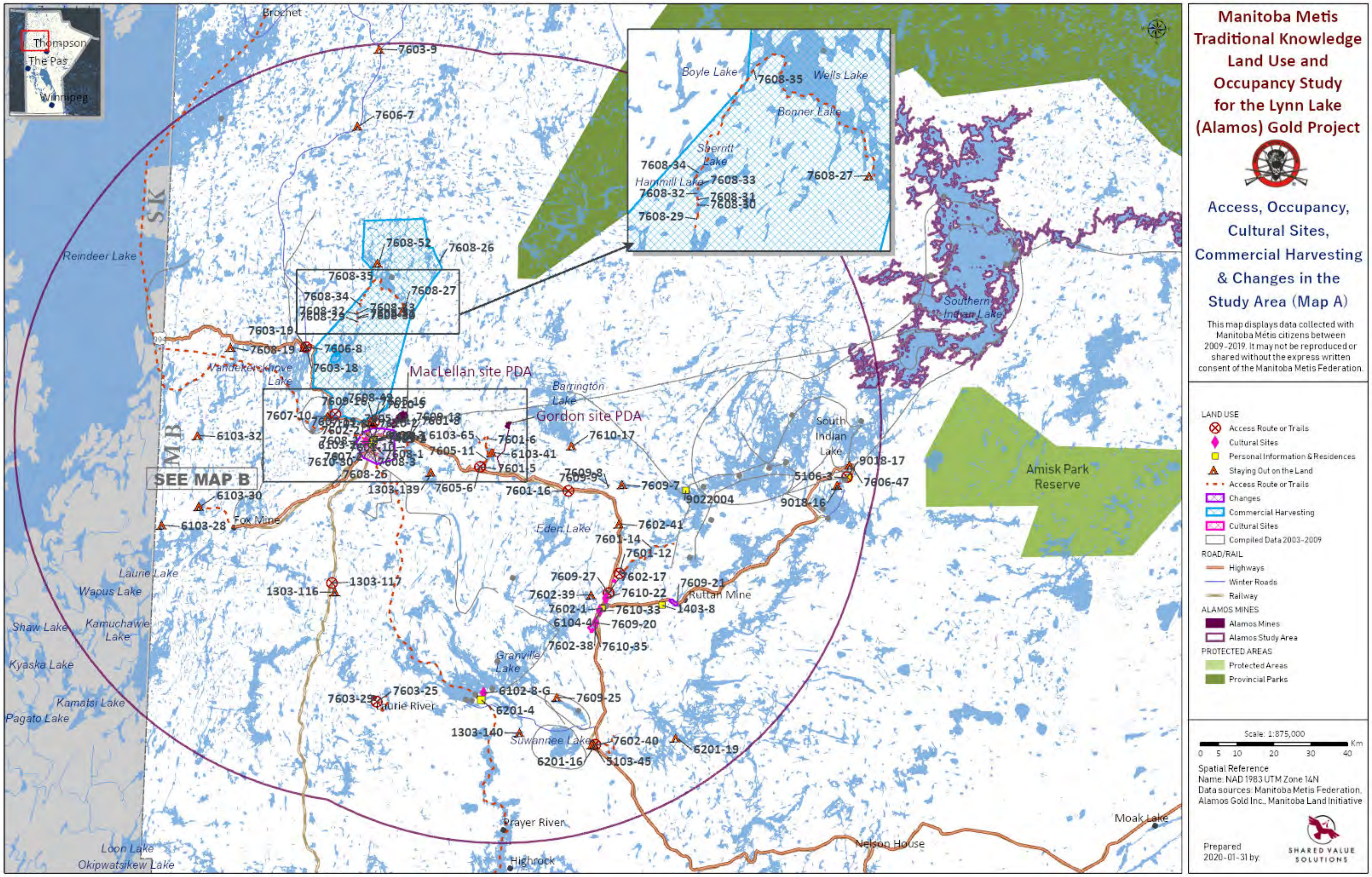


Figure 17 Métis Access, Occupancy, Cultural Sites, Commercial Harvesting, and Observed Changes in the Study Area (Map 2 of 2)

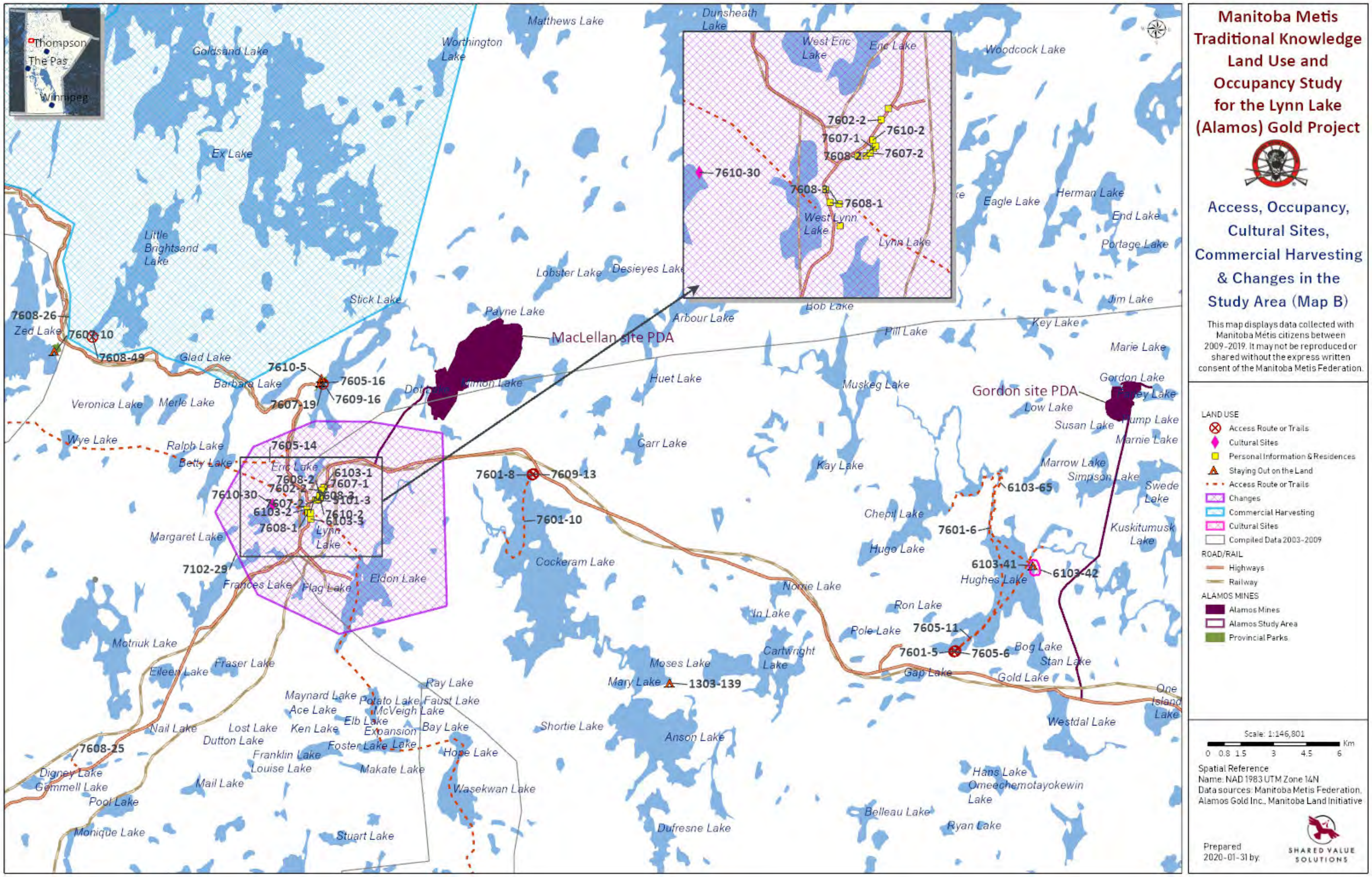


Table 4 Métis Access, Occupancy, Cultural Sites, Commercial Harvesting, and Observed Changes in the Study Area - Corresponding Attribute Tables to Map 1 - 2

PIN-GISID	Category	Type	Spring	Summer	Fall	Winter
1303-116	Occupancy	Active Cabin or Bush Camp	X	X	X	
1303-117	Access Routes	Boat Launch/Landing	X	X	X	
1303-139	Occupancy	Temporary Structure (Tent, Lean-To, Etc.)	X	X	X	
1303-140	Occupancy	Temporary Structure (Tent, Lean-To, Etc.)	X	X	X	
5103-45	Occupancy	Temporary Structure (Tent, Lean-To, Etc.)			X	
6102-8-G	Cultural Sites	Cultural Site				
6103-26	Access Routes	Land and Water Route				X
6103-28	Occupancy	Active Cabin or Bush Camp		X		
6103-29	Access Routes	Land Route/Trail	X			X
6103-30	Occupancy	Active Cabin or Bush Camp	X			X
6103-31	Access Routes	Land Route/Trail				X
6103-32	Occupancy	Active Cabin or Bush Camp				X
6103-41	Occupancy	Active Cabin or Bush Camp				
6103-42	Cultural Site	Burial Site				
6103-65	Access Route or Trails	Water & Snowmobile Route	X	X	X	X
6103-75	Access Routes	Land Route or Trail	X		X	X
6201-16	Access Routes	Boat Landing			X	
6201-17	Access Routes	Water Route or Trail			X	
6201-19	Access Routes	Overnight Site			X	
7102-29	Changes to Environment	The snow around Lynn Lake turned yellow from tailings blowing in the wind. Concerned about animals eating this.				
7601-5	Access Route or Trails	Boat Launch/Landing		X		
7601-6	Access Route or Trails	Water Route		X		
7601-8	Access Route or Trails	Boat Launch/Landing		X		

PIN-GISID	Category	Type	Spring	Summer	Fall	Winter
7601-10	Access Route or Trails	Water Route		X		
7601-12	Access Route or Trails	Boat Launch/Landing		X		
7601-14	Access Route or Trails	Water Route		X		
7601-16	Access Route or Trails	Boat Launch/Landing		X		
7602-17	Access Route or Trails	Boat Launch/Landing		X		
7602-37	Cultural Sites	Spiritual/Ceremonial/Sacred Site			X	
7602-38	Cultural Sites	Recreation Site (Swimming)		X		
7602-39	Occupancy	Cabin	X	X	X	X
7602-40	Occupancy	Temporary Structure (Tent, Lean-To, Etc.)		X		
7602-41	Occupancy	Temporary Structure (Tent, Lean-To, Etc.)		X		
7603-9	Occupancy	Temporary Structure (Tent, Lean-To, Etc.)				X
7603-18	Occupancy	Temporary Structure (Tent, Lean-To, Etc.)			X	
7603-19	Access Route or Trails	Boat Launch/Landing			X	
7603-25	Access Route or Trails	Boat Launch/Landing		X		
7603-29	Access Route or Trails	Water Route		X		
7605-6	Access Route or Trails	Boat Launch/Landing	X	X	X	
7605-11	Access Route or Trails	Water Route		X	X	
7605-14	Access Route or Trails	Land Trail (Snowmobile)				X
7605-16	Occupancy	Cabin		X	X	
7606-7	Occupancy	Trailer				X
7606-8	Occupancy	Temporary Structure (Tent, Lean-To, Etc.)				X
7606-47	Occupancy	Temporary Structure (Tent, Lean-To, Etc.)				X

PIN-GISID	Category	Type	Spring	Summer	Fall	Winter
7607-10	Occupancy	Cabin	X	X	X	X
7607-19	Access Route or Trails	Boat Launch/Landing		X		
7608-19	Occupancy	Cabin	X	X	X	X
7608-25	Access Route or Trails	Land Trail	X		X	X
7608-26	Commercial Harvesting	Trapping & Snaring - Beaver, Fox, Lynx, Marten, Mink, Muskrat, Otter, Wolf, Wolverine				X
7608-27	Occupancy	Cabin			X	X
7608-29	Access Route or Trails	Portage Route		X		
7608-30	Access Route or Trails	Water Route		X		
7608-31	Access Route or Trails	Portage Route		X		
7608-32	Access Route or Trails	Water Route		X		
7608-33	Access Route or Trails	Portage Route		X		
7608-34	Access Route or Trails	Water Route		X		
7608-35	Access Route or Trails	Water Route		X		
7608-49	Access Route or Trails	Boat Launch/Landing	X	X		
7608-50	Commercial Harvesting	Guiding - Fishing		X		
7608-52	Occupancy	Temporary Structure (Tent, Lean-To, Etc.)	X		X	
7609-7	Occupancy	Temporary Structure (Tent, Lean-To, Etc.)			X	
7609-8	Access Route or Trails	Portage Route			X	
7609-9	Access Route or Trails	Portage Route			X	

PIN-GISID	Category	Type	Spring	Summer	Fall	Winter
7609-13	Access Route or Trails	Boat Launch/Landing			X	
7609-16	Occupancy	Trailer		X		
7609-20	Cultural Sites	Recreation Site (Swimming)		X		
7609-21	Changes to Environment	Noticed orange water in the lakes of this area.		X		
7609-25	Occupancy	Temporary Structure (Tent, Lean-To, Etc.)			X	
7609-27	Access Route or Trails	Boat Launch/Landing	X	X		
7610-5	Occupancy	Cabin		X		
7610-17	Occupancy	Cabin			X	
7610-22	Cultural Sites	Recreation Site (Swimming)		X		
7610-30	Cultural Sites	Recreation Site (Swimming)		X		
7610-33	Cultural Sites	Recreation Site (Swimming)		X		
7610-35	Cultural Sites	Recreation Site (Swimming)		X		X
9018-16	Occupancy	Temporary Structure (Tent, Lean-To, Etc.)	X			
9018-17	Access Routes	Boat Landing	X			
9018-18	Access Routes	Water Route	X			
9022004	Occupancy	Bush Camp	X	X	X	

Figure 18 Métis Ecological Knowledge Identified Within the Study Area (Map 1 of 2)

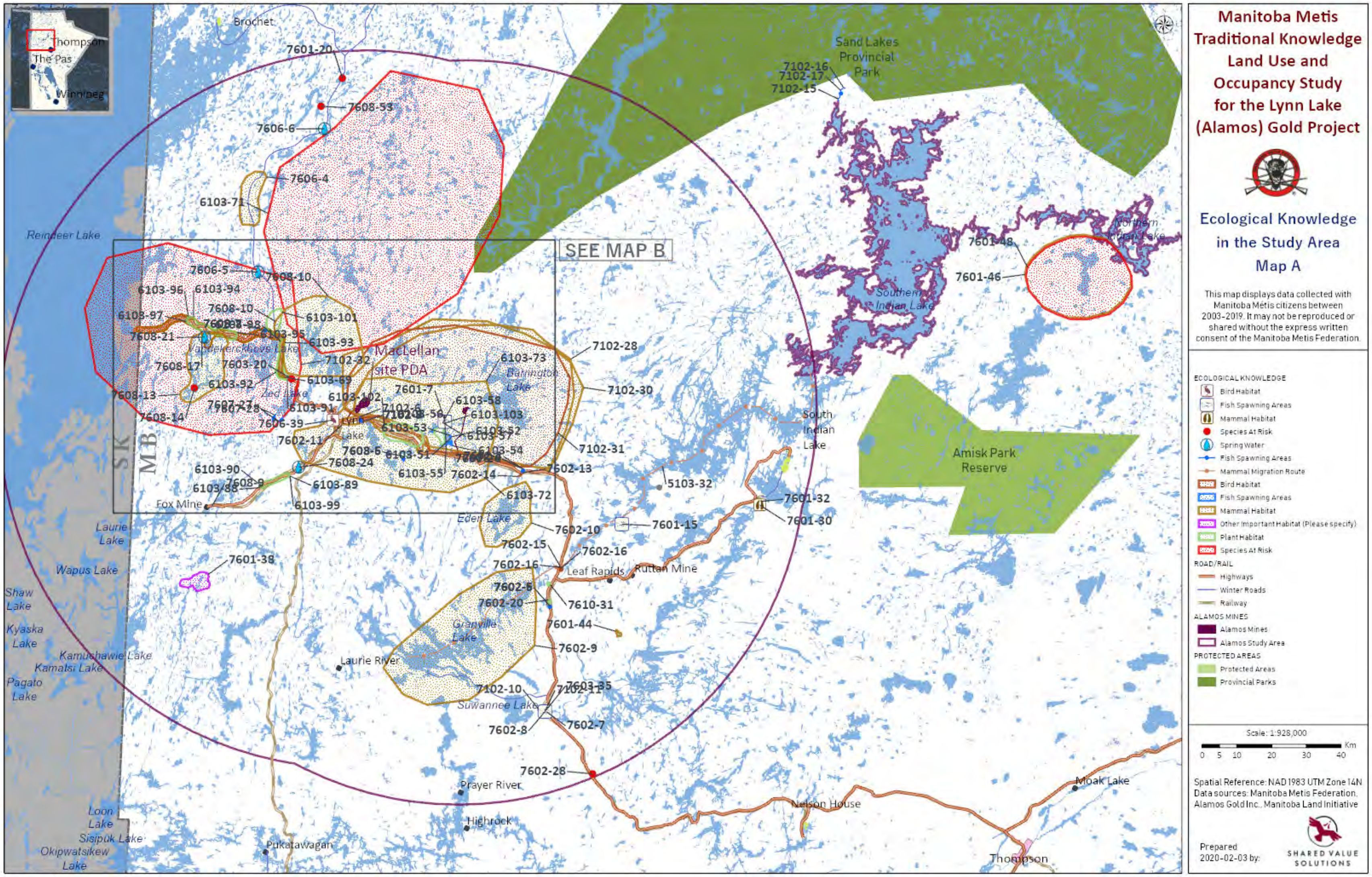


Figure 19 Métis Ecological Knowledge Identified Within the Study Area (Map 2 of 2)

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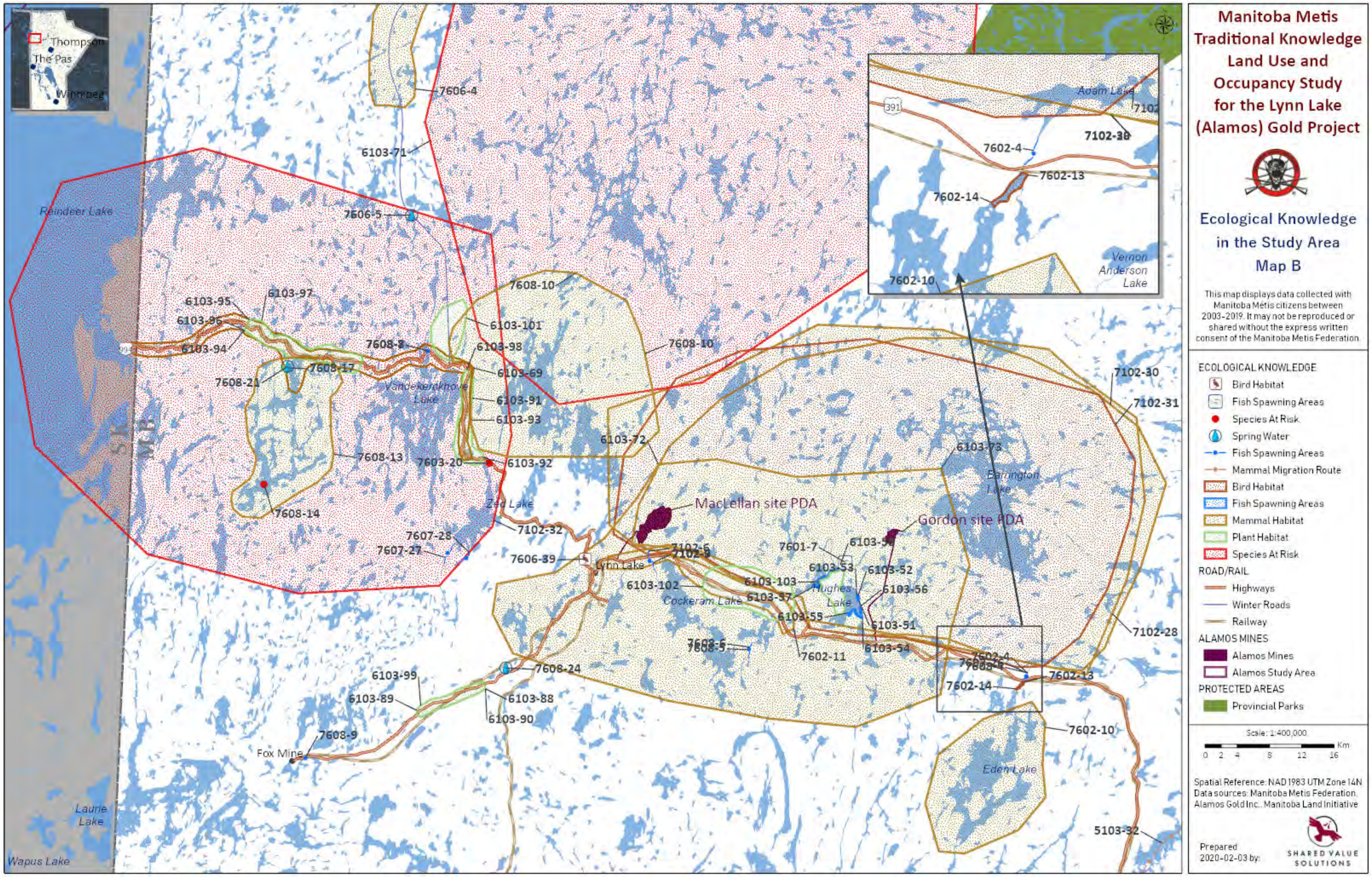

Table 5 Métis Ecological Knowledge Identified Within the Study Area - Corresponding Attribute Tables for Map 1 - 2

PIN-GISID	Type	Subtype	Spring	Summer	Fall	Winter
5103-32	Mammal Migration Route	Woodland Caribou				X
6103-51	Fish Spawning Areas	Pickerel/Walleye	X			
6103-52	Fish Spawning Areas	Jackfish/Northern Pike	X			
6103-53	Fish Spawning Areas	Yellow Perch	X			
6103-54	Fish Spawning Areas	Pickerel/Walleye	X			
6103-55	Fish Spawning Areas	Jackfish/Northern Pike	X			
6103-56	Fish Spawning Areas	Yellow Perch	X			
6103-57	Fish Spawning Areas	Pickerel/Walleye	X			
6103-58	Fish Spawning Areas	Jackfish/Northern Pike	X			
6103-69	Mammal Habitat	Moose, Bear			X	
6103-71	Species at Risk	Barren Ground Caribou				X
6103-72	Mammal Habitat	Moose	X	X	X	X
6103-73	Mammal Habitat	Bear	X	X	X	X
6103-88	Plant Habitat	Raspberries		X		
6103-89	Plant Habitat	Cedar, Pin Cherries		X		
6103-90	Plant Habitat	Mushrooms (Red Tops)		X		
6103-91	Plant Habitat	Raspberries		X		
6103-92	Plant Habitat	Pin Cherries		X		
6103-93	Plant Habitat	Mushrooms (Red Tops)		X		

PIN-GISID	Type	Subtype	Spring	Summer	Fall	Winter
6103-94	Plant Habitat	Raspberries		X		
6103-95	Plant Habitat	Pin Cherries		X		
6103-96	Plant Habitat	Mushrooms (Red Tops)		X		
6103-97	Plant Habitat	Cranberries		X	X	
6103-98	Plant Habitat	Cranberries		X	X	
6103-99	Plant Habitat	Cranberries		X	X	
6103-101	Plant Habitat	Blueberries				
6103-102	Plant Habitat	Blueberries				
6103-103	Plant Habitat	Blueberries				
7102-6	Fish Spawning Areas	Jackfish/Northern Pike	X	X		
7102-7	Fish Spawning Areas	Lake Whitefish	X	X		
7102-8	Fish Spawning Areas	Pickerel/Walleye	X	X		
7102-9	Fish Spawning Areas	Sucker (Longnose & White)	X	X		
7102-10	Fish Spawning Areas	Pickerel/Walleye	X	X		
7102-11	Fish Spawning Areas	Jackfish/Northern Pike	X			
7102-15	Fish Spawning Areas	Jackfish/Northern Pike	X	X		
7102-16	Fish Spawning Areas	Pickerel/Walleye	X	X		
7102-17	Fish Spawning Areas	Lake Whitefish			X	
7102-28	Mammal Habitat	Moose	X	X	X	X
7102-30	Mammal Habitat	Wolf, Lynx, Fox (Red, Silver and White), Marten, Otter, Fisher, Rabbit, Weasel, Squirrel, Beaver, Muskrat, Mink	X	X	X	X
7102-31	Bird Habitat	Grouse, Ptarmigan	X	X	X	X

PIN-GISID	Type	Subtype	Spring	Summer	Fall	Winter
7102-32	Species at Risk	Barren Ground Caribou	X		X	X
7601-7	Fish Spawning Areas	Pickerel/Walleye	X			
7601-15	Fish Spawning Areas	Pickerel/Walleye	X			
7601-20	Species at Risk	Barren Ground Caribou				X
7601-30	Mammal Habitat	Moose			X	
7601-32	Other Important Habitat	Pike	X	X	X	
7601-38	Other Important Habitat	Land-locked Lakes; Bird Habitat				
7601-44	Mammal Habitat	Timber Wolf				X
7601-46	Mammal Habitat	Moose	X	X		
7601-48	Species at Risk	Barren Ground Caribou				X
7602-4	Fish Spawning Areas	Pickerel/Walleye	X			
7602-5	Fish Spawning Areas	Pickerel/Walleye	X			
7602-6	Fish Spawning Areas	Jackfish/Northern Pike	X			
7602-7	Fish Spawning Areas	Pickerel/Walleye	X			
7602-8	Fish Spawning Areas	Jackfish/Northern Pike	X			
7602-9	Mammal Habitat	Moose	X	X	X	X
7602-10	Mammal Habitat	Moose	X	X	X	X
7602-11	Mammal Habitat	Moose			X	
7602-13	Bird Habitat	Duck Migration Stopover	X		X	

PIN-GISID	Type	Subtype	Spring	Summer	Fall	Winter
7602-14	Bird Habitat	Goose Migration Stopover	X		X	
7602-15	Bird Habitat	Duck	X			
7602-16	Bird Habitat	Goose	X			
7602-20	Plant Habitat	Strawberries				
7602-28	Species at Risk	Wolverine				X
7603-20	Species at Risk	Barren Ground Caribou			X	
7603-35	Fish Spawning Areas	Pickerel/Walleye	X			
7606-4	Mammal Habitat	Moose				X
7606-5	Spring Water	Spring Water				X
7606-6	Spring Water	Spring Water				X
7606-39	Bird Habitat	Ptarmigan				X
7607-26	Fish Spawning Areas	Pickerel/Walleye	X			
7607-27	Fish Spawning Areas	Pickerel/Walleye	X			
7607-28	Fish Spawning Areas	Pickerel/Walleye	X			
7608-4	Fish Spawning Areas	Pickerel/Walleye	X			
7608-5	Fish Spawning Areas	Pickerel/Walleye	X			
7608-6	Fish Spawning Areas	Lake Whitefish			X	
7608-7	Fish Spawning Areas	Pickerel/Walleye	X			
7608-8	Fish Spawning Areas	Lake Whitefish			X	
7608-9	Fish Spawning Areas	Pickerel/Walleye	X			
7608-10	Mammal Habitat	Moose Breeding Ground			X	

PIN-GISID	Type	Subtype	Spring	Summer	Fall	Winter
7608-13	Mammal Habitat	Moose			X	
7608-14	Species at Risk	Boreal Woodland Caribou			X	
7608-17	Plant Habitat	Blueberries		X	X	
7608-21	Spring Water	Spring Water	X		X	X
7608-24	Spring Water	Spring Water	X		X	X
7608-53	Species at Risk	Barren Ground Caribou				X
7610-31	Plant Habitat	Wild Rice				

Appendix B: Results of the Food Frequency Questionnaire

Table 6 Results of the Food Frequency Questionnaire

Food Harvested	Sum of Frequency (Spring)	Sum of Frequency (Summer)	Sum of Frequency (Fall)	Sum of Frequency (Winter)	Total Frequency (Year-round)
Apples		90	12		**102**
Beaver	1				**1**
Birch Water		48			**48**
Black Bear Fat		12			**12**
Black Bear Meat	12	0	24	12	**48**
Blueberries	18	56	48	18	**140**
Brook Trout	2	3	2	4	**11**
Brown Trout	2				**2**
Burbot	3			11	**14**
Caribou Kidney				1	**1**
Caribou Liver				1	**1**
Caribou Meat	81	81	81	93	**336**
Caribou Stomach				2	**2**

Food Harvested	Sum of Frequency (Spring)	Sum of Frequency (Summer)	Sum of Frequency (Fall)	Sum of Frequency (Winter)	Total Frequency (Year-round)
Caribou Tongue				4	**4**
Cedar			12		**12**
Chaga	6	7	6	7	**26**
Choke Cherries		1	3		**4**
Cisco			1		**1**
Cranberries	15	27	20	15	**77**
Crayfish		1			**1**
Deer Fat		3	36		**39**
Deer Heart			2	2	**4**
Deer Meat	48	51	51	48	**198**
Duck (Blue Wing)	1		1		**2**
Duck (Mallard)	34		14		**48**
Elk	6	6	6	6	**24**
Fiddleheads	4	2	3	3	**12**
Goose (Blue)	3	3	3	3	**12**
Goose (Canada)	35		4		**39**
Goose (General)	24		3	3	**30**
Goose (Rose)	1	1	1	1	**4**
Goose (Snow)	13	12	13	12	**50**
Grouse (General)			26		**26**
Grouse (Rough)			8		**8**
Grouse (Sharpe)			1		**1**
Grouse (Spruce)			18	18	**36**
Labrador Tea	3	4	3	3	**13**
Lake Trout	7	7	11	9	**34**
Lake Whitefish	4	11	4	9	**28**
Maple/Birch Syrup		12			**12**
Moose Heart	1		3		**4**
Moose Liver			1	1	**2**

Food Harvested	Sum of Frequency (Spring)	Sum of Frequency (Summer)	Sum of Frequency (Fall)	Sum of Frequency (Winter)	Total Frequency (Year-round)
Moose Meat	187	163	211	199	**760**
Moose Tongue			1		**1**
Muskrat	2		1		**3**
Muskrat Root		1	1	1	**3**
Northern Pike	18	12	13	14	**57**
Pickerel/Walleye	138	136	148	136	**558**
Pin Cherries	12	13	12	12	**49**
Ptarmigan	2			25	**27**
Rabbit				5	**5**
Rainbow Trout	16	30	14	16	**76**
Raspberries	12	105	24	12	**153**
Sage	12	12	12	12	**48**
Saskatoon Berries		4	3		**7**
Sauger	18	18	18	18	**72**
Spring Water	384	384	389		**1157**
Squirrel			1		**1**
Strawberries		180	2		**182**
Suckers	4		1		**5**
Wild Mint		3	3		**6**
Wild Rice	15	15	15	15	**60**
Willow	24	24	12		**60**
Yellow Perch	24	24	24	24	**96**
Frequency of Country Food Consumption per Season:	**1192**	**1562**	**1326**	**775**	

References

Tobias, T. (2009). *Living Proof: The Essential Data-Collection Guide for Indigenous Use-and-Occupancy Map Surveys.* Ecotrust Canada

ALAMOS GOLD INC.

Lynn Lake Gold Project Environmental Impact Statement Chapter 18 – Assessment of Potential Effects on Human Health

Stantec

Prepared by:

Stantec Consulting Ltd.

May 25, 2020

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Acronyms and Abbreviations

Alamos	Alamos Gold Inc.
$B[a]P_{TPE}$	benzo(a)pyrene total potency equivalents
CAAQS	Canadian Ambient Air Quality Standards
CAC	criteria air contaminants
CCME	Canadian Council of Ministers of the Environment
COPC	chemicals of potential concern
CR	concentration ratio
DPM	diesel particulate matter
EPC	exposure point concentration
ERA	ecological risk assessment
FNFNES	First Nations Food, Nutrition and Environment Study
HCN	hydrogen cyanide
HHERA	human health and ecological risk assessment
HHRA	human health risk assessment
HQ	hazard quotient
ILCR	incremental lifetime cancer risk
LAA	Local Assessment Area
LOAEL	lowest observable adverse effect level
MECP	Ontario Ministry of the Environment, Conservation and Parks
mg/kg	milligram per kilogram
MOE	Ontario Ministry of the Environment
PAH	polycyclic aromatic hydrocarbon
N/A	not applicable
NAPS	national air pollution surveillance
NO_2	nitrogen dioxide

PDA	Project Development Area
$PM_{2.5}$	particulate matter less than 2.5 microns in aerodynamic diameter
RAA	Regional Assessment Area
RIAQG	residential indoor air quality guideline
RSC	risk-specific concentration
SO_2	sulphur dioxide
TMF	tailings management facility
TRV	toxicological reference value
UCLM	upper confidence limit mean
VC	valued component
VOC	volatile organic compound
WHO	World Health Organization

18.0 ASSESSMENT OF POTENTIAL EFFECTS ON HUMAN HEALTH

The Human Health valued component (VC) evaluates effects to human health that could result from exposure to chemicals of potential concern (COPC) released during the construction, operation, decommissioning/closure phases of the Project. Project emissions include releases into the terrestrial, aquatic, and atmospheric environment. Project emissions may change the concentrations of COPC in environmental media (i.e., air, water, soil, sediment, and biota), which could change the exposure to COPC for people, and the resulting health risk.

The Human Health VC applies the information and conclusions described in the human health and ecological risk assessment (HHERA) to characterize the Project effect on human health. The HHERA consists of two main components: a human health risk assessment (HHRA) and an ecological risk assessment (ERA). The HHRA is a tool used to estimate the potential health risk to humans resulting from exposure to Project-related emissions. The HHERA technical modelling report is provided in Volume 5, Appendix H.

The HHERA applied information and data from the following VCs:

- Atmospheric Environment (Chapter 6) – Baseline air quality data and air quality dispersion modelling data from this VC was applied to the HHERA. Baseline air quality represents existing conditions, while modelled data represent future conditions during operation of the Project. Air quality is a factor considered for human health when characterizing risks from inhalation exposures or ingestion exposures to COPC that deposit onto soils and country foods (e.g., berries, wild meat).
- Noise and Vibration (Chapter 7) – Information related to changes in human health due to noise and vibration from the Project is included in the HHERA.
- Groundwater (Chapter 8) – The information on COPC transport in groundwater (seepage) is incorporated into surface water quality modelling (there are no known active groundwater water wells used as a source of drinking water in the Groundwater LAA/RAA). Changes in groundwater quality can have a potential effect on surface waters used by human receptors.
- Surface Water (Chapter 9) – Baseline surface water quality data and surface water quality modelling data from this VC was applied in the HHERA. Baseline surface water quality represents existing conditions, while modelled data represents future reasonable worst-case conditions. Surface water quality is a factor considered for human health when characterizing risks from exposure to COPC through the consumption of surface water and country foods (e.g., fish, wild meat).
- Fish and Fish Habitat (Chapter 10) – Information on fish species and fish-bearing water bodies that could be used for recreational or traditional fishing was applied in the HHERA.
- Vegetation and Wetlands (Chapter 11) – Information on plant species that could be consumed by humans as country foods or by species of wild game (e.g., moose), was applied in the HHERA.

- Wildlife and Wildlife Habitat (Chapter 12) – Information on wildlife that could be wildlife species for hunting was applied in the HHERA.
- Land and Resource Use (Chapter 15) and Current Use of Lands and Resources for Traditional Purposes (Chapter 17) – Information on current land and resource use (e.g., hunting, fishing, recreational use, traditional harvesting) provides insight on the types of exposure pathways that may apply to human receptors was applied in the HHERA.

18.1 SCOPE OF ASSESSMENT

The HHRA is based on Health Canada's guidance framework for evaluating human health. The assessment of potential changes in human health encompasses consideration of potential exposures for Indigenous and non-Indigenous people including sensitive members of the population (e.g., toddlers, women of child-bearing age). Potential Project-related inhalation risks are also evaluated for workers residing in the work camp within the Project Development Area (PDA; Section 18.1.4.1). The Final Environmental Impact Statement Guidelines for the Lynn Lake Gold Project (Appendix 4A) identifies potential Project-related changes to the environment that should be considered to assess the potential changes in human health (e.g., changes in air quality, water quality).

The health of workers when they are working on the Project and not present in the work camp is protected by occupational health and safety standards, codes and regulations established by various provincial and federal governments; thus, occupational health and safety is not addressed in the scope of this assessment.

18.1.1 Regulatory and Policy Setting

18.1.1.1 Federal Regulatory and Policy Setting

The scope of the Human Health VC satisfies the requirements under the *Canadian Environmental Assessment Act,* 2012, and guidance from Health Canada on the evaluation of potential human health risk associated with exposures to chemicals in the environment. Health Canada's mandate includes the protection of human health from exposure to chemicals in the environment. The conclusions described in the Human Health VC are based on the HHERA (Volume 5, Appendix H).

18.1.1.2 Provincial Regulatory and Policy Setting

In Manitoba, public health is the responsibility of the Manitoba Minister of Health in accordance with *The Public Health Act* (April 1, 2009). *The Public Health Act* includes provisions to address environmental health hazards from pollutants and contamination, and protection of water sources.

18.1.2 The Influence of Engagement on the Assessment

Engagement has been ongoing prior to and throughout the EIS process, and will continue with local Indigenous communities, stakeholders, the public, and government agencies through the life of the Project. More detail on the Engagement process can be found in Chapter 3.

Engagement feedback related to human health has been addressed through direct responses, updates to baseline information, and in the EIS, as appropriate.

As part of the information sharing throughout the engagement process, Project-related information was provided by Indigenous communities in the form of traditional land and resource use (TLRU) studies and other forms of information sharing.

A Project-specific TLRU study was completed collaboratively with Marcel Colomb First Nation with a final report provided to the community on January 11, 2018 (Stantec 2018). The TLRU study included interviews with participants selected by Marcel Colomb First Nation regarding traditional land use in the Project area, including availability of traditional resources, access to traditional resources or areas, occupancy, cultural sites and areas, and experience of TLRU.

A Project-specific TLRU study was completed in collaboration with Peter Ballantyne Cree Nation but has not yet been released by community leadership for use in the environmental assessment. The TLRU study included interviews with community members in Kinoosao, Saskatchewan.

A TLRU study (Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project) was completed by an independent consultant for the Manitoba Metis Federation (SVS 2020), the results of which were received in February 2020. The study documents harvesting and land use by the Manitoba Métis Community within a 100-kilometre (km) radius of the Project.

Additionally, four open house public meetings have been held to date in Lynn Lake (in 2015, 2016, 2017 and 2020) and one in Nelson House (Chapter 3). Open house attendees were invited to complete questionnaires to provide feedback on the Project, as well as identify issues, concerns or inquiries related to the Project.

Information provided by engagement and TLRU studies, as well as publicly available sources, related to locations used for traditional purposes was used to select receptor locations where Indigenous people may be present. This included locations in the Project area used for hunting, trapping, fishing, plant gathering, camping/shelter as well as cultural and spiritual areas. The receptor locations are identified on Map 18-1. As noted in Chapter 6, due to the length of time required to conduct air quality modelling, Indigenous receptors were selected early in the assessment process and represent potential receptor locations rather than individual use sites.

The comments received during engagement (Chapter 3) related to hunting, trapping and collection of plants were also used to select the wildlife species for country food used in the HHERA (Volume 5, Appendix H). Target wildlife species for hunting included in the HHERA were moose (*Alces alces*), rabbits, beavers (*Castor canadensis)*, ducks (e.g., Northern Pintail (*Anas acuta))* and terrestrial birds (e.g., Spruce grouse (*Falcipennis canadensis))*, and willow ptarmigan (*Lagopus lagopus)*. Target species for fishing included in the HHERA were northern pike (*Esox lucius*), walleye (*Sander vitreus*) and whitefish (*Coregonus clupeaformis*).

18.1.3 Potential Effects, Pathways and Measurable Parameters

The potential environmental effects, effect pathways, and measurable parameters used in the assessment of effects on human health are provided in Table 18-1. The construction, operation, and decommissioning/ closure of the Project are anticipated to release COPC into the environment. Exposure to these COPC may result in a change in human health.

The effect pathways considered include inhalation of COPC in the air, ingestion of COPC when consuming surface water, backyard garden produce, country food, incidental ingestion of soil and sediment, and dermal contact with soil and sediment containing COPC. The effects of the Project on human health related to noise and vibration are addressed in Chapter 7. The effect that the loss of habitat may have on species populations, and the health implications to those species is discussed in Chapters 10, 11 and 12.

Measurable parameters are used to assess the potential for changes in human health and are based on typical metrics for health risk described in Health Canada (2019) and Alberta Health and Wellness (2011). Alberta guidance was used because Manitoba does not have specific guidance. The measurable parameters are concentration ratio (CR), hazard quotient (HQ) and incremental increase in lifetime cancer risk (ILCR).

Table 18-1 Potential Effects, Effects Pathways and Measurable Parameters for Human Health

Potential Effect	Effect Pathway	Measurable Parameter (s) and Units of Measurement
Change in human health	• Inhalation of COPC emissions in air	CR – unitless The CR is the ratio between atmospheric concentrations of COPC and the applicable provincial or federal ambient air quality objective or the applicable toxicological reference value (TRV). The CR quantifies health risks to humans from short-term and long-term inhalation exposures to chemicals in the atmosphere.
	• Ingestion and dermal contact with COPC in soil due to Project emissions. • Ingestion of COPC in surface water due to Project emissions. • Ingestion of COPC in backyard garden produce, traditional plants, wild meat, and fish due to Project emissions and uptake of COPC from soil, water and/or tissue. • Ingestion and dermal contact with COPC in sediment due to Project emissions.	HQ – unitless The HQ is the ratio between the cumulative daily dose of a chemical and its TRV. The HQ quantifies non-carcinogenic health risks to humans from exposures to chemicals through ingestion and dermal contact. ILCR – unitless The ILCR is the product of the daily dose of a carcinogenic chemical and the cancer slope factor associated with that chemical. The ILCR quantifies incremental change in carcinogenic health risks to humans from Project-related exposures to carcinogenic chemicals through multiple pathways (e.g., ingestion and dermal contact).

18.1.4 Boundaries

18.1.4.1 Spatial Boundaries

There are three distinct spatial boundaries applied in the Human Health VC. The PDA, Local Assessment Area (LAA), and Regional Assessment Area (RAA) as shown in Map 18-1.

The PDA encompasses the Project footprint and a 30-meter buffer around its perimeter. The Project footprint includes the areas where project activities would take place and the anticipated area of direct physical disturbance associated with construction and operation activities. The PDAs for the sites include the access roads, the open pits, mine rock storage areas, overburden stockpiles, and ore stockpiles at the Gordon and MacLellan sites; and the tailings management facility and ore milling and processing plant at the MacLellan site. The PDA does not include Provincial Road 391 that connects the Gordon and MacLellan sites.

The LAA is defined as a 50 km by 28 km area centered on the Project and includes both the Gordon and MacLellan sites as shown in Map 18-1. The LAA encompasses the area in which Project-related environmental effects (direct or indirect) can be predicted or measured with a level of confidence that allows for assessment; and in which there is a reasonable expectation that those potential environmental effects in the LAA could be of potential concern to human health.

The LAA for human health is the combined spatial boundaries of the Atmospheric Environment VC (Chapter 6) and the Surface Water VC (Chapter 9), because the future environmental conditions used to predict effects to human health are based on modelled future conditions from these other VCs. Hereinafter, the LAA is further divided into the 'Gordon region' and 'MacLellan region' to characterize the potential effects to human health separately.

The RAA represents the area where environmental effects from past, present, or reasonably foreseeable future projects may have cumulative potential effects to human health. The RAA for the assessment of human health for the Project is the same area as the LAA for the Atmospheric Environment VC (Chapter 6), which encompasses the extent to which Project activities could have a measurable effect on human health.

18.1.4.2 Temporal Boundaries

The temporal boundaries for the Project consist of the following phases:

- Construction – two years (scheduled to be carried out concurrently from Year -2 to Year -1 at both sites).
- Operation – 13 years (scheduled to be carried out from Year 1 to Year 6 at the Gordon site (5 years of active ore and mine rock extraction and an extra year of materials transfer to the MacLellan site) and from Year 1 to Year 13 at the MacLellan site).
- Decommissioning/closure – five to six years of active closure (scheduled to begin in Year 6 at the Gordon site and in Year 14 at the MacLellan site). Active closure will be followed by post-closure, which

is the time period during which active reclamation measures are complete, but monitoring is still required. The expected duration for post-closure is approximately 10 years. Pit filling is expected to take 11 years at the Gordon site and 21 years at the MacLellan site under average conditions (Chapter 9, Section 9.4.1). Permanent closure will occur when the site is stable, and monitoring is no longer required. For Human Health this will occur when the requirements for fish, vegetation, and surface water monitoring cease. The duration and conditions for post-closure monitoring and permanent closure will be detailed in subsequent submissions of the Closure Plan to regulatory agencies as Project design and execution progresses.

18.1.5 Residual Effects Characterization

Table 18-2 summarizes how residual environmental effects are characterized in terms of direction, magnitude, geographic extent, timing, frequency, duration, reversibility, and ecological and socio-economic context. Quantitative measures or definitions for qualitative categories are provided.

Table 18-2 Definition of Terms Used to Characterize Residual Effects on Human Health

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Positive –** a residual effect that moves measurable parameters in a direction beneficial to human health relative to baseline **Adverse –** a residual effect that moves measurable parameters in a direction detrimental to human health relative to baseline
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	**Negligible-** Project-related environmental exposures are less than the target benchmarks established by a recognized health organization and are not expected to change human health **Low** — Project-related environmental exposures marginally exceed target benchmarks established by a recognized health organization, but are unlikely to change human health **High** — Project-related environmental exposures are predicted to substantially exceed the target benchmarks established by a recognized health organization and/or are likely to result in a long-term, substantive change in human health
Geographic Extent	The geographic area in which a residual effect occurs	**PDA –** residual effects are restricted to the PDA **LAA–** residual effects of the Project extend into the LAA
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	**Not applicable (N/A)** — Human health is unlikely to be influenced between seasons **Applicable** — potential human health effects are season-specific

Table 18-2 Definition of Terms Used to Characterize Residual Effects on Human Health

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	**Single event –**the residual effect occurs once **Multiple irregular event –** the residual effect occurs at no set schedule **Multiple regular event –** the residual effect occurs at regular intervals **Continuous –** the residual effect occurs continuously
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	**Short-term** — the residual effect lasts up to 90 days **Long-term** — the residual effect may last for more than 90 days
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	**Reversible –** the residual effect is likely to be reversed after activity completion **Irreversible –** the residual effect is unlikely to be reversed to baseline conditions
Ecological and Socio-economic Context	Existing condition and trends in the area where residual effects occur	**Undisturbed –** area is relatively undisturbed or not adversely affected by human activity **Disturbed –** area has been substantially previously disturbed by human development or human development is still present

18.1.6 Significance Definition

A significant effect on human health is one that results in Project-related risks that exceed objectives established by relevant regulatory organization(s) and are likely to result in a short-term or irreversible long-term change in human health.

18.2 EXISTING CONDITIONS FOR HUMAN HEALTH

Existing conditions for human health are characterized by the Baseline Case CRs, HQs, and ILCRs (Volume 5, Appendix H, Section 5.4). This section provides a summary of the methods and results of the existing conditions for human health.

18.2.1 Methods

Existing chemical concentrations in the LAA were established through a combination of 1) baseline sampling conducted between 2015 and 2018, which included sampling of air, surface soil, vegetation, small mammal tissue, surface water, sediment and fish tissue, and 2) modelling using uptake factors and measured concentrations in sampled media. Background concentrations of particulate matter ($PM_{2.5}$) and dustfall were based on measured data, while sulphur dioxide (SO_2) and nitrogen dioxide (NO_2) concentrations were based on air quality monitoring data from comparable remote locations outside of the LAA. The baseline air quality assessment concluded that there were no substantial sources of hydrogen cyanide (HCN), diesel particulate matter (DPM), metals, volatile organic compounds (VOC) and polycyclic aromatic hydrocarbons (PAHs) within the Air Quality LAA that would contribute to the background ambient air quality (Chapter 6 and Volume 5, Appendix A). Therefore, these COPC were not included in the baseline air quality monitoring program.

Baseline samples of surface soil, deciduous and coniferous vegetation, berries, and other types of traditional plants (e.g., Labrador tea) were collected from the LAA (Volume 4, Appendix R). Baseline samples of surface water, freshwater sediment, and fish meat (i.e., northern pike, walleye, lake whitefish, yellow perch) were collected from various lakes, rivers, inlets, and outlets within the LAA.

Further information related to baseline samples and selected exposure point concentrations for estimating human health risk under existing conditions is provided in Section 18.4.1.1.

The HHERA follows a conservative approach, using assumptions that are intended to avoid under-estimating exposures, and focuses on hypothetical receptors. In assessing potential human health risks, it is general practice to over-estimate exposures to mitigate against underestimating the health risk. The HHERA applies exaggerated behavior patterns for human receptors (e.g., assuming a person spends 100% of their time at a single location) that are intended to over-estimate exposures and the associated potential human health risks. For this Project, the human receptors that are expected to have the greatest exposures are residents and Indigenous peoples who engage in traditional practices within the LAA. Off-duty workers in the work camp could also be exposed to Project-related COPC via inhalation, therefore this receptor is also assessed.

The LAA is divided into two regions for the purpose of the assessment; the 'Gordon region' and 'MacLellan region' (see Map 18-1). The exposures for human receptors in each region are evaluated separately because changes to the environment are different between the two regions. Water-related exposures for receptors in the Gordon region are based on exposure to water or aquatic species from the Surface Water LAA for the Gordon site (boundaries provided on Map 18-1 and Chapter 9). Water-related exposures for receptors in the MacLellan region are based on exposure to water or aquatic species from the Surface Water LAA for the MacLellan site (boundaries provided on Map 18-1 and Chapter 9).

18.2.2 Overview

The human receptors considered were Indigenous Receptors, Residential Receptors, and Off-Duty Worker Receptors (staying in the work camp). A description of these receptors and the assumptions used in estimating their chemical exposures, is provided in Section 18.4.1.1. This section summarizes the existing conditions for human health risk when applying baseline and background data. The full set of potential human health risks is provided in Volume 5, Appendix H.

Gordon Region

The existing conditions for human health are quantified using the Baseline Case CRs, HQs, and ILCRs. The CRs, HQs and ILCRs are calculated as discussed in Section 18.4.1.2. The CR applies to non-cancer health risks associated with the inhalation of criteria air contaminants (CACs) such as NO_2, SO_2, and $PM_{2.5}$. The HQ applies to non-cancer health risks associated with ingestion exposures of metals in drinking water and food. The ILCR applies to carcinogenic health risks associated with exposure to carcinogenic COPC.

The Baseline Case CRs for NO_2, SO_2 and $PM_{2.5}$ were below the benchmark CR of 1.0, which suggests that baseline exposures to these compounds represents a negligible human health risk. Baseline Case CRs could not be calculated for inhalation risk associated with DPM, HCN, VOCs and PAHs because air concentration data were not available in this remote region. These chemicals are assumed to be present at negligible concentrations under the Baseline Case, and the Future Case exposures are limited to the Project.

The Baseline Case HQs for metal exposures through ingestion were below the risk acceptability benchmark of 0.2 established by Health Canada, with the following exceptions (Volume 5, Appendix H):

- Indigenous Receptor HQs for total ingestion of manganese, methylmercury, and thallium.
- Residential Receptor HQs for total ingestion exposure to manganese and thallium.

Exceedances for total ingestion for methylmercury were primarily due to consumption of fish, while exceedances for manganese and thallium were primarily due to consumption of wild meat, traditional plants and/or backyard garden produce.

MacLellan Region

The Baseline Case CRs for NO_2, SO_2 and $PM_{2.5}$, were below the benchmark CR of 1.0. Baseline Case CRs could not be calculated for inhalation risk associated with DPM, HCN, VOCs, PAHs, and metals because air concentration data were not available in this remote region. These chemicals are assumed to be present at negligible concentrations under the Baseline Case, and the Future Case exposures are limited to the Project.

The Baseline Case HQs for metal exposures through ingestion were below the benchmark of 0.2 with the following exceptions (Volume 5, Appendix H):

- Indigenous Receptor HQs for total ingestion exposure to manganese, methylmercury, nickel, and thallium.
- Residential Receptor HQs for total ingestion exposure to manganese and thallium.

Exceedances for total ingestion for methylmercury were primarily due to consumption of fish, while exceedances for manganese and thallium were primarily due to consumption of traditional plants and/or backyard garden produce.

18.3 PROJECT INTERACTIONS WITH HUMAN HEALTH

Project activities for each phase are described in detail in Chapter 2, Section 2.3 and 2.4. Project related emissions and discharges are described in Chapter 2, Section 2.8.

The potential interactions between Project activities and the environment were considered for the construction, operation, and decommissioning/closure phases of the Project. The identification of Project activities and their potential interactions was based on engagement with interested parties, the professional judgment of technical specialists involved in the assessment, and a review of existing conditions. The selection of interactions is also informed by the potential effects and effects pathways for each VC as described in Section 18.1.3.

Table 18-3 identifies the physical activities that might interact with the VC and result in changes to human health. Physical activities that might interact with human health are those that generate emissions to the environment to which human receptors may be exposed. These include chemical emissions into the air, soil, and water during construction, operation, decommissioning/closure. These interactions are indicated by check marks and the pathways by which human receptors may be exposed to emissions from these activities are discussed in Section 18.4.

Emissions, discharges, and wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many and varied Project activities. Rather than acknowledging this by placing a check mark against each of these activities, "Emissions, Discharges and Wastes" have been consolidated as integrated activity for efficiency of approach. This activity includes the emissions, discharges, and wastes generated by all other project activities under each Project phase. As potential interactions between the Project and the Human Health VC are limited to those related to emissions, discharges, and wastes, other Project activities in Table 6-12 have not been selected.

Table 18-3 Potential Project Environmental Effects on Human Health

Project Activities and Components	Environmental Effects	
	Change in Human Health	
	Gordon Site	MacLellan Site
Construction		
Site Preparation at Both Sites (removal of existing buildings; removal of contaminated materials; vegetation clearing and earthworks; development of temporary construction camp at the MacLellan site)	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	–	–
Mine Components at Both Sites (construction of: ore pads; ore, overburden and mine rock storage areas; mill feed storage area and crushing plant, ore milling and processing plant, and tailings management facility at the MacLellan site; water management facilities [e.g., sumps, ponds and ditches])	–	–

Project Activities and Components	Environmental Effects	
	Change in Human Health	
	Gordon Site	MacLellan Site
Utilities, Infrastructure, and Other Facilities at Both Sites (construction of: buildings and yards; access roads [i.e., upgrades at the Gordon and MacLellan sites] and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at the MacLellan site; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities)	–	–
Water Development and Control at Both Sites (dewatering of existing pits at the Gordon site and underground workings at the MacLellan site; re-alignment of existing diversion channel at the Gordon site; interceptor wells at the Gordon site; pumping fresh/fire water from Farley Lake at Gordon site.	–	–
Emissions, Discharges, and Wastes[1]	✓	✓
Employment and Expenditure[2]	–	–
Operation		
Open Pit Mining at Both Sites (drilling; blasting; removal, loading and on-site hauling of mined material [i.e., ore, overburden, and mine rock])	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA, including truck transportation of ore from the Gordon site to the MacLellan site)	–	–
Storage/Stockpiling of Ore, Overburden, and Mine Rock at both sites	–	–
Ore Milling and Processing at the MacLellan Site (ore crushing and conveyance; ore milling)	–	–
Water Management at Both Sites (mine water collection and storage; process water supply for the MacLellan site including water intake on Keewatin River at the MacLellan site; pumping fresh/fire water from Gordon Lake at Gordon site; operation of interceptor wells at the Gordon site)	–	–
Tailings Management at the MacLellan Site	–	–
Utilities, Infrastructure, and Other Facilities at Both Sites (presence and operation of: buildings and yards; access roads and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at the MacLellan site; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities; explosives storage, maintenance of access roads and bridges)	–	–
Emissions, Discharges, and Wastes[1]	✓	✓
Employment and Expenditure[2]	–	–
Decommissioning/Closure		
Decommissioning at Both Sites	–	–
Reclamation at Both Sites	–	–

Project Activities and Components	Environmental Effects	
	Change in Human Health	
	Gordon Site	MacLellan Site
Post-Closure at Both Sites (long-term monitoring)	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	–	–
Emissions, Discharges, and Wastes[1]	✓	✓
Employment and Expenditure[2]	–	–

[1] Emissions, Discharges, and Wastes (e.g., air, waste, noise, light, liquid and solid effluents) are generated by many Project activities. Rather than acknowledging this by placing a check mark against each of these activities, “Emissions, Discharges, and Wastes” have been introduced as an additional component under each Project phase.

[2] Project employment and expenditures are generated by most Project activities and components and are the main drivers of many socio-economic effects. Rather than acknowledging this by placing a check mark against each of these activities, “Employment and Expenditures” have been introduced as an additional component under each Project phase.

Emissions from Project activities are included in the Emissions, Discharges, and Wastes activity. As such, no other Project activities have been identified to interact with human health.

18.4 ASSESSMENT OF RESIDUAL ENVIRONMENTAL EFFECTS ON HUMAN HEALTH

Potential effects of the Project on human health are changes in human health risk associated with changes in contaminant concentrations in the environmental media to which people (i.e., the Indigenous Receptor, the Residential Receptor, and the Off-Duty Worker Receptor) could be exposed. Project activities through all phases of the Project are anticipated to release chemicals into the environment. These releases could change the chemical quality of air, soil, sediment, and surface water, which could result in changes in the quality of aquatic and/or terrestrial country foods. These changes could result in changes in human health risk for people who consume country foods from within the LAA. The potential changes to human health risk associated with changes in exposure to chemicals in air, soil, water, and country foods are presented. Where appropriate, mitigation measures to reduce Project effects on human health risk are discussed, residual effects are described, and the significance of residual effects is discussed.

The Project has been designed to reduce potential effects on human health risk by reducing Project effects on air and surface water quality and thereby reducing potential effects on other environmental media such as soil, and aquatic and terrestrial country foods. The measures proposed to reduce Project effects on surface water are discussed in Chapter 9 (Section 9.5). The measures proposed to reduce Project effects on air quality are discussed in Chapter 6 (Section 6.4). Alamos will develop a series of environmental management plans to mitigate the effects of Project development on the environment as discussed in Chapter 23.

The assessment of residual effects on human health follows Health Canada's guidance framework for conducting human health risk assessments in Canada and their guidance on Environmental Assessments. These guidance documents include:

- Guidance for Evaluating Human Health Impacts in Environmental Assessment: Human Health Risk Assessment (Health Canada 2019).
- Federal Contaminated Sites Risk Assessment in Canada, Part I: Guidance on Human Health Risk Preliminary Quantitative Risk Assessment, Version 2.0 (Health Canada 2012).
- Federal Contaminated Sites Risk Assessment in Canada, Part II: Health Canada Toxicological Reference Values (TRVs) and Chemical-Specific Factors, Version 2.0. (Health Canada 2010a).
- Federal Contaminated Sites Risk Assessment in Canada, Part V: Guidance on Human Health Detailed Quantitative Risk Assessment for Chemicals (Health Canada 2010b).
- Useful Information for Environmental Assessments (Health Canada 2010c).
- Guidance for Evaluating Human Health Impacts in Environmental Assessments: Air Quality (Health Canada 2017a).
- Guidance for Evaluating Human Health Impacts in Environmental Assessments: Drinking and Recreational Water Quality (Health Canada 2016a).
- Human Health Risk Assessment for Diesel Exhaust. (Health Canada 2016c).
- Guidance for Evaluating Human Health Impacts in Environmental Assessments: Air Quality (Health Canada 2017a).
- Guidance for Evaluating Human Health Impacts in Environmental Assessments: Country Foods (Health Canada 2017b).
- Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise (Health Canada 2017c).
- Guidance for Evaluating Human Health Impacts in Environmental Assessment: Human Health Risk Assessment (2019).

18.4.1 Analytical Assessment Techniques

The assessment of the potential change in human health associated with exposure to COPC from Project-related activities is based on the health risks characterized for receptors in the LAA (i.e., the Indigenous Receptor, the Residential Receptor, and the Off-Duty Worker Receptor). Project activities during the construction, operation, and decommissioning/closure phases are anticipated to release chemicals into the environment that could change the chemical quality of air, soil, sediment, and water. Subsequent changes to the concentrations of these chemicals in the tissues of terrestrial wildlife, aquatic wildlife, invertebrate and vegetation communities that live in the environment may also occur.

Releases into the environment include:

- Emissions of CACs, non-metals and particulate metals from combustion engines and dust into the atmosphere.
- Deposition of rock and ore dust onto the surrounding terrestrial environment during transport; thereby affecting the metal concentrations of soil, with subsequent chemical uptake by wildlife and vegetation.
- Discharges and runoff from Project activities may release metals into groundwater and surface water, thereby affecting surface water quality and sediment quality, with subsequent chemical uptake by wildlife (including fish).

For there to be a health risk, three components must be present:

1. A receptor (i.e., human receptors)
2. A COPC (a hazard)
3. A way for the receptor to come into contact with the COPC (exposure pathways).

If any one of these three components is missing, there would be no potential for health risks. For example, if a receptor and a chemical are present but there is no way for the receptor to come into contact with the chemical (i.e., an exposure pathway is not present), there would be no potential health risk.

The assessment of potential changes in human health risks associated with Project-related changes in environmental conditions, considered the following exposure pathways, if contaminants are present in the various media:

- People may inhale CACs, DPM, HCN, VOCs, PAHs, and particulate-bound metals.
- People may be exposed to metals through direct contact with surface soil (incidental ingestion and dermal contact).
- People may be exposed to metals through the ingestion of traditional country foods (e.g., berries, traditional plants, wild meat, and fish).
- People may be exposed to metals through ingestion of backyard garden produce.
- People may be exposed to metals in surface water if they drink or have dermal contact with the water.
- People may be exposed to metals through direct contact with sediment (incidental ingestion and dermal contact).

The COPC, exposure pathways and receptors are illustrated in the human health conceptual site model (CSM; Volume 5, Appendix H, Figure 5-1).

The HHERA includes the consideration of three exposure scenarios (Volume 5, Appendix H):

- The "Baseline Case" evaluates existing potential human health risks based upon measured data for existing COPC concentrations in air, soil, terrestrial plants, water, sediment, small mammals, and fish. COPC concentrations for wild meat (including moose, rabbit, beaver, duck, and terrestrial bird) were predicted based upon measured and modelled concentrations of COPC in other media.
- The “Project Alone Case” represents the Project’s contributions to Baseline Case environmental conditions. The Project Alone Case was used to assess the incremental lifetime cancer risks that would be associated with exposures to carcinogenic chemicals released to the environment from Project activities. The Project Alone Case was also used to evaluate the Project-related changes in human health risks in situations where the predicted Baseline Case risk estimates exceed existing risk acceptability benchmarks for non-carcinogenic compounds.
- The “Future Case” is the sum of Baseline Case and Project Alone conditions and represents predicted future environmental conditions, with the Project. The Future Case was used to evaluate the potential health risks that would be associated with chemical concentrations in environmental media at points in the future including during the construction, operation, decommissioning/closure phases.

The assessment of potential changes in inhalation health risk associated with changes in air quality between Baseline Case and Future Case relies on the air quality modelling information provided in Chapter 6. Changes in health risk associated with changes in soil quality between Baseline Case and Future Case rely on the deposition modelling information discussed in Volume 5, Appendix H, and is also provided in Chapter 6. The assessment of potential changes in health risk associated with changes in water quality Baseline Case and Future Case relies on the water quality modelling information provided for surface water, provided in Chapter 9 and in Volume 5, Appendices D and E. Both the air quality modelling and surface water quality modelling incorporate conservatism designed to over-predict the changes in air and water quality. The conservatism incorporated into the air and surface water quality modelling is discussed in Chapters 6 and 9, respectively. The conservatism incorporated into the air and surface water quality modelling is carried over into the HHERA calculations by providing conservative estimates of chemical concentrations in air and water for the Gordon region and the MacLellan region. In addition, where there are uncertainties or unknowns in the HHERA, they have been addressed using conservative assumptions that are intended to over-estimate exposures or to avoid under-estimating exposures.

18.4.1.1 COPC Concentrations in Environmental Media

Potential health risks related to exposure to a COPC in a given media (e.g., soil) depends on the concentration of that COPC in media. Baseline Case concentrations were estimated using measured and/or modelled data depending on the media. Future Case concentrations were estimated using Baseline Case concentrations and the predicted changes as a result of the Project (i.e., the Project Alone Case).

Measured Baseline Case Data

Baseline Case concentrations in the soil, terrestrial vegetation, small mammals, water, sediment, and fish were based on samples collected from the LAA within the Gordon and MacLellan regions. Baseline Case concentrations in the air were based on samples collected from air monitoring stations.

Air

- Baseline Case concentrations for $PM_{2.5}$ and dustfall were based on the average concentrations of samples collected between June 18, 2016 and October 9, 2016, as part of the baseline ambient air quality monitoring program (Volume 4, Appendix A).
- Baseline Case concentrations SO_2 and NO_2 were based on 2018 ambient air quality monitoring results from the National Air Pollution Surveillance Program (NAPS) station in Fort Smith, Northwest Territories (the 90th percentile of hourly measurements). Fort Smith is a remote location like Lynn Lake, experiences similar meteorological conditions, and is located approximately 700 km to the northwest of the LAA (Volume 4, Appendix A).
- No Baseline Case concentrations were available for DPM, HCN, metals, VOCs, or PAHs. Given the remoteness of the LAA, low population density, and limited industrial activity, baseline concentrations of these chemicals are assumed to be negligible.
- Baseline Case concentrations were assumed to be consistent throughout the LAA, therefore the same Baseline Case concentrations were adopted for both the Gordon region and the MacLellan region.

Soil

Gordon Region

- Baseline metal concentrations in soil for the Gordon region were based on 28 samples and three field duplicates collected in 2015 and 2016 (Volume 4, Appendix R). The 95% upper confidence limit of the mean (UCLM) concentration was adopted as the Baseline Case concentration for each metal throughout the Gordon region. The 95% UCLM concentration is an estimate of the true mean concentration with a 95% upper confidence level.

MacLellan Region

- Baseline metal concentrations in soil for the MacLellan region were based on 25 samples and three field duplicates collected in 2015 and 2016 (Volume 4, Appendix R). The 95% UCLM concentration was adopted as the Baseline Case concentration for each metal throughout the MacLellan region.

Terrestrial Vegetation-Traditional Plants

Gordon Region

- Baseline Case metal concentrations in traditional plants (i.e., berries and tea) were based on 34 samples and four field duplicates of berries and 27 samples and three field duplicates of Labrador tea collected throughout the Gordon region in 2015 and 2016 (Volume 4, Appendix R). The 95% UCLM concentrations of metals in berries and Labrador tea were adopted as the Baseline Case concentrations throughout the Gordon region.

MacLellan Region

- Baseline Case metal concentrations in traditional plants (i.e., berries and tea) were based on 28 samples and three field duplicates of berries and 25 samples and two field duplicates of Labrador tea samples collected throughout the MacLellan region (Volume 4, Appendix R). The 95% UCLM concentrations of metals in berries and Labrador tea were adopted as the Baseline Case concentrations throughout the MacLellan region.

Terrestrial Vegetation-Coniferous and Deciduous

Gordon Region

- Baseline Case metal concentrations in coniferous and deciduous vegetation (used to predict concentrations in wild meat in the Gordon region) were based on a combined total of 51 samples (28 coniferous and 23 deciduous) and six field duplicates (3 coniferous and 3 deciduous) collected throughout the Gordon region in 2015 and 2016 (Volume 4, Appendix R). The 95% UCLM concentrations of the combined coniferous and deciduous vegetation samples were adopted as the Baseline Case concentrations throughout the Gordon region.

MacLellan Region

- Baseline Case metal concentrations in coniferous and deciduous vegetation (used to predict concentrations in wild meat in the MacLellan region) were based on a combined total of 40 samples (23 coniferous and 17 deciduous) and four field duplicates (two coniferous and two deciduous) collected throughout the MacLellan region in 2015 and 2016 (Volume 4, Appendix R). The 95% UCLM concentrations of the combined coniferous and deciduous vegetation samples were adopted as the Baseline Case concentrations throughout the MacLellan region.

Terrestrial Vegetation-Backyard Garden Produce

Gordon Region

- Backyard garden produce samples were not collected from the Gordon region. The concentrations from the MacLellan region will be used to evaluate risk for receptors in the Gordon region.

MacLellan Region

- Baseline Case metal concentrations in backyard garden produce were based on nine samples of backyard garden produce (carrots (3), potatoes (5) and beets (1)) collected from the Town of Lynn Lake (within the MacLellan region) in 2016 (Volume 4, Appendix R). Backyard gardens in the Town of Lynn Lake may contain soil derived from the East Tailing Management Area (ETMA) and would include metals that have been deposited to surface soil that also originates from the ETMA. Therefore, metal concentrations measured in produce collected from backyard gardens in Lynn Lake are expected to over-predict metal concentrations that would be found in backyard garden produce grown in areas outside of the Town of Lynn Lake. The maximum concentration was adopted as the Baseline Case concentration for each metal in backyard garden produce throughout the MacLellan region.

Small Mammals

Gordon Region

- Baseline Case metal concentrations in small mammals were based on the maximum concentration of individual metals from three red-backed voles and three deer mice collected in the Gordon region (Volume 4, Appendix R).

MacLellan Region

- Baseline Case metal concentrations in small mammals were based on the maximum concentration of individual metals from six red-backed voles collected in the MacLellan region (Volume 4, Appendix R).

Sediment

Gordon Region

- Baseline metal concentrations in sediment were based on the 48 samples and nine field duplicates collected from various waterbodies throughout the Surface Water LAA for the Gordon site in 2015 and 2016 (Volume 4, Appendix K). The 95% UCLM concentration was adopted as the Baseline Case concentration for each metal throughout the Gordon region.

MacLellan Region

- Baseline metal concentrations in sediment were based on the 51 samples and nine field duplicates collected from various waterbodies throughout the Surface Water LAA for the MacLellan site in 2015 and 2016 (Volume 4, Appendix K). The 95% UCLM concentration was adopted as the Baseline Case concentration for each metal throughout the MacLellan region.

Fish

Gordon Region

- Baseline Case metal concentrations in fish were based on 33 samples each of liver, carcass and muscle samples from large-bodied fish collected from Swede Lake in 2015 and 2016 (Volume 4, Appendix J). Receptors are assumed to not obtain fish from Farley Lake (immediately downstream of the Project) based on feedback from local residents and Indigenous people. Swede Lake is located immediately downstream of Farley Lake and formerly supported a commercial fishery; therefore, it is possible that people may obtain a portion of their local fish from Swede Lake. To account for the possibility that people may consume the entire fish and not just the muscle fillets, metal concentrations in fish tissue were estimated using an average of the 95% UCLM concentrations of liver, carcass, and muscle concentrations. This value was adopted as the Baseline Case concentration for each metal in fish from Swede Lake.

MacLellan Region

- Baseline Case metal concentrations in fish were based on 29 samples each of liver, carcass and muscle tissue collected from Cockeram Lake in 2015 and 2016 (Volume 4, Appendix J). As with the Gordon region, the average of the 95% UCLM concentrations of liver, carcass and muscle concentrations was adopted as the Baseline Case concentration for each metal in fish tissue from Cockeram Lake.

Modelled Baseline Case Data

Baseline Case concentrations in surface water are based on the modelled baseline case concentrations in surface water. Baseline case concentrations of wild meat were predicted using baseline case concentrations in site media.

Surface Water

Gordon Region

- Baseline Case metal concentrations in surface water were based on the modelled concentrations for the average case. Refer to the Surface Water Chapter (Chapter 9) for further discussion on the modelled baseline. The average modelled concentrations from waterbodies within the Surface Water LAA for the Gordon site were used for assessing risks related to surface water consumption, as well as for predicting baseline concentrations in wild meat.

MacLellan Region

- Baseline Case metal concentrations in surface water were based on the modelled concentrations for the average case. Refer to the Surface Water Chapter (Chapter 9) for further discussion on the modelled baseline. The average modelled concentrations from waterbodies within the Surface Water LAA for the MacLellan site were used for assessing risks related to surface water consumption, as well as for predicting baseline concentrations in wild meat.

Wild Meat

Gordon Region

- Baseline Case metal concentrations in wild meat (moose, rabbit, beaver, duck and terrestrial bird) were modelled using Baseline Case concentrations in soil, surface water (average concentration of modelled Baseline Case concentrations for waterbodies in the Surface Water LAA for the Gordon region), sediment, and vegetation in the Gordon region.

MacLellan Region

- Baseline Case metal concentrations in wild meat (moose, rabbit, beaver, duck and terrestrial bird) were modelled using Baseline Case concentrations in soil, surface water (average concentration of modelled Baseline Case concentrations for waterbodies in the Surface Water LAA for the MacLellan region), sediment, and vegetation in the MacLellan region.

Modelled Future Case Data

Future Case concentrations in air, soil and surface water were based on modelling, as summarized below.

Air

- Air dispersion modelling was used to estimate COPC concentrations in air at receptor locations in the Gordon region and the MacLellan region (Volume 5, Appendix A).
- The receptor locations were selected to represent places where people are likely to be present and could be exposed to emissions from the Project.
- The selection of receptor locations was based on considerations of land use and on input from local communities. Locations included residential developments, commercial and institutional buildings, hunting and/or fishing camps, and potential Indigenous use locations.
- The locations of potential Indigenous receptors were informed by Alamos' engagement with Indigenous communities and publicly available sources traditional land use information. Due to the length of time required to conduct air quality modelling, Indigenous receptors were selected early in the assessment process and represent potential receptor locations rather than individual use sites.
- Airborne concentrations were modelled for operation only, as emissions during construction and decommissioning/closure are substantively lower than those of operation (Chapter 6, Section 6.4.1.1 and Volume 5, Appendix A). The modelled results for the operation phase have been applied to all phases of the Project including construction, operation, and decommissioning/closure.
- COPC concentrations in air were modelled for 1-hour, 2-hour (for DPM), 24-hour and/or annual timeframes.

Gordon Region

- Air dispersion modelling was conducted for 45 receptor locations (Volume 5, Appendix A).

MacLellan Region

- Air dispersion modelling was conducted for 115 receptor locations (1 receptor location in the work camp and 114 receptor locations within the MacLellan region outside the MacLellan PDA; Volume 5, Appendix A).

Soil

- Deposition was modelled for operation when release of rock and ore dust is expected to occur (Volume 5, Appendix H). Although it is anticipated that dust would be released from the Project during the construction phase, this dust will be composed of overburden and the metal concentrations in this material would not be expected to differ from metal concentrations in existing surface soils. Thus, dust deposition during the construction phase would not be expected to alter metal concentrations in surface soil. Therefore, the construction phase was not included in the prediction of the change in metal concentrations in surface soil over the operational life of the Project.
- Future Case concentrations in soil were assumed to be based on 5 years of operation for the Gordon site (recall the final year will be ore transport only; Chapter 2) and 13 years of operation for the MacLellan site.
- The incremental increase in metal concentration in soil resulting from rock (including fugitive road dust) and ore dust deposition (including ore stockpiles) and fugitive dust emissions from the tailings management facility (TMF; at the MacLellan site) assumed that metal accumulation in the soil would occur over the life of mine and that there would be no loss of metal from the soil (e.g., from runoff).
- The exposure point concentration in soil was calculated assuming the deposited metals mix with the top 2 cm of soil, which is the mixing depth for untilled soil recommended by the US EPA (2005).

Gordon Region

- Deposition was modelled for the 45 receptor locations (Volume 5, Appendix H). The 95% UCLM of the annual deposition rate was used to estimate future concentrations in soil at the Gordon region.
- Future Case contaminant concentrations in soil were used to predict the changes in contaminant concentrations in vegetation, including deciduous and coniferous vegetation consumed by animals as well as traditional plants (e.g., berries and Labrador tea) and backyard garden produce consumed by humans in the Gordon region. Future Case contaminant concentrations in soil, as well as Future Case concentrations in surface water, were using to predict Future Case concentrations in wild meat in the Gordon region.

MacLellan Region

- Deposition was modelled for the 115 receptor locations (1 receptor location in the work camp and 114 receptor locations within the MacLellan region outside the MacLellan PDA; Volume 5, Appendix H). The 95% UCLM deposition rate (outside the work camp) was used to estimate future concentrations in soil at the MacLellan region. Health risks related to deposition, and ingestion in general, were not assessed for occupants of the work camp.
- Similar to the Gordon region, Future Case contaminant concentrations in soil were used to predict the changes in contaminant concentrations in vegetation, including deciduous and coniferous vegetation consumed by animals as well as traditional plants (e.g., berries and Labrador tea) and backyard garden produce consumed by humans in the MacLellan region. Future Case contaminant concentrations in

soil, as well as Future Case concentrations in surface water, were used to predict Future Case concentrations in wild meat in the MacLellan region.

Surface Water

- Details related to surface water modelling are provided in Chapter 9 and Volume 5, Appendices D and E.

Gordon Region

- Future Case contaminant concentrations were calculated for West Farley Lake, East Farley Lake, Swede Lake, Ellystan Lake and Susan Lake.
- Future Case contaminant concentrations in fish tissue were based on the Future Case maximum 12-month running average concentrations in Swede Lake for the Expected Scenario. The Expected Scenario is representative of the typical changes in concentrations that may occur as a result of the Project.
- Future Case contaminant concentrations in surface water used for drinking water, as well as predicting concentrations in wild meat, were based on the average maximum 12-month running average concentrations from modelled waterbodies in the surface water LAA for the Gordon site.
- Future Case contaminant concentrations in sediment were also predicted using the average maximum 12-month running average concentrations from modelled waterbodies in the surface water LAA for the Gordon site.

MacLellan Region

- Future Case contaminant concentrations were calculated for Keewatin River, Minton Lake, Cockeram River, Cockeram Lake, and a catchment adjacent to and north of the PDA.
- Future Case contaminant concentrations in fish tissue were based on the Future Case maximum 12-month running average concentrations in Cockeram Lake for the Expected Scenario. The Expected modelling scenario is representative of the typical changes in concentrations that may occur as a result of the Project.
- Future Case contaminant concentrations in surface water used for drinking water, as well as predicting concentrations in wild meat were based on the average maximum 12-month running average concentrations from modelled waterbodies in the surface water LAA for the MacLellan site.
- Future Case contaminant concentrations in sediment were also predicted using the average maximum 12-month running average concentrations from modelled waterbodies in the surface water LAA for the MacLellan site.

Receptor Assumptions – Human Health

Three representative human receptors are evaluated. The Indigenous Receptor and Residential Receptor are assumed to be present in each region, while the Off-Duty Worker Receptor is assumed to be present only at the work camp.

- **Indigenous Receptors** – Includes Indigenous people who may live in either region, but who are assumed to consume higher levels of country foods, harvested from within their region, compared to the Residential Receptors. They are assumed to spend 100% of their time in one of the two regions. This receptor also addresses Indigenous people who do not live in either region but who harvest country foods from within the LAA.
- **Residential Receptors** – Includes non-Indigenous residents who may live in one of the two regions. Residents are assumed to spend 100% of their time in one of the two regions. Receptors who spend less than 100% time in their particular region are assumed to be exposed to lower levels of Project-related chemicals and would therefore have lower health risks compared to the Indigenous Receptor.
- **Off-Duty Worker Receptors** – Includes Off-Duty Workers present in the work camp at the MacLellan site. This receptor is only evaluated for inhalation exposures, as ingestion exposures are assumed to be comparable to those of the general population because this receptor will not consume country foods, backyard foods, or untreated water from the LAA. This receptor is assumed to spend 26 weeks per year in the work camp, based on a 14-day on/14-day off-shift rotation.

Other receptors such as temporary workers who do not work on the Project or visitors to the LAA are expected to have lower exposures than these receptor groups.

General Receptor Assumptions

The following assumptions apply to both the Indigenous Receptors and Residential Receptors:

- Human receptors were assumed to spend 100% of their time within their particular region and no distinction was made between time spent indoors and time spent outdoors. This means that the COPC concentrations in air predicted for each residential receptor location were assumed to be the same indoors and outdoors. This approach assumes that inhalation exposures to COPC happens on a 24-hour per day basis and is not limited to the time a person spends outdoors.
- Human receptors were assumed to be exposed to the exposure point concentration (EPC) calculated for the appropriate exposure averaging period (e.g., 1-hour, 24-hour, annual average etc.) for each COPC predicted in their region (i.e., Gordon region and MacLellan region).
- The combined dust deposition estimates for the Gordon site and the MacLellan site provided by the air quality modelling were assumed to represent the dust and metal deposition rate over the 5-year operational life of the Gordon site and the 13-year operational life of the MacLellan site. The 95% UCLM deposition rate for locations within a given region was used as the deposition rate across the entire region. This approach provides realistic predicted increases in metal concentrations in soil and therefore the potential exposure to COPC in soil.

- Human receptors were assumed to obtain drinking water from surface water in their particular region.
- Receptors in a given region were assumed to obtain 100% of wild meat, berries, and traditional plants from their region.
- Receptors were assumed to obtain 10% of the fish they consume on a yearly basis from Swede Lake (for Gordon region receptors) or Cockeram Lake (for MacLellan region receptors). This is considered conservative as the results of community and Indigenous engagement suggest that people are unlikely to obtain fish from either of those waterbodies due to perceived contamination of surface water related to historical mining activities.
- It was assumed that receptors would consume fish muscle (i.e., fillet), fish liver, and fish carcass from their particular region.
- Receptors were assumed to consume backyard garden produce, and it was further assumed that the consumption of backyard garden produce accounted for 10% of the yearly combined intake of root vegetables and other vegetables identified by Health Canada (2012).

Specific Assumption for the Indigenous Receptors

The following specific assumption applies to Indigenous Receptors:

- The country food consumption rates for the Indigenous Receptor were based on the 95th percentile grams of traditional food per day reported in Total Manitoba First Nations in the First Nations Food, Nutrition & Environment Study (FNFNES) – Results from Manitoba 2010 (Chan et al. 2012).

Specific Assumption for the Residential Receptors

The following specific assumption applies to the Residential Receptors:

- The country food consumption rates for the Residential Receptor were based on the mean grams of traditional food per day reported in Chan et al. 2012.

Specific Assumptions for the Off-Duty Worker Receptor

- Off-Duty Workers are assumed to be present in the work camp for 24 hours per day on a 14-days on/14-days off rotation schedule for a total of 26 weeks per year. Workers employed on the mine site would be expected to spend 12 hours per day in camp and 12 hours per day on the mine site. For COPC where the exposure benchmarks or TRVs are based on short-term exposure duration (1-hour, 2-hour, and 24-hour), concentrations were compared directly to the corresponding Canadian Ambient Air Quality Standards (CAAQS) or TRV without adjustment. For COPC where annual average exposure benchmarks or TRVs are available, predicted maximum annual average concentrations were adjusted to account for the period of the year when the worker is present in the LAA (26 weeks per year/52 weeks per year).
- Off-Duty Workers do not consume country foods or untreated water from the LAA.

General HHERA Approach

- The HHERA relied on the traditional knowledge provided by Indigenous communities through engagement input. This information was used to select receptor locations as well as wildlife used at target species for hunting.
- For each receptor scenario, published characteristics and professional judgment were used in determining exposure durations and consumption patterns (e.g., Health Canada 2012). Ingestion rates for country food were based on the information provided in the FNFNES – Results from Manitoba 2010 (Chan et al. 2012).
- Mercury in fish tissue was assumed to be 100% methylmercury.
- The potential changes in inhalation health risks for receptors in each region were assessed for exposure to non-carcinogenic and carcinogenic COPC. The risks associated with inhalation exposures to non-carcinogenic chemicals (CACs, DPM, HCN and VOCs) are evaluated for 1-hour, 2-hour, 24-hour and/or annual exposure times in cases where duration-specific (e.g., 1-hour, 2-hour, 24-hour) inhalation TRVs were available. Non-carcinogenic health risks associated with the inhalation of particulate-bound metals and PAHs were only evaluated for annual exposures. For carcinogenic chemicals (metals, VOCs, and PAHs; as benzo(a)pyrene total potency equivalents $B[a]P_{TPE}$), the maximum predicted Project-Alone Case annual average concentrations from each region were used to calculate lifetime averaged daily exposures. These lifetime-averaged daily exposures were compared to cancer-related risk-specific concentrations to assess the potential incremental increase in lifetime cancer risk associated with inhalation. Applying the maximum predicted annual average concentrations to each year of operation provides a conservative estimate of the potential change in lifetime cancer risk that may be associated with inhalation exposures to carcinogenic chemicals released by Project-related activities.
- The predicted concentrations of CACs, DPM, HCN, PAHs and VOCs were compared to human health-based air quality benchmarks. Comparisons for CACs, DPM, HCN, metals and VOCs were based on both short-term and long-term exposures. For PAHs, TRVs based on short-term exposure averaging periods (1-hour or 24-hour) were not available, therefore, the risks associated with exposures to PAHs were based on long-term annual average concentrations only.
- Potential changes in ingestion health risks for the three human receptor groups were assessed for exposure to both non-carcinogenic and carcinogenic COPC.

18.4.1.2 Calculating Health Risks

Non-Carcinogenic Chemicals

The human health risk associated with exposures to non-carcinogenic chemicals is characterized using the CRs for the inhalation pathway and HQs for oral and dermal pathways (i.e., ingestion and dermal contact).

CRs are used to evaluate the health risks from short-term and long-term inhalation exposure to CACs (SO_2, NO_2, $PM_{2.5}$), DPM, HCN, VOCs, PAHs, and particulate bound metals in air. CRs for CACs were calculated by dividing the ground-level concentration of a CAC by its TRV as shown in the formula below. Ground-level concentrations of CACs are available for the Baseline Case and Future Case (refer to Section 18.4.1.1 for definition of Baseline Case and Future Case), and apply averaging times (1-hour, 2-hour, 24-hour, or annual average) for their exposure durations. Note that the toxicological reference values for non-carcinogenic chemicals are considered protective of the general population, including sensitive sub-populations and life stages including the infant, toddler, child, teen, and adult. In general, the potential health effects associated with inhalation exposure are distinct from those associated with oral and dermal exposures and therefore the health risks are assessed separately. The methods used to calculate CRs associated with exposures to non-carcinogenic chemicals are discussed in greater detail in Volume 5, Appendix H, Section 5.4.

$$\text{Concentration Ratio (CR; unitless)} = \frac{\text{Concentration in Air } (mg/m^3)}{\text{Toxicological Reference Value } (mg/m^3)}$$

HQs for oral and dermal exposures were calculated by dividing the predicted exposure (expressed as a dose) by the oral TRV for each COPC as shown in the formula below.

$$\text{Hazard Quotient (HQ; unitless)} = \frac{\text{Exposure dose (mg/kg body weight-day)}}{\text{Toxicological Reference Value (mg/kg body weight-day)}}$$

Carcinogenic Chemicals

Potential health risks associated with inhalation exposures to cancer-causing COPC were expressed as CRs. A CR is derived by dividing the life-time averaged daily concentration of the carcinogenic COPC in air by the risk-specific concentration (RSC) associated with a 1 in 100,000 incremental increase in lifetime cancer risk. The risk-specific concentration is derived from the inhalation unit risk as shown below. A CR less than 1.0 indicates that the cancer risks associated with the predicted exposures to the COPC would not exceed the risk acceptability benchmark of 1 in 100,000 (expressed as 1E-05), which is the cancer risk acceptability benchmark recommended by Health Canada (2012).

$$\text{Concentration Ratio (CR; unitless)} = \frac{\text{Lifetime Average Daily Concentration in Air } (mg/m^3)}{\text{Risk-specific Concentration } (mg/m^3)}$$

$$\text{Risk-specific Concentration } (mg/m^3) = \frac{1E\text{-}05}{\text{Inhalation Unit Risk } (mg/m^3)^{-1}}$$

Potential health risks associated with oral and dermal exposures to cancer-causing COPC were expressed as ILCRs and represent the incremental increase in individual's overall lifetime cancer risk that could result from exposure to a carcinogenic chemical released by Project activities. The ILCR considers the increase in risk over and above background risk. For cancer-causing COPC evaluated as part of the soil, water, or food pathway assessment, ILCR estimates resulting from a lifetime of exposure through multiple pathways were calculated by estimating the lifetime average daily dose and multiplying it by the cancer slope factor for cancer-causing COPC in media other than air. The ILCR was compared to the cancer risk acceptability benchmark of 0.00001 (1.0E-05) established by Health Canada (Health Canada, 2012). This benchmark represents an incremental increase in an individual's overall lifetime cancer risk of 0.00001. A receptor's exposure to a Project-related carcinogenic compound that results in a predicted ILCR that is below 0.00001 is considered to represent a negligible human health risk (Health Canada 2012) The ILCR does not include consideration of background risk present under Baseline Case, thus only the Project-Alone Case (definition provided in Section 18.4.1.1) ILCRs are reported and these represent the increase in potential cancer risk due to the Project only. The methods used to calculate CRs associated with exposures to carcinogenic chemicals are discussed in greater detail in Volume 5, Appendix H, Section 5.4.

$$ILCR = Slope\ Factor \times Exposure$$

With the exception of PAHs, the HQs, ILCRs and CRs were characterized for single COPC and the risks were not summed. Standard risk assessment practice in Canada is to evaluate the potential human health risks associated with chemicals that have different mechanism of action and/or have different biological endpoints on an individual basis. In cases where multiple chemicals have the same mechanism of action and biological endpoint, but differ in their individual toxic potencies, individual risks are usually summed to derive an overall risk associated with the combined exposure to the group of chemicals. This is the standard approach for risk assessments conducted in Canada. The carcinogenic PAHs have similar molecular structures and are thought to exert toxic effects through the same mechanism of action but have differing degrees of toxicity. Therefore, the overall cancer risk associated with exposure to the carcinogenic PAHs is assessed as a combined cancer risk for group of COPC.

18.4.2 Change to Human Health

18.4.2.1 Project Pathways

Atmospheric emissions (vehicle exhaust, and rock and ore dust) and water discharges (e.g., effluent and seepage) from the Gordon site and the MacLellan site Project activities could increase COPC concentrations in ambient air, soil, water, and sediment. This can lead to increases of these chemicals in secondary environmental media including vegetation, wild meat, and fish tissue. In the absence of mitigation measures, potential changes in air may affect the health of Off-Duty Workers, and potential changes in air, water, and country food quality may affect the health of human receptors who live in either region and who may engage in hunting, trapping, traditional, and recreational activities.

18.4.2.2 Mitigation

A number of mitigation measures have already been incorporated into both regions, as detailed in Chapters 6, 7, 8, and 9, to reduce environmental effects of the Project that also serve to address human health effects mechanisms described above. These mitigation measures include:

- The use of dust suppressants (e.g., water and chemical), dust collectors (e.g., baghouse and wet scrubbers at crushers) and dust enclosures at mill feed conveyors and storage areas as described in Chapter 6, Section 6.4.1.3.
- An Air Quality Management Plan (Chapter 23).
- Water management as described in Chapter 8, Section 8.4.2.2, and Chapter 9, Section 9.4.1.3, and including surface water runoff control practices, diversion of freshwater away from the Project by designing culverts and ditches, management of contact water (by construction of collection pits, ponds, ditches and culverts), installation of groundwater interceptor wells and dewatering ditches, and closure rehabilitation (e.g., placement of a vegetated soil cover) to reduce infiltration into overburden and stockpiles (Appendix 23B).

The implementation of these mitigation measures and other commitments will be the responsibility of Alamos and/or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards. Regulations, industry standards, or best practices have been cited where applicable in the Atmospheric Environment and Surface Water VCs to justify the selection.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

18.4.2.3 Project Residual Effects

This section provides a summary of the predicted health risks due to the Project. Assessment of residual environmental effects related to changes in human health are presented for each of the three receptor groups identified in Section 18.4.2.1. This assessment assumed the implementation of mitigation measures, as described in Section 18.4.2.2. A detailed discussion of the predicted human health risks is presented in Volume 5, Appendix H.

Inhalation-Related Human Health Risks

The COPC for inhalation include CACs, DPM, HCN, VOCs, PAHs, and metals. Concentrations of CACs in ambient air were either measured (e.g., $PM_{2.5}$) or obtained from NAPS data. Baseline Case concentrations were not available for DPM, HCN, VOCs, PAHs, or metals. The predicted concentrations of COPC for the construction phase were lower than the predicted concentrations for the operation phase, therefore the concentrations from operation were used to evaluate potential inhalation exposures. The potential human health risks associated with inhalation exposures to COPC were evaluated separately for the Gordon region, MacLellan region and the work camp. In each area, potential human health risks were evaluated using the worst-case short-term (1-hour, 2-hour (DPM only), 24-hour) and long-term (annual average) values predicted for Future Case conditions. The predicted COPC concentrations were compared to the corresponding TRVs or human health-based air quality criteria, for the appropriate averaging period (1-hour, 2-hour, 24-hour and/or annual) to calculate the concentration ratios (CRs) used to estimate potential human health risks.

The potential changes in inhalation health risks were assessed for exposure to both non-carcinogenic and carcinogenic COPC. The risks associated with inhalation exposures to non-carcinogenic chemicals (CACs, DPM, HCN, metals and VOCs) were evaluated for 1-hour, 2-hour, 24-hour, and/or annual exposure times in cases where time-specific inhalation guidelines were available. The risks associated with inhalation of carcinogenic chemicals (metals, VOCs, and PAHs (as $B[a]P_{TPE}$)) were evaluated based on lifetime exposure. For each COPC, CRs were based on a comparison of measured or predicted concentrations for the Baseline Case and the predicted concentrations for the Future Case to the applicable objective or TRV. The full set of inhalation risk estimates are provided in Volume 5, Appendix H. The risks for the Gordon region and MacLellan region apply to both the Indigenous Receptor and the Residential Receptor in that region because both receptors are assumed to be present in that region 100% of the time. The risks for the work camp apply to Off-Duty Workers and other members of the workforce who may be housed in the camp, but do not apply to the Indigenous Receptor or the Residential Receptor who would be expected to spend less time in the work camp than Off-Duty Workers or other members of the workforce.

The human health risks associated with inhalation exposures to COPC were evaluated for the Indigenous Receptor and Residential Receptor in the Gordon and MacLellan regions and for the Off-Duty Worker at the work camp. The results of these evaluations are summarized below. The potential human health risks associated with inhalation exposures to COPC are discussed in greater detail in Volume 5, Appendix H, Section 5.4.3.

Gordon Region

A summary of the non-cancer risks for each COPC with calculated Baseline Case and/or Future Case risks for the Gordon region in excess of 1.0 is provided in Table 18-3. With the exception of exposure to 1-hour NO_2, the CRs associated with inhalation exposures for the non-carcinogenic COPC in the Gordon region are below 1.0.

The air quality assessment (Chapter 6) provided the measured and predicted NO_2 concentrations for the Baseline Case and Future Case of the Project in the Gordon region. The maximum 3-year average 98th percentile of the daily 1-hour maximum NO_2 concentrations was compared to the 1-hour NO_2 CAAQS for 2020 and 2025. The 1-hour NO_2 CAAQS for 2020 and 2025 reflect findings of the human health risk assessment for NO_2 completed by Health Canada in 2016 (Health Canada 2016b), but incorporate a recognition of the roles that magnitude and frequency of exposure play in determining the potential health risks associated with inhalation exposures to NO_2. Therefore, at receptor locations where 1-hour NO_2 concentrations are predicted to exceed the 1-hour NO_2 2025 CAAQS (79 µg/m^3), the assessment of potential human health risks should incorporate consideration of the magnitude and frequency of these exceedances. Consideration is also given to the pattern of exceedances (the time of day and time of year when the exceedances are predicted to occur and whether the exceedances occur in isolation or over consecutive 1-hour periods).

The maximum average 98th percentile of the 1-hour daily maximum 1-hour NO_2 concentration in the Gordon region exceeds the 2025 CAAQS of 79 µg/m^3 (maximum CR – 1.2). An exceedance of a CR is not an indication that human health effects will occur. Rather, it is an indication that additional investigation is required to further characterize potential human health risks. The additional evaluation of potential human health risks associated with inhalation exposures to NO_2 considered the how often the 1-hour NO_2 concentrations were predicted to exceed the 2025 CAAQS and whether the exceedances occurred individually, or if they occurred over consecutive 1-hour periods. Individual exceedances of the 1-hour NO_2 CAAQS that are separated by periods of time when the 1-hour NO_2 concentrations are below the CAAQS allow for recovery from the respiratory effects associated with the exposure. Respiratory recovery would be delayed in situations where multiple exceedances of the 1-hour NO_2 CAAQS occur in consecutive hours. Prolonged exposures to 1-hour NO_2 concentrations above the CAAQS could result in increased respiratory effects compared to shorter-term exposures. Thus, exceedances of the 1-hour NO_2 that occur in blocks of time may represent a greater potential human health risk than exceedances that occur on an individual (single hours) or a short-term basis (blocks of several hours). The 1-hour NO_2 concentrations were modelled over a 5-year period representing a total of 43,800 1-hour periods (8760 hours per year x 5 years).

The assessment of potential human health risks associated with inhalation exposures to NO_2 considered 1-hour and annual average NO_2 concentrations at 45 special receptor locations in the Gordon region. At each of the 45 receptor locations, predicted annual average NO_2 concentrations (including background NO_2) were below the 2025 annual average NO_2 CAAQS. At three special receptor locations, Potential Indigenous Receptor 24, Potential Indigenous Receptor 25, and Potential Indigenous Receptor 27 (all three locations fall within Trapping 22 and Travel 25 identified in the Marcel Colomb First Nation TLRU Study (Map 18-2), the maximum predicted 1-hour NO_2 concentration exceeded the 2025 1-hour NO_2 CAAQS.

The air quality assessment (Chapter 6) modelled 1-hour NO_2 concentrations over a 5-year period (43,800 1-hour NO_2 results per special receptor location). In the Gordon region, the maximum number of exceedances of the 2025 1-hour NO_2 CAAQS over the 5-year modelling period are predicted to occur at the Potential Indigenous Receptor 27 special receptor, located north of the Gordon PDA. At this location, the 1-hour NO_2 concentrations were predicted to exceed the 1-hour NO_2 CAAQS (79 µg/m^3) 170 times over the 5-year modelling period. This represents 0.38% of the time. Exceedances occur predominantly as single events separated by prolonged periods where the 1-hour NO_2 concentrations are below the 2025 1-hour NO_2 CAAQS. There are three instances (April 12 in Year 1, May 14 in Year 4, and December 14 in Year 3) where the exceedances are predicted to occur over 5 consecutive hours. However, the maximum 1-hour NO_2 concentration predicted during these periods is 97 µg/m^3 (May 14 in Year 4), which is below the 2020 1-hour NO_2 CAAQS. In addition, the 170 exceedances over the 5-year modelling period happen during the colder months (November through May) and between the hours of 20:00 and 6:00. Information provided in Chapter 17 and in the Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project (SVS 2020) do not identify habitations in the vicinity of the Potential Indigenous Receptor 27 special receptor location, or the other two special receptor locations where exceedances of the 1-hour NO_2 2025 CAAQS, are predicted to occur. In the absence of habitation near these special receptor locations, it is less likely that people would be present in these areas at the time of day when then these exceedances are predicted to occur, than if the exceedances were to occur during daylight hours. In addition, the maximum 1-hour NO_2 concentrations for all 5 years for each of these three special receptor locations are below the Health Canada short-term Residential Indoor Air Quality Guideline (RIAQG) for NO_2 of 170 µg/m^3, and the predicted annual average NO_2 concentrations are below the 2025 annual average NO_2 CAAQS. Predicted annual average NO_2 concentrations at the remaining 44 special receptor locations within the Gordon region are also below the annual average CAAQS.

Based on the results, it is reasonable to conclude that occasional exceedances of the 2025 1-hour NO_2 CAAQS represent a negligible human health risk for people who may be in the area. As noted above, the CRs for the other non-carcinogenic COPC are below 1.0. Therefore, Project-related health risks associated with inhalation exposures to the non-carcinogenic COPC are negligible.

Table 18-3 Inhalation Health Risks that Exceeded the Applicable Benchmark-Gordon Region

CAC and HCN	Averaging Period	CRs		Receptor/Location	Discussion
		Baseline Case	Future Case		
NO_2	1-hour	9.5E-02	**1.2E+00**	Indigenous Receptor and Residential Receptor Potential Indigenous Receptor 27	The frequency analyses indicated that the yearly frequencies of exceedance are low enough that potential health risks are negligible.

NOTE:
Bold CR exceeds benchmark of 1.0

The CRs associated with inhalation to the carcinogenic COPC (e.g., 1,3-butadiene, 2,2,4-trimethylbenzene, acetaldehyde, benzene, formaldehyde, PAHs, arsenic, beryllium, cadmium, chromium and nickel) are below 1.0, meaning that the incremental lifetime cancer risk associated with emissions from the Project is below the 10^{-5} (0.00001) cancer risk acceptability benchmark established by Health Canada (2012). The CRs associated with inhalation exposures to the carcinogenic Project-related chemicals in the Gordon region are presented in Volume 5, Appendix H, Section 5.4.

Overall, the results of the HHERA indicate that Project-related inhalation risks in the Gordon region are not significant.

MacLellan Region

A summary of the non-cancer risks for each COPC with calculated Baseline Case and/or Future Case risks for the MacLellan region in excess of 1.0 is provided in Table 18-4. With the exception of exposure to 1-hour NO_2, the CRs associated with inhalation exposures for the non-carcinogenic COPC in the MacLellan region are below 1.0.

The air quality assessment (Chapter 6) provided the measured and predicted NO_2 concentrations for the Baseline Case and Future Case of the Project in the MacLellan region. The assessment of potential human health risk considered 1-hour and annual average NO_2 concentrations at 114 special receptor locations in the Maclellan region. At each of the 114 receptor locations, the predicted annual average NO_2 concentrations (including background NO_2) were below the 2025 annual average NO_2 CAAQS. At four special receptor locations, Potential Indigenous Receptor 36 (north of the MacLellan PDA), Potential Indigenous Receptor 37 and Potential Indigenous Receptor 38 (both located southwest of the MacLellan PDA), and Waste Disposal Site 1 (located southeast of the MacLellan PDA), the maximum predicted 1-hour NO_2 concentration exceeded the 2025 1-hour NO_2 CAAQS. As noted above in the discussion for the Gordon region, at receptor locations where 1-hour NO_2 concentrations are predicted to exceed the 1-hour NO_2 2025 CAAQS (79 µg/m^3), consideration is given to the magnitude, frequency and the patterns of 1-Hour NO_2 exceedances in the evaluation of potential human health risks.

The air quality assessment (Chapter 6) modelled 1-hour NO_2 concentrations over a 5-year period (43,800 1-hour NO_2 results per special receptor location). The maximum number of exceedances of the 2025 1-hour NO_2 CAAQS over the 5-year modelling period, are predicted to occur at the Waste Disposal Site 1 special receptor, located southeast of the MacLellan PDA (167 over the 5-year modelling period). However, of the four special receptor locations within the MacLellan region where 1-hour NO_2 exceedances were predicted to occur, the Waste Disposal Site 1 location is unlikely to represent a location people would be expected to frequent. The three remaining special receptor locations where 1-hour NO_2 exceedances are predicted to occur represent locations that people could reasonably be expected to frequent (Map 18-2). Of these three locations, the highest number of exceedances of the 1-hour NO_2 2025 CAAQS are predicted to occur at Potential Indigenous Receptor 37 (163 exceedances over the 43,800 hours modelled over the 5-year modelling period). This represents 0.37% of the time. Therefore, the assessment of potential human health risks has focused on the Potential Indigenous Receptor 37 special receptor location to represent the reasonable worst-case exposure. At Potential Indigenous Receptor 37, exceedances occur predominantly as single events of one or two hours, separated by prolonged periods where the 1-hour NO_2 concentrations are below the 2025 1-hour NO_2 CAAQS. There is one instance (March 24 in Year 2) where exceedances of the 2025 1-hour NO_2 CAAQS are predicted to occur over 7 consecutive hours. Within this 7-hour period, there are 2 hours where the 1-hour NO_2 concentrations are predicted to exceed the 2020 1-hour NO_2 CAAQS of 113 µg/m3 (140 µg/m^3 and 132 µg/m^3). The predicted 1-hour NO_2 concentrations in the remaining 5 hours of this 7-hour period are below 113 µg/m^3. The 1-hour NO_2 concentrations in this 7-hour period are below the Health Canada short-term RIAQG of 170 µg/m^3. There is one instance where exceedances are predicted to occur over a 5-hour period (Jan 5 in Year 1) and three instances where exceedances are predicted to occur over a 4-hour period (December 12 in Year 1, February 16 in Year 2 and March 15 in Year 3). In these periods, the maximum predicted 1-hour NO_2 concentrations were above the 2025 1-hour NO_2 CAAQS but below the 2020 1-hour NO_2 CAAQS, and the maximum concentrations were below the Health Canada short-term RIAQG. In addition, the predicted exceedances occur between 20:00 and 6:00. No habitations have been identified in the area of Potential Indigenous Receptor 37 (Chapter 17 and SVS 2020). In the absence of habitation near these special receptor locations, it is less likely that people would be present in these areas at the time of day when then these exceedances are predicted to occur, than if the exceedances were to occur during daylight hours. In addition, the predicted annual average NO_2 concentrations were below the 2025 annual average NO_2 CAAQS of 23 ug/m^3.

Based on the results, it is reasonable to conclude that occasional exceedances of the 2025 1-hour NO_2 CAAQS represent a negligible human health risk for people who may be in the area. As noted above the CRs for the other non-carcinogenic COPC are below 1.0. Therefore, Project related health risks associated with inhalation exposures to the non-carcinogenic COPC are negligible.

Table 18-4 Inhalation Health Risks that Exceeded the Applicable Benchmark-MacLellan Region

CAC and HCN	Averaging Period	CRs		Receptor/Location	Discussion
		Baseline Case	Future Case		
NO_2	1-hour	9.5E-02	**1.2E+00**	Indigenous Receptor and Residential Receptor Potential Indigenous Receptor 37	The frequency analyses indicated that the yearly frequencies of exceedance are low enough that potential health risks are negligible.

NOTE:
Bold CR exceeds benchmark of 1.0

The CRs associated with inhalation to the carcinogenic COPC (e.g., 1,3-butadiene, 2,2,4-trimethylbenzene, acetaldehyde, benzene, formaldehyde, PAHs, arsenic, beryllium, cadmium, chromium and nickel) are below 1.0, meaning that the incremental lifetime cancer risk associated with emissions from the Project is below the 10^{-5} (1 in 100,000) cancer risk acceptability benchmark established by Health Canada (2012). The CRs associated with inhalation exposures to the carcinogenic Project-related chemicals in the MacLellan region are presented in Volume 5, Appendix H, Section 5.4.3

Overall, the results of the HHERA indicate that Project-related inhalation risks in the MacLellan region are not significant.

Work Camp

A summary of the non-cancer risks for each COPC with calculated Baseline Case and/or Future Case CRs for the MacLellan region in excess of 1.0 is provided in Table 18-5. With the exceptions of 1-hour exposure to NO_2 and 2-hour exposures to DPM, the CRs associated with inhalation exposures for COPC in the work camp do not exceed the applicable benchmarks.

The 98th percentile of the 1-hour daily maximum NO_2 concentration exceeded the 2025 CAAQS of 79 µg/m^3 (maximum CR of 1.66). The 1-hour NO_2 concentrations were modelled over a 5-year period. Over this 5-year period 1-hour NO_2 concentrations were predicted to exceed the 2025 CAAQS 695 times (1.6% of the time). In general, the predicted exceedances do not occur in blocks of more than 3 consecutive hours, and these are separated by periods where the 1-hour NO_2 concentrations are below the 2020 1-hour NO_2 CAAQS. Exceedances of the 1-hour NO_2 CAAQS could result in increases in respiratory responses such as increased respiratory tract resistance in sensitive members of the workforce (asthmatics). Individual exceedances of the 1-hour NO_2 CAAQS that are separated by periods of time when the 1-hour NO_2 concentrations are below the CAAQS allow for recovery from the respiratory effects associated with the exposure. Respiratory recovery would be delayed in situations where multiple exceedances of the 1-hour NO_2 CAAQS occur in consecutive hours. Prolonged exposures to 1-hour NO_2 concentrations above the CAAQS could result in increased respiratory effects compared to shorter-term exposures. Thus, exceedances of the 1-hour NO_2 that occur in blocks of time may represent a greater potential human health risk than exceedances that occur on an individual (single hours) or a short-term basis (blocks of several hours).

Exceedances of the 1-hour NO_2 CAAQS that occur over more than 3 hours range in duration from 4 hours (80 times) to 11 hours (2 times) and account for a total of 276 hours over the 43,800 hours of the 5-year modelling period. During these periods, particularly sensitive members of the workforce (those with asthma) who are directly exposed to 1-hour NO_2 concentrations above the CAAQS, may experience respiratory effects such as shortness of breath, that would be expected to subside as NO_2 concentrations decline.

The predicted 1-hour NO_2 exceedances usually occur in winter months (December–March). These exceedances generally happen overnight, occurring sometime between 19:00 and 6:00 the following morning. Within this period, there is no fixed pattern to when individual exceedances happen. In addition, in the winter months, between 19:00 and 6:00 workers would generally be expected to spend off-duty time indoors, and thus would not be expected to experience prolonged exposures to NO_2 concentrations that exceed the 1-hour CAAQS.

Considering the results of the assessment of potential health risks associated with inhalation exposures to NO_2, it is reasonable to conclude that inhalation exposure to NO_2 represents a negligible human health risk for Off-Duty Workers housed at the work camp.

The DPM concentrations are predicted to exceed the 2-hour air quality standard of 10 µg/m^3 on two occasions (10.4 µg/m^3 and 11.5 µg/m^3). DPM concentrations were modelled over a 5-year period representing a total of 21,900 2-hour periods. Thus, 2-hour DPM concentrations are predicted to exceed the air quality standard 0.009% of the time. The 2-hour DPM air quality standard is based on a lowest observable adverse effect level (LOAEL) of 100 µg/m^3 from studies where increased respiratory resistance was reported in study groups that included subjects that were mildly asthmatic (Health Canada, 2016c). Health Canada applied an uncertainty factor of 10 to the LOAEL to derive the 2-hour exposure limit of 10 µg/m^3, noting that the reported effects were considered mild and reversible (Health Canada 2016c). The predicted 2-hour DPM concentrations in the hours preceding and following the exceedances were below the 2-hour DPM, In addition, predicted annual average DPM concentrations were all below the annual average air quality standard of 5 µg/m^3 which is also based on respiratory effects (maximum CR = 0.026).

Thus, given that the predicted exceedances of the short-term (2-hour) exposure limit are small and of short duration, and that the health effects associated the 2-hour limit are based on mild and reversible effects in sensitive members of the population (asthmatics), and the fact that the maximum predicted annual average exposure for an Off-Duty Worker is more than 38 times (1/0.26) below the annual average exposure limit, it is reasonable to conclude that for Off-Duty Workers, inhalation exposures to DPM represents a negligible human health risk.

As noted above, the CRs associated with inhalation exposures to SO_2, and $PM_{2.5}$ do not exceed 1.0 and the CRs for HCN, VOCs, PAHs and metals are below 0.2 and thus, represent a negligible human health risk for Off-Duty Workers. Exceedances of the 1-hour NO_2 and 2-hour DPM exposure limits were predicted to occur within the work camp. However, as discussed above, the exceedances of the 1-hour NO_2 and 2-hour DPM exposure limits are considered to represent negligible human health risks for Off-Duty Workers.

Table 18-5 Inhalation Health Risks that Exceeded the Applicable Benchmark-Work Camp

COPC	Averaging Period	CRs	Receptor	Discussion
NO_2	1-hour	**1.7E+00**	Off-Duty Worker	The frequency analyses indicated that the yearly frequencies of exceedance are low and therefore, potential health risks are negligible.
DPM	2-hour	**1.2E+00**	Off-Duty Worker	The frequency analyses indicated that the yearly frequencies of exceedance are low and therefore, potential health risks are negligible.
NOTE: **Bold** CR exceeds benchmark of 1.0				

Ingestion-Related Human Health Risks

The human health risks associated with ingestion exposures to COPC were evaluated as the sum of the exposure pathways that contribute to total ingestion exposures (including dermal contact). The pathways that contribute to the total ingestion exposure are provided below. Each of these pathways was evaluated for the Indigenous Receptor and Residential Receptor in the Gordon region and the Indigenous Receptor and Residential Receptor in the MacLellan region.

The exposure pathways evaluated include:

- Soil Contact (ingestion and dermal contact) – Receptors were assumed to be exposed to maximum predicted concentration in soil in their particular region.
- Water Ingestion – Receptors were assumed to consume water from multiple locations within the Surface Water LAA for their particular region. The average of the maximum 12 month running average concentrations of COPC in surface waters for the Gordon region and for the MacLellan region were less than the applicable drinking water quality guidelines. In addition, exposures to COPC due to ingestion of surface water are likely to be occasional rather than on a consistent basis. Therefore, exposures to COPC in surface water via ingestion were not assessed quantitatively.
- Wild Meat Ingestion – Receptors were assumed to consume wild meat from their particular region.

- Fish Ingestion – Receptors were assumed to consume fish tissue from the Surface Water LAA in their particular region.
- Traditional Vegetation (e.g., berries, Labrador tea) Ingestion – Receptors were assumed to consume traditional vegetation from their particular region.
- Backyard Garden Produce Ingestion – Receptors were assumed to consume backyard garden produce. Baseline samples of backyard garden produce were collected for the MacLellan region. Backyard gardens are not present in the Gordon region. Therefore, Baseline sample concentrations for the MacLellan region were used as Baseline sample concentrations for the Gordon region.

The risks associated with each of these individual exposure pathways for receptors in each region are presented in Volume 5, Appendix H, Section 5.4.4 through Section 5.4.6. In general, the risks associated with total ingestion exposures to metals under Baseline Case and Future Case conditions are below the non-cancer risk acceptability benchmark of HQ<0.2 established by Health Canada. For several compounds, the total ingestion non-cancer risks exceed the HQ>0.2 non-cancer risk acceptability benchmark. The non-carcinogenic human health risks that exceed the 0.2 benchmark are summarized in Table 18-6 and Table 18-8 and are discussed below.

Humans could come in direct contact with sediment; however, risks related to sediment contact are considered minor. No public beaches or areas of shoreline where high intensity activities occur were identified in the LAA and locations where humans could be exposed to sediment are remote and exposure would be infrequent. With the exception of cobalt from the MacLellan region, vanadium from the Gordon region, and manganese and nickel from the Gordon and MacLellan regions, Baseline Case and Future Case concentrations of metals in sediment are below the applicable soil quality guidelines for protection of human health (Volume 5, Appendix H, Appendix B). Baseline Case concentrations of the identified metals in sediment exceed the applicable guidelines and the Project-related increases in sediment concentrations from the two regions are predicted to be less than 5%. Overall, this supports the conclusion that risks related to direct contact with sediment are minor and were therefore not quantified.

On occasion, humans could ingest water directly from the lakes located in their particular region; however, these occurrences are expected to be infrequent based on the results of engagement, which indicate that people do not obtain drinking water directly from the lakes in either region. The exception is West Lynn Lake, which is the water supply for the Town of Lynn Lake. West Lynn Lake is not expected to be affected by the Project. Hughes Lake is used as a source of water for the Black Sturgeon Reserve, but that water passes through a water treatment system prior to distribution to the community. The average of the predicted future concentrations of metals in the lakes in the Gordon region and the MacLellan region, that could be affected by Project activities, are less than the applicable drinking water guidelines (Volume 5, Appendix H, Section 4.5), suggesting that even if the water were used for consumption, health risks related to metal exposures would be negligible.

Gordon Region

- Summaries of non-carcinogenic and carcinogenic ingestion health risks for the Indigenous Receptor and the Residential Receptor in the Gordon region are provided in Table 18-6 and Table 18-7. These results suggest that changes in non-carcinogenic and carcinogenic health risks due to Project-related chemicals are less than the applicable benchmarks and therefore, negligible. The human health risks associated with exposure to non-carcinogenic and carcinogenic COPC in the Gordon region are discussed in greater detail in Volume 5, Appendix H, Section 5.4.

Table 18-6 Non-carcinogenic Human Health Risks for Total Ingestion (Toddler) – Gordon Region

Receptor	COPC	HQ		Discussion
		Baseline Case	Future Case	
Indigenous Receptor	Manganese	**1.0E+00**	**1.0E+00**	The changes in HQs between Baseline Case and Future Case for these chemicals are less than 0.2, which is below the non-cancer risk acceptability benchmark of 0.2. Thus, the predicted changes in exposure between Baseline Case and Future Case conditions represents a negligible human health risk.
	Methylmercury	**3.8E-01**	**3.8E-01**	
	Thallium	**3.2E+00**	**3.2E+00**	
Residential Receptor	Manganese	**2.9E-01**	**2.9E-01**	
	Thallium	**1.2E+00**	**1.2E+00**	
NOTE: **Bold** HQ exceeds benchmark of 0.2				

Table 18-7 Carcinogenic Human Health Risks for Total Ingestion (Composite Receptor) Gordon Region

Receptor	COPC	ILCR	Discussion
		Project Alone Case	
Indigenous Receptor	Arsenic	9.9E-06	Project-related health risks are considered not significant because the ILCRs for the Project Alone Case are less than the cancer acceptability benchmark of 0.00001 (1E-05).
Residential Receptor		2.9E-06	
NOTE: **Bold** Project Alone ILCR exceeds benchmark of 1E-05			

MacLellan Region

- Summaries of non-carcinogenic and carcinogenic ingestion health risks for the Indigenous Receptor and Residential Receptor in the MacLellan region are provided in Table 18-8 and Table 18-9. These results suggest that changes in non-carcinogenic and carcinogenic health risks due to Project-related chemicals are less than the applicable benchmarks and therefore, negligible. The human health risks associated with exposure to non-carcinogenic and carcinogenic COPC in the MacLellan region are discussed in greater detail in Volume 5, Appendix H, Section 5.4.

Table 18-8 Non-carcinogenic Human Health Risks for Total Ingestion (Toddler) – MacLellan Region

Receptor	COPC	HQ		Discussion
		Baseline Case	Future Case	
Indigenous Receptor	Manganese	**1.1E+00**	**1.1E+00**	The changes in HQs between Baseline Case and Future Case for these chemicals are less than 0.2, which is below the non-cancer risk acceptability benchmark of 0.2. Thus, the predicted changes in exposure between Baseline Case and Future Case conditions represents a negligible human health risk.
	Methylmercury	**3.4E-01**	**3.5E-01**	
	Nickel	**2.1E-01**	**2.1E-01**	
	Thallium	**3.7E+00**	**3.8E+00**	
Residential Receptor	Manganese	**3.1E-01**	**3.1E-01**	
	Thallium	**1.4E+00**	**1.4E+00**	
NOTE: **Bold** HQ exceeds benchmark of 0.2				

Table 18-9 Carcinogenic Human Health Risks for Total Ingestion (Composite Receptor) MacLellan Region

Receptor	COPC	ILCR	Discussion
		Project Alone Case	
Indigenous Receptor	Arsenic	6.8E-06	Project-related health risks are considered not significant because the ILCRs for the Project Alone Case are less than the cancer acceptability benchmark of 0.00001 (1E-05).
Residential Receptor		4.0E-06	
NOTE: **Bold** Project Alone ILCR exceeds benchmark of 1E-05			

Noise and Vibration Human Health Risks

The assessment of Project noise and vibration residual effects on human health are discussed in detail in Chapter 7 (Noise and Vibration). Potential human health effects associated with noise and vibration were assessed for the construction and operation phases of the Project, where Project-related activities are anticipated to be greater than during other Project phases.

The assessment of residual effects for noise associated with the Project was based on the change in percent highly annoyed, which was compared to the target of 6.5% change in highly annoyed as advised in the Health Canada Noise Guidance (Health Canada 2017d), and the sleep disturbance noise guideline of 40 dBA (outside, during nighttime) based on the World Health Organization (WHO) Night Guidelines for Europe (WHO 2009).

Ground vibration effects from the use of heavy equipment (i.e., piling, clearing and grubbing, earthworks) during the construction phase were considered in the assessment. The prediction of vibration effects at the human health special receptor locations were based on the FTA (2018) guidance. The health effects associated with exposures to vibration are related to annoyance.

The results of the noise and vibration assessments for the Gordon and MacLellan regions are summarized below.

Gordon Region

Noise levels predicted at each of the human health special receptor locations in the Gordon region were below the Health Canada 6.5% highly annoyed target and were also below the WHO sleep disturbance noise guideline of 40 dBA (Chapter 7, Section 7.4.1.4). Therefore, no noise-related sleep disturbances from the Project are predicted for Indigenous and non-Indigenous people at the special receptor locations within the Gordon region. Ground-borne vibrations and air over pressure vibrations are predicted to be below their respective vibration targets at special receptor locations in the Gordon region. Based on these results, noise and vibration represent negligible human health risks within the Gordon region.

MacLellan Region

Noise levels predicted at each of the human health special receptor locations in the MacLellan region were below the Health Canada 6.5% highly annoyed target and were also below the WHO sleep disturbance noise guideline of 40 dBA (Chapter 7, Section 7.4.1.4). Therefore, no noise-related sleep disturbances from the Project are predicted for Indigenous and non-Indigenous people at the special receptor locations within the MacLellan region. Ground-borne vibrations and air over pressure vibrations are predicted to be below their respective vibration targets at all but two special receptor locations in the MacLellan region (Chapter 7, Section 7.4.2.4). The two receptor locations where exceedances of the vibration targets are predicted represent trapping areas where people would not be expected to be present on a frequent or regular basis and thus, would be unlikely to experience blast-related ground vibrations while in these areas. In addition, the predicted vibration and overpressure predictions are based on a conservative estimate of blast charge (Chapter 7, Section 7.4.2.4). Based on these results, noise and vibration represent negligible human health risks within the MacLellan region.

18.4.3 Summary of Project Residual Environmental Effects on Human Health

A summary of residual environmental effects on human health that are likely to occur as a result of the Project is provided in Table 18-10. The Project will have residual effects on human health in the Gordon region and MacLellan region during the construction, operation and decommissioning/closure phases. Human health risks are predicted to increase in both the Gordon and MacLellan regions of the Project and therefore, the residual effects are considered to be adverse. However, the magnitudes of these increases are considered negligible in the both regions. Project residual effects on human health will be limited to the LAA/RAA. The predicted changes in human health risk are related to changes in metal concentrations in environmental media (soil and water). Increases in metal loadings to these media would be permanent and therefore, the duration of the effects on human health risk is considered to be long-term (permanent) and irreversible. Changes in human health risk associated with inhalation exposures to NO_2 are associated with Project activities and would only occur during Project operation, and thus would to be reversible and short-term. The Gordon and MacLellan regions are pre-existing mine sites and thus, the ecological and socio-economic context for residual effects on human health is considered to be disturbed.

Table 18-10 Project Residual Effects on Human Health

Residual Effect	Residual Effects Characterization								
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context
Gordon Region									
Change in Human Health	C,O,D	A	N	LAA/RAA	LT	N/A	C	I	D
MacLellan Region									
Change in Human Health	C,O,D	A	N	LAA/RAA	LT	N/A	C	I	D

KEY
See Table 18-2 for detailed definitions

Project Phase
C: Construction
O: Operation
D: Decommissioning

Direction:
P: Positive
A: Adverse

Magnitude:
N: Negligible
L: Low
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term;
LT: Long-term

N/A: Not applicable

Timing:
N/A: Not Applicable
A: Applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

18.5 ASSESSMENT OF CUMULATIVE ENVIRONMENTAL EFFECTS ON HUMAN HEALTH

The Project residual effects described in Section 18.4 may interact cumulatively with residual environmental effects from other physical activities (past, present, and future reasonably foreseeable).

The effects of past and current projects relative to conditions prior to historical mining activities contribute to baseline conditions upon which Project effects are assessed.

Future projects and activities that are reasonably foreseeable are defined as those that; (a) have been publicly announced with a defined project execution period and with sufficient project details that allow for a meaningful assessment, (b) are currently undergoing an environmental assessment or, (c) are in a permitting process.

The assessment of cumulative effects is initiated with a determination of whether two conditions exist:

- The Project has residual environmental effects on the VC, and
- The residual effects could act cumulatively with residual effects of other past, present, or reasonably foreseeable future physical activities.

If either is not met, the assessment of cumulative effects concludes with a statement that further assessment of cumulative effects is not warranted because the Project does not interact cumulatively with other projects or activities.

18.5.1 Project Residual Effects Likely to Interact Cumulatively

Table 4D-2 in Chapter 4, Environmental Effects Assessment Scope and Methods, presents the project and physical activities inclusion list, which identifies other projects and physical activities that might act cumulatively with the Project. Where residual environmental effects from the Project act cumulatively with residual effects from other projects and physical activities a cumulative effects assessment is undertaken to determine their significance. The environmental effects identified in Table 18-11, marked as not likely to interact cumulatively with residual effects of other projects and physical activities (no check mark) are not discussed further.

Table 18-11 Interactions with the Potential to Contribute to Cumulative Effects

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Environmental Effects
	Human Health
Past and Present Physical Activities and Resource Use	
• "A" Mine	✓
• EL Mine	✓
• Fox Mine	-
• Farley Mine	✓
• Ruttan Mine	-
• MacLellan Mine (Historical)	✓
• Burnt Timber Mine	✓
• Farley Lake Mine	✓
• Keystone Gold Mine	✓
• East/West Tailings Management Areas	✓

Table 18-11 Interactions with the Potential to Contribute to Cumulative Effects

Other Projects and Physical Activities with Potential for Cumulative Environmental Effects	Environmental Effects
	Human Health
Mineral Exploration	✓
Water and Waste Projects (sewage plants, waste disposal grounds)	✓
Residential and Community Development (including cottage subdivisions)	✓
Infrastructure Development (transmission line, airport, highways, roads, rail)	✓
Other Resource Activities (hunting, fishing, berry picking)	-
Future Physical Activities	
Mineral Development	✓
Mineral Exploration	✓
Traditional Land Use	-
Resource Use Activities	-
Recreation	-

NOTES:
✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with Project residual environmental effects.
– = Interactions between the residual effects of other projects and residual effects of the Project are not expected.
For a detailed description and mapped locations of Projects and Physical Activities, where applicable, see Chapter 4, Table 4D-2 and Maps 4-3 and 4-4.

Past and present physical activities identified in Table 18-11 include mineral development, mineral exploration, water and waste projects, residential and community development, infrastructure development, traditional land and resource use, and recreation activities. Potential human health risks associated with past and present projects (e.g., not operating, closed or decommissioned facilities) and physical activities (i.e., residential, industrial, commercial and natural environment) in the LAA, have been captured in the baseline assessment of existing human health risks (Section 18.2). As such, the contribution of present projects and activities are considered in the assessment of Project residual effects (Section 18.4).

Residual effects arising from past, present, and reasonably foreseeable future activities have the same exposure pathways as those arising from the Project (Section 18.4.3) and have the potential to result in a cumulative increase in human health risks. These pathways include changes in air quality and water quality. Changes in air quality can result in changes in potential inhalation health risks and, as a result of contaminant deposition, changes in health risks associated with changes in terrestrial country food quality. Changes in water quality can result in changes in potential human health risks associated with changes in drinking water and aquatic country food quality. Therefore, the cumulative effects assessment for human health is based on the assessment of cumulative effects on the atmospheric environment (Chapter 6, Section 6.5) and the assessment of cumulative effects on surface water (Chapter 9, Section 9.6.3). If the cumulative effects assessments for air quality (Chapter 6, Section 6.5.1) and surface water quality (Chapter 9, Section 9.6.3.3) conclude that there is no potential for cumulative effects between the Project and other reasonably foreseeable projects, then, there are no cumulative effects that contribute to changes in human health risk. Therefore, if the cumulative effects assessments for air quality and surface water quality conclude that there is no potential for cumulative effects on air or surface water quality, there is no potential for cumulative effects on human health risk and a cumulative effects assessment of human health risk would not be warranted.

The cumulative effects assessments for air quality (Chapter 6, Section 6.5.1) concluded that the potential for cumulative effects from the Project and other reasonably foreseeable projects was considered negligible. Factors considered in the evaluation of potential cumulative effects included:

- Past physical activities will not affect air quality as they do not overlap temporally with the Project and Baseline ambient concentrations account for present projects and activities.
- Future physical activities include mineral development, mineral exploration, traditional land use, resource use activities and recreation. Activities such as traditional land and resources use, hunting, outfitting, trapping, fishing, and recreation activities have negligible air and GHG emissions and therefore, do not warrant further consideration. Future mineral development activities are located further than 10 km from the Project and therefore, are not expected to have an overlapping effect with the Project with respect to air quality. Air emissions associated with advanced exploration within the site are likely to be short term in duration and much smaller in magnitude than project emissions.

The cumulative effects assessment for surface water quality (Chapter 9, Section 9.5.1) concluded that there was no potential for cumulative effects from the Project and other reasonably foreseeable projects. Factors considered in the evaluation of potential cumulative effects included:

- Past and present effects of historical mining activities on surface water quality in the LAAs have been included in the Project-specific residual effects assessment because these past effects are represented in the existing baseline conditions. Therefore, only present, or reasonably foreseeable projects that have potential to interact with the current Project are included in the cumulative effects assessment.
- Past and present resource activities (such as hunting, fish, and berry picking) and physical activities such as traditional land use, resource use activities, and recreation are not likely to have measurable residual effects on surface water quality and, thus, are not expected to interact cumulatively with Project residual effects to changes in water quality.

Future mineral exploration or mining project developments could contribute nutrients and metals to the local downstream aquatic environment. However, these projects would be expected to also implement mitigation measures to protect water quality, similar to what has been proposed for the Project. Any effects to water quality from other projects would likely be limited to a localized area downstream of the future exploration site or mine. These areas are outside of the Project LAAs where Project residual effects were identified and would not overlap spatially, so no cumulative effects would be expected. As discussed above, changes in air quality and surface water quality are the pathways through which the Project could alter human health risk from Baseline conditions. Therefore, the potential for the Project to act cumulatively with other reasonably foreseeable projects depends on the Project acting cumulatively with other projects to alter air quality and/or surface water quality. The air quality and surface water quality assessments determined that the Project would not act cumulatively with other reasonably foreseeable projects to alter air or surface water quality. In the absence of cumulative effects of the Project and other projects and activities on air quality or surface water quality, there is no potential for cumulative effects on human health from the Project and other reasonably foreseeable projects.

18.6 EFFECTS TO FEDERAL LANDS

Federal lands within the LAA and RAA for Human Health consist of Black Sturgeon Reserve, which falls within the LAA.

Air emissions from Project activities have the potential to alter ambient air quality on the Black Sturgeon Reserve. Future Case concentrations of COPC in ambient air on the Black Sturgeon Reserve are predicted to be below the applicable air quality benchmarks for each of the COPC considered in the assessment.

The deposition of Project-related dust onto soil has the potential to alter the quality of soil on the Black Sturgeon Reserve. Changes in soil quality on the Black Sturgeon Reserve have the potential to alter the quality of country foods (plants and animals) harvested on the Black Sturgeon Reserve. Increases in health risks related to exposure to COPC in soil and country foods on the Black Sturgeon Reserve are predicted to be negligible based on the assessment of the Gordon Region (which includes the Black Sturgeon Reserve).

Project-related activities at the Gordon Site have the potential to alter water quality in Hughes Lake which provides drinking water to the Black Sturgeon Reserve. Project activities at the Gordon Site are not predicted to change water quality in Hughes Lake.

Project effects on federal lands are anticipated to be similar to other receptors in the LAA as described in Sections 18.4 and 18.5.

18.7 DETERMINATION OF SIGNIFICANCE

18.7.1 Significance of Project Residual Effects

When predicted human health risks are less than the target benchmark, adverse health effects are not expected and correspondingly a change to human health is not expected. When Project-related health risks are greater than the benchmarks, then the change in human health risks may be significant (Section 18.4.2.1). Due to a strong conservative bias that arises from implicit conservative assumptions in HHRA methodologies, if predicted human health risks exceed the target benchmark, it does not necessarily indicate an adverse health effect is expected or that a change to health will occur; rather, this prompts a more in-depth review of assumptions and conservatism outlined in the HHRA to determine whether the assumptions are unreasonably precautionary.

With the implementation of mitigation measures for air and surface water, the potential for a change in human health related to exposures to COPC released to the atmosphere or surface water from Project activities, is not significant. The HHRA results indicate that:

- Health risks for most COPC will not exceed regulatory thresholds and where exceedances are predicted, they are due to baseline conditions, or

- Future Case inhalation exposures for 1-hour NO_2 and 2-hour DPM are predicted to exceed their respective regulatory thresholds on an infrequent basis. These exceedances are predicted to result in only minor exceedances of the regulatory limits (maximum calculated CR = 1.6 for 1-hour NO_2 in the work camp). For both 1-hour NO_2 and 2-hour DPM, the regulatory thresholds are based on respiratory effects that are transitory and where recovery occurs when contaminant concentrations return to levels below the regulatory limits. In addition, the 1-hour NO_2 and 2-hour DPM exceedances are predicted to occur sometime between 19:00 and 6:00, a time period where people would be unlikely to the present at the locations where the exceedances are predicted to occur. As a result, these exceedances would not be expected to represent a potential concern for human health.

Follow-up programs for surface water and air emissions will serve to confirm the HHRA predictions and this conclusion.

18.7.2 Significance of Effects on Federal Lands

The only federal land within the LAA and RAA is Black Sturgeon Reserve. Based on these results in Section 18.6, the residual environmental effects from changes to Human Health on federal land are predicted to be not significant.

18.8 PREDICTION CONFIDENCE

Confidence in predictions of residual effects on human health relies on the quality and quantity of baseline data, understanding of Project mechanisms, and risk assessment assumptions. Uncertainties associated with the environmental assessment of human health risks are addressed using conservative assumptions that err on the side of overestimating potential exposures and the associated health effects.

The quality and quantity of available scientific information on the air and water quality modelling predictions are adequate to have a high level of confidence in the conservatism of predictions for residual effects from the Project.

The health-based criteria used in the human health assessment have been developed by agencies and are designed to be protective of sensitive members of the population, including children and the elderly. The criteria established by agencies incorporate a high degree of scientific scrutiny in their development; therefore, there is a high degree of confidence that human toxicological benchmarks used in the assessment of residual effects will provide conservative (i.e., over predict) estimates of potential changes in human health. Based on the above, the conclusions presented herein related to changes to human health have been made with a high level of confidence.

18.9 FOLLOW-UP AND MONITORING

The results of follow-up and monitoring programs identified in the Atmospheric Environment VC (Chapter 6), Surface Water VC (Chapter 9), and the Fish and Fish Habitat VC (Chapter 10) can be used to confirm the conservative assumptions and modelling results applied in the Human Health VC. There are no additional future follow-up or monitoring events, that would be specifically required by the Human Health

VC beyond what is already planned within the Atmospheric Environment VC, Surface Water VC or the Fish and Fish Habitat VC.

In the event that an unexpected deterioration of the environment is observed as part of follow-up and/or monitoring, intervention mechanisms will include the adaptive management process described in Chapter 23, Section 23.2.

18.10 SUMMARY OF COMMITMENTS

Commitments made in the Chapter 6 to mitigate or manage reductions in diesel exhaust from off-road equipment and vehicles and to mitigate fugitive dust during construction and operation at the Gordon and MacLellan sites will also serve to mitigate potential human health risks associated with atmospheric releases of COPC from the Project.

Commitments made in Chapter 9 to implement surface water monitoring and management plans such as the collection and treatment of water to meet discharge criteria and operation of the TMF will also serve to mitigate potential human health risks.

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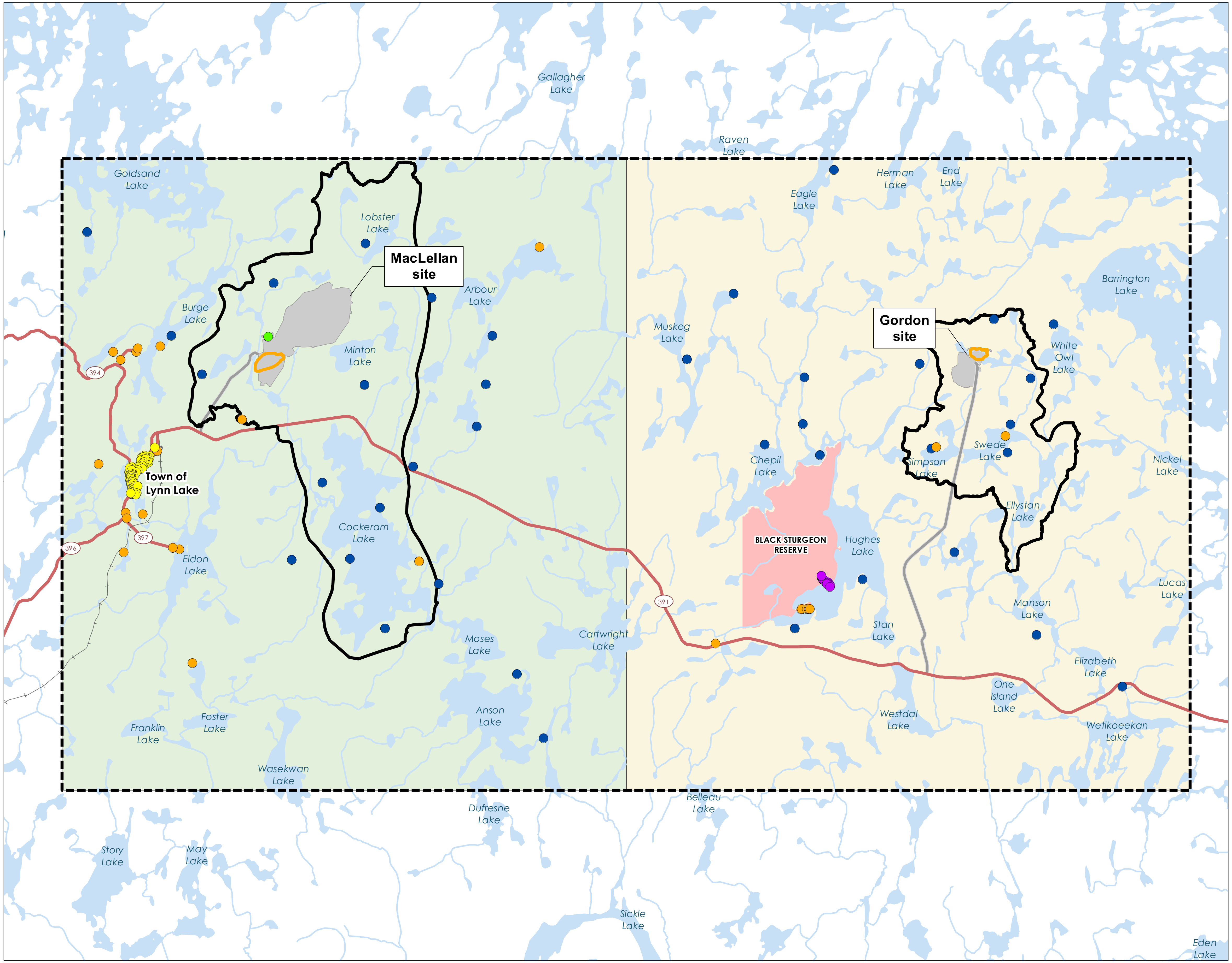

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ALAMOS GOLD INC.

Study Area

- Proposed Open Pit
- Project Development Area
- HHRA Local Assessment Area/Regional Assessment Area (LAA/RAA)
- Surface Water Local Assessment Area (LAA)
- Gordon region
- MacLellan region

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Remote Cabins and Recreational Sites
- Potential Indigenous Receptors
- Worker Camp

Landbase

- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- First Nation Reserve

N

0 2.5 5 Kilometres

(At original document size of 11x17)
1:175,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

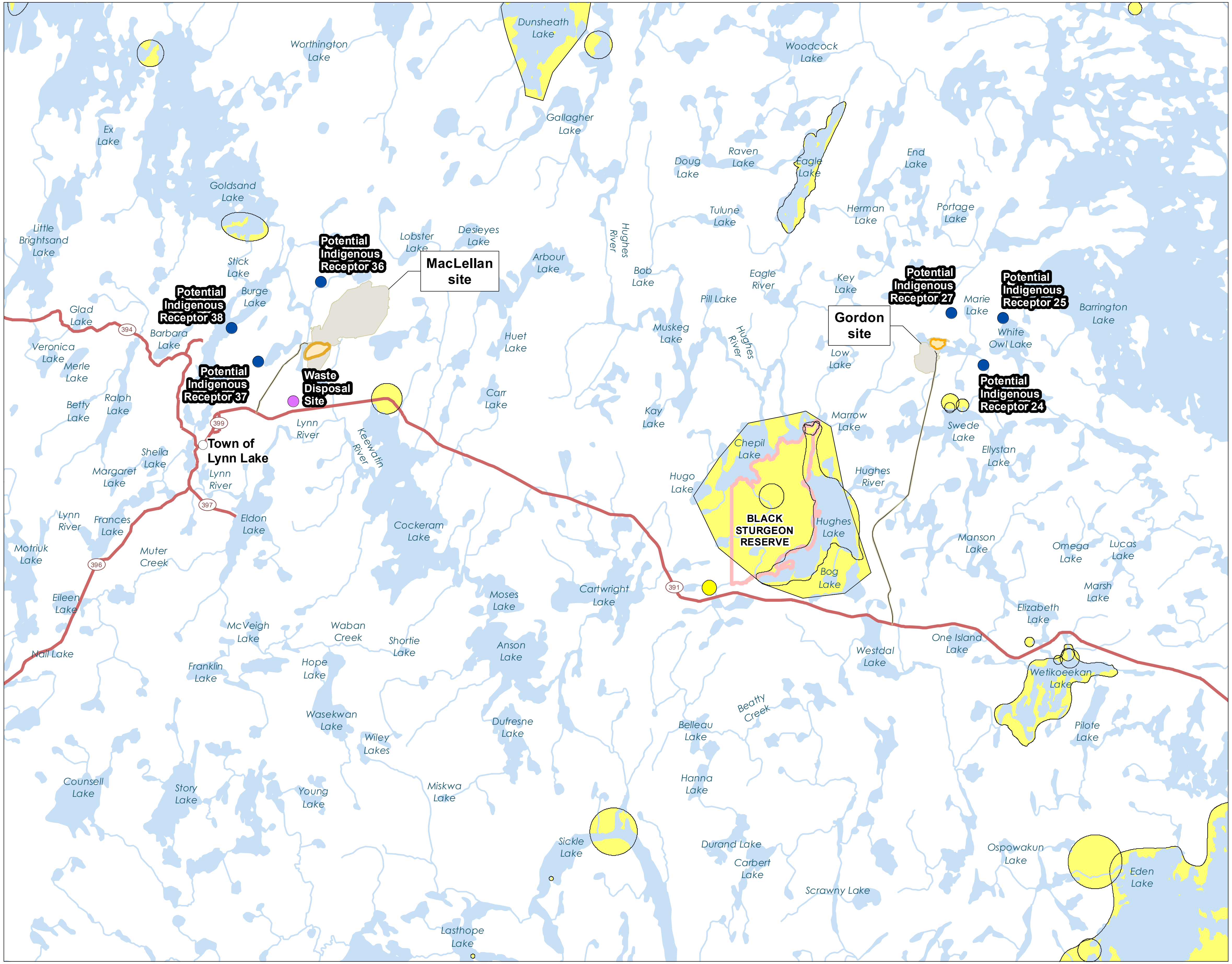
Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-04-09
Technical Review by TMcKnight-Whitford on 2020-04-09
Senior GIS Review by GKroupa on 2020-04-09

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
18-1

Title
Human Health Spatial Boundaries



Stantec

Alamos Gold Inc.

Project Infrastructure

- Proposed Open Pit
- Project Development Area

Receptor Type

- Land Use Site
- Potential Indigenous Receptors

Survey Locations

- Habitation Area

Landbase

- Existing Access Road
- Highway
- Watercourse
- Waterbody
- First Nation Reserve

N

0 2.5 5 Kilometres

(At original document size of 11x17)
1:200,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-04-09
Technical Review by TMcKnight-Whitford on 2020-04-09
Senior GIS Review by GKroupa on 2020-04-09

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
18-2

Title
Special Receptor Locations with Occasional 1-Hour NO_2 Exceedances

ALAMOS GOLD INC.

Lynn Lake Gold Project Environmental Impact Statement Chapter 19 – Assessment of Potential Effects to Indigenous Peoples

Stantec

Prepared by:

Stantec Consulting Ltd.

May 25, 2020

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Acronyms and Abbreviations

Alamos	Alamos Gold Inc.
ATEC	Atoskiwin Training and Employment Centre
CAAQS	Canadian Ambient Air Quality Standards
CEAA 2012	*Canadian Environmental Assessment Act, 2012*
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
CIZ	community interest zone
CMU	Caribou Management Unit
COPC	chemical of potential concern
CWB	community well being
EA	Environmental Assessment
EIS	environmental impact statement
FNIHB	First Nations and Inuit Health Branch
HCRPP	Heritage and Cultural Resources Protection Plan
HHERA	Human Health and Ecological Risk Assessment
HRIA	Heritage Resources Impact Assessment
IAAC	Impact Assessment Agency of Canada
ISC	Indigenous Services Canada
LAA	local assessment area
MINR	Manitoba Department of Indigenous and Northern Relations
MSCH	Manitoba Sport, Culture, and Heritage
MSD	Manitoba Sustainable Development
NRTA	Natural Resources Transfer Agreement
PBGoC	Peter Ballantyne Group of Companies

PDA	Project development area
PR	provincial road
RAA	regional assessment area
RHA	Regional Health Authority
RHS	Regional Health Survey
SVS	Shared Value Solutions
STARS	Shock Trauma Air Rescue Society
TLE	Treaty Land Entitlement
TLU	Traditional Land Use
TLRU	Traditional Land and Resource Use
TMR	technical modelling report
VC	valued component

19.0 ASSESSMENT OF POTENTIAL EFFECTS TO INDIGENOUS PEOPLES

This Chapter considers potential effects on Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage, current use of lands and resources for traditional purposes (hereinafter referred to as 'Current Use') and Indigenous or Treaty Rights in accordance with the requirements described in both federal and provincial guidance documents for the Project. Given recent terminology changes issued by the Federal government[1], the term 'Indigenous' is used in this chapter rather than 'Aboriginal'. 'Indigenous Peoples' has the same meaning as the definition for 'Aboriginal peoples of Canada' found in subsection 35(2) of the *Constitution Act,* 1982 (CanLII 2019) - unless specifically referring to Aboriginal Rights as identified in Section 35 of the *Constitution Act, 1982*.

Section 6.1.9 of the Canadian Environmental Assessment Agency[2] EIS Final Guidelines for the Project (Final EIS Guidelines; Appendix 4A) describes the requirements to address health, social conditions, and physical and cultural heritage of Indigenous peoples.

Chapter 4, Section 4.2.1 of the EIS describes VCs as features of the environment that may be affected by the Project and the value people place on it. The Indigenous Peoples assessment is an integrated assessment of Indigenous health, Indigenous socio-economic conditions, Current Use, and Indigenous physical and cultural heritage VCs because of the potential for the Project to affect Indigenous communities[3] (Section 19.2). To accomplish this, this assessment considers the conclusions of the assessments of related biophysical and socio-economic VCs, including Human Health, Land and Resource Use, Community Services, Infrastructure and Wellbeing, Labour and Economy, Heritage Resources, and Current Use. It is important to note that while Current Use information has been included in this chapter, Chapter 17 already provides an environmental effects assessment and residual effects characterization for Current Use; therefore, the findings of that chapter have not been reassessed here but summarized instead.

This assessment assumes that the exercise of traditional activities depends on the health and abundance of traditionally harvested species and the continued availability of and access to traditional use sites and areas. A review of information gathered during the Indigenous engagement process for the Project (Chapter 3, Section 3.3), reports from Traditional Land and Resource Use (TLRU) studies conducted for the Project, and publicly available literature, as well as the analysis of relevant biophysical and socio-economic assessments in the EIS (where residual effects are predicted), concludes that the Project has the potential

[1] As identified in the Impact Assessment Act, 2019, "Indigenous" has the meaning assigned by the definition of Aboriginal peoples of Canada in subsection 35(2) of the *Constitution Act, 1982*: (2) In this *Act*, "aboriginal peoples of Canada" includes Indian, Inuit, and Métis peoples of Canada. The language conventions applied in the *Impact Assessment Act*, have been applied to this chapter.
[2] As of June 21, 2019, the CEA Agency became the Impact Assessment Agency of Canada (IAAC). Documents or direction provided after this date are attributed to IAAC.
[3] Indigenous communities is used to align with the terminology used by Crown-Indigenous Relations and Northern Affairs Canada www.rcaanc-cirnac.gc.ca/eng; Manitoba Indigenous and Northern Relations https://www.gov.mb.ca/inr; the Government of Saskatchewan https://www.saskatchewan.ca/residents/first-nations-citizens/duty-to-consult-first-nations-and-metis-communities; and the CEAA Guidelines (2017).

to affect health and socio-economic conditions of Indigenous communities. Therefore, an assessment of these potential effects is presented in this chapter.

This chapter also provides an assessment of potential effects on Indigenous or Treaty Rights drawing on the information sources, methods, and findings of the preceding chapters of the EIS, where appropriate.

The Final Guidelines (Appendix 4A) include a list of Indigenous communities which Alamos Gold Inc. (Alamos) is expected to engage for the environmental assessment (EA). Indigenous communities identified in Section 5.1, Chapter 5 of the Final EIS Guidelines that are expected to be 'most affected by the Project' include:

- Marcel Colomb First Nation
- Mathias Colomb Cree Nation
- Nisichawayasihk Cree Nation
- O-Pipon-Na-Piwin Cree Nation
- Manitoba Metis[4] Federation
- Peter Ballantyne Cree Nation
- Barren Lands First Nation.

In addition, Indigenous communities identified in the Final EIS Guidelines that 'may also be affected, but to a lesser degree', include:

- Métis Nation – Saskatchewan Northern Region 1
- Métis Nation – Saskatchewan Eastern Region 1
- Hatchet Lake First Nation
- Northlands Denesuline First Nation
- Sayisi Dene First Nation.

Profiles for each Indigenous community engaged on the Project can be found in Chapter 3, Section 3.3.3. Map 19-1 provides an overview of the location of each engaged Indigenous community in relation to the Project.

[4] A note on terminology: Manitoba Metis Federation spell Metis without the *accent aigu*. Consequently, this spelling of Metis has been retained for 'Manitoba Metis Federation' and the usage of Metis in Manitoba Metis Federation documents and policies (e.g., Recognized Metis Harvesting Area; Metis Laws of the Harvest). Elsewhere in this document, Métis is spelled with the *accent aigu* to follow common usage (e.g., Métis Nation – Saskatchewan; Métis Rights).

19.1 SCOPE OF ASSESSMENT

19.1.1 Regulatory and Policy Setting

19.1.1.1 Federal Regulations

As noted above, the assessment of Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage has been conducted in conformity with the requirements of CEAA 2012 contained in Paragraph 5(1)(c) and the Final EIS Guidelines (Appendix 4A), including analysis of how changes to the environment caused by the Project will affect activities exercised by Indigenous communities as outlined in Section 6.3.4 of Chapter 6 of the Final EIS Guidelines.

Section 19.9 provides further consideration of effects to Indigenous or Treaty Rights (on a community-by-community basis).

19.1.1.2 Provincial Regulations

The Government of Manitoba established the *Northern Affairs Act* in 1966 (most recent revision in 2006), which provides a framework through which designated northern communities located within an unorganized territory of Manitoba receive municipal services. This framework is also aimed at coordinating interprovincial and interjurisdictional initiatives, policies, and strategies affecting northern Manitoba.

Manitoba's Department of Indigenous and Northern Relations (MINR) has developed an interim provincial policy for Crown consultation with First Nations, Métis Nations, and other Indigenous communities (MINR 2019). This policy recognizes Manitoba's duty to consult with First Nations, Métis Nations, and other Indigenous communities when any proposed action has the potential to adversely affect the exercise of Treaty or Indigenous rights.

In Manitoba, public health is the responsibility of the Manitoba Ministry of Health, Seniors and Active Living, in accordance with *The Public Health Act*. Health Canada's mandate includes the protection of human health from exposure to chemicals in the environment.

19.1.1.3 Indigenous Engagement Process

As outlined in the Indigenous Community Engagement Plan (Chapter 3, Section 3.3.1), the objectives of the Indigenous community engagement process are twofold: it is a way of providing meaningful opportunities for potentially affected Indigenous communities to receive information about the Project and a platform for Alamos to hear and understand Indigenous concerns and comments regarding the Project. The Indigenous community engagement process also gathers information in support of decisions regarding effects to Aboriginal and Treaty rights (as discussed in Section 19.9), as part of Crown consultation under Section 35 of the *Constitution Act, 1982*.

As discussed in the engagement chapter (Chapter 3, Section 3.3.2), Pickerel Narrows Cree Nation was also initially identified as potentially affected by the Project, but to a lesser degree; however, upon discussions with the IAAC, it was determined that Indigenous Services Canada recognizes the Granville Lake Indian Settlement (referred to as the Granville Lake community) as a reserve under the governance of Mathias Colomb Cree Nation, and therefore Pickerel Narrows Cree Nation is not discussed for the purposes of this EIS as a separately governed Indigenous community (CEA Agency pers. comm. 2018). The Granville Lake community represents the same community as Pickerel Narrows Cree Nation. The IAAC advised that until the Granville Lake community holds a referendum to be recognized as an independent First Nation (i.e., Pickerel Narrows Cree Nation), members of the Granville Lake community are members of Mathias Colomb Cree Nation. As such, the IAAC advised that engagement concerning potential effects of the Project to the Granville Lake community should occur through Mathias Colomb Cree Nation leadership. These communities, collectively, were included in the engagement process for the Project, and for the purposes of the EIS, Pickerel Narrows Cree Nation is not discussed as a separately governed Indigenous community (CEA Agency pers. comm. 2018).

Alamos funded studies with Marcel Colomb First Nation, Peter Ballantyne Cree Nation, Mathias Colomb Cree Nation, and Manitoba Metis Federation. At the time of application submission, three studies, including a TLRU study from Marcel Colomb First Nation (Appendix 17A; Stantec 2018), and the Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study for the Lynn Lake Gold Mine Project (Appendix 17A; SVS 2020), were available for review. While the TLRU study from Peter Ballantyne Cree Nation was complete at the time of writing, it had not yet been released by Peter Ballantyne Cree Nation for incorporation into the EIS. Where appropriate, information from the Marcel Colomb First Nation and Manitoba Metis Federation studies has been included in the EIS for the Project, in accordance with the terms of use discussed with respective Indigenous communities. A Project-specific TLRU study is currently being conducted by an independent consultant for Mathias Colomb Cree Nation. Should Mathias Colomb Cree Nation or Peter Ballantyne Cree Nation release the results of their respective TLRU studies, that information will be considered in supplemental filings to the EIS.

A discussion of Alamos's engagement process (from between November 19, 2014 and May 22, 2020), is provided in Chapter 3 of the EIS. Individual profiles for each engaged Indigenous community can be found in Chapter 3 (Section 3.3.3). Alamos has been engaging with Marcel Colomb First Nation for the Project since 2014; Alamos has been engaging with the additional 11 Indigenous communities potentially affected by the Project since 2017. Alamos has undertaken engagement prior to and throughout the preparation of the EIS and has worked with Indigenous communities to document and, where feasible, address Project-related concerns.

Table 19-1 summarizes issues and concerns relevant to Indigenous health, socio-economic conditions, and physical and cultural heritage, which have been raised through engagement since 2014 through to May 22, 2020.

Table 19-1 Summary of Issues Identified Through Engagement[5]

Issue or Concern	Indigenous community
Effects to soils	Marcel Colomb First Nation
Desire for baseline studies	Marcel Colomb First Nation, Mathias Colomb Cree Nation
Effects to atmospheric environment, noise and vibration	Barren Lands First Nation, Mathias Colomb Cree Nation, Marcel Colomb First Nation, Nisichawayasihk Cree Nation, Manitoba Metis Federation
Indigenous or Treaty Rights, Indigenous Agreements, and Protocols	Marcel Colomb First Nation, Mathias Colomb Cree Nation, Nisichawayasihk Cree Nation, O-Pipon-Na-Piwin Cree Nation, Manitoba Metis Federation
Effects to fish and fish habitat	Marcel Colomb First Nation, Mathias Colomb Cree Nation, Nisichawayasihk Cree Nation, Manitoba Metis Federation
Effects to water quality	Barren Lands First Nation, Marcel Colomb First Nation, Nisichawayasihk Cree Nation, Manitoba Metis Federation, O-Pipon-Na-Piwin Cree Nation, Peter Ballantyne Cree Nation, Mathias Colomb Cree Nation
Effects to vegetation and wetlands	Marcel Colomb First Nation, Nisichawayasihk Cree Nation, Manitoba Metis Federation
Effects to wildlife and wildlife habitat	Barren Lands First Nation, Hatchet Lake First Nation, Marcel Colomb First Nation, Mathias Colomb Cree Nation, Nisichawayasihk Cree Nation, Manitoba Metis Federation, Métis Nation of Saskatchewan – Eastern Region
Effects to the terrestrial environment	Barren Lands First Nation, Hatchet Lake First Nation, Mathias Colomb Cree Nation
Effects on heritage resources	Marcel Colomb First Nation, Mathias Colomb Cree Nation
Consideration of TEK and TK during the Project	Marcel Colomb First Nation, Mathias Colomb Cree Nation, Manitoba Metis Federation
Consideration of TLRU studies during the Project	Mathias Colomb Cree Nation, Marcel Colomb First Nation, Manitoba Metis Federation, Peter Ballantyne Cree Nation
Opportunities for Project-related training and employment	Barren Lands First Nation, Hatchet Lake First Nation, Mathias Colomb Cree Nation, Marcel Colomb First Nation, Manitoba Metis Federation, Nisichawayasihk Cree Nation, O-Pipon-Na-Piwin Cree Nation, Peter Ballantyne Cree Nation, Sayisi Dene First Nation, Northlands Denesuline First Nation
Opportunities for Project-related business	Marcel Colomb First Nation, Nisichawayasihk Cree Nation, Peter Ballantyne Cree Nation, Manitoba Metis Federation
Compensation offered for effects on traditional activities	Marcel Colomb First Nation, Mathias Colomb Cree Nation. Manitoba Metis Federation
Cumulative effects as a result of the Project	Marcel Colomb First Nation, Mathias Colomb Cree Nation, Manitoba Metis Federation
Level of engagement with Indigenous communities	Manitoba Metis Federation, Marcel Colomb First Nation, Nisichawayasihk Cree Nation, O-Pipon-Na-Piwin Cree Nation

[5] Specific comments and concerns raised by Indigenous communities are included in Chapter 3, Section 3.3.6, Table 3-8.

Table 19-1 Summary of Issues Identified Through Engagement[5]

Issue or Concern	Indigenous community
Socio-Economic effects	Marcel Colomb First Nation, Mathias Colomb Cree Nation, Manitoba Metis Federation
Community Services and Infrastructure effects	Marcel Colomb First Nation, Nisichawayasihk Cree Nation

Consideration of Additional Indigenous Information

While the information in this EIS is current to May 22, 2020, Alamos is committed to ongoing Indigenous engagement and will continue to provide opportunities for potentially affected Indigenous communities to share concerns and issues about the Project through the Indigenous engagement process described in Chapter 3. Alamos has employed a thorough and consistent method for considering Indigenous and community knowledge as shared by Indigenous communities. As further information is received, Alamos will apply this same methodology going forward, described in further detail below. Alamos will review additional Indigenous information in the context of the EIS and provide a written response to the Indigenous community providing the information. Alamos will provide information on Indigenous feedback and perspectives to the IAAC as a supplementary filing in January 2021.

The methodology for considering newly received Indigenous and community knowledge will review and summarize the information into a tabular format organized into the following categories:

1. TLRU Information

   This includes information shared by Indigenous groups regarding existing conditions and potential Project effects. The information is organized under the following categories:

   - Traditional Knowledge
     - hydrogeology (groundwater)
     - hydrology
     - surface water quality
     - fish and fish habitat
     - vegetation and wetlands
     - wildlife and biodiversity
   - TLRU
     - hunting
     - fishing
     - trapping
     - plant harvesting
     - travel
     - cultural, spiritual, and ceremonial practices or areas
   - Project design
   - Cumulative effects.

2. Location of Sites or Areas

   This considers where the specific sites or areas identified by Indigenous groups are in relation to the Project, including PDA, LAA, or RAA, and in geographical reference to specific Project components such as the diversion channel, off-stream dam, and floodplain berm.

3. Relevant EIS Section

   This identifies which sections of the EIS the Indigenous and community knowledge and concerns may be applicable to.

4. Proposed Mitigation Measures

   This identifies the relevant mitigation measures proposed in the EIS to mitigate potential effects from the Project relative to Indigenous and community knowledge and concerns identified in the TLRU Information category.

The purpose of this tabular summary is to categorize applicable TLRU information within relevant EIS categories to facilitate consideration of new information against the results of biophysical and socio-economic VCs, including characterization of existing conditions, assessment of potential effects, identification of thresholds and limits, proposed mitigation measures and monitoring, and consideration of cumulative effects. The objective is to determine if any new effects have been identified by the information shared by Indigenous communities that have not been assessed in the EIS and whether additional mitigation may be required.

19.1.1.4 The Influence of Engagement on the Assessment

This section summarizes the influence of engagement on the assessment. The information and concerns obtained from Indigenous communities engaged on the Project are described here, and considered with respect to Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage. As an example, when considering Indigenous health, it is important to understand that a change to water quality can have more than one effect, from rendering drinking water unsafe, to interrupting animal migration patterns, to triggering a change in an aquatic, terrestrial, or fowl species that Indigenous peoples rely upon as a source of food.

Current Use information available (to May 22, 2020) for the Indigenous communities engaged on the Project was incorporated into this section, as was information relevant to Labour and Economy (Chapter 13), Community Services, Infrastructure and Wellbeing (Chapter 14), Land and Resource Use (Chapter 15), Heritage Resources (Chapter 16), and Human Health (Chapter 18). Information was also provided through the Indigenous engagement process for the Project, and Project-specific TLRU studies.

Indigenous Health

This section summarizes the effect of engagement on the assessment of Indigenous health and is not intended to be a comprehensive list.

First Nations

Through the Indigenous engagement process for the Project and through the Project-specific TLRU study, Marcel Colomb First Nation expressed concerns about effects to species of value, including fish (including whitefish, northern pike, and walleye) and birds (including geese, “chickens” [spruce grouse], ducks, and ptarmigans). Marcel Colomb First Nation also expressed concerns about effects on air quality and water quality, terrestrial habitat, vegetation, and mammals, such as moose and caribou.

Peter Ballantyne Cree Nation reported concerns related to effects to waterways, including Reindeer Lake and effects to traditional food sources, such as caribou. Hatchet Lake First Nation expressed concerns related to effects to barren ground caribou, a key species. Barren Lands First Nation expressed concerns regarding air quality, water quality, and barren ground caribou, an important traditional food source, and O-Pipon-Na-Piwin Cree Nation had concerns regarding water quality and environmental effects to its resources.

Métis Governments

Through the Project-specific Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study (Appendix 17A; SVS 2020), Manitoba Metis Federation expressed concerns about declining moose populations and about changes in caribou ranges and migration patterns. Manitoba Metis Federation stated that this may be attributed to increased human presence or increased temperatures. Manitoba Metis Federation has also observed a decline in ptarmigan population. Manitoba Metis Federation also expressed concern about chemicals in tailings ponds entering waterways and having an effect on water, plants, fish, and wildlife and dust from tailings resulting in a yellow residue on the land. Manitoba Metis Federation stated that humans may become sick as a result of consuming foods that have been affected by tailings. An additional concern identified by Manitoba Metis Federation is that with an influx of a transient workforce who may not be invested in the local environment, litter will increase, which will affect the lands and waters. Manitoba Metis Federation also expressed concern that the Town of Lynn Lake has been under a boil water advisory for many years.

Through the Indigenous engagement process for the Project, Métis Nation of Saskatchewan – Eastern Region 1 expressed concerns regarding Project-related effects on woodland caribou migration.

Summary

The assessment of Indigenous health was scoped to consider species of value identified by Indigenous communities. Potential changes in the availability of species harvested for country food was considered in Current Use (Chapter 17) and carried forward into the assessment of quantity and quality of country foods in Section 19.4.3. The potential for Project activities to affect Indigenous health conditions through changes in consumption of caribou was considered; however, no pathways through which this effect could take place were identified. Further explanation is found in Section 19.3.

Potential effects on Indigenous health conditions arising from changes to air quality and water quality are accounted for through the identification of Indigenous Receptors and evaluating inhalation and ingestion risks, which are considered in Sections 19.2.2.1, 19.4.3, and 19.5.2.

Labour and Economy, Community Services, Infrastructure and Wellbeing

This section summarizes the effect of engagement on the assessment of labor and economy, community services, infrastructure, and wellbeing, and is not intended to be a comprehensive list.

First Nations

Through the Indigenous engagement process for the Project, Marcel Colomb First Nation expressed interest in economic opportunities related to the Project and more local opportunities. Concurrently, Marcel Colomb First Nation is concerned with potential adverse effects of the Project, including lack of capacity to benefit from the Project, and the potential lack of training, which could have effects on the Project-related opportunities available to the community. Marcel Colomb First Nation expressed the need for Project contractors to take cultural sensitivity training and the need for a Community Liaison to mentor Marcel Colomb First Nation trainees and employees.

Through the Indigenous engagement process for the Project, Marcel Colomb First Nation is interested in establishing accommodation measures in the event that traplines located in proximity to the Project are affected; Marcel Colomb First Nation also expressed concern about damage or depreciation of Marcel Colomb First Nation's water hauling equipment required by Project activities, which is discussed in Section 19.4.4.3. Mathias Colomb Cree Nation is interested in training opportunities; these opportunities are discussed in Section 19.4.4.

Through the Indigenous engagement process for the Project, Peter Ballantyne Cree Nation expressed concern that local people will be pushed out of their jobs by Project-related activity. Peter Ballantyne Cree Nation expressed an interest in economic benefits or opportunities, commitments to employment opportunities, and training that may result from the Project. Peter Ballantyne Cree Nation is also interested in partnerships and has proposed that a formal agreement be concluded with guaranteed employment quotas for Peter Ballantyne Cree Nation.

O-Pipon-Na-Piwin Cree Nation expressed interest in workforce and business opportunities and noted that some treaty land entitlements (TLEs) are located close to the Gordon site, within the RAA (for more on TLEs, see Sections 19.7.1.1 and 19.7.2.8). Nisichawayasihk Cree Nation expressed interest in opportunities for Nisichawayasihk Cree Nation businesses related to the Project, as well as employment for Nisichawayasihk Cree Nation. Nisichawayasihk Cree Nation is also interested in Project-related partnerships and proposed the building of housing for the Project workforce as part of a training alliance. Nisichawayasihk Cree Nation also indicated interest in being incorporated into an Atoskiwin Training and Employment Centre (ATEC) housing build partnership for the Project, as part of a carpenter training program. Project-related training and potential partnerships are discussed in Section 19.4.4.

Through the engagement process for the Project, First Nations generally expressed interest in employment and business opportunities. Hatchet Lake First Nation indicated its members have experience with mining and expressed an interest in employment and opportunities that may result from the Project. Barren Lands First Nation Chief and Council noted that the potential for Project-related job creation was positive. Sayisi Dene First Nation and Northlands Denesuline First Nation also expressed interest in being integrated into future labour opportunities.

Métis Governments

Manitoba Metis Federation inquired as to potential economic development opportunities associated with the Project, and described Manitoba Metis Federation's capacity to provide services, including construction services. Manitoba Metis Federation is interested in discussing mandatory minimums for Indigenous content in procurement, and recommended communication regarding potential joint venture agreements in advance of committing as partners.

Summary

The socio-economic concerns brought forward by engaged Indigenous communities are addressed in Section 19.4.4, along with relevant mitigation measures. These include effects to socio-economic conditions through the depletion of traditional resources such as fish and wildlife by non-Indigenous peoples; effects to local job security as a result of the Project; the potential effects of a mining camp and transient workers; rise in local crime rates as a result of the Project; socio-economic effects of a sudden mine closure; effects to trade economy through Project-related damages to traplines; and wear resulting from the use of Indigenous community-owned equipment that may be employed on the Project.

Heritage Resources

This section summarizes the effect of engagement on the assessment of heritage resources and is not intended to be a comprehensive list.

Through the Indigenous engagement process for the Project, Marcel Colomb First Nation expressed concern about unmarked traditional burial grounds potentially being disturbed by Project-related activity. Physical and cultural heritage concerns brought forward by engaged Indigenous communities are addressed in Section 19.4.5, along with relevant mitigation measures.

Cumulative Effects

This section summarizes the effect of engagement on the assessment of cumulative effects and is not intended to be a comprehensive list.

First Nations

Through the Indigenous engagement process for the Project, Marcel Colomb First Nation expressed concerns about ongoing industrial activities in the region where the Project is located. Mathias Colomb Cree Nation expressed concern about cumulative health effects on vulnerable people.

Métis Governments

Manitoba Metis Federation also expressed concern regarding the cumulative effects of projects on restricting resource use and availability for the Manitoba Métis Community citizens.

Summary

Concerns relayed by Indigenous communities regarding cumulative effects of the Project are addressed in Sections 19.5.2–19.5.5, along with relevant mitigation measures.

19.1.2 Identification of Related VCs and Effect Pathways

19.1.2.1 Overview

The discussion of Project effects to Indigenous peoples has been divided into effects on Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage. The assessment of these conditions relies on the results of the assessments of related biophysical and socio-economic VCs. This section identifies the related biophysical and socio-economic VCs and associated residual effects that are considered with respect to the assessment of 5(1)(c) Factors for Indigenous peoples. The identification of related VCs considers the effect pathways that could potentially affect Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage prior to the application of mitigation measures.

19.1.2.2 Identification of Related Valued Components

The assessment of Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage focuses on the interactions among changes to related biophysical and socio-economic VCs and change in conditions, attributes, sites, lands, resources, or structures of relevance for Indigenous communities. The interrelationship among various related biophysical and socio-economic VCs plays an important role in how changes to the environment may affect the conditions and material circumstances of Indigenous communities. For example, changes in surface water quality may influence fish health, which could in turn affect country foods and Indigenous health conditions.

The assessment of environmental effects on Land and Resource Use (Chapter 15), Current Use of Lands and Resources for Traditional Purposes (Chapter 17), and Human Health (Chapter 18) incorporate information from several other related VCs. For example, the Human Health VC incorporates the assessment of a change in air quality from the Atmospheric Environment VC (Chapter 6), and a change in surface water quality from the Surface Water VC (Chapter 9) as direct and indirect pathways that could affect human health. Similarly, the Current Use of Lands and Resources for Traditional Purposes VC relies on information presented in the Fish and Fish Habitat VC (Chapter 10), Vegetation and Wetlands VC (Chapter 11), and Wildlife and Wildlife Habitat VC (Chapter 12) in terms of the continued viability of those plant and animal populations to enable traditional use to occur. Figure 19-1 illustrates the biophysical and socio-economic VCs which are directly and indirectly incorporated into the assessment of Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage.

The Project effect pathways, which have been carried forward into the assessment of Indigenous health conditions, Indigenous socio-economic conditions and Indigenous physical and cultural heritage are identified in Tables 19-3, 19-4, and 19-5 below. These tables also identify the VC chapter where this potential effect is also assessed as it applies to the wider environmental and socio-economic context in which the Project is proposed. For example, Human Health (Chapter 18) assesses changes to human health through ingestion and inhalation, and that information is carried forward into this chapter.

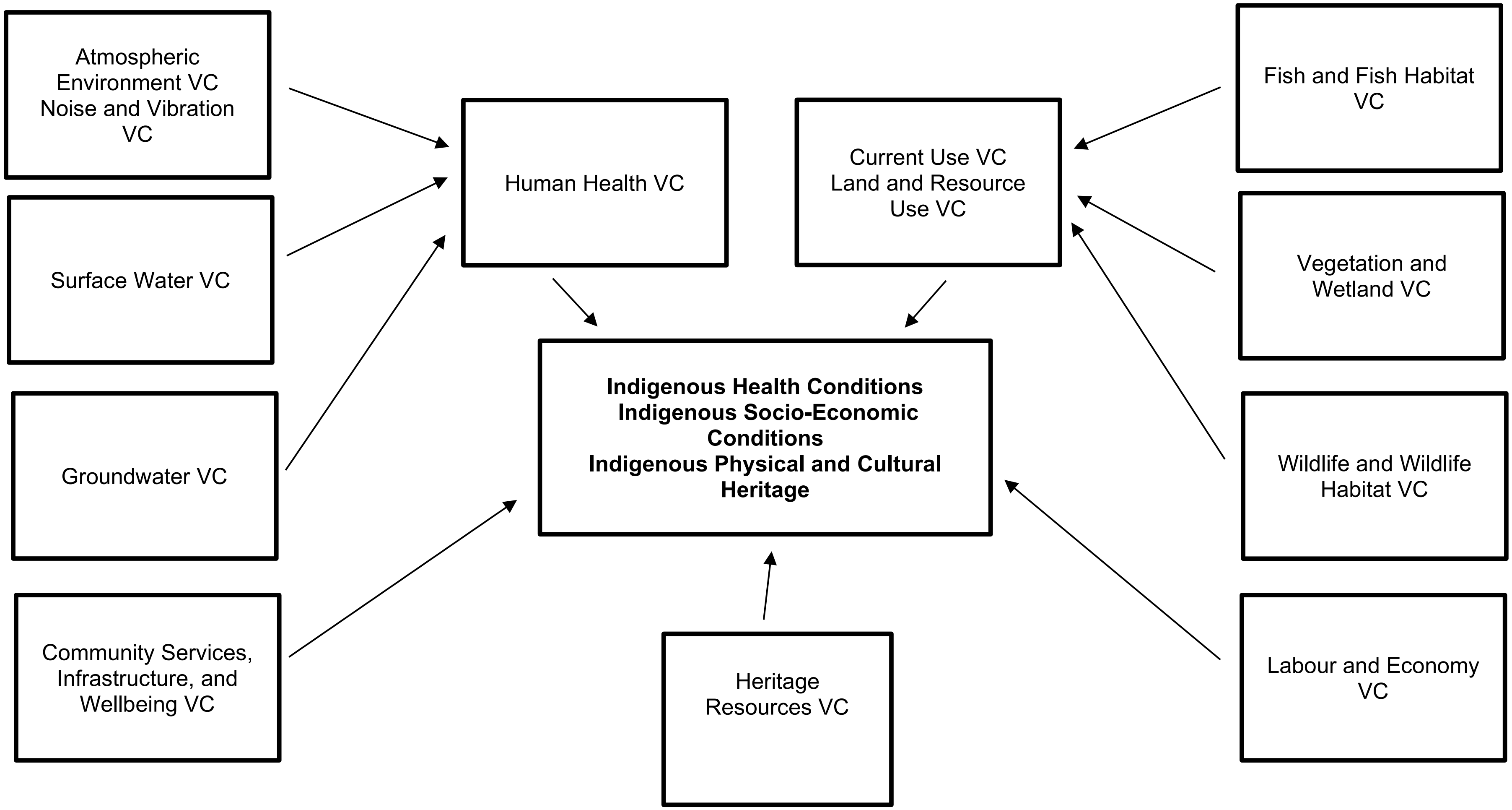
19.1.2.3 Pathways Carried Forward for Indigenous Health Conditions

Project effects pathways for the assessment of Indigenous health conditions are outlined below in Table 19-2.

Table 19-2 VCs and Potential Effect Pathways Related to Indigenous Health Conditions

Valued Component	Potential effect assessed in related VC	Effect pathways carried forward for Indigenous health conditions
Current Use (Chapter 17, Sections 17.4.2-17.4.4)	Change in availability of lands and resources currently used for traditional purposes	Project construction and operation have the potential to affect Indigenous health conditions through a reduction in the quantity of country foods to harvest.
	Change in access and resources currently used for traditional purposes	Project construction and operation have the potential to affect Indigenous health conditions through a change in access to country foods to harvest.
	Change to traditional cultural and spiritual sites and areas	Construction and operation activities have the potential to affect Indigenous health conditions through a reduction in the value and perceived quality of country foods.
Human Health (Chapter 18, Section 18.4.2)	Change to Human Health	Construction and operation of the Project may affect Indigenous health conditions through changes in air quality, changes in noise, changes in water quality, and country foods.

Figure 19-1 Valued Components Related to Indigenous Health, Indigenous Socio-Economic Conditions, and Indigenous Physical and Cultural Heritage



19.1.2.4 Pathways Carried Forward for Indigenous Socio-Economic Conditions

Project effects pathways for the assessment of Indigenous socio-economic conditions are outlined below in Table 19-3.

Table 19-3 VCs and Potential Effect Pathways to Indigenous Socio-Economic Conditions

Valued Component	Potential effect assessed in Related VC	Effect pathways carried forward for Indigenous Socio-Economic conditions
Land and Resource Use (Chapter 15, Sections 15.5.2-15.5.4)	Change in land use	Project construction and operation activities have the potential to affect Indigenous socio-economic conditions through disturbance and nuisance effects (noise, dust, visuals).
	Change in recreation	Project construction and operation activities may change Indigenous socio-economic conditions by resulting in loss of area available for recreational use, access to or quality of recreational use.
	Change in resource use	Project construction and operation activities may change Indigenous socio-economic conditions by affecting commercial activities that Indigenous peoples engage in, such as fishing, hunting, trapping, gathering.
Community Services, Infrastructure, and Wellbeing (Chapter 14, Sections 14.5.2-14.5.5)	Change in housing and temporary accommodations	Construction activities for the Project may result in increased workforce demand for temporary housing and accommodations, affecting off-reserve members of Indigenous communities.
	Change in local services and infrastructure	The workforce required for construction and operation of the Project may increase demand for services that Indigenous peoples use, such as fire and police, roads and medical.
	Change in transportation services and infrastructure	Project-related construction and operation will increase traffic on roadways, including PR 391, which is used by Indigenous communities.
	Change in community wellbeing	The Project-related employment may increase disposable income, reduce financial barriers to beneficial health practices, change the demographics of nearby communities and result in changes of sense of place, alter participation in recreational, subsistence, and family-related activities.
Labour and Economy (Chapter 13, Sections 13.4.2,13.4.3)	Change in regional labour force	An increased workforce associated with the Project could lead fewer workers available for local positions and an increase in wages.
	Change in regional business	Project spending could affect local and region businesses, including those owned or operated by Indigenous communities.

19.1.2.5 Pathways Carried Forward for Indigenous Physical and Cultural Heritage

Project effects pathways for the assessment of Indigenous physical and cultural heritage are outlined below in Table 19-4.

Table 19-4 VCs and Potential Effect Pathways to Indigenous Physical and Cultural Heritage

Valued Component	Potential Effect assessed in Related VC	Effect pathways carried forward for Indigenous Physical and Cultural Heritage
Heritage Resources (Chapter 16, Section 16.4.2)	Change to the number of heritage sites	Project construction and operation could affect or reduce the number of heritage sites important to Indigenous communities.
Current Use (Chapter 17, Sections 17.4.2,17.4.4)	Change in access to resources currently used for traditional purposes	Project construction and operation has the potential to affect Indigenous physical and cultural heritage through changing access to plant and animal species of value to Indigenous communities, as well as areas and sites of cultural value.
	Change to traditional cultural and spiritual sites and areas	Project construction and operation has the potential to affect cultural and spiritual sites, such that their value to Indigenous peoples is compromised or reduced.

19.1.3 Boundaries

19.1.3.1 Spatial Boundaries

Spatial boundaries for Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage were determined through a review of information from Indigenous communities, related biophysical and socio-economic VCs, and professional judgement. Indigenous communities may identify spatial boundaries in relation to their traditional lands or territories. However, boundaries identified by Indigenous communities can vary considerably, and aligning Indigenous health, socio-economic, and physical and cultural heritage boundaries with those of relevant VCs provides a more comprehensive view of effects and increases predictive confidence.

The Project development area (PDA), local assessment area (LAA), and regional assessment area (RAA) for the assessment of effects on Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are shown in Maps 19-2 and 19-3 and are described below.

Project Development Area

The Project Development Area (PDA) encompasses the immediate area in which Project activities and components may occur plus a 30-metre (m) buffer and is the anticipated area of direct physical disturbance associated with construction and operation of the Project (i.e., the Project footprint).

Local Assessment Area

The local assessment area (LAA) for Indigenous health conditions and Indigenous physical and cultural heritage includes the PDA and the largest extent of the LAA established for Human Health, Heritage Resources and Current Use. The LAA for Indigenous socio-economic conditions includes the PDA and the largest extent of the LAA established for Land and Resource Use (Chapter 15), Community Services, Infrastructure and Wellbeing (Chapter 14), Labour and Economy (Chapter 13), and Current Use (Chapter 17).

Regional Assessment Area

The regional assessment area (RAA) for Indigenous health conditions and Indigenous physical and cultural heritage includes the PDA and LAA and the largest extent of the RAA established for Current Use which incorporated the Indigenous Receptor locations which were established for the Human Health assessment, and the Heritage Resources RAA. The RAA for Indigenous socio-economic conditions includes the PDA, LAA, and the largest extent of the RAA established for Land and Resource Use (Chapter 15), Community Services, Infrastructure and Wellbeing (Chapter 14), Labour and Economy (Chapter 13), and Current Use (Chapter 17). The RAAs are made up of mostly Crown land, and unorganized Crown land within the RAA includes First Nation Reserves, registered traplines, and Community Interest Zones (CIZs).

19.1.3.2 Temporal Boundaries

The temporal boundaries for the Project consist of the following phases:

- Construction – two years (scheduled to be carried out concurrently from Year -2 to Year -1 at both sites).
- Operation – 13 years (scheduled to be carried out from Year 1 to Year 6 at the Gordon site and from Year 1 to Year 13 at the MacLellan site).
- Decommissioning/closure – five to six years of active closure (scheduled to begin in Year 6 at the Gordon site and in Year 14 at the MacLellan site). Active closure will be followed by post-closure, which is the time period during which active reclamation measures are complete, but monitoring is still required. The expected duration for post-closure is approximately 10 years. Pit filling is expected to take 11 years at the Gordon site and 21 years at the MacLellan site under average conditions (Chapter 9, Section 9.4.1). Permanent closure will occur when the site is stable, and monitoring is no longer required. The duration and conditions for post-closure monitoring and permanent closure will be detailed in subsequent submissions of the Closure Plan to regulatory agencies as Project design and execution progresses.

19.1.4 Residual Effects Characterization

Table 19-5 presents definitions for the characterization of residual environmental effects on Indigenous health conditions, Indigenous socio-economic conditions, Indigenous and physical and cultural heritage. The criteria describe the potential residual effects remaining after mitigation measures have been implemented.

Table 19-5 Definition of Terms used to Characterize Residual Effects on Indigenous Health, Indigenous Socio-Economic Conditions, and Indigenous Physical and Cultural Heritage

Factor	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Positive –** A net benefit (or desirable change) on the VC. **Adverse –** A net loss (adverse or undesirable change) on the VC.
Magnitude	The degree of change for each residual effect	***Indigenous Health Conditions*** **Negligible –** No measurable change from existing conditions to Indigenous health conditions and Project-related environmental exposures are less than the target benchmarks established by a recognized health organization. Current Use practices can continue without behaviour alteration. **Low –** Measurable change from existing conditions but is below environmental and/or regulatory criteria, and Project-related environmental exposures marginally exceed target benchmarks established by a recognized health organization. Current Use is able to continue at current levels, with minor alteration of behavior is required to continue current traditional practices. **Moderate –** A measurable change from existing conditions that exceeds the target benchmarks established by a recognized health organization and/or may result in a long-term, substantive change in change in human health. Current Use is able to continue at a reduced level or with some restrictions on current practice and some alteration of behaviour to continue current use and traditional practices. **High –** A measurable change from existing conditions that exceeds the target benchmarks established by a recognized health organization and/or are likely to result in a long-term, substantive change in human health. Current Use cannot continue or cannot continue without substantial changes to current practices and substantial restriction on ability to engage in current practice and use. ***Indigenous Socio-Economic Conditions*** **Negligible -** No measurable change in: • Land or resource use capacity. • Use or access to or interference with infrastructure. • Baseline levels of local employment, goods and services, and economic activity. **Low –** Small, measurable change in: • Land and resource use and capacity – activities can take place at or near similar levels as baseline.

Table 19-5 Definition of Terms used to Characterize Residual Effects on Indigenous Health, Indigenous Socio-Economic Conditions, and Indigenous Physical and Cultural Heritage

Factor	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The degree of change for each residual effect	• Use of, access to, or interference with infrastructure and services within the current available capacity, without effect to quality of service. • Local employment, goods and services, and economic activity. **Moderate –** Measurable change in: • Baseline land, resource use and capacity conditions that is less than high. • Use of, access to, or interference with infrastructure and services that nears the available capacity, or which may affect the quality of services provided. • Risk or benefit to the economy while unlikely to pose a substantial risk or benefit to it. **High –** Measurable change in: • Land, resource use, and capacity, such that activities and production cannot take place at similar levels as under baseline conditions. • The use of, access to, or interference with infrastructure and services that meets or exceeds the available capacity or degrades the quality of service provided. • Scale that is substantial compared to current economic conditions and if negative, represents a management challenge. ***Physical and Cultural Heritage*** **Negligible** - No measurable change from existing conditions to Indigenous physical and cultural heritage, including heritage resources sites. **Low** - Measurable change from existing conditions to Indigenous physical and cultural heritage but insufficient to result in disturbance to heritage sites. **Moderate** - Measurable change to Indigenous physical and cultural heritage, but less than a high degree of change. Effects to heritage sites would be moderate. **High** - High degree of physical disturbance on heritage sites and cultural areas. Loss of integrity of heritage sites.
Geographic Extent	The geographic area in which a residual effect occurs	**PDA –** Residual effects are restricted to the PDA. **LAA –** Residual effects extend into the LAA. **RAA –** Residual effects interact with those of other projects and activities in the RAA.

Table 19-5 Definition of Terms used to Characterize Residual Effects on Indigenous Health, Indigenous Socio-Economic Conditions, and Indigenous Physical and Cultural Heritage

Factor	Description	Quantitative Measure or Definition of Qualitative Categories
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant	**No sensitivity –** Effect to Indigenous health conditions, socio-economic conditions, and physical and cultural heritage does not occur during a sensitive timing period as identified by related VCs and/or Indigenous communities. **Moderate sensitivity –** Effect to Indigenous health conditions, socio-economic conditions, and physical and cultural heritage may occur during a lower sensitivity timing period, as identified by related VCs and/or Indigenous communities. **High sensitivity –** Effect on Indigenous health conditions, socio-economic conditions, and physical and cultural heritage may occur during a higher sensitivity timing period, as identified by related VCs and/or Indigenous communities.
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	**Single event –** The potential effect occurs once or seldom during the life of the Project (e.g., timber clearing, site preparation). **Irregular event –** The potential effect occurs only occasionally and without any predictable pattern during the life of the Project (e.g., site-specific construction; vehicular collisions with wildlife). **Regular event –** The potential effect occurs at regular and frequent intervals during the Project phase in which they occur or over the life of the Project (e.g., increased traffic noise on PR 391). **Continuous –** The potential effect occurs continuously.
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived	**Short-term –** Residual effect restricted to no more than the duration of the construction phase (2 years). **Medium-term –** Residual effect extends through the operation phase (13 years). **Long-term –** Residual effect extends beyond the life of the Project (>13 years).
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	**Reversible (short-term) –** Potential effect is readily reversible over a relatively short period (< than five years). **Reversible (long-term)** - Potential effect is potentially reversible but over a long period (> than five years). **Irreversible –** Project-specific potential effects are permanent and irreversible.
Ecological and Socio-Economic Context	Existing condition and trends in the area where residual effects occur	**Undisturbed –** Area is relatively undisturbed or not adversely affected by human activity. **Disturbed –** Area has been substantially previously disturbed by human development or human development is still present.

19.1.5 Significance Definition

The determination of significance for Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage considers the conclusions presented in the assessment of related biophysical and socio-economic VCs, as well as their associated environmental effects, and relates those conclusions to the conditions and circumstances of Indigenous communities. If residual effects on a related VC were identified as significant and would have a substantial effect on Indigenous health conditions, socio-economic conditions, and physical and cultural heritage, the resulting effects of changes would also be considered significant. For example, if effects on vegetation and wetlands were characterized as significant, effects on Indigenous health conditions may also be significant if the residual Project or cumulative effects resulted in long-term loss of availability of vegetation species harvested for medicinal or consumptive purposes. However, if effects on vegetation and wetlands were characterized as significant because of residual project or cumulative effects to species identified on the Species at Risk Act (SARA) but which are not harvested for medicinal or consumptive purposes by Indigenous community, effects on Indigenous health conditions may not be significant. The determination of significance is guided by information provided by Indigenous communities, professional judgment applied to the Project context, and the criteria listed below. Conversely, Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage may experience significant effects where related biophysical and socio-economic VCs conclude no significant effects.

A significant effect on Indigenous health conditions is one that results in:

- A long-term loss of availability of traditional use resources or access to lands relied on for current use practices or current use sites and areas, such that current use is critically reduced in the Indigenous Health Conditions LAA.
- Chemical exposures that exceed objectives established by relevant regulatory organization(s) and are likely to result in a long-term change in the health of an identified receptor(s).
- Audible noise levels that exceed provincial guidelines, and where there is a reasonable expectation that the predicted changes in noise levels could result in an increase in public annoyance and could affect public health and welfare.

A significant effect on Indigenous socio-economic conditions is one that results in:

- Wide degradation, restriction or disruption of present land and resource uses to a point where these activities and production cannot continue at or near baseline levels and cannot be adequately compensated.
- An exceedance of available capacity or a substantial decrease in the quality of a service provided, on a persistent and ongoing basis, which cannot be mitigated with current or anticipated programs, policies, or mitigation measures, and that is unlikely to recover to existing conditions.
- Economic effects which are distinguishable – meaning that the adverse effect is measurable, predictable, and attributable to one or more project or cumulative interactions (i.e., it is not within the boundaries of normal variation of the measurable parameter under existing conditions) – from current

conditions and trends, and cannot be managed or mitigated through adjustments to programs, policies, plans, or through other mitigation measures.

A significant effect on Indigenous physical and cultural heritage is one that results in:

- Project-related unmitigated disturbance to, or destruction of, heritage sites in the Project PDA or a disturbance or destruction of a culturally important area identified by members of potentially affected Indigenous communities through Project-specific TLRU studies.

19.2 EXISTING CONDITIONS FOR INDIGENOUS HEALTH CONDITIONS, INDIGENOUS SOCIO-ECONOMIC CONDITIONS, AND INDIGENOUS PHYSICAL AND CULTURAL HERITAGE

This section describes existing conditions for Indigenous communities and potential effect pathways identified by Indigenous communities (to May 22, 2020). It also identifies interactions between the residual environmental effects predicted in the assessment of other VCs and the health conditions, socio-economic conditions, and physical and cultural heritage of Indigenous communities engaged on the Project.

19.2.1 Methods

The baseline conditions for Indigenous health conditions, socio-economic conditions, and physical and cultural heritage were obtained through review of TLRU studies and Indigenous engagement activities for the Project, as well as other primary and secondary data sources identified in Chapter 12 (Labour and Economy), Chapter 13 (Community Services, Infrastructure, and Wellbeing), Chapter 15 (Land and Resource Use), Chapter 17 (Current Use), and Chapter 18 (Human Health). Publicly available literature was reviewed for information for Indigenous communities engaged on the Project to deepen the understanding of current Indigenous health conditions, socio-economic conditions, and physical and cultural heritage. Confidential studies or those stipulating one-time use were excluded from the literature review. As previously noted, the information is current to May 22, 2020. As further information is received, Alamos will review the new information in the context of the EIS, provide a written response to the Indigenous community providing the information, incorporate the Indigenous feedback and perspectives on the response and file the final results of the correspondence with the IAAC as a supplementary filing. (Section 19.1.1.3).

The following types of information sources were considered:

- TLRU studies conducted by Indigenous communities.
- Government reports and databases (i.e., Crown-Indigenous Relations and Northern Affairs Canada, Canadian Census).
- Historical literature.
- Internet sources (e.g., Indigenous community websites).

- Geospatial analysis of land and resource use.

The review considered the baseline information, issues and concerns, potential effects, and residual effects that are relevant to potentially affected Indigenous communities' health conditions, socio-economic conditions, and physical and cultural heritage.

The results of the literature review do not comprehensively represent Indigenous health conditions, socio-economic conditions, and physical and cultural heritage, but are an overview of information relevant to understanding potential Project effects on Indigenous communities. Alamos will continue to engage with potentially affected Indigenous communities to hear issues or concerns, and to learn about Indigenous health conditions, socio-economic conditions, and physical and cultural heritage, so as to incorporate pertinent information into Project planning, as appropriate.

Below is a summary of Indigenous health conditions, socio-economic conditions, and physical and cultural heritage from Indigenous communities engaged for the Project. Concerns that have been shared by indigenous communities with respect to the Project are also included. As indicated previously, engagement by Alamos is ongoing, and additional information may become available at a future date.

19.2.2 Overview

This section provides an overview of Indigenous health conditions, Indigenous socio-economic conditions, Indigenous physical and cultural heritage and provides cross references for Current Use. Information related to these conditions within the RAA is presented for the Indigenous communities engaged on the Project and provides context for the assessment. This is a summary of existing conditions designed to inform the assessment and is not intended to be comprehensive.

19.2.2.1 Indigenous Health Conditions

General

Health care for Indigenous communities in Manitoba is provided by the federal First Nations and Inuit Health Branch (FNIHB) and through Regional Health Authorities (RHAs). Indigenous communities within the Project RAA are eligible for health services in the Northern RHA, the largest of the five RHAs in Manitoba. Health care for Indigenous communities in Saskatchewan is provided by the federal FNIHB and through a single provincial body, the Saskatchewan Health Authority. First Nations engaged on the Project that draw upon health services provided by the Northern RHA include Barren Lands First Nation, Marcel Colomb First Nation, Mathias Colomb Cree Nation, Northlands Denesuline First Nation, O-Pipon-Na-Piwin Cree Nation, and Sayisi Dene First Nation (Northern Health Region 2019). Indigenous communities that draw upon health services through the 13 authorities provided by the Saskatchewan Health Authority include Peter Ballantyne Cree Nation, Hatchet Lake First Nation, Métis Nation – Saskatchewan Northern Region 1, and Métis Nation – Saskatchewan Eastern Region 1 (Saskatchewan Health Authority 2020). Mathias Colomb Cree Nation's community health care is facilitated by the Mathias Colomb Cree Nation Health Authority.

The First Nations Regional Health Survey (RHS) was initiated in 1997. Phase 3 of the survey was conducted between March 2015 and December 2016 (FNIGC 2018a; 2018b). The Phase 3, Volume 1 report indicated that almost two-thirds (59.8%) of First Nation adults, one third (33.2%) of First Nation youth, and over one-quarter (28.5%) of First Nation children had one or more chronic health conditions. Chronic health conditions such as diabetes, arthritis, hypertension, allergies, and chronic back pain remain the most commonly reported conditions among First Nation adults.

A study by the Manitoba Centre for Health Policy (Martens et al. 2010) found that in 2006, Métis citizens in Manitoba had a larger proportion of youth, a lower proportion of middle-aged, and a lower proportion of older adults. Youth between 0 and 19 years of age comprised 33.9% of the Métis population compared with 26.4% of other Manitobans. People aged 65+ comprised 9.1% of the Métis population compared to 13.9% of other Manitobans. The study also found that Métis people have higher mortality rates compared to other Manitobans and that, with the exception of osteoporosis, chronic disease conditions are higher for the Métis population.

As discussed in the Community services, Infrastructure, and Wellbeing VC (Chapter 14), hospital facilities within the immediate Project area are limited. As of 2016, the Town of Lynn Lake had a population of 494, of which 385 identified as Indigenous (Statistics Canada 2016). The Town of Lynn Lake is also home to the only hospital in the Indigenous Health Conditions RAA, a 24-hour facility with 11 acute-care beds and eight long-term care beds. Patients with medical emergencies or requiring specialist appointments are transported via medivac to either Thompson or Winnipeg. The Leaf Rapids Health Centre, approximately 105 km southeast of Lynn Lake, shares medical resources with the hospital in Lynn Lake. There is also a small South Indian Lake nursing station (201 km east of Lynn Lake), but members of the associated First Nations in that region often use health services available in Lynn Lake and Leaf Rapids. Members of Marcel Colomb First Nation and Kinoosao do not have local nursing stations, and as such, travel to Lynn Lake for health services. Accessing medical treatment is a challenge of the health care system (Northern Health Region 2016). For example, members of Marcel Colomb First Nation sometimes miss appointments because of issues associated with obtaining medical papers needed for transportation. Furthermore, it can be difficult for residents of the area to see a specialist, especially when appointments may be one or two days apart and the patient is reliant on medical transport (Brohman 2018).

Further emergency services include the Shock Trauma Air Rescue Society (STARS), which is contracted by the Government of Manitoba to provide rapid and emergency medical care and air transport for critically ill and injured patients within flying range of Winnipeg. The Winnipeg RHA oversees STARS. Further detail regarding Indigenous community access to health services can be found in the engagement chapter of this EIS, under Indigenous Community Profiles (Chapter 3, Section 3.1.3).

First Nations

Indigenous communities engaged on the Project reported participating in traditional hunting, fishing, trapping, and gathering, and in the consumption of country foods (Chapter 17, Section 17.2.14), an integral component of Indigenous health. Through the Project-specific TLRU study, Marcel Colomb First Nation members reported hunting for large mammals, including deer, moose, caribou, and bear. Birds harvested include ducks, geese, grouse, swans, and ptarmigan. Fished species include trout (including lake trout), sturgeon, northern pike, and pickerel. Trapped species include beaver, mink, muskrat, marten, rabbit, wolverine, and fox. Marcel Colomb First Nation members harvests cranberries, blueberries, and moss berries in the RAA, and also gather a variety of other berry species including strawberry, chokecherry, Saskatoon berry, and raspberry. Medicinal plants gathered include rat root, spruce gum, Seneca root, and chaga (tree fungus).

Through the Indigenous engagement process for the Project, Barren Lands First Nation indicated a reliance on barren-ground caribou as an important food source. Northlands Denesuline First Nation members consumes wild berries and nuts, including cranberries and blueberries. Through review of publicly available literature, Northlands Denesuline First Nation also reported consuming fish, such as trout, lake whitefish, and walleye, birds such as Canada goose and grouse, and large mammals, including moose and caribou (Chapter 17, Section 17.2.14.10). Sayisi Dene First Nation members consume moose and caribou meat, as well as fish species, including trout, lake whitefish, and walleye. Plants are gathered and consumed, including blueberries, cranberries, and nuts. Bird species harvested include geese and grouse (Chapter 17, Section 17.2.14.11).

No information relating to the consumption of specific species as country foods was available for Mathias Colomb Cree Nation, Peter Ballantyne Cree Nation, O-Pipon-Na-Piwin Cree Nation, and Nisichawayasihk Cree Nation. Species relied upon for subsistence and traditional practice by each Indigenous community engaged on the Project can be found in Chapter 17 (Section 17.2.14).

Indigenous communities engaged on the Project also use water sources within the Indigenous Health Conditions LAA and RAA. Marcel Colomb First Nation indicated that several natural springs, located near Eden Lake, Hughes Lake, and at Michaluck Bay near Westdal Lake, were used as traditional drinking water sources.

Métis Governments

Through the Project-specific Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study (Appendix 17A; SVS 2020), Manitoba Metis Federation indicated that Manitoba Métis Community citizens hunt for caribou, deer, moose, and rabbit, as well as mallard duck, goose (including Canada goose), grouse (including spruce grouse), and ptarmigan. They indicated fishing for species such as burbot, yellow perch, northern pike, sauger, suckers, trout (including brown, lake, and rainbow trout), walleye/pickerel, and lake whitefish. Manitoba Metis Federation also reported that Manitoba Métis Community citizens practice trapping and snaring, including for beaver, fox, lynx, marten, muskrat, otter, wolf, and wolverine, and gather medicinal plants such as muskrat root or Labrador tea and wild mint. Berries, including blueberries, cranberries, pin cherries, raspberries, saskatoon berries, and strawberries are also gathered and consumed. Manitoba Metis Federation stated that Manitoba Métis Community citizens also consume birch water, chaga, black bear fat, and spring water (Chapter 17, Section 17.2.14.4).

No information relating the consumption of specific species as country foods was available for Métis Nation – Saskatchewan Eastern Region 1 and Métis Nation – Saskatchewan Northern Region 1. Species relied upon for subsistence and traditional practice by each Indigenous community engaged on the Project can be found in Chapter 17 (Section 17.2.14).

Additional Context for Indigenous Health Conditions

As part of the Human Health VC (Chapter 18), sampling was conducted to determine the concentration ratios (CR) and hazard quotients (HQ) for metals and compounds which may currently exist and pose risks to human health. Baseline CRs for compounds of potential concern were found to be below the risk acceptability benchmarks established by Health Canada. Indigenous Receptors HQ for total ingestion exposure to manganese, methylmercury, and thallium, however, were found to be above Health Canada benchmarks. The current total ingestion exceedance for methylmercury is attributed primarily to consumption of fish, while exceedances for manganese and thallium are attributed primarily due to consumption of traditional plants. Additional information about Indigenous Receptors and the sampling used to establish existing conditions for human health can be found in Chapter 18, Section 18.2.

Indigenous health is also influenced by wellbeing. Vulnerable populations, including Indigenous communities, often experience disproportionate health effects, and as indicated in Chapter 14 (Section 14.1), wellbeing is linked to socio-economic determinants of health (i.e., socio-economic conditions, health behaviours, and personal resources). Community wellbeing is indicated by levels of perceived health, stress, sense of community belonging, life satisfaction, rates of obesity, smoking and heavy drinking compared with provincial averages.

19.2.2.2 Indigenous Socio-Economic Conditions

Through the Indigenous engagement process for the Project, a number of Indigenous communities identified issues related to Indigenous socio-economic conditions, and a comprehensive list of key issues are captured in Chapter 3, Section 3.3.6, Table 3-8. Key issues have also been included in Section 19.1.2.

Labour Force

In 2016, the Indigenous labour force of Lynn Lake totaled 70 persons (78.6% of whom were female), representing 40.0% of the total labour force. The RAA labour force totaled 3,090 persons (48.7% female), representing 37.3% of the total labour force. Generally, participation rates among the Indigenous population were lower than total population participation rates within Lynn Lake and the RAA and greater than provincial Indigenous averages (except for Indigenous males within Lynn Lake; Chapter 13, Section 13.2.2.3).

Within O-Pipon-Na-Piwin Cree Nation there is limited employment; employment opportunities include the school, the O-Pipon-Na-Piwin Cree Nation Band office, the South Bay Construction Company, and temporary construction jobs with outside contractors (Chapter 3, Section 3.3.3.4). Marcel Colomb First Nation operates its own water treatment plant and sewage lagoon on the Black Sturgeon Reserve (Chapter 3, Section 3.3.3.1). The Mathias Colomb Cree Nation Health Authority employs a staff of approximately five (Chapter 3, Section 3.3.3.2). Through the Indigenous engagement process for the Project, Marcel Colomb First Nation identified a lack of opportunities in education, employment, and information flow; lack of community capacity; and the need for community liaisons and councilors to mentor trainees and employees.

In 2006, Nisichawayasihk Cree Nation signed the Wuskwatim Project Development Agreement with Manitoba Hydro. The project provided job opportunities for qualified Nisichawayasihk Cree Nation members and business opportunities for Nisichawayasihk Cree Nation businesses and joint-venture business partnerships during construction (Chapter 3, Section 3.3.3.3).

Peter Ballantyne Cree Nation is the main employer for the community of Southend through delivery of community programs and community-based operations that include Peter Ballantyne Cree Nation Health Services, Band office, Band school, child and family services, Band store and gas stations, community services, and housing maintenance. Bird's Nest Contracting is a private business for geophysical line cutting, oilfield slashing and bucking, site and access brushing and cleanup, camp set up, operation and take down, scouting, flagging and access construction, reclamation and revegetation provides work opportunities for community members (Chapter 3, Section 3.3.3.6). Peter Ballantyne Cree Nation's community of Kinoosao has limited employment opportunities (Chapter 3, Section 3.3.3.6).

Housing

As indicated in the Community Services, Infrastructure and Wellbeing chapter of this EIS (Chapter 14), the majority of the housing in the RAA is located in Thompson, Leaf Rapids and Lynn Lake. Two communities are located in the Indigenous Socio-Economic Conditions LAA, the Town of Lynn Lake and Black Sturgeon Reserve. Housing in the Town of Lynn Lake consists of a mix of private ownership and rental units, with much of the viable housing being several decades old and in poor repair. The price of homes in the Town of Lynn Lake and the nearby community of Leaf Rapids are low, and rental rates are often set to match those that can be afforded by a Manitoba Housing allowance. The Black Sturgeon Reserve has 14 housing units. Overcrowding is an issue on the Reserve, with an average occupancy of 14 people per unit. Construction on an additional 14 and 8 housing units began in 2018 and 2019, respectively, but has not yet been completed (Manager pers. comm. 2019).A variety of temporary accommodations, in the form of hotels, motels, campgrounds, and RV parks are available in the Indigenous Socio-Economic Conditions LAA and RAA (Chapter 14, Section 14.2.2.1). The Peter Ballantyne Cree Nation community of Southend (outside of RAA) has 163 houses with an average of three bedrooms per household and an average per house occupancy rate of seven persons, and the community of Kinoosao (outside of RAA) contains 10 houses and an average occupancy rate of 5.2 persons (Chapter 3, Section 3.3.3.6).

Education and Services

As also discussed in the Community Services, Infrastructure and Wellbeing VC (Chapter 14, Section 14.2.2.1), three communities located in the Indigenous Socio-Economic Conditions RAA – Lynn Lake, Leaf Rapids, and Thompson – are the most likely communities to provide services and infrastructure.

Access to education and social services influences Indigenous socio-economic conditions. Education services within the Indigenous Socio-Economic Conditions LAA and RAA include K-12, community college, and adult education facilities and programs. West Lynn Heights School, a K-12 public school, serves residents of the Town of Lynn Lake and Black Sturgeon Reserve (Chapter 14, Section 14.2.2.2). The community of Kinoosao has a community school which does not extend past Grade 9 (Chapter 3, Section 3.3.3.6).

Social services in Lynn Lake include employment counseling, parenting skills training, childcare, a youth drop-in centre, and social development programs. Indigenous-specific social services are offered through the Lynn Lake Friendship Centre. More comprehensive social services are offered in the City of Thompson, located approximately 322 kilometers south-east (Chapter 14, Section 14.2.2.4). Through the Indigenous engagement process for the Project, Marcel Colomb First Nation also indicated that a lack of opportunities and amenities in the community is causing social problems and identified a need for programming and funding for social programming to address socio-economic issues.

The only hospital in the Indigenous Socio-Economic Conditions LAA is the Lynn Lake Hospital. Additional health services are available at the Leaf Rapids Health Centre and Thompson General Hospital. There are no health services located on Black Sturgeon Reserve or in Kinoosao. Both the Town of Lynn Lake and Leaf Rapids have 24-hour emergency services with one ambulance each. Marcel Colomb First Nation also provides medical transport services for the residents of the Town of Lynn Lake and Black Sturgeon Reserve (Chapter 14, Section 14.2.2.4).

Police and fire services are present in the Indigenous Socio-Economic Conditions LAA (Chapter 14, Section 14.2.2.4). The Town of Lynn Lake retains an RCMP detachment which serves the town and nearby Black Sturgeon Reserve, and which provides occasional response to Kinoosao. A band constable program no longer operates but a First Nations Safety Officer Program has been implemented to address potential service gaps on reserve (Chapter 14, Section 14.2.2.4). Police caseloads in Manitoba are heavy, and common offences in the RAA are related to substance abuse, property crimes, assault, and drug-trafficking. Leaf Rapids has an RCMP detachment which services that community, as well as South Indian Lake and Granville Lake. South Indian Lake also has two community constables on duty.

Fire services in the RAA include the voluntary Lynn Lake Fire Department, which operates as an on-call department that serves both the Town of Lynne Lake and Black Sturgeon Reserve. Lead Rapids also has a volunteer fire department, with more comprehensive services available in Thompson, including 24-hour operations providing fire and emergency medical services, as well as wildlife detection and suppression services.

Waste and water services are available in the Indigenous Socio-Economic Conditions LAA and RAA (Chapter 14, Section 14.2.2.6). The Town of Lynn Lake offers curb-side pickup of solid waste for residents of the Town of Lynn Lake and Black Sturgeon Reserve. A landfill is available for tipping at a fee, and the town has plans to establish a recycling depot. The City of Thompson is expanding its waste disposal capabilities, with plans for a centre that would accept electronic waste, household hazardous waste, and used oil. The Town of Lynn Lake is reliant on water from West Lynn Lake, and has its own treatment and distribution network. Despite this, the water plant experiences operation issues, and since 2012, a boil water advisory has been in effect for Lynn Lake and Leaf Rapids (Chapter 14, Section 14.2.2.6). Wastewater is fed into a lagoon, which has operational capacities to sustain a much larger population than is currently present in Lynn Lake. Marcel Colomb First Nation operates a separate treatment plant and lagoon on the Black Sturgeon Reserve. The City of Thompson has two wastewater treatment facilities and plans for a new wastewater treatment plant are underway. At the time of filing, Northlands Denesuline First Nation and Peter Ballantyne Cree Nation (Chief Joseph Custer Reserve) remain under boil water advisories (Government of Canada 2020c).

Transportation to and from the Indigenous communities engaged on the Project can occur by road, rail, air, and ferry. Some roads are permanent while other roads are only accessible during winter. The profiles for each Indigenous community in Chapter 3, Section 3.3.3 describe the methods of transportation accessible to each Indigenous community engaged on the Project. The Town of Lynn Lake is accessible by road via PR391 only, which also connects the Town of Lynn Lake and Marcel Colomb First Nation to Leaf Rapids and Thompson. Both the Gordon and MacLellan sites are accessed via PR391, and then via gravel roads that will be updated to accommodate Project activities (Chapter 2, Section 2.3.1). The Town of Lynn Lake also has an airport, but flights must be chartered, and much of the air traffic in the Lynn Lake region operates in service of recreational hunting and fishing. A small airport is also available at Leaf Rapids. The City of Thompson is home to the second-busiest airport in Manitoba and operates regional air service to scheduled or chartered flights to nearly 60 communities in northern Manitoba.

Lands

As noted in Chapter 15, Section 15.2.2.1, the RAA is mostly made up of Crown land, with a variety of permits and leases. Unorganized Crown land includes First Nation Reserves, TLE sites, Registered Trapline Districts, and Community Interest Zones (CIZs). The Marcel Colomb First Nation's CIZ lies within the RAA, as do TLE parcels for Nisichawayasihk Cree Nation and O-Pipon-Na-Piwin Cree Nation. The Kamuchawie Caribou Management Unit (CMU) also lies within the RAA.

Lands in the RAA support recreation and resource use, and attract those interested in sport fishing, snowmobiling, hiking, camping, cross-country skiing, and ice fishing. Within the RAA, there are two campgrounds and several remote cottages. A network of recreation trails exists, and recreational water use includes canoeing and boating. Hunting opportunities are varied, and game species include moose, black bear, and grey wolf. Upland birds such as grouse and ptarmigan are hunted, as are ducks, geese, and cranes. At least five lodges operate in the RAA, servicing hunting and fishing clients (Chapter 14, Section 14.2.2.2.1).

Agreements

In 2006, Nisichawayasihk Cree Nation signed the Wuskwatim Project Development Agreement with Manitoba Hydro in relation to the Wuskwatim Hydroelectric Generation Project at Taskinigahp Falls (Chapter 3, Section 3.3.3.3). This project was built approximately 40 km downstream (south-east) of Nelson House, in Nisichawayasihk Cree Nation's resource management area. Nisichawayasihk Cree Nation has expressed concern that their resource management area is directly adjacent to the Project, resulting in traditional land and resources use issues and concerns (Section 17.6.3.2, Chapter 17). The agreement provides for Nisichawayasihk Cree Nation to own up to 33% of the project (balance owned by Manitoba Hydro) and related revenues, pending repayment of project loans. Job opportunities for qualified Nisichawayasihk Cree Nation Members resulted, as well as business opportunities for Nisichawayasihk Cree Nation businesses and joint-venture business partnerships during construction. Nisichawayasihk Cree Nation also established the Taskinigahp Power Corporation to act as a partner with Manitoba Hydro in the Wuskwatim Power Limited Partnership and the corporation's directors represent Nisichawayasihk Cree Nation's interest.

As indicated in Chapter 3, Section 3.3.3.8, in November 2010, Métis Nation – Saskatchewan and the Province of Saskatchewan signed a Memorandum of Understanding (MOU) regarding Métis harvesting rights. The agreement pertains to the negotiation of key harvesting practices for Métis Nation citizens in Saskatchewan and traditional territories, including food harvesting customs and traditions; ancestral and community acceptance requirements necessary to be a beneficiary of harvesting rights; achieving legal enforceability and certainty of those rights; and the identification of additional research or studies necessary to assist Métis Nation - Saskatchewan and the Province of Saskatchewan to reach interim and final agreements (Métis Nation - Saskatchewan 2020).In early 2012, the Métis Environment and Resource Management Advisory Committee was established to consult with the Government of Saskatchewan regarding a framework for managing and protecting the environment while supporting the province's growing economy. Agreements related to Métis harvesting rights are discussed in Section 19.9.

In the spring of 2019, the Government of Manitoba entered into an airport partnership with Mathias Colomb Cree Nation, signaling its intent to "continue to support the establishment of Indigenous-led partnerships and ventures that will increase Indigenous participation and economic benefits to Indigenous communities, and to Manitoba's economy as whole" (Government of Manitoba 2019b).

Businesses

Indigenous communities engaged on the Project operate businesses that service community members, area residents, and tourists. The businesses operated by Indigenous communities engaged on the Project conduct operations outside of the RAA and will not interact with the Project's procurement of goods and services.

Peter Ballantyne Cree Nation operates the Peter Ballantyne Group of Companies (PBGoC), which focuses on managing and developing the corporate interests of the band. PBGoC owns businesses involved in construction, food retail, fueling service, casino operations, forestry, and emergency services. PBGoC also has partnerships with Industrial companies, development corporations, insurance groups, freight and logistics companies, and property management companies (Peter Ballantyne Group of Companies 2019).

Guided sportfishing can be an important income source for Indigenous communities. A number of hunting and fishing lodges also operate in the Indigenous Socio-Economic Conditions RAA, and some of these may employ local Indigenous community members as guides.

Commercial fishing is an important industry in Manitoba and is a source of income for people living in northern Manitoba. Through review of publicly available literature, it was shown that commercial fishing contributes to the economies of Mathias Colomb Cree Nation, Peter Ballantyne Cree Nation, and Barren Lands First Nation (Chapter 17, Section 17.2.14). While there are no commercial fish waterbodies overlapped by the PDA, portions of two listed commercial fish lakes (Cockeram and Cartwright Lakes) which are located are within 1.5 km of the PDA for the Gordon and MacLellan sites or the stretch of Provincial Road (PR) 391 between the Gordon site access road and the MacLellan site access road (Chapter 15, Section 15.2.2.3). These lakes were last commercially fished in 1997 and 2012, respectively (Regional Fisheries Manager pers. comm. 2017; Fisheries Biologist pers. comm 2019). As identified in Chapter 15, there are 17 commercial fish waterbodies in the RAA (Chapter 15, Section 15.2.2.3), and through the Project-specific TLRU studies (Appendix 17A), Marcel Colomb First Nation and Manitoba Metis Federation indicated that Manitoba Métis Community citizens are employed in the commercial fishing industry. Through the Project-specific Manitoba Métis Traditional Knowledge, Land Use, and Occupancy

Study, Manitoba Metis Federation indicated that Manitoba Métis Community citizens are employed in the commercial fishing industry. Watercourses in the RAA support recreation fishing for a variety of species, including burbot, northern pike, perch, lake whitefish, lake trout, stickleback, and white sucker. Commercial fishing in the RAA has occurred as recently as 2012, and has taken place in Goldsand Lake, Cartwright Lake, and Cockeram Lake.

Registered Traplines

Trapping is an important source of income for Indigenous communities. A description of Indigenous peoples traditional trapping activities in the Indigenous Socio-Economic Conditions LAA and RAA is provided in the Current Use VC (Chapter 17). The registered trapline district system in Manitoba is a commercial furbearer harvest management system (Chapter 15). Registered trapline holders are granted exclusive commercial harvest rights of furbearing animals within their traplines (Chapter 15, Section 15.2.2). The Indigenous Socio-Economic Conditions RAA intersects the Registered Trapline Districts of Pukatawagan and Southern Indian Lake (Map 19-5). Manitoba Sustainable Development (MSD; now Manitoba Conservation and Climate) manages the Registered Trapline Districts and issues trapping licenses (MSD 2018). The names of individual trapline owners and their potential affiliation with and Indigenous community were not disclosed by MSD. Marcel Colomb First Nation, Mathias Colomb Cree Nation and members of the public have identified concerns about Project effects on traplines (Chapter 3, Sections 3.3.6 and 3.4.4).

Furbearer species trapped include beaver, coyote, fox, lynx, marten, mink, muskrat, otter, squirrel, wolf, wolverine, and others; furbearer and other small mammal species observed near the Gordon and MacLellan sites during fieldwork included snowshoe hare, marten, lynx, beaver, and red fox (Chapters 15 and 17). While engaged Indigenous communities did not provide a specific list or locations of traplines, it was indicated in Chapter 17 that Indigenous communities in the RAA do participate in commercial and traditional fur trapping and trading. Through their Project-specific TLRU Study (Appendix 17A), Marcel Colomb First Nation Elders teach younger generations, including at Mile 7 camp, which is located along a trapline.

Through the Project-specific Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study (Appendix 17A; SVS 2020), Manitoba Metis Federation indicated that Manitoba Métis Community citizens engage in trapping.

The Indigenous Socio-Economic Conditions LAA overlaps 19 traplines within the Registered Trapline Districts, of Pukatawagan and Southern Indian Lake all of which have had trapper permits; however, it is unknown if they are currently in active use. Six of these are within 1.5 km of the PDA for the Gordon and MacLellan sites or the stretch of PR 391 between the Gordon site access road and the MacLellan site access road: Pukatawagan Registered Traplines 30, 32, 35, 36, and a Community Youth Trapline (YTC), and Southern Indian Lake) Registered Trapline 42. The PDA for the Gordon and MacLellan sites overlap four individual traplines: Pukatawagan Registered Traplines 36, 30, and YTC (MacLellan), and 32 (Gordon).

19.2.2.3 Indigenous Physical and Cultural Heritage

First Nations

Through their Project-specific TLRU study, Marcel Colomb First Nation indicated the existence of a number of trails, routes, cabins, and camps that fall within the Indigenous Physical and Cultural Heritage LAA and RAA; one winter road identified by Marcel Colomb First Nation passes through the PDA, as does Keewatin River, which is used by Marcel Colomb First Nation as a travelway (Chapter 17, Appendix A). Marcel Colomb First Nation has also reported multiple burial sites in the RAA and stated that Goldsand Lake is a culturally important area that may house burial sites. Other burial sites include locations on an island in Eden Lake, and at the north end of Hughes Lake. Marcel Colomb First Nation also reported a sweat lodge located at Swede Lake. These sites are within the Indigenous physical and cultural heritage RAA

Métis Governments

Through the Project-specific Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study (Appendix 17A; SVS 2020), Manitoba Metis Federation identified access routes, campsites, and cultural sites within 100 km of the Project sites including a cemetery with affiliation to the Manitoba Métis Community located near Lynn Lake (Chapter 17, Section 17.2.14.4).

Additional Context for Indigenous Physical and Cultural Heritage

A total of 781 heritage resources sites have been recorded in the RAA; these sites were recorded with the Ministry of Manitoba Sport, Culture, and Heritage (MSCH) as a result of Heritage Resources Impact Assessments (HRIAs; Chapter 16, Section 16.2.2). Through the HRIA conducted for the environmental assessment, 11 archaeological sites were recorded within the Heritage Resources MacLellan site LAA[8] and Indigenous Physical and Cultural Heritage LAA. Of the 11 sites, three are Historic Period camp sites, one is a wooden structure, one is a trail, and six are Precontact Period sites. Eight of the 11 recorded sites at the MacLellan site are located within 100 m of Keewatin River, and these are relatively undisturbed, with the exception of the wooden structure, which is in an advanced stage of collapse. TLRU data indicates that travel along Keewatin River between Cockeram Lake and Goldsand Lake was common, for purposes of hunting, fishing, gathering, and trap line access (Map 19-4). No sites have been recorded within the Gordon site PDA.

As discussed in the Current Use VC (Chapter 17, Section 17.2), the history of Indigenous activity and occupancy in the Project area is lengthy. Documents sourced from the Provincial Museum of Manitoba indicate that Indigenous communities in the region traded with the Hudson's Bay Company (HBC) at various trading posts throughout the area. Journals kept by employees of the HBC reveal interactions with Mathias Colomb Cree Nation.

Alamos recognizes that new information related to Indigenous physical and cultural heritage may be submitted to the Province of Manitoba, to the IAAC, and to Alamos by engaged Indigenous communities at any point in the Project life cycle. Alamos will consider relevant Current Use information and incorporate it

[8] As defined in Chapter 16 (Section 16.2.2), the Heritage Resources MacLellan site LAA includes the areas between the MacLellan site PDA and Keewatin River and adjacent to the access to include heritage resources that are near, but not within the MacLellan site PDA.

into Project planning as practical. Alamos will also continue to engage with interested Indigenous communities throughout the life of the Project.

19.2.2.4 Current Use of Lands and Resources for Traditional Purposes

Indigenous communities undertake Current Use activities, including hunting, fishing, trapping, gathering, habitation, travel, and other cultural activities in the RAA, and have reported that there are cultural and spiritual sites and areas in the RAA. A detailed overview of Current Use information, including information specific to each Indigenous community engaged on the Project, is included in Chapter 17, Section 17.2.14.

19.3 PROJECT INTERACTIONS WITH INDIGENOUS HEALTH, INDIGENOUS SOCIO-ECONOMIC CONDITIONS, INDIGENOUS PHYSICAL AND CULTURAL HERITAGE, AND CURRENT USE

Table 19-6 identifies, for each potential effect, the physical activities that might interact with Indigenous health conditions, socio-economic conditions, physical and cultural heritage, and Current Use, and result in the identified environmental effect. These interactions are indicated by check mark and are discussed in detail in Section 19.4, in the context of effects pathways, standard and project-specific mitigation and enhancement, and residual effects. A justification for no effect is provided following the table.

Project activities for each phase are described in detail in Chapter 2, Section 2.3 and 2.4. Project related emissions and discharges are described in Chapter 2, Section 2.8.

The potential interactions between Project activities and the environment were considered for the construction, operation, and decommissioning/closure phases of the Project. The identification of Project activities and their potential interactions was based on engagement with interested parties, the professional judgment of technical specialists involved in the assessment, and a review of existing conditions. The selection of interactions is informed by the potential effects and effects pathways for each VC as described in Section 10.1.3.

Emissions, discharges, and wastes (e.g., air, waste, noise, light, liquid, and solid effluents) are generated by many varied Project activities. Rather than acknowledging this by placing a check mark against each of these activities, “Emissions, Discharges and Wastes” have been consolidated as integrated activity for efficiency with details discussed in the text. This activity includes the emissions, discharges, and wastes generated by all other project activities under each Project phase.

Table 19-6 Project-Environment Interactions with Indigenous Health, Socio-Economic Conditions, Physical and Cultural Heritage, and Current Use

Project Activities and Components	Environmental Effects							
	Change to Indigenous Health Conditions		Change to Indigenous Socio-Economic Conditions		Change to Indigenous Physical and Cultural Heritage		Change in Current Use	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
Construction								
Site Preparation at Both Sites (removal of existing buildings; removal of contaminated materials; vegetation clearing and earthworks; development of temporary construction camp at the MacLellan site)	✓	✓	✓	✓	✓	✓	✓	✓
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	✓	✓	✓	✓	✓	✓	✓	✓
Mine Components at Both Sites (construction of: ore pads; ore, overburden and mine rock storage areas; mill feed storage area and crushing plant, ore milling and processing plant, and Tailings Management Facility at MacLellan site; water management facilities [e.g., sumps, ponds and ditches]; interceptor wells at the Gordon site)	✓	✓	✓	✓	✓	✓	–	–
Utilities, Infrastructure, and Other Facilities at Both Sites (construction of: buildings and yards; access roads [i.e., upgrades at the Gordon and MacLellan site] and internal mine roads; site lighting and security; power supply and distribution system; potable water treatment plant at the MacLellan site; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities)	✓	✓	✓	✓	✓	✓	–	–

Table 19-6 Project-Environment Interactions with Indigenous Health, Socio-Economic Conditions, Physical and Cultural Heritage, and Current Use

Project Activities and Components	Environmental Effects							
	Change to Indigenous Health Conditions		Change to Indigenous Socio-Economic Conditions		Change to Indigenous Physical and Cultural Heritage		Change in Current Use	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
Water Development and Control at Both Sites (dewatering of existing pits at the Gordon site and underground workings at the MacLellan site; re-alignment of existing built diversion channel at the Gordon site)	✓	✓	✓	✓	✓	✓	✓	✓
Emissions, Discharges, and Wastes[1]	✓	✓	✓	✓	✓	✓	✓	✓
Employment and Expenditure[2]	✓	✓	✓	✓	–	–	–	–
Operation								
Open Pit Mining at Both Sites (drilling; blasting; removal, loading and on-site hauling of mined material [i.e., ore, overburden, and mine rock])	✓	✓	✓	✓	✓	✓	–	–
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA, including truck transportation of ore from the Gordon site to the Maclellan site)	✓	✓	✓	✓	✓	✓	✓	✓
Storage/Stockpiling of Ore, Overburden, and Mine Rock at Both Sites	✓	✓	✓	✓	✓	✓	–	–
Ore Milling and Processing at the MacLellan Site (ore crushing and conveyance; ore milling)	✓	✓	✓	✓	✓	✓	–	–
Water Management at Both Sites (mine water collection and storage; process water supply for the MacLellan site including water intake on Keewatin River at the MacLellan site; operation of interceptor wells at the Gordon site; pumping fresh/fire water from Farley Lake at Gordon site)	✓	✓	✓	✓	✓	✓	✓	✓
Tailings Management at the MacLellan Site	–	✓	–	✓	–	✓	–	✓

Table 19-6 Project-Environment Interactions with Indigenous Health, Socio-Economic Conditions, Physical and Cultural Heritage, and Current Use

Project Activities and Components	Environmental Effects							
	Change to Indigenous Health Conditions		Change to Indigenous Socio-Economic Conditions		Change to Indigenous Physical and Cultural Heritage		Change in Current Use	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
Utilities, Infrastructure, and Other Facilities at Both Sites (presence and operation of: buildings and yards; access roads and internal mine roads; site lighting and security; on-site power lines; potable water treatment plant at the MacLellan site; on-site pipelines at the MacLellan site; fuel storage and distribution systems; sewage treatment facilities; domestic solid waste handling facilities; explosives storage, maintenance of access roads and bridges)	✓	✓	✓	✓	✓	✓	✓	✓
Emissions, Discharges, and Wastes[1]	✓	✓	✓	✓	✓	✓	✓	✓
Employment and Expenditure[2]	✓	✓	✓	✓	–	–	–	–
Decommissioning/Closure								
Decommissioning at Both Sites	✓	✓	✓	✓	–	–	✓	✓
Reclamation at Both Sites	✓	✓	✓	✓	–	–	✓	✓
Post-Closure at Both Sites (long-term monitoring)	✓	✓	✓	✓	–	–	✓	✓
Project-related Transportation within the LAA (movement of trucks, equipment, bulk materials, supplies, and personnel within the LAA)	✓	✓	✓	✓	–	–	✓	✓
Emissions, Discharges, and Wastes[1]	✓	✓	✓	✓	–	–	✓	✓
Employment and Expenditure[2]	✓	✓	✓	✓	–	–	–	–

NOTES:
✓ = Potential interaction
– = No interaction
[1] Emissions, Discharges, and Wastes (e.g., air, waste, noise, light, liquid, and solid effluents) are generated by many Project activities. Rather than acknowledging this by placing a check mark against each of these activities, "Emissions, Discharges and Wastes have been introduced as an additional component under each Project phase.

Table 19-6 Project-Environment Interactions with Indigenous Health, Socio-Economic Conditions, Physical and Cultural Heritage, and Current Use

Project Activities and Components	Environmental Effects							
	Change to Indigenous Health Conditions		Change to Indigenous Socio-Economic Conditions		Change to Indigenous Physical and Cultural Heritage		Change in Current Use	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
[2] Project employment and expenditures are generated by most Project activities and components and are the main drivers of many socio-economic effects. Rather than acknowledging this by placing a check mark against each of these activities, "Employment and Expenditures" have been introduced as an additional component under each Project phase.								

Construction and operation-related employment and expenditures are expected to have no effect to Indigenous physical and cultural heritage, as no physical or heritage resources have been previously recorded in the Gordon site PDA and Indigenous Physical and Cultural Heritage LAA. Available Current Use data and archival records indicate limited historical use of the area. Activities that do not involve some form of ground disturbance will not interact with Indigenous physical and cultural heritage.

Activities proposed during operation, except for utilities, infrastructure, and other facilities, will not interact with Indigenous physical and cultural heritage at either the Gordon or MacLellan site because these activities will not further disturb areas previously disturbed during construction.

Similarly, decommissioning/closure at the Gordon and MacLellan sites will not have effects to Indigenous physical and cultural heritage, as at this point in the development life cycle, mitigation will have addressed physical and cultural heritage concerns, including inadvertently exposed archaeological sites.

19.4 ASSESSMENT OF RESIDUAL ENVIRONMENTAL EFFECTS ON INDIGENOUS PEOPLES

This section discusses the potential for the Project to affect Indigenous peoples through changes to Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage. A summary of the effects on Current Use presented in Chapter 17 is also provided in Section 19.4.6.

19.4.1 Analytical Assessment Techniques

The assessment of residual environmental effects on Indigenous Peoples presents Project interactions and pathways, mitigation measures and residual effects for each potential Project effect on Indigenous Peoples.

Recommendations and mitigation measures were identified by Indigenous communities through the Indigenous engagement process for the Project, as well as requested through Project-specific TLRU studies funded by Alamos. The mitigation measures sections (Sections 19.4.3.2, 19.4.4.2, and 19.4.5.2) list those measures proposed by Indigenous communities and presents mitigation measures that Alamos would implement for the Project.

The analysis of residual effects on Indigenous Peoples is based on information from Project-specific TLRU studies; the results of the Indigenous engagement process for the Project; the results of a review of publicly available literature; and the conclusions of relevant biophysical and socio-economic assessments. Feedback received after filing will be reviewed in the context of the EIS and incorporated into Project planning, as appropriate. If residual effects are anticipated to be unique for one or more Indigenous communities, those distinctions are addressed.

Indigenous Receptor locations were incorporated into the Atmospheric Environment, Human Health, and Indigenous Peoples assessments (Chapters 6, 18, and 19). The selection of these receptors was informed by Alamo's engagement with Indigenous communities and publicly available sources of traditional land use information. Due to the length of time required to conduct air quality modelling, Indigenous Receptors were selected early in the assessment process and represent potential receptor locations rather than individual use sites.

This assessment of residual effects considers Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage. Project effects on Indigenous Peoples include the conclusions of related bio-physical and socio-economic VCs, the specific environmental effects related to each category considered, and potential effects identified for particular Indigenous communities.

19.4.2 Assumptions and the Conservative Approach

The assessment of residual environmental effects on Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage presents project interactions and pathways, mitigation measures and residual effects for each potential Project effect on this VC.

Marcel Colomb First Nation is the only Indigenous community that has a reserve and community location within the Indigenous Health Conditions and Indigenous Socio-Economic Conditions LAAs (Maps 19-2 and 19-3). However, members of the other 11 Indigenous communities engaged on the Project may choose to live and work within the Indigenous Health Conditions and Indigenous Socio-Economic Conditions LAAs and RAAs or travel to areas within the Indigenous Health Conditions and Indigenous Socio-Economic Conditions LAAs or RAAs to access services, temporary employment or to harvest country food (Maps 19-2, 19-3 and 19-4). The assessment of residual effects included in this section applies to Indigenous peoples living, working, or harvesting country foods within the Indigenous Health Conditions and Indigenous Socio-Economic Conditions LAA and RAA. The potential for adverse effects and benefits of the Project would primarily be experienced by Indigenous peoples who reside within the Indigenous Health Conditions and Indigenous Socio-Economic Conditions LAA and RAA and, as a result, are the focus of this assessment.

Potential interactions and pathways include information from biophysical, and socio-economic assessments where potential Project effects on Indigenous health conditions, Indigenous socio-economic conditions, and

Indigenous physical and cultural heritage are applied. This assessment incorporates information from related VC assessments (Section 19.1.3.2). The assumptions made in those assessments are relevant here. For example, a conservative approach was used to identify potential interactions between the Project and Current Use (Chapter 17). Where there is an absence of Project-specific information, Chapter 17 and this Indigenous Peoples assessment assumes that Current Use activities have the potential to occur within the RAA, even if Indigenous communities did not specifically identify these areas or uses. The Human Health assessment (Chapter 18) assumed that Indigenous Receptors, including Indigenous peoples who live near the Project, consume higher levels of country foods compared to Residential Receptors. This assumption is carried forward into the assessment of Indigenous Health Conditions below. Additional information about the assumptions made by related VC assessments and which apply to this chapter are provided in Chapter 13, Section 13.4.1; Chapter 14, Section 14.4.1; Chapter 16, Section 16.7; Chapter 17, Section 17.4.1.1; and Chapter 18, Section 18.4.1.1.

Although residual effects are considered on a community-specific basis, Project residual effects on Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are summarized and presented in a single table (Table 19-8).

19.4.3 Change in Indigenous Health Conditions

19.4.3.1 Effect Pathways

The effect pathways carried forward for Indigenous health conditions are also addressed as part of the Current Use (Chapter 17) and Human Health (Chapter 18) assessments.

Indigenous health conditions may be affected through changes to the availability of wildlife, fish, and plants that are harvested for country foods and the perceived quality of country foods, which are assessed in Current Use. The Project is expected to remove vegetation during construction activities that may be used as country food by Indigenous communities. Development of the PDA will remove habitat suitable for wildlife, vegetation or fish species harvested for consumption. Project-related transportation may cause wildlife mortality and reduce the availability of traditionally harvested resources (Chapter 12, Section 12.4.3). Project-related traffic on PR391 between Thompson and Suwannee Lake may also result in a greater potential for wildlife/vehicle collisions and mortality (Chapter 17, Section 17.4.2.1). Project-related noise, light and vibration may also alter the availability of traditional resources (Chapter 17, Section 17.4.2.1). For example, Project-related noise (e.g., heavy equipment operation, blasting, and increased traffic levels) could result in avoidance by wildlife such as moose and reduce the abundance of moose available to traditional harvesters within 1 km of the PDA. The potential for residual effects to fish and fish habitat due to increases in water levels in Gordon and Farley lakes are within the range of natural variability in these lakes which are continually affected by beaver activity. Riparian, terrestrial, and wetland habitats have the potential to be temporarily altered (i.e., flooded), which could affect the habitat for species such as moose and water birds (Chapter 17, Section 17.4.2.1).

Information about the importance of caribou and caribou harvesting is incorporated in the Regional Context and existing conditions portions of the Current Use (Chapter 17) assessment. Through Project-related engagement, Marcel Colomb First Nation expressed concerned about effects on caribou populations and, therefore, hunting success. Peter Ballantyne Cree Nation, Barren Lands First Nation, and Hatchet Lake First Nation also expressed concern about potential effects on caribou and the consumption of caribou.

Manitoba Metis Federation and Métis Nation Saskatchewan – Eastern Region 1 expressed concern about potential effects on caribou and the consumption of caribou.

As identified in the Wildlife and Wildlife Habitat VC (Chapter 12), the Gordon site is outside the Boreal Caribou Manitoba North Range (Chapter 12, Map 12-4). The MacLellan site will result in a small loss of potential boreal caribou habitat, however, there has been no evidence to suggest the contemporary range of woodland caribou includes the MacLellan site. This is supported by Marcel Colomb First Nation traditional knowledge as Elders reported that caribou have not been observed in the area of the Project since the 1950s. As it was found that the Project is unlikely to result in an appreciable loss or alteration of boreal caribou habitat (Chapter 12, Section 12.4.2.4) and recent caribou harvesting within the Indigenous Health Conditions RAA was not identified by engaged Indigenous communities, there were no effect pathways identified through which the Project may alter the consumption of caribou and affect Indigenous Health Conditions. Alamos acknowledges that Indigenous communities are concerned about caribou and has committed to including Woodland caribou monitoring in the Wildlife Monitoring and Management Plan (Chapter 23, Section 23.5.15).

The Project may initiate a change in access patterns or routes used to travel to harvesting locations. Clearing of natural vegetation or earthworks, including digging of channels or infilling of ponds, may restrict or prevent travel within the PDA. Increased Project-related traffic also has the potential to effect travel along roads within the Indigenous Health Conditions LAA and RAA and the new distribution line required for the MacLellan site may alter access conditions. Marcel Colomb First Nation identified a travelway that is intersected by the MacLellan PDA and several travelways intersected by the Gordon Lake access road that are used to access lakes within the Indigenous Health Conditions LAA.

The Project may alter or deter the harvest and consumption of country foods by changing the value or perceived quality of country foods. Marcel Colomb First Nation, Mathias Colomb Cree Nation, Peter Ballantyne Cree Nation, and O-Pipon-Na-Piwin Cree Nation expressed concerns about potential for changes in water quality to affect the health of harvested fish within or downstream.

Manitoba Metis Federation expressed concerns about potential for changes in water quality to affect the health of harvested fish within or downstream of the RAA. Nisichawayasihk Cree Nation expressed concerns regarding human health (Chapter 17, Section 17.6.3.2).

The potential for the Project to affect the health of harvested wildlife and vegetation was also identified by several Indigenous communities (Chapter 17, Section 17.4.2). Alamos appreciates that the value or perceived quality (taste, smell, appearance) of country foods is subjective, conditional, and contingent on beliefs, perceptions, and the qualitative experience of Indigenous land users. Alamos will continue to engage with potentially affected Indigenous communities to better understand the extent to which this effect pathway may occur.

The Human Health VC (Chapter 18) considers potential changes to Indigenous health through inhalation and ingestion of chemicals of potential concern (COPCs), which could include exposure through ambient air, soil, water, and sediment, as well as through the consumption of wild meat, fish tissue, and vegetation. Potential changes to air, water and country food quality may affect the health of Indigenous peoples who live in the RAA region and who may engage in hunting, trapping, traditional and recreational activities. The human receptors that are expected to have the greatest exposures are residents and Indigenous peoples who engage in traditional practices within the Indigenous Health Conditions LAA. These receptors include Indigenous peoples who may in live in the Indigenous Health Conditions RAA, but who are assumed to consume higher levels of country foods, harvested from within their region, compared to Residential Receptors (Chapter 18, Section 18.3-18.4.1.1). Marcel Colomb First Nation expressed concerns about mining dust, chemicals, and contaminants entering into the country foods chain and making people sick.

Manitoba Metis Federation expressed concerns about mining dust, chemicals, and contaminants (such as arsenic) entering into the country foods chain and making people sick (Appendix 17A; SVS 2020).

As identified in Section 19.2.2, Indigenous Receptors HQ for total ingestion exposure to manganese, methylmercury and thallium are currently above Health Canada benchmarks and this is attributed to the consumption of fish and traditional plants harvested from within the RAA.

Pathways for effects to human health include Project-related atmospheric emissions, such as vehicle exhaust and rock and ore dust, and water discharges, including effluent and seepage. Project-related activities at the Gordon and MacLellan sites could increase the concentrations of chemicals of potential concern (COPC) in ambient air, soil, water, and sediment. An increase in such concentrations can lead to increases of these chemicals in vegetation, wild meat, and fish tissue. Noise from site preparation or mine operation may also affect Indigenous health conditions, particularly for Marcel Colomb First Nation members who reside in Black Sturgeon Reserve, or Indigenous people living in Lynn Lake. In the absence of mitigation, Project related changes in air, water, and country food quality may affect the health of Indigenous peoples who live within the RAA and who may engage in hunting, trapping, fishing, and recreational activities (Chapter 18, Section 18.4.2.1).

19.4.3.2 Mitigation

Mitigation measures to effects on Indigenous health as a result of Project activities are discussed here. Mitigation measures proposed to avoid or reduce potential adverse effects on Indigenous health conditions include those identified in the Current Use (Chapter 17) and Human Health (Chapter 18) assessments.

The implementation of the mitigation measures will be the responsibility of Alamos and or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards and based upon engagement with potentially affected Indigenous peoples. Alamos commits to ongoing engagement with potentially affected Indigenous peoples to discuss the efficacy of mitigation measures.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Key mitigation measures which will be implemented to reduce changes in Indigenous health are discussed for plant harvesting sites and access:

Design for implementation of one or more of the following mitigation measures for plant harvesting sites within the PDA:

- Avoidance through Project design.
- Avoidance through timing of Project activities and potential scheduling of construction during periods of lower sensitivity.
- Incorporation of plant species of interest to Indigenous communities into rehabilitation plans where appropriate and technically feasible.

Design for implementation of one or more of the following mitigation measures for changes in access to lands and resources currently used for traditional purposes:

- Avoidance through Project design.
- Avoidance through timing of Project activities and potential scheduling of construction during periods of least effect.
- Signage

Alamos has also developed a Conceptual Closure Plan (Appendix 23B) to provide direction in the development of the rehabilitation strategy for the end of the Project life cycle. Design for incorporation of plant species of interest to Indigenous communities will be implemented into the Closure Plan, where appropriate and technically feasible, through the following:

- Ongoing engagement with Indigenous communities regarding their concerns, mitigation of potential Project effects on TLRU, and potential monitoring opportunities.
- Design for implementation of work schedules for Project construction workers (12 hours per day, seven days per week) will deter workers from hunting and fishing locally outside of working hours during a shift.
- Development and implementation of Project-specific environmental management and monitoring plans, and discussion with Indigenous communities regarding these plans.

- Implementation of the additional mitigation measures outlined for the Vegetation and Wetlands (Chapter 11, Section 11.4.4.2), Fish and Fish Habitat (Chapter 10, Section 10.4.3), Wildlife and Wildlife Habitat (Chapter 12, Section 12.5), and Land and Resource Use (Chapter 15, Section 15.4.2) VCs.

A detailed Closure Plan will be developed once the detailed design process progresses.

Through the Indigenous engagement process for the Project, Indigenous communities provided recommendations and requests to mitigate for potential effects to Indigenous socio-economic conditions. As outlined above, Alamos identified mitigation measures which align with several of the concerns and measures recommended by Indigenous communities. Alamos will continue to engage with Indigenous communities with respect to outstanding mitigation recommended by Indigenous communities, including consideration of Indigenous concerns such as:

- Marcel Colomb First Nation recommends cultural sensitivity training for contractors and monitoring of vegetation clearing by an Elder.
- Manitoba Metis Federation indicated that a clear closure plan needs to be put in place to ensure potential social, economic, and environmental impacts from the mine closure upon decommissioning are avoided.

19.4.3.3 Residual Effects

Residual effects will act upon Indigenous peoples harvesting and consuming country foods within the Indigenous Health Conditions LAA and RAA. It is anticipated that residual effects would primarily be experienced by Marcel Colomb First Nation, the only Indigenous community whose reserve is located within the Indigenous Health Conditions LAA and RAA. However, other Indigenous communities may also experience residual effects as a result of the Project, through members traveling to the Lynn Lake area to harvest and consume country foods.

Indigenous health conditions may be affected by changes in the availability of country foods and value or perceived quality of country foods, as assessed in Current Use (Chapter 17). The availability of country foods within the PDA is currently limited by the former mine sites. The Project will remove approximately 1,210 ha of land and is expected to increase wildlife mortality and habitat loss for wildlife, fish, and plants within the PDA during construction and operation (Chapters 9, 10, and 12). However, the residual effects are not anticipated to cause population-level effects to plant, animal, and fish species, including those harvested as country foods within the Indigenous Health Conditions RAA. The MacLellan and Gordon sites are located on Crown land. Of the Crown land within the Indigenous Health Conditions LAA, the PDA for the Gordon site represents approximately 269 ha of provincial Crown land (0.002%). The PDA for the MacLellan site contains approximately 938 ha of municipally administered land (0.007% of the total Crown land area within the Indigenous Health Conditions LAA).

Although vehicular collisions and human-wildlife conflicts may result in mortality for a few individual animals, the health of harvested resources at a population level is not anticipated to change within the Indigenous Health RAA. Changes to fish habitat, and thus the availability of fish resources, are not expected to cause measurable reductions in the productivity of focal fish populations and fishing activities are expected to be able to continue at or near current levels. As the value or perceived quality of country foods is subjective Alamos will provide opportunities for Indigenous communities to discuss potential mitigation if concerns about the value of country food are identified.

Indigenous health conditions may also be affected by changes in access to harvesting areas. Site preparation activities and safe mine operation will prevent the use of the travelway overlapped by the MacLellan PDA identified by Marcel Colomb First Nation. Increased Project related traffic along the Gordon site access road is anticipated to alter the use of travelways which are intersected by Gordon Lake access road and which Marcel Colomb First Nation identified as used to access lakes within the Indigenous Health Conditions LAA (Chapter 17, Section 17.4.3.3).

The human health risks associated with inhalation exposures to carcinogenic and non-carcinogenic chemical of potential concern (COPCs) were evaluated for the Indigenous Receptors. The health risks associated with inhalation of carcinogenic COPCs in the Indigenous Health Conditions RAA were found to be below the acceptability benchmarks established by Health Canada (i.e., acceptable). The health risks associated with inhalation of non-carcinogenic COPCs in the Indigenous Health Conditions RAA were below acceptability benchmarks, with the exception of two Indigenous Receptor locations. Occasional exceedances of the 2025 1-hour NO_2 Canadian Ambient Air Quality Standards (CAAQS) are anticipated at Potential Indigenous Receptors 1, 2, and 3 (all located north or northeast of the Gordon PDA). Potential Indigenous Receptor 4 (north of the MacLellan PDA), Potential Indigenous Receptors 5 and 6 (both located southwest of the MacLellan PDA). To characterize potential human health risks, the assessment considers the magnitude and frequency of these exceedances as well as the pattern of exceedances as described in Chapter 18, Section 18.4.2.3; therefore, these exceedances are not an indication that human health effects will occur. Rather, they are an indication that additional investigation is required to further characterize potential human health risks.

The additional evaluation of health risks considers how often exceedances were predicted and whether the areas were also used for habitation. For Potential Indigenous Receptors 1, 2, and 3 (north of Gordon PDA) exceedances are anticipated to occur less than 1% of the time and are predominantly single events separated by prolonged periods where the air quality meets the CAAQS. For Potential Indigenous Receptors 4, 5, and 6 (near MacLellan PDA) exceedances are anticipated to occur less than 1% of the time. As these areas were not identified as habitation sites and exceedances are anticipated to occur at night it is less likely that people would be present and potentially exposed to the risk. Based on these results it is reasonable to conclude that occasional exceedances of the 2025 1-hour NO_2 CAAQS represent a negligible human health risk for people who may be in the area.

Noise levels predicted at Potential Indigenous Receptors and at the Black Sturgeon Reserve Receptors were found to be below both the Health Canada 6.5% “highly annoyed” target and the World Health Organization sleep disturbance noise guideline (Chapter 18, Section 18.4.2.3). As a result, noise-related sleep disturbances from the Project are not anticipated for Marcel Colomb First Nation members who reside in Black Sturgeon Reserve, Indigenous people living in Lynn Lake, or Indigenous or non-Indigenous people at the special receptor locations identified in the human health assessment.

Project-related changes (project alone case) in risks to Indigenous peoples due to ingestion exposure, through consumption of wild meat, fish, and traditional vegetation, were determined to be below the thresholds established Health Canada, including for arsenic. The baseline levels of manganese, methylmercury and thallium exceed the total ingestion benchmarks set by Health Canada for toddlers. As a result, the future case (which combines baseline case and project alone) is also anticipated to have levels of these three COPCs which are above the total ingestion benchmarks set by Health Canada for toddlers. On occasion, Indigenous peoples may ingest water directly from the lakes located in their particular region; however, these occurrences are expected to be infrequent based on the results of engagement, which indicate that people do not obtain drinking water directly from the lakes in the Indigenous Health Conditions RAA. The exception of West Lynn Lake, which is the water supply for the town of Lynn Lake (and which has been under a boil water advisory since 2012; Government of Manitoba 2020). The water supply for the Town of Lynn Lake is not expected to be affected by the Project. Hughes Lake is used as a source of water for the Marcel Colomb First Nation members living on the Black Sturgeon Reserve; however, that water passes through a water treatment system prior to distribution to the community. It is noted that the average of the predicted future concentrations of metals in the lakes in the Indigenous Health Conditions RAA are less than the applicable drinking water guidelines (Chapter 18, Section 18.4.2) suggesting even if the water were used for consumption that health risks related to metal exposures would be negligible.

Residual effects to Indigenous health conditions are expected to be adverse and moderate in magnitude. Harvest of country foods will be able to continue with some alteration of behavior such as changes in patterns of access or travel routes. Effects are anticipated to extend to trapping, harvesting sites, travel, and multi-use sites, such as the Potential Indigenous Receptor 6 within the Indigenous Health Conditions LAA, and to take place during all phases of the Project. Increases in metal loadings in environmental media (soil and water) and risk associated with ingestion would be permanent and irreversible whereas risk associated with inhalation exposures to NO_2 would only occur during Project operation and be reversible. Residual effects are characterized as irregular in frequency and long-term in duration as change to access to harvesting areas and availability of harvested species will occur occasionally and without predictable pattern and persist throughout the construction and operation phase of the Project. Effects are anticipated to be reduced during Project decommissioning/closure.

19.4.4 Change in Indigenous Socio-Economic Conditions

19.4.4.1 Effect Pathways

The effect pathways carried forward for Indigenous socio-economic conditions are also addressed as part of the assessments of Labour and Economy (Chapter 13), Community Services, Infrastructure, and Wellbeing (Chapter 14), and Land and Resource Use (Chapter 15).

Through the Indigenous engagement process for the Project, Mathias Colomb Cree Nation indicated that the Project may result in an effect on socio-economic conditions due to wildlife and fish resource depletion by non-Mathias Colomb Cree Nation members. Project construction and operation may change Indigenous socio-economic conditions through the loss of land area, restriction of access to designated lands and competition with additional recreational land users, thereby affecting commercial trapping, and guiding hunters that Indigenous peoples engage in. Pukatawagan Registered Traplines 30, 32, 35, 36, and YTC and Southern Indian Lake Registered Trapline 42 are within 1.5 km of the PDA for the Gordon and MacLellan sites or the stretch of PR 391 between the Gordon site access road and the MacLellan site access road and may be affected by Project related dust and noise (Map 19-5). There is potential for workers to engage in recreational land and resource during the Project construction and operation phases placing additional demands on resources also relied on by Indigenous people and businesses.

Project construction may also reduce the amount of land available for the purposes of recreation, and could affect the quality of outdoor recreation, and by extension, have similar effects on Indigenous experience of land and resource use. Project construction and operation may affect visual aesthetic values through Project presence (e.g., recreational users' quality of experience due to operation activities at both sites) and disturbance of trapping, and guiding hunters due to noise disturbance.

The Land and Resource Use chapter of the EIS (Chapter 15) noted that a recreational canoe route is crossed by the existing Gordon site access road, and that there is potential for a proposed 34.5-kV distribution line to be used as a recreational trail for snowmobiles and ATVs (Chapter 15, Section 15.4.3.1,). It is possible that recreational hunters could use the trail resulting from this line, pursuing species of value to Indigenous communities, and thereby potentially increasing hunting pressure on traditionally harvested species and affecting Indigenous socio-economic conditions.

There are several waterbodies within the Indigenous Socio-Economic Conditions LAA that are sport fished or have sport fish species, including: Minton Lake, Keewatin River, Lynn River, Cockeram Lake, Cartwright Lake, Hughes Lake, Hughes River, Simpson Lake, and Swede Lake (Map 19-2). Access to these fishing areas may be restricted by Project construction (Chapter 15, Section 15.4.4.1). Changes to fish habitat, and thus the availability of fish resources, may occur as a result of the placement of materials or structures in water during construction. Changes to fish habitat may also occur as a result of the potential changes in water levels in Gordon and Farley lakes due to the depression of the groundwater table and loss of surface water due to development of the open pit during construction (Chapter 10). It is anticipated that the bulk of the Project workforce will be drawn from outside the RAA, and these workers will be housed in a camp built for the Project at the MacLellan site (Chapter 14, Section 14.4.2.1). The Town of Lynn Lake offers several temporary accommodation options, including a motel, an inn, and various housing properties available for rent. As workers will be housed in a dedicated camp, the Project is not anticipated to have negative effects on Indigenous access to housing, but neither will it yield opportunities for Indigenous property owners to charge rental fees to Project workers.

As discussed in Chapter 14, Section 14.5.3.1, the overall population of the Town of Lynn Lake has declined with mine closures, and the current capacity of local infrastructure reflects this decline. A relatively sudden influx of workers for the Project could tax current services and infrastructure, thereby affecting Indigenous use and reliance on these services. The Project could reduce the capacity of existing service providers and local infrastructure to respond to and manage emergencies in Indigenous and non-Indigenous communities. For example, injuries at construction sites, vehicle collisions due to increased traffic, and incidents requiring police response, could contribute to overwhelming the capacity of local emergency services. Construction of the Project will also generate solid waste and the construction camp will require water, wastewater, and solid waste services, which are to be provided by the Town of Lynn Lake (Chapter 14, Section 14.4.3.2).

Movement of trucks, equipment, supplies and personnel within the Indigenous Socio-Economic Conditions LAA will place additional demands on local roads and airports. This may affect Indigenous peoples, including Marcel Colomb First Nation, who live and work within the Indigenous Socio-Economic Conditions LAA. PR 391, which connects Thompson and Lynn Lake, will be used for access to the Gordon and MacLellan sites. Nisichawayasihk Cree Nation has also expressed concerns regarding increased traffic on PR 391 resulting in further deterioration of their main access road (Chapter 17, Section 17.6.3.2). This roadway will also be used by mine personnel, delivery and maintenance personnel, and for ore haulage. The Project will result in increased commercial traffic on PR 391, as well as additional road wear, which could adversely affect Indigenous peoples who live and work in the Indigenous Socio-Economic Conditions LAA, as it is the travel route which links the residents of Black Sturgeon Reserve to the Town of Lynn Lake and larger centers such as Thompson.

As discussed in Chapter 14, busses will transport workers between the sites. Generation of additional traffic within the Town of Lynn Lake is not anticipated as a result of worker movements, as workers are likely to return to their home communities during scheduled time off of work. However increased traffic at the beginning and end of shift rotations may occur as workers may travel to the area from cities such as Thompson, Flin Flon, and Winnipeg. Workers may also require air transport, if coming from further afield, and this may increase demand for airport services in the Lynn Lake area.

As indicated in Chapter 14, community wellbeing could be affected through changes to employment and income as a result of the Project, and these effects could extend to Indigenous peoples. Levels of disposable income and health practices could be affected in both positive and adverse ways. These effects could occur through increased employment for local Indigenous communities. Engaged Indigenous communities, as identified in Chapter 3, Section 3.3.5, have expressed interest in Project-related economic opportunities. In assessing changes to community wellbeing, adverse effects on baseline conditions are examined using quantitative and qualitative methods, relying upon two indicators to measure Project-related changes to wellbeing: CIRNAC's Community Well-Being (CWB) Index and a working definition of 'social cohesion' proposed by Health Canada. The CWB Index is a published index that provides comparability across Canadian Census Subdivisions (CSDs) for which data are available and comprises four components that are widely accepted as important to wellbeing (i.e., education, labour force activity, income and housing). Social cohesion is defined as "the ongoing process of developing a community of shared values, shared challenges and equal opportunity within Canada, based on a sense of trust, hope and reciprocity among all Canadians" (Health Canada 2003). The CWB Index does not consider physical or mental health conditions and therefore should not be considered as the only measurement of CWB (Chapter 14, Section 14.2.2.7).

Construction and mining workers from Manitoba tend to be primarily non-Indigenous males and between the ages of 25-54 (Chapter 15). Because this demographic profile differs from that of the Indigenous Socio-Economic Conditions LAA, fly in fly out/drive in drive out (FIFO/DIDO) workers are expected to change the demographic profile of the Indigenous Socio-Economic Conditions LAA. Changes in population and the demographic profile have the potential to result in adverse changes in social cohesion. Social cohesion is an especially valuable indicator for Indigenous communities, as these communities are often subject to disproportionate degrees of inequity of vulnerability and are less likely to realize benefits of Project-related employment and income. One of the engaged Indigenous communities, Marcel Colomb First Nation, indicated that it is concerned about the community's capacity to benefit from the Project, and expressed a need for a cultural sensitivity training program for Project employees and contractors. Marcel Colomb First

Nation also indicated a need for a community liaison for mentoring community members employed on the Project.

Manitoba Metis Federation stated that a mining camp would reduce economic opportunities for the Town of Lynn Lake and if workers are transient, they will not be investing in the local economy. Manitoba Metis Federation expressed concern that crime rates could increase as a result of a transient workforce.

Engaged Indigenous communities also indicated interest in partnerships, so as to better realize potential Project benefits. Indigenous communities that expressed interest in partnerships were Marcel Colomb First Nation, Peter Ballantyne Cree Nation, and Nisichawayasihk Cree Nation. Barren Lands First Nation, although indicating no interest in employment or business opportunities for its community, supported Project-related job creation for Indigenous peoples.

Manitoba Metis Federation expressed interest in partnerships and also indicated interest in discussing mandatory minimums for Indigenous procurement related to the Project.

Indigenous and non-Indigenous persons employed on the Project are likely to experience differential demands in terms of the amount of time they have available to participate in recreational, subsistence, and family-related activities and physical exercise. Levels of income are also likely to increase with Project-related employment and increased disposable income could in turn lower financial barriers to accessing healthy market foods, resulting in a positive effect. Increased disposable income could also decrease financial barriers to harmful practices such as overeating, smoking, heavy drinking, and illicit drug use, resulting in adverse effects. Combined, these changes can both positively and adversely affect wellbeing and social cohesion (Chapter 14, Section 14.4.5).

Employment related to the Project could result in both positive and adverse effects to Indigenous communities. The Indigenous labour force has higher unemployment rates than the non-Indigenous labour force of Lynn Lake and the Indigenous Socio-Economic Conditions RAA (a similar discrepancy seen across the province). Unemployment rates within Lynn Lake and the Indigenous Socio-Economic Conditions RAA were also generally greater than provincial averages (total and Indigenous population). During construction, Project contractors and sub-contractors will hire local workers and will also bring in workers from outside the Indigenous Socio-Economic Conditions LAA to meet labour requirements. Local suppliers to the Project would create additional indirect jobs, and spending by the direct and indirect workforce would result in induced employment (Chapter 13, Section 13.4).

While Project-related employment is anticipated to be primarily beneficial, as it will result in increased household income, it is also recognized that a sudden change in discretionary income may result in changes in spending decisions that could cause adverse social outcomes for Indigenous communities. Project-related employment may also limit the amount of time harvesters are able to engage in current use such as the harvesting of country foods and increase reliance on purchased foods and paid employment. (Chapter 3, Section 3.4 and Chapter 14, Section 14.4).

Through the Indigenous engagement process for the Project, Peter Ballantyne Cree Nation expressed concern for local people being pushed out of jobs. All engaged Indigenous communities have expressed interest in potential project-related economic opportunities and the beneficial effects those may provide (Chapter 3, Section 3.3.5).

There are also potential adverse effects to the workforce and local services as a result of the Project decommissioning/closure, and these effects could be experienced by Indigenous communities (Chapter 3, Section 3.4).

In the Project-specific Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study (Appendix 17A; SVS 2020), Manitoba Metis Federation expressed concern about socio-economic effects in the event of abrupt Project closure without effective management and reclamation.

Spending related to the Project could both benefit and adversely affect regional businesses, including Indigenous-owned businesses. Benefits typically relate to an increase in revenues, which can enhance the capacity of local businesses by supporting capital investment and hiring. There is potential for Indigenous business owners to offer goods and services to Project workers during the life of the Project, which could positively affect Indigenous socio-economic conditions.

Adverse effects relate to increased demand for labour, goods, and services, which can increase operational costs for both Indigenous and non-Indigenous business owners (decreasing revenues) through wage inflation and employee turnover. Increased competition for labour can also decrease the capacity of businesses through labour shortages. Indigenous communities may be reliant on proceeds derived from subsistence economies, such as trapping. Marcel Colomb First Nation expressed concerns for potential Project-related damages to traplines.

19.4.4.2 Mitigation

Mitigation measures proposed to avoid or reduce potential adverse effects on Indigenous socio-economic conditions include those identified in the Land and Resource Use (Chapter 15), Community Services, Infrastructure, and Wellbeing (Chapter 14), and Labour and Economy assessments (Chapter 13).

The implementation of the mitigation measures will be the responsibility of Alamos and or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards and based upon engagement with potentially affected Indigenous peoples. Alamos commits to ongoing engagement with potentially affected Indigenous peoples to discuss the efficacy of mitigation measures.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Mitigation measures which will be implemented to reduce adverse changes in Indigenous socio-economic conditions include:

- Alamos will engage local land and resource users (e.g., Indigenous guides), affected tenure holders (trappers), and the Town of Lynn Lake to address, to the extent possible, issues related to the removal and inaccessibility of lands and resources within the PDA at Project sites, including the restriction in use of the Gordon site access road.
- Alamos will engage with local resource users (hunters, outfitters, trappers, anglers) and MCC Regional Officials to address to the extent possible the potential conflict, disturbance, or access restrictions to hunting, trapping, and fishing areas in the PDA, and availability of wildlife and fish resources.
- Alamos has been collaborating with Indigenous communities and will continue to work towards potential training and education partnerships with Manitoba Keewatinowi Okimakanak Inc, (MKO) the Northern Manitoba Sector Council (NMSC), and Atoskiwin Training and Employment Centre (ATEC) to provide opportunities for Indigenous people to obtain skills and training required for Project participation.
- With Alamos's support, Marcel Colomb First Nation has previously facilitated activities intended to increase Indigenous cultural awareness for Project employees. Alamos will continue to engage with Marcel Colomb First Nation in supporting development and presentation of these activities and events.
- Work schedules will be implemented for Project construction workers (subject to fly-in/fly-out employment) to deter workers from hunting locally outside of working hours during a shift.
- Alamos will communicate the schedule of Project activities throughout the construction, operation, and decommissioning/closure phases to affected Indigenous communities.
- Development and implementation of Project-specific environmental management and monitoring plans, and discussion with Indigenous communities regarding these plans.
- Design for site security services to help limit demands on the local police system.
- Design for implementation of work schedules for Project construction workers (12 hours per day, seven days per week) that deter FIDO/DIDO workers from spending time off shift in local communities and accessing community recreation services and facilities outside of working hours as these services and infrastructure are relied upon by Indigenous and non-Indigenous residents.
- Implement standard construction procedures and a Traffic Management Plan to reduce traffic delays during construction. The Traffic Management Plan will be developed during ongoing planning and engineering design to address traffic staging to reduce delays.
- Scheduling of alternating work shifts so that all workers do not arrive in and leave the area at the same time, will limit Project-related demands on both traffic and air services and infrastructure.

- A work camp will be put in place for construction, commissioning, and operation.
- Provide bussing services between the temporary camp and the Gordon site.
- Encouraging carpooling among locally resident construction and operation workers.
- Schedule arrivals/departures of employee traffic to occur earlier than the existing observed a.m. peak hour for local traffic and later than the existing observed p.m. peak hour if needed.
- Plan for workforce education to encourage healthy lifestyle choices, cultural sensitivity training and strict enforcement of Alamos' health and safety policies will also help mitigate adverse social effects. For example, such training would raise the level of awareness about the potential effects that workers can have on the community and their families through drug and alcohol use or other social concerns.
- If during operation workers and their families relocate to Lynn Lake, Alamos will collaborate with the Town of Lynn Lake and surrounding Indigenous communities to discuss appropriate monitoring or management plans to address draws on services.
- Alamos is in discussions with Manitoba Infrastructure regarding the need for upgrades to PR 391 and/or weight exception requirements to support the Project.
- Design to enhance potential positive effects by:
  - Posting of job qualifications in advance and identifying available training programs and providers so that local and Indigenous residents can acquire the necessary skills and qualify for potential Project-related employment.
  - Posting of Project purchasing requirements in advance so that Indigenous businesses can position themselves to effectively compete to supply goods and services needed for Project construction and operation.
  - Working with Indigenous communities to develop training programs oriented to Project operational needs.
  - Developing a plan for working with Indigenous-owned businesses to enhance their potential for successfully bidding on Project contracts regarding the supply of goods and services.

Alamos has also developed a conceptual closure plan (Chapter 23, Section 23.5.2) to provide direction in the development of the rehabilitation strategy for the end of the Project life cycle. A detailed Closure Plan will be developed once the detailed design process progresses.

Through the Indigenous engagement process for the Project, Indigenous communities provided recommendations and requests to mitigate for potential effects to Indigenous socio-economic conditions. As outlined above, Alamos identified mitigation measures which align with several of the concerns and measures recommended by Indigenous communities. Alamos will continue to engage with Indigenous communities with respect to outstanding mitigation recommended by Indigenous communities, including consideration of Indigenous concerns such as:

- Marcel Colomb First Nation requested cultural sensitivity training for contractors and monitoring of vegetation clearing by an Elder.
- Mathias Colomb Cree Nation indicated that the Granville Lake community was interested in training programs and training alliances.
- Peter Ballantyne Cree Nation requested that Peter Ballantyne Cree Nation community members would be guaranteed employment as part of the Project. Peter Ballantyne Cree Nation also expressed interest in economic benefits/opportunities, commitments to employment, and training. Peter Ballantyne also expressed interest in partnerships that will be offered.
- Nisichawayasihk Cree Nation, O-Pipon-Na-Piwin Cree Nation, Hatchet Lake First Nation, and Sayisi Dene First Nation each expressed interest in workforce and business opportunities. Barren Lands First Nation indicated that the biggest positive outcome of the Project was job creation.
- Manitoba Metis Federation requested the employment of Manitoba Métis Community citizens as monitors.
- Manitoba Metis Federation indicated that the biggest positive outcome of the Project was job creation
- Manitoba Metis Federation expressed interest in potential economic development opportunities and in provision of construction services through Métis N4 Construction Inc. Manitoba Metis Federation also would like to discuss mandatory minimums for Indigenous procurement and suggested that contract work that goes out for tender needs to prioritize Métis-owned businesses.
- Manitoba Metis Federation indicated that the hiring, retention, and support of local Manitoba Métis Community citizens will be good for Métis people and families.
- Manitoba Metis Federation indicated that a clear closure plan needs to be put in place so that potential adverse social, economic, and environmental from the mine closure are avoided.

19.4.4.3 Residual Effects

Residual effects to Indigenous socio-economic conditions are anticipated to Indigenous peoples living and working within the Indigenous Socio-Economic Conditions LAA and RAA. Effects are anticipated to include change to the use of and access to road infrastructure, medical, and other public services, as well as effects to economic and financial conditions through changes to commercial trapline harvest and employment with the Project. These effects are expected to be positive and adverse, and are expected to primarily affect Marcel Colomb First Nation, which is the only community with a reserve lying within the Indigenous Socio-Economic Conditions LAA. Effects may extend to other Indigenous communities through members who live, work, or harvest in the Lynn Lake area.

Project construction may affect, restrict, or change the land base available for recreational activities, including hunting and fishing. The MacLellan and Gordon sites are located on Crown land. Of the Crown land within the Indigenous Socio-Economic Conditions LAA, the PDA for the Gordon site represents approximately 269 ha of provincial Crown land (0.0006%). The PDA for the MacLellan site contains approximately 938 ha of municipally administered land (0.002% of the total Crown land area within the Indigenous Socio-Economic Conditions LAA). Project clearing and construction activities will affect Pukatawagan Registered Traplines 30, 32, 36, and YTC, and lead to a loss of area available for trapping. The loss of area will vary for each trapline and is listed in Table 19-7. The portions of these four traplines that are located outside of the PDA may experience temporary sensory disturbance (e.g., construction noise, visual) and nuisance effects (e.g., traffic) displacing big game or furbearers and reducing harvesting success rates. Access restrictions will be in place for the period of construction. Traffic control measures will be developed to address access accommodation plans and logistics and lessen effects during construction.

Table 19-7 Registered Traplines within the PDA at Gordon and MacLellan Sites

Registered Traplines	Percentage of PDA in Trapline	PDA Trapline Area in (ha)	Percentage of Total PDA*
Pukatawagan Registered Trapline YTC	0.1%	21 (MacLellan)	1.7%
Pukatawagan Registered Trapline 36	2.1%	808 (MacLellan)	66.9%
Pukatawagan Registered Trapline 30	0.2%	109 (MacLellan)	9.0%
Pukatawagan Registered Trapline 32	0.4%	269 (Gordon)	22.3%
Note: *Percentage of total PDA for Gordon and MacLellan combined.			

Residual effects are not anticipated to extend to the Pukatawagan Registered Trapline 35 and Southern Indian Lake Registered Trapline 42 as these areas will not be cleared or are likely to experience noise or access related changes.

If unmitigated, changes to these 4 Registered Traplines (Table 19-7) may place socio-economic burdens on the trapline holders, as trapping can provide a means of income. Alamos and Marcel Colomb First Nation will continue to work together on establishing a Participation Agreement (Impact Benefit Agreement or similar), to achieve mutual benefits considering potential adverse effects, including interruption to trapline users (Chapter 3).

In the construction phase, two cabins are located within the Indigenous Socio-Economic LAA, and any visitors to or occupants of these cabins may experience nuisance effects in the form of increased vibration levels resulting from construction activities and equipment (Chapter 15, Section 15.4.2.3). Predicted sound levels at the MacLellan site are below Health Canada targets and anticipated to be below annoyance levels for the closest receptors (Volume 5, Appendix C; Chapter 7, Section 7.4.2.4). Indigenous peoples may be affected by increased noise levels generated from the hauling of ore by trucks. Vibration levels from Project-related blasting may cause annoyance.

Recreational users may experience sensory disturbance resulting from Project construction activities, affecting the quality of the recreation experience. During construction, the presence of workers, equipment, and Project-related traffic on local roads in the Indigenous Socio-Economic Conditions LAA will generate noise, dust, and visual disturbance, including lighting. While Project-related increases in lighting are not anticipated to have effects that extend beyond a few kilometers from Lynn Lake and Black Sturgeon Reserve (Volume 4, Appendix B and Chapter 5, Section 5.1), the presence of workers and equipment could detract from the recreational experience of tourists who may reduce or stop their use of areas near Project work sites during periods of construction activity. A reduction in tourists or recreation users in the area could also affect Indigenous communities who act as guide-outfitters.

Visual quality within the Indigenous Socio-Economic Conditions LAA is expected to change overall with the Project, as are sensory disturbances, as the industrial vehicular traffic servicing the mine will create dust, noise, and contribute to the wear of and overall traffic presence on PR 391. Portions of the ore stockpile, overburden stockpile, and mine rock storage area at MacLellan site will be visible from a high viewpoint along PR 391 (Appendix 15A). The Gordon site will be just barely visible from Black Sturgeon Reserve, and potentially from the north portion of Hughes Lake (Appendix 15A). As noted in Chapter 15, Section 15.4.2, the PDA and surrounding areas have been previously disturbed by mining activity and the anticipated change to noise, dust, and visual disturbance are likely to be incremental.

Simpson and Swede lakes are sport fished or have sport fish species. During construction, access to these lakes along the existing access road to the Gordon site will be interrupted. However, there is alternative access to these lakes through existing trails and old winter roads that can be utilized (Chapter 15, Section 15.4.4.3). Changes to fish habitat, and thus the availability of fish resources, are not expected to cause measurable reductions in the productivity of focal fish populations and fishing activities are expected to be able to continue at or near current levels (Chapter 15, 15.5.4.3 and Chapter 10).

Residual effects to local services and infrastructure that could affect Indigenous socio-economic conditions are anticipated to be limited. Overall, increased demand on local services, including education, health, and emergency services as a result of the Project, is anticipated to be minimal. Project workers are not expected to bring their families to the area and will be housed at a dedicated camp, and as a result effects on housing and education are not anticipated (Chapter 14, Section 14.4.2). As workers for the construction and operation phases of the Project will be housed in a camp at the MacLellan site, effects on the availability of temporary accommodation in Lynn Lake are expected to be negligible. There could, however, be an economic benefit to services in the Indigenous Socio-Economic Conditions LAA due to spending by workers and contractors.

During construction, the Project will contract its own first aid facilities, which will include Emergency Medical Services first responders who can provide patient transfer to the hospital in Lynn Lake. This will reduce potential demands on health services during construction. While the hospital in Lynn Lake is fully staffed with primary care physicians, capacity and personnel issues have been noted. Although Project employees are expected to see healthcare providers in their own hometowns, which will reduce potential demands on health care during operation, the emergency health care needs of Project employees resulting from an accident or incident are likely to be addressed in Lynn Lake, which could also affect Indigenous peoples' access to such care.

The Project will not place additional demands on power, water, and wastewater services and infrastructure. As indicated in Chapter 14, Section 14.4.2.3, power for the MacLellan site will be supplied by Manitoba

Hydro via infrastructure built by Alamos, waste disposal will follow a Waste Management Plan (Chapter 23, Section 23.5.6), while non-hazardous domestic waste will be deposited at the Lynn Lake landfill. Because domestic and construction waste from the Project will be taken to the local landfill, there may be some adverse effect on that infrastructure. The Lynn Lake waste disposal site is nearing capacity but has space available for expansion, which would provide another 20 years of capacity at current rates of use (Chapter 14, Section 14.2.2.6). Alamos will continue to communicate with local communities and service providers with respect to scheduling so they may prepare for the residual effect associated with increased demands on the municipal landfill. Power, water, and wastewater systems for the Project will be independent of the Town of Lynn Lake and Marcel Colomb First Nation's community at Black Sturgeon Reserve, thus eliminating increased demands on that infrastructure within the town or Black Sturgeon Reserve.

Although there are RCMP detachments in Lynn Lake and nearby Leaf Rapids, as well as in Thompson, the detachments have experienced staffing issues, which could cause effects to Indigenous peoples who access RCMP and policing services.

Traffic volumes along PR 391 between Thompson and Lynn Lake are expected to increase by one to two truckloads per day as a result of the Project; however, greater volumes of traffic associated with the movement of equipment and personnel are anticipated along PR 391 between the Gordon and MacLellan sites (Chapter 14, Section 14.2.2). The Project is estimated to require seven truckloads per hour between the Gordon and MacLellan sites during the six years of mining operation at the Gordon site. These changes will be noticeable and may inconvenience Indigenous peoples in the area, particularly Marcel Colomb First Nation members who reside in Black Sturgeon Reserve and use the portion of PR 391 between the Gordon and MacLellan sites for all road-based travel. As indicated in Chapter 14, Section 14.4.3.3, due to increased haulage on PR 391 and the existing surface conditions of the road being rated as in need of repairs, the road will require increased maintenance activity and at least one 6-km section of the road will need to be resurfaced prior to hauling operation beginning. Alamos is in discussions with Manitoba Infrastructure regarding the need for upgrades to PR 391 and/or weight exception requirements to support the Project (Chapter 14, Section 14.2.2).

While bussing of workers to and from the job sites is anticipated to reduce overall vehicle traffic on PR 391, it is also expected that many Project workers will commute regularly to the camp and MacLellan site from Thompson, Flin Flon, Winnipeg or other Canadian cities, based on shift rotations. This will increase vehicular traffic on PR 391 at the beginning and end of work rotations. These workers may also stop in Lynn Lake for fuel or supplies, and effect a visible change for residents, including Indigenous peoples' access to local services on shift rotation end and beginning days.

Alamos estimates that an annual average direct workforce of 406 full-time equivalents[9] (FTE) will be required over the two-year construction period, a 412 FTE workforce over the 13-year operational period, and an annual 90 FTE workforce during decommissioning/closure (Ausenco 2019; PwC 2020a; PwC 2020b). As indicated in Chapter 13, Section 13.4.2.3, Alamos estimates that 100% of direct employment effects will occur in the Northern Region of Manitoba, an area that includes the Indigenous Socio-Economic

[9] Defined as the number of hours worked by one individual on a full-time basis. FTEs are used to describe the total hours worked by several part-time employees (e.g., contract, seasonal, fulltime) into the hours worked by full-time employees.

Conditions LAA and RAA. Compared to existing labour force conditions (Chapter 13, Section 13.2.2.3), employment estimates for the Northern Region exceed the overall available labour force size and scope of occupations available to respond Project demands. It is possible that Project employment could result in the in-migration of workers (and their families) to the Indigenous Socio-Economic Conditions LAA; however, due to workforce planning that calls for the use of a ‘fly in, fly out/drive in, drive out’ workforce to satisfy a large percentage (i.e., 95%) of labour demand, the likelihood of this occurring is low. It is assumed that most local employment (5% of total direct demand) would flow to usual (or already existing) residents of the Indigenous Socio-Economic Conditions LAA, assuming that local residents seek employment with the Project and are appropriately skilled.

Recognizing that the Indigenous population represents 40% of Lynn Lake’s labour force and just over 37% of the Indigenous Socio-Economic Conditions RAA labour force (17.9% of Lynn Lake’s Indigenous labour force (equal to 33.3% of the total labour force) hold an apprenticeship or trades certificate or diploma, while 6.7% (equal to 17.9% of the total labour force) of the Indigenous Socio-Economic Conditions RAA population hold an apprenticeship or trades certificate or diploma, it is likely that the Project will employ more non-Indigenous than Indigenous persons. It is also possible that the Project could employ more males than females because most jobs associated with the Project will be in trades- and construction-related occupations and other industries that have disproportionately high employment among males (Chapter 13, Section 13.4.2).

Indigenous and non-Indigenous peoples employed on the Project may experience temporal and financial effects as a result of the Project. Time available for participation in recreation, physical exercise, family activities, and subsistence practices may change as a result of the Project, and increased levels of income associated with Project employment may have both positive and adverse effects related to wellbeing and social cohesion. Indigenous and non-Indigenous peoples may be able to access higher grades of food and products as a result of financial changes but may also experience increased access to harmful practices such as smoking and heavy consumption of alcohol (Chapter 14, Section 14.4.5).

As the Project transitions into decommissioning/closure, a planned decrease in workforce that ultimately results in the loss of employment will occur. This loss of employment is known and will be anticipated by Project workers as the operational life of the Gordon site and the MacLellan site will be communicated at early stages of the Project (Chapter 13, Section 13.4).

The Project is anticipated to residually affect the community well-being (CWB) index score and social cohesion within the Indigenous Socio-Economic Conditions LAA. It is expected that the labour force and income subcomponents of Lynn Lake’s CWB score will increase, as Project employment will have beneficial effects on participation and employment rates, and as Project wages are greater than existing conditions. While existing CWB Index scores are not available for Black Sturgeon Reserve, given that increased employment and income are expected to occur throughout the LAA, positive changes in labour force and income variables of the CWB Index (i.e., income per capita and participation and employment rates) are also expected (Chapter 14, Section 14.4.5).

Despite the implementation of mitigation and management measures, Project employment and related beneficial effects on individual and household income may not be equitably realized by active labour force participants within the Indigenous Socio-Economic Conditions LAA’s ‘vulnerable population’ classification (defined in Chapter 14, Section 14.4.1.2). For example, non-Indigenous males employed in construction and mining with trades training may realize a disparate share of total local employment (Chapter 14, Section 14.4.5). The Project is not anticipated to result in changes to housing quality or quantity within Black Sturgeon Reserve and negligible changes in existing conditions related to housing and community wellbeing are anticipated within the Indigenous Socio-Economic Conditions LAA.

While Alamos will work with Indigenous communities to address educational and skills shortages that may arise as barriers to employment, and employment policies will be in place that encourage workers to complete high school, the Project is not anticipated to have a measurable positive or adverse effect on the proportion of the current Indigenous Socio-Economic Conditions LAA population with high school or university educational attainment. As such, the Project is expected to result in negligible changes to education and wellbeing (Chapter 14, Section 14.4.5).

While total estimated changes in population are substantial, due to the Project's use of an accommodation camp and Alamos' planned cultural sensitivity training, the relatively short period of time FIFO/DIDO workers will spend in Indigenous Socio-Economic Conditions LAA communities, the likelihood that residents will perceive overall population effects is moderate (Chapter 14, Section 14.4.5). As identified in Chapter 14, Section 14.4.5, the socio-economic context is considered to be non-resilient with respect to changes in personal health practices given that relative to provincial averages, residents have higher rates of obesity and greater reliance on negative coping mechanisms (i.e., smoking and heavy drinking). As employment and income effects are not anticipated to be equitably realized by all members of the Indigenous Socio-Economic Conditions LAA population, active labour force members of the Indigenous population (and other vulnerable populations) are less likely to experience positive or adverse Project effects on personal health practices related to changes in employment and income. Alamos will develop a workforce education plan to encourage healthy lifestyle choices and provide cultural sensitivity training with the intent of raising awareness and reducing negative effects on the well-being of Indigenous and non-indigenous communities. Alamos' strict enforcement of health and safety work policies will also help mitigate adverse social effects.

Overall, effects to Indigenous socio-economic conditions are anticipated to be both adverse – removal of portions of Registered Traplines, increased traffic along PR 391, and noise disturbance at two cabins – and positive, due to the potential for increased local spending by Project workers and increased employment of Indigenous peoples. These effects are moderate in magnitude, as the use of and access to, infrastructure and services is at available capacity, which may affect the quality of services provided, and the changes in the economy are unlikely to pose substantial risks or benefits. The effects will extend to the Indigenous Socio-Economic Conditions LAA, and are expected to be of long-term duration, given that the Project life is estimated at 13 years. Changes to Indigenous socio-economic conditions are considered reversible, as the Project will be decommissioned, the workforce released, and the areas reclaimed.

19.4.5 Change in Indigenous Physical and Cultural Heritage

19.4.5.1 Effect Pathways

The effect pathways carried forward for Indigenous physical and cultural heritage are also addressed as part of the Heritage Resources (Chapter 16) and Current Use (Chapter 17) assessments. Effects to Indigenous physical and cultural heritage can include indirect changes, as would occur through increases in noise, light, dust (and other emissions) and sensory changes, and direct changes, such as could occur through physical loss of, or loss of access to, resources as a result of Project activities.

Indigenous physical and cultural heritage may be affected by the Project. The Current Use assessment considers changes to traditional cultural and spiritual sites and areas (Chapter 17, Section 17.4.4). The Project is expected to directly interact with cultural sites and areas through the physical removal of, or changes to, features and indirectly through Project-generated emissions. During construction, vegetation will be removed during the physical clearing of the site, and signage and fencing will be erected to manage access to the Project. Project-related emissions during all Project phases, such as noise, and dust from blasting and traffic, as well as removal of visual buffers as a result of vegetation clearing could disturb or change the use of cultural and spiritual sites and areas. Dewatering activities will take place through the construction phase. Changing water levels will continue during the operation phases of the Project and have the potential to introduce changes to sites and areas if access becomes blocked or if sites are directly affected by overland water flows. Changes during the decommissioning/closure phase may have positive outcomes, including reductions of sensory disturbance and vegetation succession.

During the engagement process, Marcel Colomb First Nation indicated concern regarding the potential for Project-related activity to disturb unmarked traditional burial sites. Alamos recognizes these concerns and will both continue to engage with potentially-affected indigenous communities on the Project and adhere to all provincial regulations related to the Heritage and Cultural Resources Protection Plan (HCRPP).

The HRIA conducted for the environmental assessment (Chapter 16) recorded 11 heritage resource sites in the Heritage Resources MacLellan site LAA and Indigenous Physical and Cultural Heritage LAA (Chapter 16, Section 16.2.2). Eight of the 11 recorded heritage resources sites are located within 100 m of Keewatin River. Of the 11 sites, three are Historic Period camp sites, one is a wooden structure, one is a trail, and six are Precontact Period sites containing small assemblages of lithic flakes. One camp site (HfMf-8) is located on a terrace on the east side of Keewatin River, and is thought to relate to an early mineral exploration camp or habitation. The other two camp sites are located on the west side of Keewatin River and are likely to relate to early mineral exploration camps or temporary habitation. The lone structural site is adjacent to an old quarry and may have been a storage building and is currently in an advanced state of collapse. The Precontact Period sites contained lithic fragments, but as few artifacts were recovered, the activities that produced the cultural deposit are not evident. One Precontact Period site, HfMf-3, produced 34 quartz flakes, while the other five contain one to two lithic flakes. The known heritage resources in the MacLellan site PDA do not interact with the proposed Project components; therefore, there is low potential for effects on these heritage resource sites. No heritage resource sites have been recorded in the Gordon site PDA, and predictive modelling has indicated that there is a low potential for the Gordon site PDA to contain unknown heritage resources.

At the time of filing the EIS, Indigenous communities engaged on the Project had not identified cultural sites, buildings, or landscapes within the MacLellan site PDA or the Gordon site PDA (Chapter 16, Section 16.4.1.1). However, the Project has the potential to introduce change to heritage resources through construction activities that create soil disturbance that could disturb or displace known or unknown artifacts through means such as brushing, removal of vegetation, removal of soil, grading, and compaction from vehicular traffic (Chapter 16, Section 16.4.2.1). Brushing and soil removal activities are anticipated to continue during the operation phase of the Project and could potentially directly affect Indigenous physical and cultural heritage. All Project phases have the potential to have indirect effects on heritage resources through unauthorized collection of heritage resources if the Project creates new human access opportunities or exposes artifacts. Direct Project effects are not anticipated to extend beyond the MacLellan or Gordon sites PDA. Alamos will continue to engage with Indigenous communities on the Project and consider new information in Project planning.

19.4.5.2 Mitigation

Mitigation measures proposed to avoid or reduce potential adverse effects on Indigenous physical and cultural heritage include those identified in the Current Use (Chapter 17, Sections 17.4.2.2, 17.4.3.2, and 17.4.4.2) and Heritage Resources chapters (Chapter 16, Section 16.4.2.2).

The implementation of the mitigation measures will be the responsibility of Alamos and or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents.

Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists in consideration of standard design codes and practices and industry standards and based upon engagement with potentially affected Indigenous peoples. Alamos commits to ongoing engagement with potentially affected Indigenous peoples to discuss the efficacy of mitigation measures.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations which will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified environmental professionals and engineers as part of the development of detailed mitigation and environmental management planning. These detailed mitigation measures and monitoring programs including adaptive management procedures will be reviewed by applicable regulatory agencies prior to their implementation.

Key mitigation measures which will be implemented to reduce changes to Indigenous physical and cultural heritage include:

- Consideration of mitigation measures proposed by Indigenous communities.
- Ongoing engagement with Indigenous communities regarding their concerns, mitigation of potential Project effects on traditional land and resource use, and potential monitoring.

- Development and implementation of Project-specific environmental management and monitoring plans, and discussion with Indigenous communities regarding these plans.
- Implementation of the HCRPP when heritage or cultural resources, or objects thought to be heritage or cultural objects, are exposed.
- Protective barriers placed around heritage resource sites that are inadvertently found during construction so that the area can be protected while work proceeds.
- Evaluation by a professional archaeologist of PDA changes or added development components.
- Controlled surface collection or salvage excavation of known heritage resource sites, or a portion thereof, that cannot be avoided.
- Education of construction contractors for the appropriate protocols if heritage or cultural resources, or objects thought to be heritage or cultural resources, are discovered.
- Training of staff in the recognition of archaeological features and objects such as precontact Indigenous material culture, and 19th and 20th century Euro-Canadian material culture.
- Review the potential and documented historical use and occupation of the PDA and Indigenous physical and cultural heritage LAA with staff.
- Construction monitoring by a professional archaeologist in areas that are heritage sensitive such as sites identified as being culturally sensitive by Indigenous engagement.
- Potential for the hiring of Indigenous field support staff as part of an environmental monitoring team.
- Implementation of the procedures identified in the HCRPP in the event of a suspected archaeological discovery.

Through the Indigenous engagement process for the Project, Indigenous communities provided recommendations and requests mitigate for potential effects to Indigenous physical and cultural heritage. Marcel Colomb First Nation recommended protection for unmarked burials.

Alamos will continue to engage with Indigenous communities with respect to proposed mitigation and mitigation recommended by Indigenous communities.

19.4.5.3 Residual Effects

Residual effects to traditional cultural and spiritual sites are anticipated. These effects will be on Indigenous peoples that undertake traditional practices and visit cultural or spiritual sites in the Indigenous Physical and Cultural Heritage LAA. Effects are anticipated to primarily affect Indigenous communities within the Indigenous Physical and Cultural Heritage LAA (i.e., Marcel Colomb First Nation). However, other Indigenous communities engaged on the Project may also experience residual effects to cultural and spiritual sites. The MacLellan and Gordan sites are located on Crown land. Of the Crown land within the Indigenous Physical and Cultural Heritage LAA, the PDA for the Gordon site represents approximately 269 ha of provincial Crown land (0.02%). The PDA for the MacLellan site contains approximately 938 ha of municipally administered land (0.07% of the total Crown land area within the Indigenous Physical and Cultural Heritage LAA). Project construction will result in 1,210 ha of upland and wetland disturbance in the PDA; at the time of filing, no cultural and spiritual sites within the Gordon and MacLellan PDA, or within 1 km of the PDAs, had been identified by Indigenous communities engaged on the Project. Therefore, no direct physical effects to cultural and physical sites are anticipated. None of the proposed Project components interact with known heritage resources at the MacLellan site. There are no known heritage resources at the Gordon site. As such, no Project residual effects are anticipated for changes to heritage resources. The HCRPP is in place to mitigate inadvertently exposed heritage resources; therefore, no residual Project effect to heritage resources is anticipated.

Access to some unidentified cultural and spiritual sites may be restricted due to security, fencing or water management activities. During the construction and operation phase, the presence of workers and equipment in the Indigenous Physical and Cultural Heritage LAA will generate noise, dust, and visual disturbance. Visual quality within the Indigenous Physical and Cultural Heritage LAA is expected to change overall with the Project, and sensory disturbances and degradation of infrastructure are also likely, as the industrial vehicular traffic servicing the mine will create dust, noise, and contribute to the deterioration of, and overall traffic load on, PR 391. These residual effects may affect the use and enjoyment of cultural and spiritual sites within the LAA. As noted in Chapter 15, Section 15.4.2, the PDA and surrounding area have been previously disturbed by mining activity and transportation infrastructure, and the anticipated changes are likely to be incremental.

Alamos has not been made aware of any Indigenous physical and cultural heritage sites that directly intersect Project components or physical disturbances. Changes to physical and cultural heritage sites as a result of the Project would only be expected as a result of disturbance though noise or air emissions. Consequently, residual effects to Indigenous physical and cultural heritage are expected to be adverse, and low in magnitude. The extent of indirect effects is anticipated to extend to the LAA, and disturbance will take place during all phases of the Project. Duration of the effects is long-term, as they will persist throughout the life of the Project. Even though conditions will return to baseline following decommissioning/closure, changes are considered irreversible, as the use, value, or visitation of any cultural or spiritual sites may be discontinued by Indigenous communities.

Should any Indigenous physical and cultural heritage sites not currently known to Alamos be found that directly intersect Project components or physical disturbances, residual effects to these sites will be of high magnitude because these sites will be permanently removed. Consequently, the effects of the Project on these Indigenous physical and cultural heritage sites will be restricted to the PDA, continuous in duration, long-term, and irreversible. Timing is not applicable because the loss of access to current use sites or areas located within the area would occur regardless of time of day or season.

19.4.6 Change in Current Use

Project residual environmental effects on Current Use are assessed in Chapter 17 (Section 17.4). In summary, with the application of mitigation, Project residual effects on Current Use will be adverse through construction, operation, and decommissioning/closure. Because the PDA is within the disturbed context of existing mine sites and the Current Use LAA includes an existing road, magnitude is anticipated to be low with indirect effects, especially sensory disturbance, extending into the Current Use LAA. The effects will be long term, extending beyond the Project life until the PDA returns to its pre-Project state, except for the open pits and mine rock, which will be permanent features. While the timing of construction, operation, and decommissioning/closure may affect Current Use dependent on seasonal resources and access, effects on land-based cultural sites and areas are not conditioned by season. Effects on Current Use will be reversible with decommissioning/closure, except for the open pits and mine rock, which will be permanent features.

19.4.7 Summary of Project Residual Environmental Effects on Indigenous Health Conditions, Indigenous Socio-Economic Conditions, and Indigenous Physical and Cultural Heritage

Table 19-8 summarizes residual environmental effects on Indigenous Health Conditions, Indigenous Socio-Economic Conditions, and Indigenous Physical and Cultural Heritage.

Table 19-8 Summary of Project Residual Effects on Indigenous Health Conditions, Indigenous Socio-Economic Conditions, and Indigenous Physical and Cultural Heritage

Residual Effect	Residual Effects Characterization								
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-Economic Context
Gordon and MacLellan Sites									
Change in Indigenous Health Conditions	C, O, D	A	M	LAA	LT	A	IR	I/R	D
Change in Indigenous Socio-Economic Conditions	C, O, D	A, P	M	LAA	LT	A	C	R	D
Change in Indigenous Physical and Cultural Heritage	C,O,D	A	L	LAA	LT	N/A	C	I	D

Table 19-8 Summary of Project Residual Effects on Indigenous Health Conditions, Indigenous Socio-Economic Conditions, and Indigenous Physical and Cultural Heritage

Residual Effect	Residual Effects Characterization								
	Project Phase	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-Economic Context

KEY

See Table 20-75 for detailed definitions.

Project Phase
C: Construction
O: Operation
D: Decommissioning

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term

N/A: Not Applicable

Timing:
N/A: Not Applicable
A: Applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological and Socio-Economic Context:
U: Undisturbed
D: Disturbed

19.5 ASSESSMENT OF CUMULATIVE ENVIRONMENTAL EFFECTS ON INDIGENOUS PEOPLES

Project effects on Indigenous Peoples could potentially overlap with other planned projects and activities to cause cumulative adverse effects to Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage.

The Project residual effects described in Section 19.4 are likely to interact cumulatively with residual environmental effects from other physical activities (past, present, and reasonably foreseeable).

The effects of past and current projects relative to conditions prior to historical mining activities contribute to baseline conditions upon which Project effects are assessed. Conditions prior to historical mining activities are generally considered to be similar to currently undisturbed areas of the RAA.

The resulting cumulative environmental effects (future scenario with the Project) are assessed. Cumulative environmental effects (the future scenario without the Project) are also described. This is followed by an analysis of the Project contribution to cumulative effects. Future projects and activities that are reasonably foreseeable are defined as those that (a) have been publicly announced with a defined project execution period and with sufficient project details that allow for a meaningful assessment, (b) are currently undergoing an environmental assessment or (c) are in a permitting process.

The assessment of cumulative effects is initiated with a determination of whether two conditions exist:

- The Project has residual environmental effects on the VC, and
- The residual effects could act cumulatively with residual effects of other past, present, or reasonably foreseeable future physical activities.

If either determination is not met, the assessment of cumulative effects concludes with a statement that further assessment of cumulative effects is not warranted because the Project does not interact cumulatively with other projects or activities.

19.5.1 Project Residual Effects Likely to Interact Cumulatively

The Project and activity inclusion list identifies known past, present and reasonably foreseeable future projects and physical activities that could overlap spatially and temporally with the Project's residual environmental effects. Table 4D-1 (Chapter 4, Appendix 4D) presents the names, proponents, targeted commodity, use or activity, descriptions, and status of these projects and activities. Where residual environmental effects from the Project act cumulatively with residual effects from other projects and physical activities (Table 19-9), a cumulative effects assessment is undertaken.

Table 19-9 Interactions with the Potential to Contribute to Cumulative Effects

Projects and Physical Activities with Potential for Cumulative Environmental Effects	Environmental Effects							
	Change in Indigenous Health Conditions		Change in Indigenous Socio-Economic Conditions		Change in Indigenous Physical and Cultural Heritage		Change in Current Use	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
Past and Present Physical Activities and Resource Use								
Mineral Development								
• A Mine	✓	✓	✓	✓	✓	✓	✓	✓
• EL Mine	✓	✓	✓	✓	✓	✓	✓	✓
• Fox Mine	✓	✓	✓	✓	–	–	–	–
• Farley Mine	✓	✓	✓	✓	✓	✓	✓	✓
• Ruttan Mine	✓	✓	✓	✓	–	–	–	–

Table 19-9 Interactions with the Potential to Contribute to Cumulative Effects

Projects and Physical Activities with Potential for Cumulative Environmental Effects	Environmental Effects							
	Change in Indigenous Health Conditions		Change in Indigenous Socio-Economic Conditions		Change in Indigenous Physical and Cultural Heritage		Change in Current Use	
	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site	MacLellan Site
• MacLellan Mine (Historical)	✓	✓	✓	✓	✓	✓	✓	✓
• Burnt Timber Mine	✓	✓	✓	✓	✓	✓	✓	✓
• Farley Lake Mine	✓	✓	✓	✓	✓	✓	✓	✓
• Keystone Gold Mine	✓	✓	✓	✓	✓	✓	✓	✓
• East/West Tailings Management Areas	✓	✓	✓	✓	✓	✓	✓	✓
Mineral Exploration	✓	✓	✓	✓	✓	✓	✓	✓
Water and Waste Projects (sewage plants, waste disposal grounds)	✓	✓	✓	✓	✓	✓	✓	✓
Residential and Community Development (including cottage subdivisions)	✓	✓	✓	✓	✓	✓	✓	✓
Infrastructure Development (transmission line, airport, highways, roads, rail)	✓	✓	✓	✓	✓	✓	✓	✓
Other Resource Activities (hunting, fishing, berry picking)	✓	✓	✓	✓	✓	✓	✓	✓
Future Physical Activities								
Mineral Development	✓	✓	✓	✓	✓	✓	✓	✓
Mineral Exploration	✓	✓	✓	✓	✓	✓	✓	✓
Traditional Land Use	–	–	–	–	–	–	–	–
Resource Use Activities	✓	✓	–	–	✓	✓	✓	✓
Recreation	✓	✓	✓	✓	–	–	✓	✓

NOTES:
✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with Project residual environmental effects.
– = Interactions between the residual effects of other projects and residual effects of the Project are not expected.
For a detailed description and mapped locations of Projects and Physical Activities, where applicable, see Chapter 4, Table 4D-2 and Maps 4-1 and 4-2.

Past and present projects and activities identified in Table 19-9 form the baseline conditions which are discussed in Section 19.2. It is within the existing baseline where the Project residual effects are anticipated to occur. As such, the past and present projects and activities are assessed as part of Project residual effects. Environmental effects identified in Table 19-9 are not likely to interact cumulatively with residual effects of other projects and physical activities (no check mark) are not discussed further. There are no residential or community developments, water and waste projects, or infrastructure developments that spatially and temporally overlap with the Project's residual environmental effects. Resource use and development in the RAAs (Map 19-3) is limited to mineral development at the Gordon and MacLellan sites and other mineral exploration activity (i.e., claim staking) outside of these sites. No timber harvest taking place through the allocation of timber sales or timber leases is currently underway in the RAAs.

The assessment of the cumulative environmental effects that are likely to result from the Project in combination with other projects and physical activities are discussed in subsequent sections.

19.5.2 Changes to Indigenous Health Conditions

19.5.2.1 Cumulative Effect Pathways

The effects of future projects and activities may interact cumulatively with the residual effects of the Project by affecting Indigenous health conditions through cumulative changes to the availability of, access to, and quality, or perception of safety of country foods. Activities that can affect Indigenous health conditions include developments that involve land clearing, construction of infrastructure, presence personnel or operation workforce and the use of heavy equipment.

Through the Indigenous engagement process for the Project, Mathias Colomb Cree Nation described the traditional territory as heavily cumulatively altered and expressed concern about the vulnerability of Mathias Colomb Cree Nation members and the ecosystem to future changes.

Through the Project-specific Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study (Appendix 17A; SVS 2020), Manitoba Metis Federation expressed concern about successive developments, such as logging and mining, affecting the environment, including the climate, water quality, and the effects on wildlife and vegetation, including harvested resources.

In addition to considering potential effects on the availability of, access to, and quality, or perception of safety of country foods the assessment of Indigenous health conditions also considers effects on inhalation and ingestion risks. As identified in the Human Health assessment (Chapter 18, Section 18.5.1), the effects of future mineral development activities, are not expected to spatially overlap and therefore will not cumulatively interact with the effects of Project on air quality and water quality. Therefore, cumulative effects of the Project and other reasonably foreseeable projects on inhalation and ingestion risks are not anticipated.

19.5.2.2 Mitigation for Cumulative Effects

Implementation of the mitigation measures described in Section 19.5.3 will reduce the Project's contribution to cumulative effects on Indigenous Health Conditions. As well, mitigation designed to reduce effects on fish, wildlife, and vegetation will also benefit Indigenous health conditions by reducing effects on country food (Chapters 9, 10 and 11). These mitigation measures are also applicable to the effects of identified future physical activities

19.5.2.3 Cumulative Effects

The Project will affect Indigenous health conditions by reducing the availability harvested species and altering access to areas where country foods are harvested. Residual Project effects to the value or perceived quality of country foods may also occur. The residual effects of future mineral exploration and mineral development activities may act cumulatively with the residual effects of the Project to result in changes to the availability of harvested species, access to country food harvesting areas and potentially the perceived value of country food. Cumulative effects on surface water quality are not anticipated as Project residual effects will not overlap spatially with the effects of other foreseeable projects (Chapter 9, Section 9.5.3).

Cumulative effects on Indigenous health conditions are expected to be adverse and low in magnitude as the harvest of country foods will be able to continue with minor alteration of behavior such as changes in patterns of access or travel routes. Effects are anticipated to extend to the Indigenous Health Conditions LAA, and to take place during all phases of the Project. Residual effects are characterized as multiple irregular in frequency and long-term in duration as change to access to harvesting area and availability of harvested species will occur occasionally throughout the construction and operation phase of the Project. Effects are anticipated to be reduced during Project decommissioning/closure decommissioning/closure. Effects to Indigenous health conditions are considered irreversible, although the changes in availability and access to country food are anticipated to return to baseline following decommissioning/closure, changes to residual effects on human health are unlikely to be reversed.

19.5.3 Changes to Indigenous Socio-Economic Conditions

19.5.3.1 Cumulative Effect Pathways

The effects of future projects and activities have the potential to interact with the Project's residual effects and increase demands on community infrastructure and services (Chapter 14, Section 14.4, Section 14.5), which could result in a cumulative reduction in available capacity and/or quality of services for Indigenous peoples living within the LAA.

Through the Project-specific Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study (Appendix 17A; SVS 2020), Manitoba Metis Federation noted that as additional projects are developed there can be an accumulation of socio-economic effects.

Future mineral exploration and development projects may interact cumulatively with the residual effects of the Project by affecting commercial harvest at Pukatawagan Registered Traplines 30, 32, 36, and YTC through vegetation clearing, change in access, sensory disturbance and change in habitat. The use of PR 391 by future mineral exploration and development projects may interact cumulatively with the residual effects of the Project and result in increased traffic volumes. If future mineral development and exploration occur within the Indigenous Socio-Economic Conditions RAA and transition into completion or decommissioning/closure at the same time as the Project (13 years from the beginning of Project construction), it is possible that cumulative losses of direct employment and GDP contributions to the economy of the RAA could occur. These pathways are the same for the Gordon site and MacLellan site.

19.5.3.2 Mitigation for Cumulative Effects

Implementation of the mitigation measures described in Section 19.5.4 will reduce effects on Indigenous socio-economics conditions. As well, mitigation designed to reduce effects on fish wildlife, and vegetation will also benefit socio-economics (Chapters 9, 10, and 11). These mitigation measures are also applicable to the effects of identified future physical activities.

19.5.3.3 Cumulative Effects

The labour forces required for future projects and activities are likely to be local and incremental. Where community service and infrastructure improvements, such as power and transportation upgrades, are made, projects and users generally benefit as these projects will increase capacity of local services and infrastructure. The Project is not expected to compete with other projects for services and infrastructure since power, water, and wastewater infrastructure for the Project will be built by Alamos. It is also expected that current and reasonably foreseeable future projects and physical activities will be required to apply standard mitigation and other management measures to avoid or reduce their effect on infrastructure and services (e.g., emergency response plans) and comply with applicable regulatory requirements (Chapter 14, Section 14.5.3).

Residual effects of future mineral exploration and development may result in cumulative changes to commercial harvest at the Pukatawagan Registered Traplines 30, 32, 36, and YTC which will be affected by the Project. Alamos and Marcel Colomb First Nation are working together on establishing Participation Agreement (Impact Benefit Agreement or similar) to achieve mutual benefits considering potential adverse Project effects, including interruption to trapline users. It cannot be assumed that future project proponents would engage in similar discussions.

During the first six years of mining operation, the Project will result in seven truckloads per hour along PR 391 between the Gordon and MacLellan sites, resulting in residual effects on traffic volumes for Marcel Colomb First Nation members who reside in Black Sturgeon Reserve. Residual effects to other portions of PR 391 (within the Town of Lynn Lake and south towards Thompson) will be experienced through increased traffic volumes, particularly at the beginning and end of a crew change. Future mineral exploration and development, and other projects, will use PR 391, as it is the main all-weather road within the RAA, and may cumulatively affect traffic volumes experience by Marcel Colomb First Nation and as well as communities located along located along PR 391, including Nisichawayasihk Cree Nation, and the Town of Lynn Lake.

Should future mineral development and exploration within the Indigenous Socio-Economic Conditions RAA become active projects and subsequently transition into decommissioning/closure phases at the same time as the Project cumulative losses of employment (direct, indirect, and induced) and capital spending on goods and services (Chapter 13, Sections 13.5.2 and 13.5.4) would be anticipated, though temporal overlap is unlikely.

The Project's contribution to cumulative effects will be mitigated through measures identified in Section 19.5.4. Overall, effects to Indigenous socio-economic conditions are anticipated to be both adverse (potential for cumulative losses in employment and capital spending) and positive (power and transportation upgrades). These effects are moderate in magnitude, as the use of, and access to, infrastructure such as increased traffic along the segment of PR 391 between the Gordon and MacLellan sites may interfere with the use this infrastructure. The changes in the economy are unlikely to pose substantial risks or benefits. Cumulative effects occur within the RAA on a continual basis over the long-term (due to uncertainty regarding the timing of other projects and activities over the operational life of the Project). Effects are reversible assuming future employment is created within the Indigenous Socio-Economic Conditions RAA. There are no seasonal timing considerations to cumulative effects.

19.5.4 Changes to Physical and Cultural Heritage

19.5.4.1 Cumulative Effect Pathways

The effects of future projects and activities may interact cumulatively with the residual effects of the Project by limiting access to cultural and spiritual sites and areas, removing cultural and spiritual sites and areas or altering the experience of using these sites and areas.

19.5.4.2 Mitigation for Cumulative Effects

Implementation of the mitigation measures described in Section 19.4.5.2. will reduce effects on access to cultural and spiritual sites and areas, the ability to use cultural and spiritual sites and areas, or the experience of using cultural and spiritual sites and areas. These mitigation measures are also applicable to the effects of identified future physical activities.

19.5.4.3 Cumulative Effects

Although the Project does not directly interact with known cultural, or spiritual sites or areas, there will be an increase in noise, dust and light during the Project that may affect experience of using currently unidentified traditional, cultural, and spiritual sites within the Indigenous physical and cultural heritage RAA. Future projects and activities in the RAA will result in residual effects that alter the experience of using currently unknown cultural, or spiritual sites or areas, and these effects may interact cumulatively with those of the Project.

The cumulative effects for change in physical and cultural heritage are considered of low magnitude, long-term in duration, continuous in frequency, and reversible.

19.5.5 Changes to Current Use

Residual cumulative effects on Current Use are assessed in Chapter 17 (Section 17.5). In summary, the Project is anticipated to contribute adversely to effects on the availability of and access to traditionally used resources and to cultural and spiritual sites and areas; however, the magnitude is anticipated to be low due to the small number and widespread nature of past, present and future projects and activities and the history of disturbance in Current Use RAA. These effects extend to the RAA and will be long-term, extending beyond the life of the Project. The effects will be continuous for the Project life.

19.5.6 Cumulative Effects Without the Project

If the Project was not to be developed, the future scenario in the RAAs would be largely similar to existing conditions for Indigenous peoples. Future projects and activities would be expected to result in only minor changes to the biophysical and socio-economic environment and therefore minor effects to Indigenous peoples. These future projects and activities may restrict access to areas used by Indigenous peoples and may indirectly affect the use of these areas through air, sound, and light emissions. The future projects and activities planned for the RAAs are small in scale, however, and would not result in wide-spread changes. Accordingly, in a future scenario without the Project, the activities and practices of Indigenous peoples would be expected to continue in a similar fashion as they are presently.

19.5.7 Summary of Cumulative Effects

Table 19-10 summarizes cumulative environmental effects on Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage.

Table 19-10 Residual Cumulative Effects

Residual Cumulative Effect	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-Economic Context
Changes to Indigenous Health Conditions								
With the Project	A	L	LAA	LT	N/A	IR	R	D
Without the Project	A	N	LAA	LT	N/A	IR	R	D
Contribution from the Project to the residual cumulative effect	*The Project's contribution to cumulative effects is a low magnitude change in Indigenous health conditions as a result of changes to patterns of access or travel routes.*							
Changes to Indigenous Socio-Economic Conditions								
With the Project	A, P	M	LAA	LT	N/A	C	R	D
Without the Project	A, P	L	LAA	LT	N/A	C	R	D
Contribution from the Project to the residual cumulative effect	*The Project's contribution to cumulative effects is a moderate magnitude change in Indigenous socio-economic conditions resulting in changes to the use of, and access to, the segment of PR 391 between the Gordon and MacLellan sites.*							
Changes to Physical and Cultural Heritage								
With the Project	A	L	LAA	MT	N/A	C	I	D
Without the Project	A	L	LAA	MT	N/A	C	I	D

Table 19-10 Residual Cumulative Effects

Residual Cumulative Effect	Residual Cumulative Effects Characterization							
	Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-Economic Context
Contribution from the Project to the residual cumulative effect	*The Project's contribution to cumulative effects is a low magnitude change in Indigenous physical and cultural heritage as a result of changes to currently unidentified traditional cultural and spiritual sites.*							
Changes to Current Use								
With the Project	A	L	RAA	LT-MT	N/A	C	R	D
Without the Project	A	L	RAA	LT	N/A	IR	R	D
Contribution from the Project to the residual cumulative effect	*As identified in Chapter 17, the cumulative effects on Current Use include the following:* - *changes in access to land and water travel routes, the addition of gated access roads and fences and firearms restrictions, adding to access restrictions already present from projects elsewhere in the RAA.* - *the loss or degradation of plant and wildlife habitat due to vegetation clearance, and changes in air quality and water quality from all projects in the RAA. A cumulative effect of activities past, present and future, may result in changes in distribution of some wildlife species.* - *cultural and spiritual sites and areas from the Project are primarily aesthetic and may act cumulatively with past, current, and future projects on the aesthetics of the cultural landscape.*							

KEY

See Table 20-7 for detailed definitions.

Direction:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PDA: Project Development Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term

N/A: Not applicable

Timing:
N/A: Not Applicable
A: Applicable

Frequency:
S: Single event
IR: Irregular event
R: Regular event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological/Socio-Economic Context:
D: Disturbed
U: Undisturbed

Project Contribution to Cumulative Effects

The cumulative effects will be small; however, the Project is the largest project contributing to the cumulative effects. Although the Project is expected to contribute much of the total cumulative effects anticipated, those cumulative effects are generally of low magnitude.

19.6 EFFECTS TO FEDERAL LANDS

Federal lands within the LAA and RAA consist of Black Sturgeon Reserve in the LAA and the following lands in the RAA:

- Highrock 199
- Hills Island Indian Reserve
- Kamihkowapihskak Pawistik Indian Reserve
- Kapawasihk
- Kimosominahk Indian Reserve
- Mile 20 Second Revision Indian Reserve
- Mistiategameek Sipi Indian Reserve
- Monahawuhkan
- Moosowhapihsk Sakahegan Indian Reserve
- Napahkapihskow Sakhahigan Indian Reserve
- Nelson House 170 / 170a / 170b / 170 C
- Nihkik Ohnikapihs Indian Reserve
- Numaykoos Sakaheykun
- Odei River Indian Reserve
- Ohpahahpiskow Sakahegan Indian Reserve
- Opekanowi Sakaheykun
- Opekunosakakanihk
- O-Pipon-Na-Piwin Cree Nation 1
- Pachapesihk Wasahow Indian Reserve

- Pukatawagan 198
- Sisipuk Sakahegan (A) / (B) / (C) Indian Reserve
- Suwannee Lake Indian Reserve
- Wapasihk
- Wapikunoo Bay Indian Reserve
- Wapisu Lake Indian Reserve
- Wepuskow Ohnikahp Indian Reserve
- Wuskwi Sakaheykun
- Wuskwi Sipi.

Effects pathways for Indigenous health, are described in Section 19.4.3.1. These include changes to the availability of wildlife, fish, and plants that are harvested for country foods and the perceived quality of country foods; changes in access patterns or routes used to travel to harvesting locations; changes to Indigenous health through inhalation and ingestion of chemicals of potential concern (COPCs); and Project-related atmospheric emissions, such as vehicle exhaust and rock and ore dust, and water discharges, including effluent and seepage. Potential effects to Indigenous health are assessed in Section 19.4.3.3. No new or different Project-related effects have been identified for Federal lands; overall, effects to Indigenous health on Federal lands are anticipated to be similar to those described in Sections 19.4.3 and 19.5.2.

Effects pathways for Indigenous socio-economic conditions are described in Section 19.4.4.1. These include loss of land area; restriction of access to designated lands and competition with additional recreational land users, thereby affecting commercial trapping, and guiding opportunities for Indigenous peoples; reduced capacity of existing service providers and local infrastructure to respond to and manage emergencies in Indigenous and non-Indigenous communities; effects of increased commercial traffic on PR 391, as well as additional road wear, on Indigenous peoples who live and work in the Indigenous Socio-Economic Conditions LAA. Changes to employment and income as a result of the Project could affect Indigenous peoples in both positive and adverse ways. Increased demand for labour, goods, and services, can increase operational costs for both Indigenous and non-Indigenous business owners. Potential effects to Indigenous socio-economic conditions are assessed in Section 19.4.4.3. No new or different Project-related effects have been identified for Federal lands. Federal lands within the Indigenous socio-economic RAA are First Nations reserves, and the effects assessment for Indigenous socio-economic conditions considers effects to employment, infrastructure, provision of services, increased traffic and community wellbeing on First Nations reserves. However, effects related to increased competition from recreational land users and loss of commercial trapping, and guiding opportunities will not occur for Federal lands, because these activities cannot take place on First Nations reserves. Overall, effects to Indigenous socio-economic conditions on Federal lands are anticipated to be similar to those described in Sections 19.4.4 and 19.5.3, apart from effects from competition from recreational land users and loss of commercial trapping, and guiding opportunities.

Effects pathways for Indigenous physical and cultural heritage are described in Section 19.4.4.1. These include direct changes through physical loss of, or loss of access to, cultural sites, buildings, or landscapes as a result of Project activities, and indirect changes through sensory disturbances (noise, light, dust, and other emissions). Potential effects to Indigenous physical and cultural heritage are assessed in Section 19.4.5.3. No new or different Project-related effects have been identified for Federal lands. Direct Project effects are not anticipated to extend beyond the MacLellan or Gordon sites PDA and no federal lands occur within the PDA. Indirect effects are not anticipated to extend beyond the Indigenous physical and cultural heritage LAA, and a small portion of the Black Sturgeon Reserve is the only Federal lands that occur within the Indigenous physical and cultural heritage LAA. Overall, effects Indigenous physical and cultural heritage on Federal lands are anticipated to be similar to those described in Sections 19.4.5 and 19.5.3.

19.7 DETERMINATION OF SIGNIFICANCE

19.7.1 Significance of Project Residual Effects

Significant effects on Indigenous peoples are defined in Section 19.1.6, which includes criteria for identifying significant effects to Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage. Significant effects for Current Use are defined in Chapter 17, Section 17.1.7 and assessed in Section 17.7.1.

Significance of Project Residual Effects for Indigenous Health Conditions

The residual effect of a change in Indigenous Health conditions are predicted to be not significant. Although some alteration of behavior will be required to continue harvesting country foods, there will not be a long-term loss of availability of traditional use resources or access to lands relied on for harvesting country foods. Exposures for most chemicals of potential concern are not expected to exceed regulatory thresholds. Where exceedances are predicted, they existed prior to the Project at baseline conditions, and are expected to be infrequent. The predicted exceedances in inhalation exposures are based on single events and do not represent continuous exposures that would represent potential concerns for Indigenous health. Audible noise levels from the Project are not expected to exceed provincial guidelines or result in an increase that could affect Indigenous health and wellbeing. The PDA and Indigenous Health Conditions LAA have been previously disturbed by mining activity and the anticipated change to noise disturbance is likely to be incremental.

Significance of Project Residual Effects for Indigenous Socio-Economic Conditions

The residual effect of a change in Indigenous socio-economic conditions is predicted to be not significant. While Project construction may affect, restrict, or change the land base available for recreational activities, the Project will not result in wide degradation, restriction or disruption of present land and resource use activities. Land and resource use activities and production are predicted to continue at or near baseline levels. Residual effects to local services and infrastructure, including education, health care and emergency services, that could affect Indigenous socio-economic conditions are anticipated to be limited. Economic effects from the Project for Indigenous people are anticipated to be positive due to the potential for increased local spending by Project workers and increased employment opportunities for Indigenous peoples

Significance of Project Residual Effects for Indigenous Physical and Cultural Heritage

The residual effects of a change in Indigenous Physical and Cultural Heritage is predicted to be not significant. Indigenous communities engaged on the Project have not identified Indigenous physical and cultural heritage sites that directly intersect Project components or physical disturbances. Unmitigated disturbance to disturbance to, or destruction of, heritage sites in the Project PDA or unmitigated disturbance or destruction of a cultural area identified by Indigenous communities are not anticipated.

19.7.2 Significance of Cumulative Effects

With mitigation and environmental protection measures, the residual cumulative environmental effects on Indigenous peoples are predicted to be not significant. They will not result in long-term effects to Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage. It is acknowledged that Indigenous communities perspective on significance may differ from that determined through the methods used in the environmental assessment process. Alamos is committed to providing meaningful opportunities for ongoing dialogue about the Project including the findings of this assessment where requested by Indigenous communities.

19.7.3 Significance of Effects on Federal Lands

Based on the results in Section 19.6, the residual environmental effects on federal lands from changes to Indigenous health conditions, Indigenous socio-economic conditions, physical and cultural heritage, and current use are predicted to be not significant.

19.8 PREDICTION CONFIDENCE

Prediction confidence in the assessment of effects on Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage is moderate. This reflects the level of information available for Indigenous communities engaged on the Project and the results of the Indigenous engagement process for the Project. Alamos has been engaging with Marcel Colomb First Nation for the Project since 2014; Alamos has been engaging with the additional 11 Indigenous communities potentially affected by the Project since 2017. Through this process, Alamos has worked with Indigenous communities to document and, where feasible, address Project-related concerns. Given the qualitative and subjective nature of assessing Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage, the views of Indigenous communities may differ from the findings of this assessment. As identified in Chapter 17, Section 17.8, the prediction confidence in the assessment of effects on Current Use is high.

The Indigenous engagement process for the Project guided by Alamos' Indigenous Community Engagement Program is ongoing and will continue throughout the Project phases to consider information, concerns, and recommendations provided by Indigenous communities.

19.9 INDIGENOUS OR TREATY RIGHTS

Alamos recognizes that Indigenous communities are in the best position to identify potential Project effects on the ability to exercise their Indigenous or Treaty rights, and feedback received from Indigenous communities on potential Project effects to rights will be provided to the IAAC in a supplemental filing of the EIS.

19.9.1 Scope of the Assessment

Indigenous or Treaty Rights are recognized and affirmed in Section 35(1) of the *Constitution Act, 1982*, which provides constitutional protection to these rights in Canada (Crown-Indigenous Relations and Northern Affairs Canada [CIRNAC] 2019). As established in Supreme Court of Canada decisions, the honour of the Crown requires that the Crown act honourably in recognition of a special trust relationship with Indigenous peoples. Consequently, the Crown has a duty to consult and, where appropriate, accommodate when the Crown contemplates conduct that could adversely impact potential or established Aboriginal or Treaty rights (AANDC 2011).

Both the federal and provincial Crown have a constitutional duty to consult with Indigenous communities when contemplating conduct that could adversely affect potential or established Indigenous or Treaty rights, such as the approval of this Project by federal and provincial regulatory agencies (AANDC 2011). Further, the Government of Canada (2017) has recognized that, through consultation, the Crown seeks to strengthen relationships and partnerships with Indigenous peoples and thereby achieve reconciliation objectives. Based on the Government of Canada's (AANDC 2011) guiding principles and consultation directives, existing consultation mechanisms, such as environmental assessment and regulatory approval processes in which Indigenous consultation will be integrated, will be used to coordinate decision making and determine if additional consultation is required.

Manitoba's Department of Indigenous and Northern Relations (MINR) also has developed an interim provincial policy for Crown consultations that identifies three key objectives:

- To ensure the Government of Manitoba informs itself and gains a proper understanding of the interests of First Nations, the Métis Nation's Manitoba Government, and other Indigenous communities, with respect to a proposed government decision or action.
- To seek ways to address and/or accommodate those interests where appropriate through a process of consultation while continuing to work towards the best interests of the citizens of Manitoba.
- To advance the process of reconciliation between the Crown and First Nations, the Métis Nation's Manitoba Government, and other Indigenous communities (Government of Manitoba n.d.).

Information gathered during the Indigenous engagement process for the Project prior to and throughout preparation of the EIS (to May 22, 2020) is summarized in Chapter 3. Alamos will continue to engage with Indigenous communities, government agencies, and stakeholders throughout the life of the Project. The Indigenous communities engaged on the Project have been identified by the CEA Agency and are listed in Section 19.1.

This section is not intended to define or delimit existing or asserted Indigenous or Treaty rights within a given traditional territory or occupancy area, nor is it a complete depiction of the dynamic way of life and systems of knowledge maintained by Indigenous communities engaged on the Project. Rather, this section relies on information obtained through the Project's Indigenous engagement process and publicly available sources to document the assertion of potential or established Indigenous or Treaty rights and Indigenous communities' perspectives on Project impacts on the ability to exercise Indigenous or Treaty rights. The Crown has the ultimate responsibility to fulfill the Duty to Consult and, where appropriate, accommodate adverse effects on Indigenous or Treaty rights. Alamos acknowledges that Indigenous communities may provide additional information about potential impacts to Indigenous or Treaty rights to the Crown, to Alamos through the Indigenous Community engagement process for the Project, and to the IAAC.

19.9.1.1 Regulatory and Policy Setting

Federal Regulations and Policies

The Final Guidelines (CEA Agency 2017) require that consideration be given to potential impacts to Indigenous rights. Part 2, Section 5.1 of the Guidelines requires Alamos to assess potential adverse impacts resulting from the Project on Section 35 rights, including to title and related interests, when this information is directly provided by an Indigenous community to the proponent, the IAAC, or available through public records.

Early in 2020, the IAAC's *Policy Context: Assessment of Potential Impacts on the Rights of Indigenous Peoples* and *Interim Guidance: Assessment of Potential Impacts to the Rights of Indigenous Peoples* were made available (Government of Canada 2020a; 2020b). Alamos reviewed both the Policy Context and Interim Guidance, and incorporated elements of the guidance, where feasible.

Provincial Regulations and Policies

In 1930, the Natural Resources Transfer Agreement (NRTA) transferred control of Crown land and natural resources from Canada to the provinces. The NRTA modified the definition of Treaty rights exercised by Indigenous communities under Treaty. The NRTA secures the right of Indigenous peoples to hunt, fish, and trap for food on unoccupied Crown lands or other lands to which Indigenous peoples have a right of access for the purposes of hunting, fishing, or trapping. These rights were affirmed by Section 35 of the *Constitution Act*, *1982*.

The Manitoba Treaty Land Entitlement Framework Agreement (MFA) was signed in 1997 between Canada, Manitoba, and the Treaty Land Entitlement Committee to fulfill outstanding land obligations arising out of Treaty Land Entitlement (TLE) claims, shortfalls in allocation of reserve lands under treaty or claims for unlawful expropriation of reserve lands. To participate in the lands selection process, First Nations with recognized TLE claims execute a Treaty Entitlement Agreement (TEA) with Manitoba and Canada, and then conduct a land selection study to review parcels of land to be selected or acquired (purchased in areas where unoccupied Crown land supply is low). Once selections are made, the MFA Additions to Reserve policy guides the process of converting the lands into reserve lands, to be held by Canada for the benefit of the First Nation (MFA 1997).

Section 11 of the MNRTA also requires that Manitoba set aside sufficient unoccupied Crown land to accommodate the settlement of Canada's outstanding Treaty obligations. The quantity of Treaty Land Entitlement (TLE) lands promised to each Treaty signatory was based on the population of the First Nation and the per capita formula in the numbered treaties (Tough 1996). As confirmed in Schedule 1 of *The Constitution Act*, *1982*, TLE is a constitutional obligation. Under the nine TLE agreements covering 29 Entitlement First Nations, Manitoba is obligated to transfer to Canada 1,423,110 acres [approximately 575,912.18 ha] (including residual interests in acquisition lands; Government of Manitoba 2019a). These transfers are ongoing.

The Indigenous communities engaged on the Project in Manitoba that have TLE claims are Marcel Colomb First Nation, Mathias Colomb Cree Nation, Nisichawayasihk Cree Nation, O-Pipon-Na-Piwin Cree Nation, Barren Lands First Nation, Northlands Denesuline First Nation, and Sayisi Dene First Nation (Government of Manitoba 2019a). Of these, Barren Lands First Nation, Mathias Colomb Cree Nation, Nisichawayasihk Cree Nation, and Northlands Denesuline First Nation have executed their TLE agreements. According to the most recent information available, Marcel Colomb First Nation, O-Pipon-Na-Piwin Cree Nation, and Sayisi Dene First Nation have not executed their TLE agreements (Indigenous and Northern Affairs Canada 2017).

Nisichawayasihk Cree Nation (Nelson House) and O-Pipon-Na-Piwin Cree Nation (South Indian Lake) have four existing TLE sites within the RAA: at Barrington Lake North, Barrington Lake/Brooks Island, Melvin Lake South, and Melvin Lake North (Crown Lands and Property Agency 2017; Manitoba Growth, Enterprise and Trade 2019).

TLE agreements are also in place in Saskatchewan, under the 1992 TLE Framework Agreement. Peter Ballantyne Cree Nation has a TLE claim in Saskatchewan (CIRNAC 2017b). No further details regarding Peter Ballantyne Cree Nation's TLE claim were available.

The Government of Manitoba Métis Policy (2010) establishes a strategic guide for the Government of Manitoba in its relationships with Métis people and the Manitoba Metis Federation. The Métis Policy defines a framework that is designed to enhance Métis people's participation in decision-making processes of the Government of Manitoba; promote better understanding of Métis history, culture and circumstances; and expand the role of the Métis people in the implementation of policy and programming, and in the delivery of services. The Métis Policy formally recognizes the Manitoba Metis Federation as sole representative of the Manitoba Métis Community (Government of Manitoba 2010).

Agreements

First Nations Land Management Act, 1999: The First Nations Lands Management Act enables participating First Nations to opt out of the 34 land-related sections of the *Indian Act* and develop their own land codes to govern their lands and resources (Government of Canada 2012). Nisichawayasihk Cree Nation adopted the First Nations Land Management Act and is developing a Land Code to re-establish First Nation control over the administration and management of Nisichawayasihk Cree Nation (Nisichawayasihk Cree Nation 2020).

Province of Manitoba / Manitoba Metis Federation Agreement on Métis Natural Resource Harvesting: In September 2012, the Manitoba Metis Federation and the Province of Manitoba entered into an agreement that recognizes Métis rights to harvest for natural resources for food and domestic use in defined Metis Recognized Harvesting Area. Métis rights holders may harvest throughout the Metis Recognized Harvesting Area on all unoccupied provincial Crown Lands in Manitoba and occupied provincial Crown lands, including provincial parks, wherever First Nation Members are allowed to harvest; and on any privately owned lands in Manitoba on which that Métis rights holders has been given permission by the owner or occupant, or Indian Reserve lands with permission of Band Council. Under this agreement, Métis natural resource harvesting includes hunting, trapping, fishing, and gathering for food and domestic use, including for social and ceremonial purposes. It also includes the harvest of timber for domestic purposes. Outside of the Metis Natural Resource Harvesting Area, Métis rights holders will be required to comply with all provincial legislative requirements including the purchase of a license. (Government of Manitoba 2012).

Manitoba Metis Federation-Canada Framework Agreement on Advancing Reconciliation, 2016: seeks to improve the social and economic well-being of Métis citizens in Manitoba and recognizes the Manitoba Metis Federation's legal status, role and jurisdiction as a Métis government and represents the Manitoba Métis Community's vision of greater self-determination.

19.9.1.2 Boundaries

The assessment of Indigenous or Treaty rights adopts the largest extent of the spatial boundaries identified for Indigenous health conditions and Indigenous socio-economic conditions (Section 19.1.4), which include the spatial boundaries established in the Current Use, Human Health, Heritage Resources, Labour and Economy, Community Services, Infrastructure, and Wellbeing, and Land and Resource Use assessments; the spatial boundaries are referred to hereafter as the Rights LAA and RAA. Spatial boundaries identified for Indigenous Health Conditions, Indigenous Socio-Economic Conditions and Indigenous Physical and Cultural Heritage Conditions are illustrated in Maps 19-2 and 19-3, while the portions of Adhesions to Treaty No. 5, Treaty No. 6, and Treaty No. 10, which overlap or are adjacent to the Rights LAA and RAA and management areas (including resource management, planning, harvesting, and notification areas) are illustrated in Map 19-6. Areas outside of the Rights RAA are displayed to provide context for the changes to Indigenous or Treaty rights, which may occur within the assessment boundaries and in recognition that the boundaries of Adhesions to Treaty No. 5, Treaty No. 6, and Treaty No. 10 extend to areas not included in the scope of this assessment.

Alignment of the Indigenous or Treaty rights boundaries and those of Current Use (Chapter 17) was selected for the purpose of identifying existing conditions related to the exercise of potential or established Indigenous or Treaty rights. Current Use boundaries were selected because they provide a clear link between the access to and availability of resources and sites for traditional use, including effects on the conditions that support the ability to exercise Indigenous or Treaty rights.

Similar to the remainder of the EIS the PDA encompasses the immediate area in which Project activities and components may occur plus a 30-m buffer and is the anticipated area of direct physical disturbance associated with construction and operation of the Project (i.e., the Project footprint). The Rights LAA and RAA represent the maximum combined extent of predicted impacts of the Project to the environmental valued components that directly and indirectly support the exercise or practice of Indigenous or Treaty rights considered in this assessment.

Indigenous communities may identify spatial boundaries in relation to their traditional lands or traditional territories; however, physical effects of the Project are not expected to extend beyond the RAA. Information about the ability to exercise Indigenous or Treaty rights beyond the RAA is considered where that information has been provided by Indigenous communities. Information was drawn from sources covering the Indigenous health conditions, Indigenous socio-economic conditions and Indigenous physical and cultural heritage RAAs of the Project components. While physical effects of the Project are not expected to extend beyond the Rights RAA, information about traditional use sites, activities, and practices, including preferred harvesting sites, beyond the Rights RAA is considered where that information has been provided by Indigenous communities.

19.9.1.3 Potential Pathways of Impacts

A conservative approach was used to identify potential interactions between the Project and Indigenous or Treaty rights. As such, activities with a degree of uncertainty are assumed to contribute to an environmental effect. Residual effects identified in Section 19.2 are carried forward because the exercise of Indigenous or Treaty rights depends on the health and abundance of traditionally harvested species and the continued availability of and access to traditional use sites and areas. The Project's residual and cumulative effects on Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are also carried forward.

Indigenous communities engaged by the Project are signatories to Treaty No. 5, Treaty No. 6, or Treaty No. 10 Adhesions.The terms of each treaty differ but generally stipulate that First Nations have the right to hunt, trap, fish, and gather resources in their traditional territory until lands are taken up for development or settlement. Additional information about Indigenous or Treaty rights including comments from Indigenous communities regarding how rights are understood and exercised, where available, is presented in Section 19.9.

Manitoba Metis Federation is signatory to the Manitoba Metis Federation-Canada Framework Agreement for Advancing Reconciliation, which provides funding and capacity for advancing self-government negotiations for Métis citizens in Manitoba (Manitoba Metis Federation 2018).

Potential Project effects assessed in this chapter include changes to the ability to exercise Indigenous or Treaty rights to hunt, trap, fish, and gather resources[10]. As noted above this is not intended to define or delimit existing or asserted Indigenous or Treaty rights; rather, this section relies on information from Indigenous communities and publicly available sources to identify potential Project effects on activities or practices upon which the exercise of potential or established Indigenous or Treaty rights.

The pathways through which changes to Indigenous or Treaty rights may occur include:

- Loss or alteration of resources relied on to exercise a right.

[10] This includes the commercial and trade-related rights identified by Manitoba Metis Federation, which are further discussed in sections 19.7.2.3, 19.7.2.8, and 19.7.2.9.

- Restricted or altered ability to access sites and areas associated with the exercise of a right.
- Alteration of specific areas of cultural importance where rights are exercised.
- Sensory disturbances or other changes which detract from use of the area or lead to avoidance of the area associated with the exercise of rights.
- Indirect effects on cultural traditions, laws and governance systems that inform the way rights are exercised.
- Change in disposition of Crown land, through sale or conversion from unoccupied to occupied, which may affect the ability to exercise rights. Change in disposition of Crown land may also constrain the selection of TLE lands under the MFA.

Alamos recognizes that Indigenous communities are in the best position to identify potential Project effects on the ability to exercise their Indigenous or Treaty rights. Feedback received from Indigenous communities on potential effect pathways and other assessment parameters can be found in Section 19.9.

19.9.1.4 Measures to Address Impacts

Extensive mitigation measures have been developed to address effects on the environmental resources relied upon for the exercise and practice of Indigenous or Treaty rights. To consolidate information assessed throughout the EIS into this chapter, key mitigation measures from relevant VC's have been identified, including mitigation measures provided or recommended by Indigenous communities, as identified in Chapter 17, Sections 17.4.2.2, 17.4.3.2, 17.4.4.2 and in Sections 19.4.3.2, 19.4.4.2, 19.4.5.2, and 19.4.6.2.

19.9.1.5 Assessing the Severity of Impact

Alamos has summarized the nature and extent of potential impacts on the rights of Indigenous peoples using the criteria established for the VCs relevant to this assessment (i.e., Current Use, Heritage Resources, and Human Health). This approach is informed by best environmental assessment practices; feedback received from potentially affected Indigenous communities; recent Crown consultation and accommodation reports for linear projects such as the Robert Banks Terminal 2 project (Government of Canada 2019a); the Trans Mountain Expansion Project Crown Consultation and Accommodation Report (Government of Canada 2019b; the CEA Agency submission to the Teck Frontier Panel (BCEAO 2016; CEA Agency 2019); and IAAC's *Policy Context: Assessment of Potential Impacts on the Rights of Indigenous Peoples* and *Interim Guidance: Assessment of Potential Impacts on the Rights of Indigenous Peoples* (Government of Canada 2020a; 2020b).

Table 19-11 presents definitions for each of the criteria used to characterize severity of impacts on Indigenous or Treaty rights, which are in keeping with the approaches proposed above. Alamos understands that the conclusions regarding the seriousness of impacts on Indigenous or Treaty rights and the adequacy of mitigation, accommodation, and consultation, are the responsibility of the Crown.

Table 19-11 Definitions used to Assess the Level of Severity of Impact on Indigenous or Treaty Rights

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Likelihood	The certainty that the effect on an Indigenous or Treaty Right will occur	**Low –** A potential impact is unlikely but could occur. **Moderate -** A potential impact is likely but may not occur. **High –** A potential impact is highly likely to occur.
Direction	The long-term trend of the impact	**Positive –** A residual effect that is beneficial to availability and access to resources, culturally important sites, or the cultural value of sites currently used in exercise of a right, relative to baseline. **Adverse –** A residual effect that is detrimental to availability and access to resources, culturally important sites, or the cultural value of sites currently used in exercise of a right, relative to baseline.
Geographic Extent	The geographic area in which an impact occurs	**Low –** Impacts are restricted to the PDA. Impacts are not expected within areas of preferred use identified by Indigenous communities. **Moderate –** Impacts extend into the Rights LAA. Impacts may occur within areas of preferred use identified by Indigenous communities. **High –** Extend into the Rights RAA. Impacts are expected to occur within areas of preferred use identified by Indigenous communities.
Frequency	Identifies how often the residual effect occurs and how often during the Project or in a specific phase	**Single event** – Occurs once or seldom during the life of the Project. **Multiple irregular event** – Occurs at no set schedule. **Multiple regular event –** Occurs at regular intervals. **Continuous –** Occurs continuously.
Duration and Reversibility	The period of time required until the ability to use lands and resources for the exercise of rights returns to its existing condition, or whether it is possible for impacts on rights to be reversed	**Low** – Restricted to construction phase and is likely to be reversed after activity completion and reclamation. **Moderate** – Extends through operation phase and may or may not be reversed after activity completion and reclamation. **High** – Extends beyond the life of the Project and is unlikely to be reversed.
Equity	The degree to which the specific groups or social units most likely to experience an impact can maintain the exercise of their Indigenous rights	**Low** – Adverse or positive impacts resulting from the project that would flow between all segments of the community. **Moderate** – Some disparity exists between the segments of a community that will experience adverse or positive impacts resulting from the project. **High** – A large disparity exists between the segments of a community that will experience adverse or positive impacts resulting from the project.

Table 19-11 Definitions used to Assess the Level of Severity of Impact on Indigenous or Treaty Rights

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Cultural well-being	The ability of an Indigenous community to continue customs, traditions, and practices that are integral to an Indigenous community's culture	**Low** – Changes will not reduce the ability of an Indigenous community to continue customs, traditions, and practices. **Moderate** – Changes will reduce the ability to of an Indigenous community to continue customs, traditions, and practices. **High** – The ability of an Indigenous community to continue customs, traditions, and practices will be substantially diminished or lost.
Governance	The ability of an Indigenous community to govern or manage lands and resources according to Indigenous laws, customs, and structures	**Low** – Changes will not reduce the ability of an Indigenous community to govern or manage lands and resources. **Moderate** – Changes will reduce the ability to of an Indigenous community to govern or manage lands and resources. **High** –The ability of an Indigenous community to govern or manage lands and resources will be substantially diminished or lost.
Health	Physical, mental, emotional, and spiritual health of an Indigenous community or its members	**Negligible** – No measurable change from existing conditions to Indigenous health conditions and project-related environmental exposures are less than the target benchmarks established by Health Canada. Current practices which Indigenous communities identify as important to mental, emotional, and spiritual health can continue without behaviour alteration. **Low** – A small but measurable change from existing conditions, but below environmental and/or regulatory criteria, and project-related environmental exposures marginally exceed target benchmarks established by Health Canada. Practices which Indigenous communities identify as important to mental, emotional, and spiritual health can continue at very near to current levels, with potential minor alteration of behaviour required to continue current practices. **Moderate** – Measurable change from existing conditions that exceeds the target benchmarks established by Health Canada and/or which may result in a long-term, substantive change in human health practices which Indigenous communities identify as important to mental, emotional, and spiritual health can continue at a reduced level or with some restrictions on current practice and some alteration of behaviour.

Table 19-11 Definitions used to Assess the Level of Severity of Impact on Indigenous or Treaty Rights

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Health continued	Physical, mental, emotional, and spiritual health of an Indigenous community or its members	**High** – Measurable change from existing conditions that exceeds the target benchmarks established by Health Canada and/or which are likely to result in long-term, substantive change in human health. Practices which Indigenous communities identify as important to mental, emotional, and spiritual health cannot continue, or cannot continue without substantial changes to current practices and substantial restriction on ability to engage in current practices.
Cumulative Impacts Context	Impacts on the environmental and social landscape from past, existing, and anticipated future projects	**Low** – Little to no development, private or tenured land ownership, or legislation which has or may restrict the exercise of Indigenous or Treaty rights. **Moderate** – Some development, private or tenured land ownership, or legislation which has or may restrict the exercise of Indigenous or Treaty rights. **High** – High degree of development, private or tenured land ownership, or legislation which has or may restrict the exercise of Indigenous or Treaty rights.

19.9.1.6 Input from Indigenous Communities on Methods

On April 28, 2020, Alamos provided Sections 19.7.1 and 19.7.2 to Indigenous communities engaged on the Project for review and comment. Alamos is committed to ongoing engagement with potentially affected Indigenous communities and will provide further opportunities for Indigenous communities to provide perspectives on potential impacts to Indigenous or Treaty rights. Comments or feedback on the assessment of impacts to Indigenous or Treaty rights that Alamos receives will be filed with the IAAC. Alamos will work to develop mutually acceptable mitigation measures that will avoid or reduce potential effects on Indigenous or Treaty rights.

On May 7, 2020, Alamos met virtually with Manitoba Metis Federation and received verbal feedback on Sections 19.7.1 and 19.7.2. Manitoba Metis Federation expressed concern that these sections did not fully acknowledge the distinct rights of the Manitoba Métis Community, contained errors in the terminology, and that the transmittal of the package for review did not align with Manitoba Metis Federation Resolution 8. Alamos provided a revised draft of Sections 19.7.1 and 19.7.2 to Manitoba Metis Federation on May 13, 2020, addressing the concerns raised. Manitoba Metis Federation provided revisions to these sections on May 19, 2020 and those were incorporated into this assessment. Where Manitoba Metis Federation's recommended edits were not implemented Alamos provide Manitoba Metis Federation with a written explanation to support further conversations if requested.

Alamos will continue to engage with potentially affected Indigenous communities in regard to Indigenous or Treaty Rights, and will incorporate pertinent information into Project planning, as appropriate.

19.9.2 Existing Conditions for Indigenous or Treaty Rights

19.9.2.1 Methods

The assessment of adverse impacts on Indigenous or Treaty rights presents existing conditions, effect pathways, and mitigation measures, and provides a discussion of potential Project impacts on Indigenous or Treaty rights. The assessment considered information from the Project-specific TLRU studies, as identified in Section 19.1.1.3. Also considered in this section are perspectives on potential impacts on Indigenous or Treaty rights and recommendations for avoiding, mitigating, or accommodating those impacts identified through Indigenous engagement.

A review of publicly available literature was also conducted, and included the following:

- Regulatory and policy literature.
- Current and historical legislation.
- Analyses conducted by treaty scholars.
- Agreements in place with Indigenous communities.

Section 6.0 of Part 2 of the Final EIS Guidelines establishes requirements to address impacts to potential or established Indigenous or Treaty rights. As indicated in Section 19.1.1, the Agency Guidelines, citing the *Updated Guidelines for Federal Officials to Fulfill the Duty to Consult* (AANDC 2011), offer definitions of Indigenous or Treaty rights.

Indigenous or Treaty rights are recognized and affirmed in Section 35(1) of the *Constitution Act, 1982* which provides constitutional protection to these rights in Canada (CIRNAC 2019). As established through Supreme Court of Canada decisions, the honour of the Crown requires that the Crown conduct itself honourably in recognition of a special trust relationship with Indigenous peoples. Consequently, the Crown has a duty to consult and, where appropriate, accommodate, when the Crown contemplates conduct that could adversely impact potential or established Indigenous or Treaty rights (AANDC 2011).

Indigenous Rights are defined as:

> *Practices, traditions, and customs integral to the distinctive culture of the Aboriginal group claiming the right that exist[ed] prior to contact with the Europeans (Van de Peet). In the context of Métis groups, Aboriginal rights means practices, traditions, and customs integral to the distinctive culture of the Métis group that existed prior to effective European control, that is, prior to the time when Europeans effectively established political and legal control in the claimed area (Powley). Generally, these rights are fact and site specific. For greater certainty, the Guidelines also define Aboriginal title as an Aboriginal right (AANDC 2011:61).*

19.9.2.2 Treaties

Treaty rights are defined as:

> *Rights that are defined by the terms of a historic Treaty, rights set out in a modern land claims agreement or certain aspects of some self-government agreements. In general, Treaties (historic and modern) are characterized by the intention to create obligations, the presence of mutually binding obligations and a measure of solemnity (Simon, Sioui). A treaty right may be an expressed term in a Treaty, an implied term or reasonably incidental to the expressed Treaty right. The scope of Treaty rights will be determined by their wording, which must be interpreted in accordance with the principles enunciated by the Supreme Court of Canada (Badger 1996; Sundown 1999; Marshall 1999)* (AANDC 2011:62*).*

The Project occurs within Treaty 5 territory, which spans the entirety of central and northern Manitoba, and a portion of eastern-central Saskatchewan, as well as central-western Ontario (Map 19-6). There are 40 Treaty 5 Nations in Manitoba (Summit of Treaty 5 2019), and IAAC (2017) identified three of these, Nisichawayasihk Cree Nation, O-Pipon-Na-Piwin Cree Nation, and Sayisi Dene First Nation, as potentially affected by the Project (Section 19.1.2).

In Manitoba, Treaty rights are collective entitlements derived through seven numbered treaties (1 through 6, and 10) plus a Treaty 5 adhesion area. These treaties signed between 1871 and 1906, and each with similar but slightly different terms, collectively account for the inhabited lands within the current provincial boundaries of Manitoba (Treaty Relations Commission of Manitoba 2019). In the 1990 decision for *R. v. Sparrow*, the Supreme Court of Canada stated that Treaties and statutes relating to First Nations should be liberally construed and uncertainties resolved in favour of First Nations.

The numbered treaties often, but not always, included:

- Land to be set aside for First Nation use only (known as reserves).
- Money to be paid to a First Nation every year (known as annuities).
- Hunting and fishing rights on unoccupied Crown land.
- Schools and teachers on reserves to be paid for by the government.
- One-time benefits (such as farm equipment and animals, ammunition, and clothing).

The Indigenous communities engaged by the Project are signatory to Adhesions to Treaty No. 5, Treaty No. 6, or Treaty No. 10, which provide historically defined treaty rights (Map 19-6).

19.9.2.3 Treaty 5

Three First Nations engaged in the Project are signatory to Adhesions to Treaty No. 5. The Project is located in the area subject to Adhesion to Treaty No. 5 (Treaty Relations Commission of Manitoba 2020). Adhesions to Treaty No. 5 were entered into at various dates, beginning in 1875 and concluding in 1908. First Nations engaged on the Project that are signatories to Treaty No. 5 Adhesions are Nisichawayasihk Cree Nation, O-Pipon-Na-Piwin Cree Nation, and Sayisi Dene First Nation.

Provisions for Treaty 5 included land allowance of 160 acres [approximately 64.75 ha] per family of five, with government retention of right to sell, lease or appropriate lands, subject to Indigenous agreement. Specific signatories were also mentioned, including members of Norway House, for whom a reserve location "in the vicinity of Fisher River", was promised, with a land allocation of 100 acres [approximately 40.47 ha] per family of five, for those who moved to the reserve within a three-year period. Members of Norway House who elected not to move to reserve were to "retain for their own use their present gardens, buildings and improvements until the same be departed with by the Queen's Government, with their consent first had and obtained". Provisions were also made for "Band of Woods Indians" (Cross Lake), with land allocations of 160 acres [approximately 64.75 ha] per family of five. All signatories were also to be provided schools located on their respective reserves, as per terms of the treaty.

Treaty signatories retained the right to hunt, fish, and trap, and annuities were to be paid at five dollars per person, with headmen receiving 15 dollars, and chiefs receiving 25 dollars. An annual payment of 500 dollars was also to be made to families for ammunition and twine, with chiefs and headmen to receive new clothing every three years. As well, a one-time payment of 500 dollars per person, along with farmstock, tools, equipment, flags, and medals, was to be made.

19.9.2.4 Treaty 6

Although Treaty No. 6 territory falls within Saskatchewan and Alberta, Marcel Colomb First Nation (Hughes Lake) and Mathias Colomb Cree Nation (Granville Lake) are Treaty No. 6 signatories. Historically, the people of Marcel Colomb First Nation and Mathias Colomb Cree Nation were affiliated with leaders that signed Treaty 6. Later, both Marcel Colomb First Nation and Mathias Colomb Cree Nation established themselves as separate First Nations and although they are located in Manitoba, each Nation remains members of Treaty 6.

The text of Treaty 6 indicates that provisions were to include land allocations in the amount of up to 1 square mile [approximately 2.6 square kilometers] per family of five, and cash annuities of 12 dollars per person, 15 dollars per headman, and 25 dollars per chief. Families were to be given agricultural tools such as hoes and spades, as well as livestock and wagons, and were to receive 1500 dollars per year for the purchase of ammunition and twine. Signatories of Treaty 6 were to retain their right to hunt, trap, and fish, and a medicine chest was to be kept at the house of the "Indian agent" located on each reserve. Three years after the signing of Treaty 6, families who had settled on reserve and were engaged in agricultural work, were to receive 1000 dollars to be spent on agricultural provisions. Signatories were also to have access to a school once settled on reserve and could receive rations when food was in short supply or when insects affected agricultural success.

19.9.2.5 Treaty 10

Manitoba First Nations that are signatories to Treaty 10 engaged on the Project are Barren Lands First Nation and Northlands Denesuline First Nation. Saskatchewan First Nation communities engaged on the

Project that are signatories to Treaty No. 10 are Peter Ballantyne Cree Nation and Hatchet Lake First Nation.

Provisions for Treaty 10 included the setting aside of up to one square mile [approximately 2.6 square kilometers] of land for a family of five that agreed to live on the reserve, or 160 acres [approximately 64.75 ha] of land per person for those who chose not to reside on the reserve. Signatories were to receive a one-time cash payment of 12 dollars per person, 22 dollars per headman, and 32 dollars per chief, as well as annual payments of five dollars per person, 15 dollars per headman, and 25 dollars per chief. Signatories were to retain the right to pursue hunting, fishing, and trapping. Chiefs who signed the treaty were to receive a silver medal and flag, and on every third year thereafter, "a suitable suit of clothing", while headmen were to receive a bronze medal and clothing every third year. Provisions were also to be made for the education of children and for assisting signatories in undertaking "farming or stock-raising or other work and to make such a distribution of twine and ammunition to them annually" (CIRNAC 2010).

19.9.2.6 Treaties and the NRTA

The *NRTA* had the effect of enlarging the area in which First Nations can hunt, fish and trap for food to the entire province. Under the treaties, First Nations were limited to hunting in their treaty areas. The *NRTA* also had the effect of limiting First Nation rights to hunt, fish, and trap for food only. As a result, commercial rights were extinguished. The *NRTA* is binding law – it is the legal instrument that currently sets out and governs the First Nation right to hunt, fish, and trap[11].

19.9.3 Assessments of Impacts on Indigenous or Treaty Rights

This section presents information that is related to the understanding and exercise of Indigenous rights, as provided by the 12 Indigenous communities engaged on the Project. Full details regarding the Indigenous Community Engagement Plan (Chapter 3, Section 3.3.1) for the Project can be found in Chapter 3 of the EIS. Information pertaining to the understanding and exercise of Indigenous rights was gathered from Project-specific TLRU studies and as well as from meetings, workshops, open houses, correspondence, and other Indigenous engagement activities conducted by Alamos.

First Nations

19.9.3.1 Marcel Colomb First Nation

Alamos recognizes that Marcel Colomb First Nation is best placed to provide information about how the community understands and exercises their Indigenous or Treaty rights and has incorporated feedback that Marcel Colomb First Nation has provided into the EIS.

A detailed profile of Marcel Colomb First Nation is provided in Section 3.3.3.1. A summary of Marcel Colomb First Nation TLRU activities and practices, including available information on traditional sites, areas, and resources harvested, is provided in Section 17.2.14.1.

[11] R v Badger, [1996] 1 SCR 771 at para 47

Marcel Colomb First Nation has discussed Project-related impacts to Indigenous rights with Alamos on several occasions. Two examples of these discussions include the following:

- During a meeting with Alamos in March of 2019 related to trap-line and land rights, Marcel Colomb First Nation indicated that direct compensation should be provided by Alamos due to Project-related activities, as they were expected to have impacts on traplines and land rights.
- In a November 2018 meeting with Alamos to discuss a funding agreement, Marcel Colomb First Nation indicated that exploratory helicopter flights over the Black Sturgeon Reserve during moose and goose season are not allowed and infringe on treaty rights. Through the establishing of the Elders committee in April 2019, Marcel Colomb First Nation and Alamos agreed that planned flights related to planned exploration activities would be reviewed during quarterly meetings of the Committee. Alamos noted the concerns provided during this meeting and committed to advising them internally.

The reserve for Marcel Colomb First Nation, Black Sturgeon Reserve, is located within the RAA, and lies six kilometers from the Gordon site and 22 kilometers from the MacLellan site.

Under the Manitoba Framework Agreement (1997), Marcel Colomb First Nation has a TLE allocation of 17,007 acres [approximately 6,882.49 ha]. As of 2017, Marcel Colomb First Nation has not signed the Agreement, so no lands have yet been converted to reserve land (CIRNAC 2017a). Marcel Colomb First Nation does not have any TLE parcels within the Project RAA. There is a 30 km Community Interest Zone (CIZ) surrounding the Black Sturgeon Reserve in the RAA. The purpose of the CIZ is to provide temporary protection of areas from development while the First Nation is involved in TLE selection or acquisition; however, it does not apply to lands where mining claims are staked or converted to leases (Map 19-6).

The ability to exercise or practice Indigenous or Treaty rights, including harvesting rights and integral practices, traditions, and customs, depends upon the health of the land to support these practices. The potential effects of the Project on asserted or established Indigenous or Treaty rights are derived directly or indirectly from the physical effects of the Project on the environment. Consequently, the pathways are similar for potential effects for the exercise and practice of Indigenous or Treaty rights (including the availability of and access to traditionally harvested resources and traditional sites and areas), as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage). The identification of Project interactions and the assessment of potential effects on Indigenous or Treaty rights considers both the exercise and practice and the conditions that support the exercise of the rights, as presented in Section 19.4.

Impacts on Indigenous or Treaty rights may occur through the six effect pathways identified in Section 19.7.1.3.

Where the Project has a residual effect on traditional harvesting (hunting, trapping, fishing, plant, or material gathering) or on physical activities associated with traditional use (travel and navigation, use of habitation, cultural, and spiritual sites or areas), that has been considered as a residual effect on Indigenous or Treaty rights. In Chapter 17, Section 17.4, Project impacts on the current use of lands and resources for traditional purposes, including change in availability of resources currently used for traditional purposes, change in access resources currently used for traditional purposes, change to traditional cultural and spiritual sites or

areas, and change to the environment that affects cultural value or importance associated with current use were assessed.

Residual environmental effects to Indigenous health, through effects to air, water, and soil quality, as well as consumptive resources (country foods) are anticipated during the construction and operation phase of the Project. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. However, these environmental effects are not anticipated at population levels to plant, animal, and fish species, including those harvested as country foods within the Indigenous Health RAA. Although vehicular collisions and human-wildlife conflicts may result in mortality for a few individual animals the health of harvested resources at a population level is not anticipated to experience residual effects within the Indigenous Health RAA.

Residual effects on Indigenous socio-economic conditions such as fishing, trapping, and recreation are expected, particularly during construction. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. It is anticipated, however, that the exercise of Indigenous or Treaty rights related to Indigenous socio-economic conditions will be able to continue at similar levels as under baseline conditions. The Project will also result in loss of lands available for recreational activities; however, the Gordon site PDA results in direct disturbance of approximately 269 ha of provincial Crown land, which is 0.0006% of the Crown land within the Indigenous Rights LAA. The MacLellan site PDA contains approximately 938 ha of municipally administered land (0.002% of the Crown land area within the Indigenous Rights LAA). The Project is anticipated to increase demands on community infrastructure and services during construction and operation and could result in a reduction in available capacity and/or quality of services for Indigenous peoples living within the Rights LAA, including emergency services. Project-generated construction phase road traffic will increase traffic volumes, which may affect Indigenous people who live and work within the Rights LAA. Community wellbeing and social cohesions could be affected in both positive and adverse ways (changes to employment and income; differential demands on time; participation in recreational, subsistence, and family-related activities and physical exercise). Spending related to the Project could both benefit and adversely affect regional businesses, including Indigenous-owned businesses.

Residual effects to Indigenous physical and cultural heritage are anticipated, especially during the construction and operation phase, when the presence of workers and equipment in the Rights LAA will generate noise, dust, and visual disturbance. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. Visual quality within the Rights LAA is expected to change overall with the Project, and sensory disturbances are also likely. These residual effects may affect the use and enjoyment of cultural and spiritual sites within the Rights LAA. Predictive modelling indicates a low potential for the PDA and Rights LAA of the Project sites to contain unknown heritage resources, so residual effects are not anticipated for changes to heritage resources. In the event of inadvertently exposed heritage resources, a protection plan is in place to mitigate such exposures.

Overall, with the implementation of mitigation measures, residual Project effects on the exercise or practice of Indigenous or Treaty rights in the Rights LAA are expected to reflect the residual effects predicted for Current Use, including the availability of and access to traditionally harvested resources and traditional sites

and areas, as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, Indigenous physical and cultural heritage).

Criteria for assessing the severity of impacts on Indigenous or Treaty Rights are defined in Table 19-11. Impacts on Indigenous or Treaty rights are anticipated to be high in likelihood and adverse in direction because low magnitude residual effects are predicted for Current Use and Indigenous physical and cultural heritage, and moderate magnitude effects are predicted for Indigenous health and Indigenous socio-economic conditions. The PDA is within a disturbed context of existing mine sites, and not expected to cause population level effects on traditionally harvested resources. Patterns of access to travel routes and harvesting areas in the Rights LAA will be altered by access restrictions to the PDA including preferred access routes such as the Gordon site access road. Predicted exceedances in inhalation exposures are expected to be infrequent and based on single events and do not represent continuous exposures that would represent potential concerns for Indigenous health. As well, the use of and access to infrastructure and services is at available capacity, which may affect the quality of services provided, and the changes in the economy are unlikely to pose substantial risks or benefits.

The geographic extent for impacts on Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to extend to the Rights LAA.

The frequency of impacts to Indigenous or Treaty rights is expected to be continuous because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to occur throughout construction and operation.

The duration and reversibility of impacts to Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to be long-term and reversible. Residual effects are anticipated to extend through decommissioning/closure. Change in availability and access to traditional resources and areas will extend beyond closure until the Project returns to its natural state. Changes to Indigenous socio-economic conditions are considered reversible, as the Project will be decommissioned, the workforce released, and the areas reclaimed.

Residual effects to Indigenous or Treaty rights are characterized as multiple, irregular in frequency and long-term in duration as change to access to harvesting areas and availability of harvested species will occur occasionally and without predictable pattern and persist throughout the construction and operation phase of the Project. Effects to Indigenous or Treaty rights are considered irreversible, as residual effects are unlikely to be reversed to baseline conditions.

Alamos is committed to ongoing engagement with Marcel Colomb First Nation and will consider any additional information about effects to Indigenous or Treaty rights brought forward by Marcel Colomb First Nation according to the methodology outlined in Section 19.1.1.3.

19.9.3.2 Mathias Colomb Cree Nation

Under the Manitoba Framework Agreement (1997), Mathias Colomb Cree Nation has a TLE Settlement Agreement of 217,364 acres [approximately 87,964.09 ha]. As of March 1, 2015, 172,538.49 acres [approximately 69,823.85 ha] have been converted to reserve land (CIRNAC 2017a). Mathias Colomb Cree Nation's TLE parcels are located outside the Project RAA (Map 19-6).

A detailed profile of Mathias Colomb Cree Nation is provided in Section 3.3.3.2. A summary of Mathias Colomb Cree Nation TLRU activities and practices, including available information on traditional sites, areas, and resources harvested, is provided in Section 17.2.14.2.

The ability to exercise or practice Indigenous or Treaty rights, including harvesting rights and integral practices, traditions, and customs, depends upon the health of the land to support these practices. The potential effects of the Project on asserted or established Indigenous or Treaty rights are derived directly or indirectly from the physical effects of the Project on the environment. Consequently, the pathways are similar for potential effects for the exercise and practice of Indigenous or Treaty rights (including the availability of and access to traditionally harvested resources and traditional sites and areas), as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage). The identification of Project interactions and the assessment of potential effects on Indigenous or Treaty rights considers both the exercise and practice and the conditions that support the exercise of the rights, as presented in Section 19.4.

Impacts on Indigenous or Treaty rights may occur through the six effect pathways identified in Section 19.7.1.3.

Where the Project has a residual effect on traditional harvesting (hunting, trapping, fishing, plant, or material gathering) or on physical activities associated with traditional use (travel and navigation, use of habitation, cultural, and spiritual sites or areas), that has been considered as a residual effect on Indigenous or Treaty rights. In Chapter 17, Section 17.4, Project impacts on the current use of lands and resources for traditional purposes, including change in availability of resources currently used for traditional purposes, change in access resources currently used for traditional purposes, change to traditional cultural and spiritual sites or areas, and change to the environment that affects cultural value or importance associated with current use were assessed.

Residual environmental effects to Indigenous health, through effects to air, water, and soil quality, as well as consumptive resources (country foods) are anticipated during the construction and operation phase of the Project. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. However, these environmental effects are not anticipated at population levels to plant, animal, and fish species, including those harvested as country foods within the Indigenous Health RAA. Although vehicular collisions and human-wildlife conflicts may result in mortality for a few individual animals the health of harvested resources at a population level is not anticipated to experience residual effects within the Indigenous Health RAA.

Residual effects on Indigenous socio-economic conditions such as fishing, trapping, and recreation are expected, particularly during construction. This in turn could lead to effects on the ability to exercise

Indigenous or Treaty rights. It is anticipated, however, that the exercise of Indigenous or Treaty rights related to Indigenous socio-economic conditions will be able to continue at similar levels as under baseline conditions. The Project will also result in loss of lands available for recreational activities; however, the Gordon site PDA results in direct disturbance of approximately 269 ha of provincial Crown land, which is 0.0006% of the Crown land within the Indigenous Rights LAA. The MacLellan site PDA contains approximately 938 ha of municipally administered land (0.002% of the Crown land area within the Indigenous Rights LAA). The Project is anticipated to increase demands on community infrastructure and services during construction and operation and could result in a reduction in available capacity and/or quality of services for Indigenous peoples living within the Rights LAA, including emergency services. Project-generated construction phase road traffic will increase traffic volumes, which may affect Indigenous people who live and work within the Rights LAA. Community wellbeing and social cohesions could be affected in both positive and adverse ways (changes to employment and income; differential demands on time; participation in recreational, subsistence, and family-related activities and physical exercise). Spending related to the Project could both benefit and adversely affect regional businesses, including Indigenous-owned businesses.

Residual effects to Indigenous physical and cultural heritage are anticipated, especially during the construction and operation phase, when the presence of workers and equipment in the Rights LAA will generate noise, dust, and visual disturbance. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. Visual quality within the Rights LAA is expected to change overall with the Project, and sensory disturbances are also likely. These residual effects may affect the use and enjoyment of cultural and spiritual sites within the Rights LAA. Predictive modelling indicates a low potential for the PDA and Rights LAA of the Project sites to contain unknown heritage resources, so residual effects are not anticipated for changes to heritage resources. In the event of inadvertently exposed heritage resources, a protection plan is in place to mitigate such exposures.

Overall, with the implementation of mitigation measures, residual Project effects on the exercise or practice of Indigenous or Treaty rights in the Rights LAA are expected to reflect the residual effects predicted for Current Use, including the availability of and access to traditionally harvested resources and traditional sites and areas, as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, Indigenous physical and cultural heritage).

Criteria for assessing the severity of impacts on Indigenous or Treaty Rights are defined in Table 19-11. Impacts on Indigenous or Treaty rights are anticipated to be high in likelihood and adverse in direction because low magnitude residual effects are predicted for Current Use and Indigenous physical and cultural heritage, and moderate magnitude effects are predicted for Indigenous health and Indigenous socio-economic conditions. The PDA is within a disturbed context of existing mine sites, and not expected to cause population level effects on traditionally harvested resources. Patterns of access to travel routes and harvesting areas in the Rights LAA will be altered by access restrictions to the PDA including preferred access routes such as the Gordon site access road. Predicted exceedances in inhalation exposures are expected to be infrequent and based on single events and do not represent continuous exposures that would represent potential concerns for Indigenous health. As well, the use of and access to infrastructure and services is at available capacity, which may affect the quality of services provided, and the changes in the economy are unlikely to pose substantial risks or benefits.

The geographic extent for impacts on Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to extend to the Rights LAA.

The frequency of impacts to Indigenous or Treaty rights is expected to be continuous because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to occur throughout construction and operation.

The duration and reversibility of impacts to Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to be long-term and reversible. Residual effects are anticipated to extend through decommissioning/closure. Change in availability and access to traditional resources and areas will extend beyond closure until the Project returns to its natural state. Changes to Indigenous socio-economic conditions are considered reversible, as the Project will be decommissioned, the workforce released, and the areas reclaimed.

Residual effects to Indigenous or Treaty rights are characterized as multiple, irregular in frequency and long-term in duration as change to access to harvesting areas and availability of harvested species will occur occasionally and without predictable pattern and persist throughout the construction and operation phase of the Project. Effects to Indigenous or Treaty rights are considered irreversible, as residual effects are unlikely to be reversed to baseline conditions.

Alamos is committed to ongoing engagement with Mathias Colomb Cree Nation and will consider any additional information about effects to Indigenous or Treaty rights brought forward by Mathias Colomb Cree Nation according to the methodology outlined in Section 19.1.1.3.

19.9.3.3 Nisichawayasihk Cree Nation

Nisichawayasihk Cree Nation signed the *First Nations Land Management Act* (1999) in Manitoba and is developing a Land Code (Nisichawayasi Aski Pumenikewin) that would re-establish First Nation control over the administration and management of NCN lands under a Framework Agreement (1996) on First Nation Land Management. The Land Code was ratified in 2017 by Nisichawayasihk Cree Nation members. This land code came into force in October 2017 (Government of Canada 2019c).

Under the Manitoba Framework Agreement (1997), Nisichawayasihk Cree Nation has a TLE Settlement Agreement of 61,761 acres [approximately 24,993.80 ha]. As of March 1, 2015, 33,816.01 acres [approximately 13,684.85 ha] have been converted to reserve land (CIRNAC 2017a). Nisichawayasihk Cree Nation has TLE parcels that are located within the Project RAA (Map 19-6).

A detailed profile of Nisichawayasihk Cree Nation is provided in Section 3.3.3.3. A summary Nisichawayasihk Cree Nation TLRU activities and practices, including available information on traditional sites, areas, and resources harvested, is provided in Section 17.2.14.7.

The ability to exercise or practice Indigenous or Treaty rights, including harvesting rights and integral practices, traditions, and customs, depends upon the health of the land to support these practices. The potential effects of the Project on asserted or established Indigenous or Treaty rights are derived directly or indirectly from the physical effects of the Project on the environment. Consequently, the pathways are similar for potential effects for the exercise and practice of Indigenous or Treaty rights (including the availability of and access to traditionally harvested resources and traditional sites and areas), as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage). The identification of Project interactions and the assessment of potential effects on Indigenous or Treaty rights considers both the exercise and practice and the conditions that support the exercise of the rights, as presented in Section 19.4.

Impacts on Indigenous or Treaty rights may occur through the six effect pathways identified in Section 19.7.1.3.

Where the Project has a residual effect on traditional harvesting (hunting, trapping, fishing, plant, or material gathering) or on physical activities associated with traditional use (travel and navigation, use of habitation, cultural, and spiritual sites or areas), that has been considered as a residual effect on Indigenous or Treaty rights. In Chapter 17, Section 17.4, Project impacts on the current use of lands and resources for traditional purposes, including change in availability of resources currently used for traditional purposes, change in access resources currently used for traditional purposes, change to traditional cultural and spiritual sites or areas, and change to the environment that affects cultural value or importance associated with current use were assessed.

Residual environmental effects to Indigenous health, through effects to air, water, and soil quality, as well as consumptive resources (country foods) are anticipated during the construction and operation phase of the Project. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. However, these environmental effects are not anticipated at population levels to plant, animal, and fish species, including those harvested as country foods within the Indigenous Health RAA. Although vehicular collisions and human-wildlife conflicts may result in mortality for a few individual animals the health of harvested resources at a population level is not anticipated to experience residual effects within the Indigenous Health RAA.

Residual effects on Indigenous socio-economic conditions such as fishing, trapping, and recreation are expected, particularly during construction. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. It is anticipated, however, that the exercise of Indigenous or Treaty rights related to Indigenous socio-economic conditions will be able to continue at similar levels as under baseline conditions. The Project will also result in loss of lands available for recreational activities; however, the Gordon site PDA results in direct disturbance of approximately 269 ha of provincial Crown land, which is 0.0006% of the Crown land within the Indigenous Rights LAA. The MacLellan site PDA contains approximately 938 ha of municipally administered land (0.002% of the Crown land area within the Indigenous Rights LAA). The Project is anticipated to increase demands on community infrastructure and services during construction and operation and could result in a reduction in available capacity and/or quality of services for Indigenous peoples living within the Rights LAA, including emergency services. Project-generated construction phase road traffic will increase traffic volumes, which may affect Indigenous people who live and work within the Rights LAA. Community wellbeing and social cohesions could be affected in both positive and adverse ways (changes to employment and income; differential demands on time; participation in recreational, subsistence, and family-related activities and physical exercise). Spending related to the Project could both benefit and adversely affect regional businesses, including Indigenous-owned businesses.

Residual effects to Indigenous physical and cultural heritage are anticipated, especially during the construction and operation phase, when the presence of workers and equipment in the Rights LAA will generate noise, dust, and visual disturbance. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. Visual quality within the Rights LAA is expected to change overall with the Project, and sensory disturbances are also likely. These residual effects may affect the use and enjoyment of cultural and spiritual sites within the Rights LAA. Predictive modelling indicates a low potential for the PDA and Rights LAA of the Project sites to contain unknown heritage resources, so residual effects are not anticipated for changes to heritage resources. In the event of inadvertently exposed heritage resources, a protection plan is in place to mitigate such exposures.

Overall, with the implementation of mitigation measures, residual Project effects on the exercise or practice of Indigenous or Treaty rights in the Rights LAA are expected to reflect the residual effects predicted for Current Use, including the availability of and access to traditionally harvested resources and traditional sites and areas, as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, Indigenous physical and cultural heritage).

Criteria for assessing the severity of impacts on Indigenous or Treaty Rights are defined in Table 19-11. Impacts on Indigenous or Treaty rights are anticipated to be high in likelihood and adverse in direction because low magnitude residual effects are predicted for Current Use and Indigenous physical and cultural heritage, and moderate magnitude effects are predicted for Indigenous health and Indigenous socio-economic conditions. The PDA is within a disturbed context of existing mine sites, and not expected to cause population level effects on traditionally harvested resources. Patterns of access to travel routes and harvesting areas in the Rights LAA will be altered by access restrictions to the PDA including preferred access routes such as the Gordon site access road. Predicted exceedances in inhalation exposures are expected to be infrequent and based on single events and do not represent continuous exposures that would represent potential concerns for Indigenous health. As well, the use of and access to infrastructure and services is at available capacity, which may affect the quality of services provided, and the changes in the economy are unlikely to pose substantial risks or benefits.

The geographic extent for impacts on Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to extend to the Rights LAA.

The frequency of impacts to Indigenous or Treaty rights is expected to be continuous because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to occur throughout construction and operation.

The duration and reversibility of impacts to Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to be long-term and reversible. Residual effects are anticipated to extend through decommissioning/closure. Change in availability and access to traditional resources and areas will extend beyond closure until the Project returns to its natural state. Changes to Indigenous socio-economic conditions are considered reversible, as the Project will be decommissioned, the workforce released, and the areas reclaimed.

Residual effects to Indigenous or Treaty rights are characterized as multiple, irregular in frequency and long-term in duration as change to access to harvesting areas and availability of harvested species will occur occasionally and without predictable pattern and persist throughout the construction and operation phase of the Project. Effects to Indigenous or Treaty rights are considered irreversible, as residual effects are unlikely to be reversed to baseline conditions.

Alamos is committed to ongoing engagement with Nisichawayasihk Cree Nation and will consider any additional information about effects to Indigenous or Treaty rights brought forward by Nisichawayasihk Cree Nation according to the methodology outlined in Section 19.1.1.3.

19.9.3.4 O-Pipon-Na-Piwin Cree Nation

Under the Manitoba Framework Agreement (1997), O-Pipon-Na-Piwin Cree Nation has a TLE Settlement Agreement of 17,674.29 acres [approximately 7,152.53 ha]. As of 2017, O-Pipon-Na-Piwin Cree Nation has not signed the Agreement, so no lands have yet been converted to reserve land (CIRNAC 2017a). O-Pipon-Na-Piwin Cree Nation has TLE parcels that are located within the Project RAA (Map 19-6).

A detailed profile of O-Pipon-Na-Piwin Cree Nation is provided in Section 3.3.3.4. A summary of O- Pipon-Na-Piwin Cree Nation TLRU activities and practices, including available information on traditional sites, areas, and resources harvested, is provided in Section 17.2.14.6.

The ability to exercise or practice Indigenous or Treaty rights, including harvesting rights and integral practices, traditions, and customs, depends upon the health of the land to support these practices. The potential effects of the Project on asserted or established Indigenous or Treaty rights are derived directly or indirectly from the physical effects of the Project on the environment. Consequently, the pathways are similar for potential effects for the exercise and practice of Indigenous or Treaty rights (including the availability of and access to traditionally harvested resources and traditional sites and areas), as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage). The identification of Project interactions and the assessment of potential effects on Indigenous or Treaty rights considers both the exercise and practice and the conditions that support the exercise of the rights, as presented in Section 19.4.

Impacts on Indigenous or Treaty rights may occur through the six effect pathways identified in Section 19.7.1.3.

Where the Project has a residual effect on traditional harvesting (hunting, trapping, fishing, plant, or material gathering) or on physical activities associated with traditional use (travel and navigation, use of habitation, cultural, and spiritual sites or areas), that has been considered as a residual effect on Indigenous or Treaty rights. In Chapter 17, Section 17.4, Project impacts on the current use of lands and resources for traditional purposes, including change in availability of resources currently used for traditional purposes, change in access resources currently used for traditional purposes, change to traditional cultural and spiritual sites or

areas, and change to the environment that affects cultural value or importance associated with current use were assessed.

Residual environmental effects to Indigenous health, through effects to air, water, and soil quality, as well as consumptive resources (country foods) are anticipated during the construction and operation phase of the Project. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. However, these environmental effects are not anticipated at population levels to plant, animal, and fish species, including those harvested as country foods within the Indigenous Health RAA. Although vehicular collisions and human-wildlife conflicts may result in mortality for a few individual animals the health of harvested resources at a population level is not anticipated to experience residual effects within the Indigenous Health RAA.

Residual effects on Indigenous socio-economic conditions such as fishing, trapping, and recreation are expected, particularly during construction. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. It is anticipated, however, that the exercise of Indigenous or Treaty rights related to Indigenous socio-economic conditions will be able to continue at similar levels as under baseline conditions. The Project will also result in loss of lands available for recreational activities; however, the Gordon site PDA results in direct disturbance of approximately 269 ha of provincial Crown land, which is 0.0006% of the Crown land within the Indigenous Rights LAA. The MacLellan site PDA contains approximately 938 ha of municipally administered land (0.002% of the Crown land area within the Indigenous Rights LAA). The Project is anticipated to increase demands on community infrastructure and services during construction and operation and could result in a reduction in available capacity and/or quality of services for Indigenous peoples living within the Rights LAA, including emergency services. Project-generated construction phase road traffic will increase traffic volumes, which may affect Indigenous people who live and work within the Rights LAA. Community wellbeing and social cohesions could be affected in both positive and adverse ways (changes to employment and income; differential demands on time; participation in recreational, subsistence, and family-related activities and physical exercise). Spending related to the Project could both benefit and adversely affect regional businesses, including Indigenous-owned businesses.

Residual effects to Indigenous physical and cultural heritage are anticipated, especially during the construction and operation phase, when the presence of workers and equipment in the Rights LAA will generate noise, dust, and visual disturbance. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. Visual quality within the Rights LAA is expected to change overall with the Project, and sensory disturbances are also likely. These residual effects may affect the use and enjoyment of cultural and spiritual sites within the Rights LAA. Predictive modelling indicates a low potential for the PDA and Rights LAA of the Project sites to contain unknown heritage resources, so residual effects are not anticipated for changes to heritage resources. In the event of inadvertently exposed heritage resources, a protection plan is in place to mitigate such exposures.

Overall, with the implementation of mitigation measures, residual Project effects on the exercise or practice of Indigenous or Treaty rights in the Rights LAA are expected to reflect the residual effects predicted for Current Use, including the availability of and access to traditionally harvested resources and traditional sites

and areas, as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, Indigenous physical and cultural heritage).

Criteria for assessing the severity of impacts on Indigenous or Treaty Rights are defined in Table 19-11. Impacts on Indigenous or Treaty rights are anticipated to be high in likelihood and adverse in direction because low magnitude residual effects are predicted for Current Use and Indigenous physical and cultural heritage, and moderate magnitude effects are predicted for Indigenous health and Indigenous socio-economic conditions. The PDA is within a disturbed context of existing mine sites, and not expected to cause population level effects on traditionally harvested resources. Patterns of access to travel routes and harvesting areas in the Rights LAA will be altered by access restrictions to the PDA including preferred access routes such as the Gordon site access road. Predicted exceedances in inhalation exposures are expected to be infrequent and based on single events and do not represent continuous exposures that would represent potential concerns for Indigenous health. As well, the use of and access to infrastructure and services is at available capacity, which may affect the quality of services provided, and the changes in the economy are unlikely to pose substantial risks or benefits.

The geographic extent for impacts on Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to extend to the Rights LAA.

The frequency of impacts to Indigenous or Treaty rights is expected to be continuous because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to occur throughout construction and operation.

The duration and reversibility of impacts to Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to be long-term and reversible. Residual effects are anticipated to extend through decommissioning/closure. Change in availability and access to traditional resources and areas will extend beyond closure until the Project returns to its natural state. Changes to Indigenous socio-economic conditions are considered reversible, as the Project will be decommissioned, the workforce released, and the areas reclaimed.

Residual effects to Indigenous or Treaty rights are characterized as multiple, irregular in frequency and long-term in duration as change to access to harvesting areas and availability of harvested species will occur occasionally and without predictable pattern and persist throughout the construction and operation phase of the Project. Effects to Indigenous or Treaty rights are considered irreversible, as residual effects are unlikely to be reversed to baseline conditions.

Alamos is committed to ongoing engagement with O-Pipon-Na-Piwin Cree Nation and will consider any additional information about effects to Indigenous or Treaty rights brought forward by O-Pipon-Na-Piwin Cree Nation according to the methodology outlined in Section 19.1.1.3.

19.9.3.5 Peter Ballantyne Cree Nation

Peter Ballantyne Cree Nation entered into the 1992 TLE Framework Agreement in Saskatchewan. Under the Agreement, Peter Ballantyne Cree Nation has a TLE Settlement Agreement of 234,248.85 acres [approximately 94,797.15 ha] (Government of Canada 2019d). To date, information has not been available regarding how many of these acres/ha have been converted to reserve land. Peter Ballantyne Cree Nation's TLE parcels lie outside the Project RAA (Map 19-6).

A TLRU study has been submitted by Peter Ballantyne Cree Nation, but Alamos has not received permission to use the information in the EIS.

A detailed profile of Peter Ballantyne Cree Nation is provided in Section 3.3.3.6. A summary of Peter Ballantyne Cree Nation TLRU activities and practices, including available information on traditional sites, areas, and resources harvested, is provided in Section 17.2.14.3.

The ability to exercise or practice Indigenous or Treaty rights, including harvesting rights and integral practices, traditions, and customs, depends upon the health of the land to support these practices. The potential effects of the Project on asserted or established Indigenous or Treaty rights are derived directly or indirectly from the physical effects of the Project on the environment. Consequently, the pathways are similar for potential effects for the exercise and practice of Indigenous or Treaty rights (including the availability of and access to traditionally harvested resources and traditional sites and areas), as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage). The identification of Project interactions and the assessment of potential effects on Indigenous or Treaty rights considers both the exercise and practice and the conditions that support the exercise of the rights, as presented in Section 19.4.

Impacts on Indigenous or Treaty rights may occur through the six effect pathways identified in Section 19.7.1.3.

Where the Project has a residual effect on traditional harvesting (hunting, trapping, fishing, plant, or material gathering) or on physical activities associated with traditional use (travel and navigation, use of habitation, cultural, and spiritual sites or areas), that has been considered as a residual effect on Indigenous or Treaty rights. In Chapter 17, Section 17.4, Project impacts on the current use of lands and resources for traditional purposes, including change in availability of resources currently used for traditional purposes, change in access resources currently used for traditional purposes, change to traditional cultural and spiritual sites or areas, and change to the environment that affects cultural value or importance associated with current use were assessed.

Residual environmental effects to Indigenous health, through effects to air, water, and soil quality, as well as consumptive resources (country foods) are anticipated during the construction and operation phase of the Project. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. However, these environmental effects are not anticipated at population levels to plant, animal, and fish species, including those harvested as country foods within the Indigenous Health RAA. Although vehicular collisions and human-wildlife conflicts may result in mortality for a few individual animals the health of harvested resources at a population level is not anticipated to experience residual effects within the Indigenous Health RAA.

Residual effects on Indigenous socio-economic conditions such as fishing, trapping, and recreation are expected, particularly during construction. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. It is anticipated, however, that the exercise of Indigenous or Treaty rights related to Indigenous socio-economic conditions will be able to continue at similar levels as under baseline conditions. The Project will also result in loss of lands available for recreational activities; however, the Gordon site PDA results in direct disturbance of approximately 269 ha of provincial Crown land, which is 0.0006% of the Crown land within the Indigenous Rights LAA. The MacLellan site PDA contains approximately 938 ha of municipally administered land (0.002% of the Crown land area within the Indigenous Rights LAA). The Project is anticipated to increase demands on community infrastructure and services during construction and operation and could result in a reduction in available capacity and/or quality of services for Indigenous peoples living within the Rights LAA, including emergency services. Project-generated construction phase road traffic will increase traffic volumes, which may affect Indigenous people who live and work within the Rights LAA. Community wellbeing and social cohesions could be affected in both positive and adverse ways (changes to employment and income; differential demands on time; participation in recreational, subsistence, and family-related activities and physical exercise). Spending related to the Project could both benefit and adversely affect regional businesses, including Indigenous-owned businesses.

Residual effects to Indigenous physical and cultural heritage are anticipated, especially during the construction and operation phase, when the presence of workers and equipment in the Rights LAA will generate noise, dust, and visual disturbance. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. Visual quality within the Rights LAA is expected to change overall with the Project, and sensory disturbances are also likely. These residual effects may affect the use and enjoyment of cultural and spiritual sites within the Rights LAA. Predictive modelling indicates a low potential for the PDA and Rights LAA of the Project sites to contain unknown heritage resources, so residual effects are not anticipated for changes to heritage resources. In the event of inadvertently exposed heritage resources, a protection plan is in place to mitigate such exposures.

Overall, with the implementation of mitigation measures, residual Project effects on the exercise or practice of Indigenous or Treaty rights in the Rights LAA are expected to reflect the residual effects predicted for Current Use, including the availability of and access to traditionally harvested resources and traditional sites and areas, as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, Indigenous physical and cultural heritage).

Criteria for assessing the severity of impacts on Indigenous or Treaty Rights are defined in Table 19-11. Impacts on Indigenous or Treaty rights are anticipated to be high in likelihood and adverse in direction because low magnitude residual effects are predicted for Current Use and Indigenous physical and cultural heritage, and moderate magnitude effects are predicted for Indigenous health and Indigenous socio-economic conditions. The PDA is within a disturbed context of existing mine sites, and not expected to cause population level effects on traditionally harvested resources. Patterns of access to travel routes and harvesting areas in the Rights LAA will be altered by access restrictions to the PDA including preferred access routes such as the Gordon site access road. Predicted exceedances in inhalation exposures are expected to be infrequent and based on single events and do not represent continuous exposures that would represent potential concerns for Indigenous health. As well, the use of and access to infrastructure and services is at available capacity, which may affect the quality of services provided, and the changes in the economy are unlikely to pose substantial risks or benefits.

The geographic extent for impacts on Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to extend to the Rights LAA.

The frequency of impacts to Indigenous or Treaty rights is expected to be continuous because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to occur throughout construction and operation.

The duration and reversibility of impacts to Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to be long-term and reversible. Residual effects are anticipated to extend through decommissioning/closure. Change in availability and access to traditional resources and areas will extend beyond closure until the Project returns to its natural state. Changes to Indigenous socio-economic conditions are considered reversible, as the Project will be decommissioned, the workforce released, and the areas reclaimed.

Residual effects to Indigenous or Treaty rights are characterized as multiple, irregular in frequency and long-term in duration as change to access to harvesting areas and availability of harvested species will occur occasionally and without predictable pattern and persist throughout the construction and operation phase of the Project. Effects to Indigenous or Treaty rights are considered irreversible, as residual effects are unlikely to be reversed to baseline conditions.

Alamos is committed to ongoing engagement with Peter Ballantyne Cree Nation and will consider any additional information about effects to Indigenous or Treaty rights brought forward by Peter Ballantyne Cree Nation according to the methodology outlined in Section 19.1.1.3.

19.9.3.6 Barren Lands First Nation

Under the Manitoba Framework Agreement (1997), Barren Lands First Nation has a TLE Settlement Agreement of 66,420 acres [approximately 26,875.17 ha]. As of March 1, 2015, no lands have been converted to reserve lands (CIRNAC 2017a). Barren Lands First Nation's TLE parcels lie outside the Project RAA (Map 19-6).

A detailed profile of Barren Lands First Nation is provided in Section 3.3.3.7. A summary of Barren Lands First Nation TLRU activities and practices, including available information on traditional sites, areas, and resources harvested, is provided in Section 17.2.14.8.

The ability to exercise or practice Indigenous or Treaty rights, including harvesting rights and integral practices, traditions, and customs, depends upon the health of the land to support these practices. The potential effects of the Project on asserted or established Indigenous or Treaty rights are derived directly or indirectly from the physical effects of the Project on the environment. Consequently, the pathways are similar for potential effects for the exercise and practice of Indigenous or Treaty rights (including the availability of and access to traditionally harvested resources and traditional sites and areas), as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage). The identification of Project interactions and the assessment of potential effects on Indigenous or Treaty rights considers both the exercise and practice and the conditions that support the exercise of the rights, as presented in Section 19.4.

Impacts on Indigenous or Treaty rights may occur through the six effect pathways identified in Section 19.7.1.3.

Where the Project has a residual effect on traditional harvesting (hunting, trapping, fishing, plant, or material gathering) or on physical activities associated with traditional use (travel and navigation, use of habitation, cultural, and spiritual sites or areas), that has been considered as a residual effect on Indigenous or Treaty rights. In Chapter 17, Section 17.4, Project impacts on the current use of lands and resources for traditional purposes, including change in availability of resources currently used for traditional purposes, change in access resources currently used for traditional purposes, change to traditional cultural and spiritual sites or areas, and change to the environment that affects cultural value or importance associated with current use were assessed.

Residual environmental effects to Indigenous health, through effects to air, water, and soil quality, as well as consumptive resources (country foods) are anticipated during the construction and operation phase of the Project. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. However, these environmental effects are not anticipated at population levels to plant, animal, and fish species, including those harvested as country foods within the Indigenous Health RAA. Although vehicular collisions and human-wildlife conflicts may result in mortality for a few individual animals the health of harvested resources at a population level is not anticipated to experience residual effects within the Indigenous Health RAA.

Residual effects on Indigenous socio-economic conditions such as fishing, trapping, and recreation are expected, particularly during construction. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. It is anticipated, however, that the exercise of Indigenous or Treaty rights related to Indigenous socio-economic conditions will be able to continue at similar levels as under baseline conditions. The Project will also result in loss of lands available for recreational activities; however, the Gordon site PDA results in direct disturbance of approximately 269 ha of provincial Crown land, which is 0.0006% of the Crown land within the Indigenous Rights LAA. The MacLellan site PDA contains approximately 938 ha of municipally administered land (0.002% of the Crown land area within the Indigenous Rights LAA). The Project is anticipated to increase demands on community infrastructure and services during construction and operation and could result in a reduction in available capacity and/or quality of services for Indigenous peoples living within the Rights LAA, including emergency services. Project-generated construction phase road traffic will increase traffic volumes, which may affect Indigenous people who live and work within the Rights LAA. Community wellbeing and social cohesions could be affected in both positive and adverse ways (changes to employment and income; differential demands on time; participation in recreational, subsistence, and family-related activities and physical exercise). Spending related to the Project could both benefit and adversely affect regional businesses, including Indigenous-owned businesses.

Residual effects to Indigenous physical and cultural heritage are anticipated, especially during the construction and operation phase, when the presence of workers and equipment in the Rights LAA will generate noise, dust, and visual disturbance. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. Visual quality within the Rights LAA is expected to change overall with the Project, and sensory disturbances are also likely. These residual effects may affect the use and enjoyment of cultural and spiritual sites within the Rights LAA. Predictive modelling indicates a low potential for the PDA and Rights LAA of the Project sites to contain unknown heritage resources, so residual effects are not anticipated for changes to heritage resources. In the event of inadvertently exposed heritage resources, a protection plan is in place to mitigate such exposures.

Overall, with the implementation of mitigation measures, residual Project effects on the exercise or practice of Indigenous or Treaty rights in the Rights LAA are expected to reflect the residual effects predicted for Current Use, including the availability of and access to traditionally harvested resources and traditional sites and areas, as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, Indigenous physical and cultural heritage).

Criteria for assessing the severity of impacts on Indigenous or Treaty Rights are defined in Table 19-11. Impacts on Indigenous or Treaty rights are anticipated to be high in likelihood and adverse in direction because low magnitude residual effects are predicted for Current Use and Indigenous physical and cultural heritage, and moderate magnitude effects are predicted for Indigenous health and Indigenous socio-economic conditions. The PDA is within a disturbed context of existing mine sites, and not expected to cause population level effects on traditionally harvested resources. Patterns of access to travel routes and harvesting areas in the Rights LAA will be altered by access restrictions to the PDA including preferred access routes such as the Gordon site access road. Predicted exceedances in inhalation exposures are expected to be infrequent and based on single events and do not represent continuous exposures that would represent potential concerns for Indigenous health. As well, the use of and access to infrastructure and services is at available capacity, which may affect the quality of services provided, and the changes in the economy are unlikely to pose substantial risks or benefits.

The geographic extent for impacts on Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to extend to the Rights LAA.

The frequency of impacts to Indigenous or Treaty rights is expected to be continuous because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to occur throughout construction and operation.

The duration and reversibility of impacts to Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to be long-term and reversible. Residual effects are anticipated to extend through decommissioning/closure. Change in availability and access to traditional resources and areas will extend beyond closure until the Project returns to its natural state. Changes to Indigenous socio-economic conditions are considered reversible, as the Project will be decommissioned, the workforce released, and the areas reclaimed.

Residual effects to Indigenous or Treaty rights are characterized as multiple, irregular in frequency and long-term in duration as change to access to harvesting areas and availability of harvested species will occur occasionally and without predictable pattern and persist throughout the construction and operation phase of the Project. Effects to Indigenous or Treaty rights are considered irreversible, as residual effects are unlikely to be reversed to baseline conditions.

Alamos is committed to ongoing engagement with Barren Lands First Nation and will consider any additional information about effects to Indigenous or Treaty rights brought forward by Barren Lands First Nation according to the methodology outlined in Section 19.1.1.3.

19.9.3.7 Northlands Denesuline First Nation

Under the Manitoba Framework Agreement (1997), Northlands Denesuline First Nation has a TLE Settlement Agreement of 94,084 acres [approximately 38,074.44 ha. As of March 1, 2015, 4,134 acres [approximately 1,672.97 ha] have been converted to reserve lands (CIRNAC 2017a). Northlands Denesuline First Nation's TLE parcels lie outside the Project RAA (Map 19-6).

A detailed profile of Northlands Denesuline First Nation is provided in Section 3.3.3.10. A summary of Northlands Denesuline First Nation TLRU activities and practices, including available information on traditional sites, areas, and resources harvested, is provided in Section 17.2.14.10.

The ability to exercise or practice Indigenous or Treaty rights, including harvesting rights and integral practices, traditions, and customs, depends upon the health of the land to support these practices. The potential effects of the Project on asserted or established Indigenous or Treaty rights are derived directly or indirectly from the physical effects of the Project on the environment. Consequently, the pathways are similar for potential effects for the exercise and practice of Indigenous or Treaty rights (including the availability of and access to traditionally harvested resources and traditional sites and areas), as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage). The identification of Project interactions and the assessment of potential effects on Indigenous or Treaty rights considers both the exercise and practice and the conditions that support the exercise of the rights, as presented in Section 19.4.

Impacts on Indigenous or Treaty rights may occur through the six effect pathways identified in Section 19.7.1.3.

Where the Project has a residual effect on traditional harvesting (hunting, trapping, fishing, plant, or material gathering) or on physical activities associated with traditional use (travel and navigation, use of habitation, cultural, and spiritual sites or areas), that has been considered as a residual effect on Indigenous or Treaty rights. In Chapter 17, Section 17.4, Project impacts on the current use of lands and resources for traditional purposes, including change in availability of resources currently used for traditional purposes, change in access resources currently used for traditional purposes, change to traditional cultural and spiritual sites or

areas, and change to the environment that affects cultural value or importance associated with current use were assessed.

Residual environmental effects to Indigenous health, through effects to air, water, and soil quality, as well as consumptive resources (country foods) are anticipated during the construction and operation phase of the Project. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. However, these environmental effects are not anticipated at population levels to plant, animal, and fish species, including those harvested as country foods within the Indigenous Health RAA. Although vehicular collisions and human-wildlife conflicts may result in mortality for a few individual animals the health of harvested resources at a population level is not anticipated to experience residual effects within the Indigenous Health RAA.

Residual effects on Indigenous socio-economic conditions such as fishing, trapping, and recreation are expected, particularly during construction. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. It is anticipated, however, that the exercise of Indigenous or Treaty rights related to Indigenous socio-economic conditions will be able to continue at similar levels as under baseline conditions. The Project will also result in loss of lands available for recreational activities; however, the Gordon site PDA results in direct disturbance of approximately 269 ha of provincial Crown land, which is 0.0006% of the Crown land within the Indigenous Rights LAA. The MacLellan site PDA contains approximately 938 ha of municipally administered land (0.002% of the Crown land area within the Indigenous Rights LAA). The Project is anticipated to increase demands on community infrastructure and services during construction and operation and could result in a reduction in available capacity and/or quality of services for Indigenous peoples living within the Rights LAA, including emergency services. Project-generated construction phase road traffic will increase traffic volumes, which may affect Indigenous people who live and work within the Rights LAA. Community wellbeing and social cohesions could be affected in both positive and adverse ways (changes to employment and income; differential demands on time; participation in recreational, subsistence, and family-related activities and physical exercise). Spending related to the Project could both benefit and adversely affect regional businesses, including Indigenous-owned businesses.

Residual effects to Indigenous physical and cultural heritage are anticipated, especially during the construction and operation phase, when the presence of workers and equipment in the Rights LAA will generate noise, dust, and visual disturbance. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. Visual quality within the Rights LAA is expected to change overall with the Project, and sensory disturbances are also likely. These residual effects may affect the use and enjoyment of cultural and spiritual sites within the Rights LAA. Predictive modelling indicates a low potential for the PDA and Rights LAA of the Project sites to contain unknown heritage resources, so residual effects are not anticipated for changes to heritage resources. In the event of inadvertently exposed heritage resources, a protection plan is in place to mitigate such exposures.

Overall, with the implementation of mitigation measures, residual Project effects on the exercise or practice of Indigenous or Treaty rights in the Rights LAA are expected to reflect the residual effects predicted for Current Use, including the availability of and access to traditionally harvested resources and traditional sites

and areas, as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, Indigenous physical and cultural heritage).

Criteria for assessing the severity of impacts on Indigenous or Treaty Rights are defined in Table 19-11. Impacts on Indigenous or Treaty rights are anticipated to be high in likelihood and adverse in direction because low magnitude residual effects are predicted for Current Use and Indigenous physical and cultural heritage, and moderate magnitude effects are predicted for Indigenous health and Indigenous socio-economic conditions. The PDA is within a disturbed context of existing mine sites, and not expected to cause population level effects on traditionally harvested resources. Patterns of access to travel routes and harvesting areas in the Rights LAA will be altered by access restrictions to the PDA including preferred access routes such as the Gordon site access road. Predicted exceedances in inhalation exposures are expected to be infrequent and based on single events and do not represent continuous exposures that would represent potential concerns for Indigenous health. As well, the use of and access to infrastructure and services is at available capacity, which may affect the quality of services provided, and the changes in the economy are unlikely to pose substantial risks or benefits.

The geographic extent for impacts on Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to extend to the Rights LAA.

The frequency of impacts to Indigenous or Treaty rights is expected to be continuous because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to occur throughout construction and operation.

The duration and reversibility of impacts to Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to be long-term and reversible. Residual effects are anticipated to extend through decommissioning/closure. Change in availability and access to traditional resources and areas will extend beyond closure until the Project returns to its natural state. Changes to Indigenous socio-economic conditions are considered reversible, as the Project will be decommissioned, the workforce released, and the areas reclaimed.

Residual effects to Indigenous or Treaty rights are characterized as multiple, irregular in frequency and long-term in duration as change to access to harvesting areas and availability of harvested species will occur occasionally and without predictable pattern and persist throughout the construction and operation phase of the Project. Effects to Indigenous or Treaty rights are considered irreversible, as residual effects are unlikely to be reversed to baseline conditions.

Alamos is committed to ongoing engagement with Northlands Denesuline First Nation and will consider any additional information about effects to Indigenous or Treaty rights brought forward by Northlands Denesuline First Nation according to the methodology outlined in Section 19.1.1.3.

19.9.3.8 Sayisi Dene First Nation

Under the Manitoba Framework Agreement (1997), Sayisi Dene First Nation has a TLE Settlement Agreement of 22,372 acres [approximately 9,053.63 ha]. As of 2017, Sayisi Dene First Nation has not signed the Agreement, so no lands have yet been converted to reserve lands (CIRNAC 2017a). Sayisi Dene First Nation's TLE parcels lie outside the Project RAA (Map 19-6).

A detailed profile of Sayisi Dene First Nation is provided in Section 3.3.3.11. A summary of Sayisi Dene First Nation TLRU activities and practices, including available information on traditional sites, areas, and resources harvested, is provided in Section 17.2.14.11.

The ability to exercise or practice Indigenous or Treaty rights, including harvesting rights and integral practices, traditions, and customs, depends upon the health of the land to support these practices. The potential effects of the Project on asserted or established Indigenous or Treaty rights are derived directly or indirectly from the physical effects of the Project on the environment. Consequently, the pathways are similar for potential effects for the exercise and practice of Indigenous or Treaty rights (including the availability of and access to traditionally harvested resources and traditional sites and areas), as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage). The identification of Project interactions and the assessment of potential effects on Indigenous or Treaty rights considers both the exercise and practice and the conditions that support the exercise of the rights, as presented in Section 19.4.

Impacts on Indigenous or Treaty rights may occur through the six effect pathways identified in Section 19.7.1.3.

Where the Project has a residual effect on traditional harvesting (hunting, trapping, fishing, plant, or material gathering) or on physical activities associated with traditional use (travel and navigation, use of habitation, cultural, and spiritual sites or areas), that has been considered as a residual effect on Indigenous or Treaty rights. In Chapter 17, Section 17.4, Project impacts on the current use of lands and resources for traditional purposes, including change in availability of resources currently used for traditional purposes, change in access resources currently used for traditional purposes, change to traditional cultural and spiritual sites or areas, and change to the environment that affects cultural value or importance associated with current use were assessed.

Residual environmental effects to Indigenous health, through effects to air, water, and soil quality, as well as consumptive resources (country foods) are anticipated during the construction and operation phase of the Project. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. However, these environmental effects are not anticipated at population levels to plant, animal, and fish species, including those harvested as country foods within the Indigenous Health RAA. Although vehicular collisions and human-wildlife conflicts may result in mortality for a few individual animals the health of harvested resources at a population level is not anticipated to experience residual effects within the Indigenous Health RAA.

Residual effects on Indigenous socio-economic conditions such as fishing, trapping, and recreation are expected, particularly during construction. This in turn could lead to effects on the ability to exercise

Indigenous or Treaty rights. It is anticipated, however, that the exercise of Indigenous or Treaty rights related to Indigenous socio-economic conditions will be able to continue at similar levels as under baseline conditions. The Project will also result in loss of lands available for recreational activities; however, the Gordon site PDA results in direct disturbance of approximately 269 ha of provincial Crown land, which is 0.0006% of the Crown land within the Indigenous Rights LAA. The MacLellan site PDA contains approximately 938 ha of municipally administered land (0.002% of the Crown land area within the Indigenous Rights LAA). The Project is anticipated to increase demands on community infrastructure and services during construction and operation and could result in a reduction in available capacity and/or quality of services for Indigenous peoples living within the Rights LAA, including emergency services. Project-generated construction phase road traffic will increase traffic volumes, which may affect Indigenous people who live and work within the Rights LAA. Community wellbeing and social cohesions could be affected in both positive and adverse ways (changes to employment and income; differential demands on time; participation in recreational, subsistence, and family-related activities and physical exercise). Spending related to the Project could both benefit and adversely affect regional businesses, including Indigenous-owned businesses.

Residual effects to Indigenous physical and cultural heritage are anticipated, especially during the construction and operation phase, when the presence of workers and equipment in the Rights LAA will generate noise, dust, and visual disturbance. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. Visual quality within the Rights LAA is expected to change overall with the Project, and sensory disturbances are also likely. These residual effects may affect the use and enjoyment of cultural and spiritual sites within the Rights LAA. Predictive modelling indicates a low potential for the PDA and Rights LAA of the Project sites to contain unknown heritage resources, so residual effects are not anticipated for changes to heritage resources. In the event of inadvertently exposed heritage resources, a protection plan is in place to mitigate such exposures.

Overall, with the implementation of mitigation measures, residual Project effects on the exercise or practice of Indigenous or Treaty rights in the Rights LAA are expected to reflect the residual effects predicted for Current Use, including the availability of and access to traditionally harvested resources and traditional sites and areas, as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, Indigenous physical and cultural heritage).

Criteria for assessing the severity of impacts on Indigenous or Treaty Rights are defined in Table 19-11. Impacts on Indigenous or Treaty rights are anticipated to be high in likelihood and adverse in direction because low magnitude residual effects are predicted for Current Use and Indigenous physical and cultural heritage, and moderate magnitude effects are predicted for Indigenous health and Indigenous socio-economic conditions. The PDA is within a disturbed context of existing mine sites, and not expected to cause population level effects on traditionally harvested resources. Patterns of access to travel routes and harvesting areas in the Rights LAA will be altered by access restrictions to the PDA including preferred access routes such as the Gordon site access road. Predicted exceedances in inhalation exposures are expected to be infrequent and based on single events and do not represent continuous exposures that would represent potential concerns for Indigenous health. As well, the use of and access to infrastructure and services is at available capacity, which may affect the quality of services provided, and the changes in the economy are unlikely to pose substantial risks or benefits.

The geographic extent for impacts on Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to extend to the Rights LAA.

The frequency of impacts to Indigenous or Treaty rights is expected to be continuous because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to occur throughout construction and operation.

The duration and reversibility of impacts to Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to be long-term and reversible. Residual effects are anticipated to extend through decommissioning/closure. Change in availability and access to traditional resources and areas will extend beyond closure until the Project returns to its natural state. Changes to Indigenous socio-economic conditions are considered reversible, as the Project will be decommissioned, the workforce released, and the areas reclaimed.

Residual effects to Indigenous or Treaty rights are characterized as multiple, irregular in frequency and long-term in duration as change to access to harvesting areas and availability of harvested species will occur occasionally and without predictable pattern and persist throughout the construction and operation phase of the Project. Effects to Indigenous or Treaty rights are considered irreversible, as residual effects are unlikely to be reversed to baseline conditions.

Alamos is committed to ongoing engagement with Sayisi Dene First Nation and will consider any additional information about effects to Indigenous or Treaty rights brought forward by Sayisi Dene First Nation according to the methodology outlined in Section 19.1.1.3.

19.9.3.9 Hatchet Lake First Nation

Hatchet Lake First Nation does not have an outstanding TLE at this time (CIRNAC 2017b).

A detailed profile of Hatchet Lake First Nation is provided in Section 3.3.3.9. A summary of Hatchet Lake First Nation TLRU activities and practices, including available information on traditional sites, areas, and resources harvested, is provided in Section 17.2.14.9.

The ability to exercise or practice Indigenous or Treaty rights, including harvesting rights and integral practices, traditions, and customs, depends upon the health of the land to support these practices. The potential effects of the Project on asserted or established Indigenous or Treaty rights are derived directly or indirectly from the physical effects of the Project on the environment. Consequently, the pathways are similar for potential effects for the exercise and practice of Indigenous or Treaty rights (including the availability of and access to traditionally harvested resources and traditional sites and areas), as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage). The identification of Project interactions and the assessment of potential effects on Indigenous or Treaty rights considers both the exercise and practice and the conditions that support the exercise of the rights, as presented in Section 19.4.

Impacts on Indigenous or Treaty rights may occur through the six effect pathways identified in Section 19.7.1.3.

Where the Project has a residual effect on traditional harvesting (hunting, trapping, fishing, plant, or material gathering) or on physical activities associated with traditional use (travel and navigation, use of habitation, cultural, and spiritual sites or areas), that has been considered as a residual effect on Indigenous or Treaty rights. In Chapter 17, Section 17.4, Project impacts on the current use of lands and resources for traditional purposes, including change in availability of resources currently used for traditional purposes, change in access resources currently used for traditional purposes, change to traditional cultural and spiritual sites or areas, and change to the environment that affects cultural value or importance associated with current use were assessed.

Residual environmental effects to Indigenous health, through effects to air, water, and soil quality, as well as consumptive resources (country foods) are anticipated during the construction and operation phase of the Project. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. However, these environmental effects are not anticipated at population levels to plant, animal, and fish species, including those harvested as country foods within the Indigenous Health RAA. Although vehicular collisions and human-wildlife conflicts may result in mortality for a few individual animals the health of harvested resources at a population level is not anticipated to experience residual effects within the Indigenous Health RAA.

Residual effects on Indigenous socio-economic conditions such as fishing, trapping, and recreation are expected, particularly during construction. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. It is anticipated, however, that the exercise of Indigenous or Treaty rights related to Indigenous socio-economic conditions will be able to continue at similar levels as under baseline conditions. The Project will also result in loss of lands available for recreational activities; however, the Gordon site PDA results in direct disturbance of approximately 269 ha of provincial Crown land, which is 0.0006% of the Crown land within the Indigenous Rights LAA. The MacLellan site PDA contains approximately 938 ha of municipally administered land (0.002% of the Crown land area within the Indigenous Rights LAA). The Project is anticipated to increase demands on community infrastructure and services during construction and operation and could result in a reduction in available capacity and/or quality of services for Indigenous peoples living within the Rights LAA, including emergency services. Project-generated construction phase road traffic will increase traffic volumes, which may affect Indigenous people who live and work within the Rights LAA. Community wellbeing and social cohesions could be affected in both positive and adverse ways (changes to employment and income; differential demands on time; participation in recreational, subsistence, and family-related activities and physical exercise). Spending related to the Project could both benefit and adversely affect regional businesses, including Indigenous-owned businesses.

Residual effects to Indigenous physical and cultural heritage are anticipated, especially during the construction and operation phase, when the presence of workers and equipment in the Rights LAA will generate noise, dust, and visual disturbance. This in turn could lead to effects on the ability to exercise Indigenous or Treaty rights. Visual quality within the Rights LAA is expected to change overall with the Project, and sensory disturbances are also likely. These residual effects may affect the use and enjoyment of cultural and spiritual sites within the Rights LAA. Predictive modelling indicates a low potential for the

PDA and Rights LAA of the Project sites to contain unknown heritage resources, so residual effects are not anticipated for changes to heritage resources. In the event of inadvertently exposed heritage resources, a protection plan is in place to mitigate such exposures.

Overall, with the implementation of mitigation measures, residual Project effects on the exercise or practice of Indigenous or Treaty rights in the Rights LAA are expected to reflect the residual effects predicted for Current Use, including the availability of and access to traditionally harvested resources and traditional sites and areas, as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, Indigenous physical and cultural heritage).

Criteria for assessing the severity of impacts on Indigenous or Treaty Rights are defined in Table 19-11. Impacts on Indigenous or Treaty rights are anticipated to be high in likelihood and adverse in direction because low magnitude residual effects are predicted for Current Use and Indigenous physical and cultural heritage, and moderate magnitude effects are predicted for Indigenous health and Indigenous socio-economic conditions. The PDA is within a disturbed context of existing mine sites, and not expected to cause population level effects on traditionally harvested resources. Patterns of access to travel routes and harvesting areas in the Rights LAA will be altered by access restrictions to the PDA including preferred access routes such as the Gordon site access road. Predicted exceedances in inhalation exposures are expected to be infrequent and based on single events and do not represent continuous exposures that would represent potential concerns for Indigenous health. As well, the use of and access to infrastructure and services is at available capacity, which may affect the quality of services provided, and the changes in the economy are unlikely to pose substantial risks or benefits.

The geographic extent for impacts on Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to extend to the Rights LAA.

The frequency of impacts to Indigenous or Treaty rights is expected to be continuous because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to occur throughout construction and operation.

The duration and reversibility of impacts to Indigenous or Treaty rights is expected to be moderate because residual effects to Current Use, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to be long-term and reversible. Residual effects are anticipated to extend through decommissioning/closure. Change in availability and access to traditional resources and areas will extend beyond closure until the Project returns to its natural state. Changes to Indigenous socio-economic conditions are considered reversible, as the Project will be decommissioned, the workforce released, and the areas reclaimed.

Residual effects to Indigenous or Treaty rights are characterized as multiple, irregular in frequency and long-term in duration as change to access to harvesting areas and availability of harvested species will occur occasionally and without predictable pattern and persist throughout the construction and operation phase of the Project. Effects to Indigenous or Treaty rights are considered irreversible, as residual effects are unlikely to be reversed to baseline conditions.

Alamos is committed to ongoing engagement with Hatchet Lake First Nation and will consider any additional information about effects to Indigenous or Treaty rights brought forward by Hatchet Lake First Nation according to the methodology outlined in Section 19.1.1.3.

Métis Governments

Métis Governments engaged on the Project include the Manitoba Metis Federation, Métis Nation – Saskatchewan Northern Region 1, and Métis Nation - Saskatchewan Eastern Region 1. In *Daniels v. Canada*, the Supreme Court of Canada (SCC) determined that Métis people are considered 'Indians' under the *Constitution Act, 1867*, and as such, the Crown has a fiduciary responsibility to the Métis peoples (Daniels *v.* Canada 2016).

In *R. v. Powley* (2003), criteria on who can legally qualify for Métis Rights were established, and *R. v. Goodon* (2008) affirmed Métis people in the province of Manitoba as a distinct Indigenous community with Section 35 rights. The Goodon decision also recognized the Manitoba Metis Federation as the democratic, self-governing representative body of the Manitoba Métis Community.

The harvesting rights of the Manitoba Métis Community are codified in the Manitoba Metis Federation Metis Laws of the Harvest (Manitoba Metis Federation 2013a). The Metis Laws of the Harvest define Métis harvesting as hunting, trapping, fishing and gathering for food and domestic use, including sharing, social and ceremonial purposes, of fish, big-game, small game, furbearers, game-bird (upland and migratory), berries, mushrooms, medicinal and other plants including wild rice, and firewood or timber. Métis harvesting is identified as a right protected under Section 35 of the Constitution and asserts that Métis rights holders have harvesting access equivalent to First Nations peoples, and the Métis peoples' right to harvest has priority over non-Indigenous recreational and commercial harvesters. The Metis Laws of the Harvest sets out requirements for Metis Harvester Identification Card, big-game tags, health and safety regulations, and harvesting restrictions. The Metis Laws of the Harvest define the Metis Recognized Harvesting Area.

As stated by the Manitoba Metis Federation, "Beyond those rights already established through litigation and recognized by agreements, the Manitoba Métis Community claims commercial and trade-related rights" (Appendix 17A; SVS 2020:17).

19.9.3.10 Manitoba Metis Federation

Alamos recognizes that Manitoba Metis Federation is best placed to provide information about how the Manitoba Métis Community understands and exercises their Indigenous rights and has incorporated feedback that Manitoba Metis Federation has provided into the EIS. Alamos acknowledges that Manitoba Metis Federation is the democratic, self-governing representative body of the Manitoba Métis Community and has been authorized under Manitoba Metis Federation Resolution No. 8 by the citizens of the Manitoba Métis Community to address collective Métis rights, claims, and interests, including conducting consultation (Manitoba Metis Federation 2013b:15; SVS 2020:13).

Alamos received an interim Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study from Manitoba Metis Federation in December 2019 and the final Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study in March 2020 (Appendix 17A), both of which included Manitoba Metis

Federation's perspective on Métis Rights, claims, and interests. Information from the interim and final Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study reports have been considered by Alamos, and where appropriate, incorporated into this EIS. Manitoba Metis Federation have stated that the Manitoba Métis Community has Indigenous rights under in Section 35 of the *Constitution Act, 1982*, and these rights were affirmed in *R. v. Goodon* (2008). Manitoba Metis Federation report that Manitoba Métis Community also claims commercial and trade-related rights, which remain outstanding, and that courts have recognized that Métis citizens harvesting rights may not be limited to unoccupied Crown lands (*R. v. Kelley* 2007). Further, Manitoba Metis Federation explained that the right to hunt is not contingent on harvesting game and that lack of hunting success may indicate that a previously reliable area is under increasing harvesting pressure, making it more difficult for Manitoba Metis Federation to exercise their rights (SVS 2020:35). The Manitoba Metis Federation indicated that "Commerce and trade are, and always have been, integral to the distinctive culture of the Manitoba Métis Community. Today, the Manitoba Métis have an Aboriginal, constitutionally protected right to continue this trading tradition in modern ways to ensure that their distinct community will not only survive, but also flourish" (SVS 2020:17-18). Manitoba Metis Federation maintain that Manitoba Metis Federation and its harvesters should be compensated in the event that Project activities affect access to lands and waters for personal and commercial harvesting.

Alamos has met with Manitoba Metis Federation, regarding Métis harvesting in the Lynn Lake area. Métis Rights in the Lynn Lake region were also discussed at this meeting. During a meeting focused on Indigenous engagement and business opportunities, Manitoba Metis Federation indicated that their engagement with the Project would be contingent on several factors, including Métis exercise of rights. Manitoba Metis Federation also indicated that if impacts to Métis rights were adequately mitigated, the conversation would shift to economic considerations. When asked if there were rights-bearing Métis in the Project area, Manitoba Metis Federation indicated that Métis rights are not geographically based, and that Métis peoples are highly mobile, and can exercise their harvesting rights anywhere.

As noted in Section 19.7.1.1, Métis rights to harvest for natural resources for food and domestic use are recognized under the *Province of Manitoba / Manitoba Metis Federation Agreement on Metis Natural Resource Harvesting.* This agreement is intended to provide Métis harvesters with "certainty with respect to the exercise of their rights to hunt, fish, trap and gather for food and domestic purposes within Manitoba" (Government of Manitoba 2012). This agreement also defines the Metis Recognized Harvesting Area (Manitoba Metis Federation 2013a; Map 19-6). The Metis Natural Resource Harvesting territory lies outside of the Project RAA, approximately 260 kilometers south of the MacLellan site, and 265 kilometers south of the Gordon site (Map 19-6); however, through the final Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study, Manitoba Metis Federation asserts that rights and interests extend beyond the Metis Recognized Harvesting Area; the Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study documents use by Manitoba Métis Community harvesters within 100 km of the Project (SVS 2020:6). In the final Project-specific Manitoba Métis Traditional Knowledge, Land Use, and Occupancy Study, Manitoba Metis Federation reported 440 land use and occupancy features within 100 km of the Project sites, with 14 of these features residing with 1km of the PDA.

The 2016 Manitoba Metis Federation-Canada Framework Agreement on Advancing Reconciliation sets out a process to further discussions on a constitutional grievance related to land grants under Section 31 of the *Manitoba Act, 1870* (CIRNAC 2017). Among other items, the Framework Agreement enabled a formal negotiation process to begin discussing terms of a self-government agreement between Canada and Manitoba Metis Federation (Manitoba Metis Federation 2018). As of September 2018, Manitoba Metis Federation and Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) had agreed to a three-part plan for advancing reconciliation that includes approximately $154 million in funding (Manitoba Metis Federation 2018). The three-part Agreement seeks to improve the social and economic well-being of Métis in Manitoba, enable working towards timely Métis self-government.

Manitoba Metis Federation has stated that land is vitally important for the exercise of Métis rights, and "Unoccupied Crown land represents areas where the Metis of Manitoba have access to exercise their Metis rights that does not require permissions" (Calliou Group 2016:5). Manitoba Métis Community have expressed concerns regarding access to lands with regard to other projects in the province. As noted in a MLUOS for the Minnesota-Manitoba Transmission Project (Calliou Group 2016), recognized Métis Rights include "hunting, trapping, fishing and gathering for food and domestic use, including for social and ceremonial purposes and for greater certainty, Metis harvesting includes the harvest of timber for domestic purposes" (Manitoba Metis Federation-Manitoba Harvesting Agreement 2012; as cited by Calliou Group 2016). As a result, Manitoba Metis Federation stated that changes to the amount of land available for use by the Manitoba Métis Community, as well as changes in access and changes in harvesting activities and experience, can have adverse impacts on Métis Rights (Calliou Group 2016:34-35).

A detailed profile of Manitoba Metis Federation is provided in Section 3.3.3.5. A summary of Manitoba Metis Federation TLRU activities and practices, including available information on traditional sites, areas, and resources harvested, is provided in Section 17.2.14.4.

The ability to exercise or practice Métis rights, including harvesting rights and integral practices, traditions, and customs, depends upon the health of the land to support these practices. The potential effects of the Project on asserted or established Métis rights are derived directly or indirectly from the physical effects of the Project on the environment. Consequently, the pathways are similar for potential effects for the exercise and practice of Métis rights (including the availability of and access to traditionally harvested resources and traditional sites and areas), as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage). The identification of Project interactions and the assessment of potential effects on Métis rights considers both the exercise and practice and the conditions that support the exercise of the rights, as presented in Section 19.4.

Impacts on Métis rights may occur through the six effect pathways identified in Section 19.7.1.3.

Where the Project has a residual effect on traditional harvesting (hunting, trapping, fishing, plant, or material gathering) or on physical activities associated with traditional use (travel and navigation, use of habitation, cultural, and spiritual sites or areas), that has been considered as a residual effect on Métis rights. In Chapter 17, Section 17.4, Project impacts on the current use of lands and resources for traditional purposes, including change in availability of resources currently used for traditional purposes, change in access resources currently used for traditional purposes, change to traditional cultural and spiritual sites or areas, and change to the environment that affects cultural value or importance associated with current use were assessed.

Residual environmental effects to Indigenous health, through effects to air, water, and soil quality, as well as consumptive resources (country foods) are anticipated during the construction and operation phase of the Project. This in turn could lead to effects on the ability to exercise Métis rights. However, these environmental effects are not anticipated at population levels to plant, animal, and fish species, including those harvested as country foods within the Indigenous Health RAA. Although vehicular collisions and human-wildlife conflicts may result in mortality for a few individual animals the health of harvested resources at a population level is not anticipated to experience residual effects within the Indigenous Health RAA.

Residual effects on Indigenous socio-economic conditions such as fishing, trapping, and recreation are expected, particularly during construction. This in turn could lead to effects on the ability to exercise Métis rights. It is anticipated, however, that the exercise of Métis rights related to Indigenous socio-economic conditions will be able to continue at similar levels as under baseline conditions. The Project will also result in loss of lands available for recreational activities; however, the Gordon site PDA results in direct disturbance of approximately 269 ha of provincial Crown land, which is 0.0006% of the Crown land within the Indigenous Rights LAA. The MacLellan site PDA contains approximately 938 ha of municipally administered land (0.002% of the Crown land area within the Indigenous Rights LAA). The Project is anticipated to increase demands on community infrastructure and services during construction and operation and could result in a reduction in available capacity and/or quality of services for Indigenous peoples living within the Rights LAA, including emergency services. Project-generated construction phase road traffic will increase traffic volumes, which may affect Indigenous people who live and work within the Rights LAA. Community wellbeing and social cohesions could be affected in both positive and adverse ways (changes to employment and income; differential demands on time; participation in recreational, subsistence, and family-related activities and physical exercise). Spending related to the Project could both benefit and adversely affect regional businesses, including Indigenous-owned businesses.

Residual effects to Indigenous physical and cultural heritage are anticipated, especially during the construction and operation phase, when the presence of workers and equipment in the Rights LAA will generate noise, dust, and visual disturbance. This in turn could lead to effects on the ability to exercise Métis rights. Visual quality within the Rights LAA is expected to change overall with the Project, and sensory disturbances are also likely. These residual effects may affect the use and enjoyment of cultural and spiritual sites within the Rights LAA. Predictive modelling indicates a low potential for the PDA and Rights LAA of the Project sites to contain unknown heritage resources, so residual effects are not anticipated for changes to heritage resources. In the event of inadvertently exposed heritage resources, a protection plan is in place to mitigate such exposures.

Overall, with the implementation of mitigation measures, residual Project effects on the exercise or practice of Métis rights in the Rights LAA are expected to reflect the residual effects predicted for Current Use, including the availability of and access to traditionally harvested resources and traditional sites and areas, as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, Indigenous physical and cultural heritage).

Criteria for assessing the severity of impacts on Métis Rights are defined in Table 19-11. Impacts on Métis rights are anticipated to be high in likelihood and adverse in direction because low magnitude residual effects are predicted for Current Use and Indigenous physical and cultural heritage, and moderate magnitude effects are predicted for Indigenous health and Indigenous socio-economic conditions. The PDA is within a disturbed context of existing mine sites, and not expected to cause population level effects on traditionally harvested resources. Patterns of access to travel routes and harvesting areas in the Rights LAA will be altered by access restrictions to the PDA including preferred access routes such as the Gordon site access road. Predicted exceedances in inhalation exposures are expected to be infrequent and based on single events and do not represent continuous exposures that would represent potential concerns for Indigenous health. As well, the use of and access to infrastructure and services is at available capacity, which may affect the quality of services provided, and the changes in the economy are unlikely to pose substantial risks or benefits.

The geographic extent for impacts on Métis rights is expected to be moderate because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to extend to the Rights LAA.

The frequency of impacts to Métis rights is expected to be continuous because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to occur throughout construction and operation.

The duration and reversibility of impacts to Métis rights is expected to be moderate because residual effects to Current Use, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to be long-term and reversible. Residual effects are anticipated to extend through decommissioning/closure. Change in availability and access to traditional resources and areas will extend beyond closure until the Project returns to its natural state. Changes to Indigenous socio-economic conditions are considered reversible, as the Project will be decommissioned, the workforce released, and the areas reclaimed.

Residual effects to Métis rights are characterized as multiple, irregular in frequency and long-term in duration as change to access to harvesting areas and availability of harvested species will occur occasionally and without predictable pattern and persist throughout the construction and operation phase of the Project. Effects to Métis rights are considered irreversible, as residual effects are unlikely to be reversed to baseline conditions.

Alamos is committed to ongoing engagement with Manitoba Metis Federation and will consider any additional information about effects to Métis rights brought forward by Manitoba Metis Federation according to the methodology outlined in Section 19.1.1.3.

19.9.3.11 Métis Nation – Saskatchewan Northern Region 1

The Métis Environment and Resource Management Advisory Committee was established in 2012 to consult with the Government of Saskatchewan regarding a framework for managing and protecting the environment while encouraging innovative environmental solutions and supporting the province's growing economy.

In November 2010, Métis Nation - Saskatchewan and the Province of Saskatchewan signed a Memorandum of Understanding (MOU) on Métis people's harvesting rights. The agreement pertains to the negotiation of key harvesting practices, and includes consideration of Métis community and Métis traditional territories; Métis peoples food harvesting customs, practices and traditions; ancestral and community acceptance requirements necessary to be a beneficiary of harvesting rights; achieving legal enforceability and certainty of those rights; and the identification of additional research or studies necessary to assist Métis Nation - Saskatchewan and the Province of Saskatchewan to reach interim and final agreements (Métis Nation-Saskatchewan 2020).

A detailed profile of Métis Nation – Saskatchewan Northern Region 1 is provided in Section 3.3.3.8. A summary of Métis Nation – Saskatchewan Northern Region 1 TLRU activities and practices, including available information on traditional sites, areas, and resources harvested, is provided in Section 17.2.14.12.

The ability to exercise or practice Métis rights, including harvesting rights and integral practices, traditions, and customs, depends upon the health of the land to support these practices. The potential effects of the Project on asserted or established Métis rights are derived directly or indirectly from the physical effects of the Project on the environment. Consequently, the pathways are similar for potential effects for the exercise and practice of Métis rights (including the availability of and access to traditionally harvested resources and traditional sites and areas), as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage). The identification of Project interactions and the assessment of potential effects on Métis rights considers both the exercise and practice and the conditions that support the exercise of the rights, as presented in Section 19.4.

Impacts on Métis rights may occur through the six effect pathways identified in Section 19.7.1.3.

Where the Project has a residual effect on traditional harvesting (hunting, trapping, fishing, plant, or material gathering) or on physical activities associated with traditional use (travel and navigation, use of habitation, cultural, and spiritual sites or areas), that has been considered as a residual effect on Métis rights. In Chapter 17, Section 17.4, Project impacts on the current use of lands and resources for traditional purposes, including change in availability of resources currently used for traditional purposes, change in access resources currently used for traditional purposes, change to traditional cultural and spiritual sites or areas, and change to the environment that affects cultural value or importance associated with current use were assessed.

Residual environmental effects to Indigenous health, through effects to air, water, and soil quality, as well as consumptive resources (country foods) are anticipated during the construction and operation phase of the Project. This in turn could lead to effects on the ability to exercise Métis rights. However, these environmental effects are not anticipated at population levels to plant, animal, and fish species, including those harvested as country foods within the Indigenous Health RAA. Although vehicular collisions and human-wildlife conflicts may result in mortality for a few individual animals the health of harvested resources at a population level is not anticipated to experience residual effects within the Indigenous Health RAA.

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The frequency of impacts to Métis rights is expected to be continuous because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to occur throughout construction and operation.

The duration and reversibility of impacts to Métis rights is expected to be moderate because residual effects to Current Use, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to be long-term and reversible. Residual effects are anticipated to extend through decommissioning/closure. Change in availability and access to traditional resources and areas will extend beyond closure until the Project returns to its natural state. Changes to Indigenous socio-economic conditions are considered reversible, as the Project will be decommissioned, the workforce released, and the areas reclaimed.

Residual effects to Métis rights are characterized as multiple, irregular in frequency and long-term in duration as change to access to harvesting areas and availability of harvested species will occur occasionally and without predictable pattern and persist throughout the construction and operation phase of the Project. Effects to Métis rights are considered irreversible, as residual effects are unlikely to be reversed to baseline conditions.

Alamos did not receive feedback on the exercise of Indigenous rights from Métis Nation – Saskatchewan Northern Region 1 prior to finalizing this EIS. Alamos is committed to ongoing engagement with Métis Nation – Saskatchewan Northern Region 1 and will consider any additional information about effects to Métis rights brought forward by Métis Nation – Saskatchewan Eastern Region 1 according to the methodology outlined in Section 19.1.1.3.

19.9.3.12 Métis Nation - Saskatchewan Eastern Region 1

The Métis Environment and Resource Management Advisory Committee was established in 2012 to consult with the Government of Saskatchewan regarding a framework for managing and protecting the environment while encouraging innovative environmental solutions and supporting the province's growing economy.

In November 2010, Métis Nation – Saskatchewan and the Province of Saskatchewan signed a Memorandum of Understanding (MOU) on Métis peoples harvesting rights. The agreement pertains to the negotiation of key harvesting practices, and includes consideration of Métis community and Métis traditional territories; Métis peoples food harvesting customs, practices and traditions; ancestral and community acceptance requirements necessary to be a beneficiary of harvesting rights; achieving legal enforceability and certainty of those rights; and the identification of additional research or studies necessary to assist Métis Nation - Saskatchewan and the Province of Saskatchewan to reach interim and final agreements (Métis Nation-Saskatchewan 2020).

A detailed profile of Métis Nation – Saskatchewan Eastern Region 1 is provided in Section 3.3.3.8. A summary of Métis Nation – Saskatchewan Eastern Region 1 TLRU activities and practices, including available information on traditional sites, areas, and resources harvested, is provided in Section 17.2.14.5.

The ability to exercise or practice Métis rights, including harvesting rights and integral practices, traditions, and customs, depends upon the health of the land to support these practices. The potential effects of the

Project on asserted or established Métis rights are derived directly or indirectly from the physical effects of the Project on the environment. Consequently, the pathways are similar for potential effects for the exercise and practice of Métis rights (including the availability of and access to traditionally harvested resources and traditional sites and areas), as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage). The identification of Project interactions and the assessment of potential effects on Métis rights considers both the exercise and practice and the conditions that support the exercise of the rights, as presented in Section 19.4.

Impacts on Métis rights may occur through the six effect pathways identified in Section 19.7.1.3.

Where the Project has a residual effect on traditional harvesting (hunting, trapping, fishing, plant, or material gathering) or on physical activities associated with traditional use (travel and navigation, use of habitation, cultural, and spiritual sites or areas), that has been considered as a residual effect on Métis rights. In Chapter 17, Section 17.4, Project impacts on the current use of lands and resources for traditional purposes, including change in availability of resources currently used for traditional purposes, change in access resources currently used for traditional purposes, change to traditional cultural and spiritual sites or areas, and change to the environment that affects cultural value or importance associated with current use were assessed.

Residual environmental effects to Indigenous health, through effects to air, water, and soil quality, as well as consumptive resources (country foods) are anticipated during the construction and operation phase of the Project. This in turn could lead to effects on the ability to exercise Métis rights. However, these environmental effects are not anticipated at population levels to plant, animal, and fish species, including those harvested as country foods within the Indigenous Health RAA. Although vehicular collisions and human-wildlife conflicts may result in mortality for a few individual animals the health of harvested resources at a population level is not anticipated to experience residual effects within the Indigenous Health RAA.

Residual effects on Indigenous socio-economic conditions such as fishing, trapping, and recreation are expected, particularly during construction. This in turn could lead to effects on the ability to exercise Métis rights. It is anticipated, however, that the exercise of Métis rights related to Indigenous socio-economic conditions will be able to continue at similar levels as under baseline conditions. The Project will also result in loss of lands available for recreational activities; however, the Gordon site PDA results in direct disturbance of approximately 269 ha of provincial Crown land, which is 0.0006% of the Crown land within the Indigenous Rights LAA. The MacLellan site PDA contains approximately 938 ha of municipally administered land (0.002% of the Crown land area within the Indigenous Rights LAA). The Project is anticipated to increase demands on community infrastructure and services during construction and operation and could result in a reduction in available capacity and/or quality of services for Indigenous peoples living within the Rights LAA, including emergency services. Project-generated construction phase road traffic will increase traffic volumes, which may affect Indigenous people who live and work within the Rights LAA. Community wellbeing and social cohesions could be affected in both positive and adverse ways (changes to employment and income; differential demands on time; participation in recreational, subsistence, and family-related activities and physical exercise). Spending related to the Project could both benefit and adversely affect regional businesses, including Indigenous-owned businesses.

Residual effects to Indigenous physical and cultural heritage are anticipated, especially during the construction and operation phase, when the presence of workers and equipment in the Rights LAA will generate noise, dust, and visual disturbance. This in turn could lead to effects on the ability to exercise Métis rights. Visual quality within the Rights LAA is expected to change overall with the Project, and sensory disturbances are also likely. These residual effects may affect the use and enjoyment of cultural and spiritual sites within the Rights LAA. Predictive modelling indicates a low potential for the PDA and Rights LAA of the Project sites to contain unknown heritage resources, so residual effects are not anticipated for changes to heritage resources. In the event of inadvertently exposed heritage resources, a protection plan is in place to mitigate such exposures.

Overall, with the implementation of mitigation measures, residual Project effects on the exercise or practice of Métis rights in the Rights LAA are expected to reflect the residual effects predicted for Current Use, including the availability of and access to traditionally harvested resources and traditional sites and areas, as well as for the conditions that support the exercise of rights (including Indigenous health, Indigenous socio-economic conditions, Indigenous physical and cultural heritage).

Criteria for assessing the severity of impacts on Métis Rights are defined in Table 19-11. Impacts on Métis rights are anticipated to be high in likelihood and adverse in direction because low magnitude residual effects are predicted for Current Use and Indigenous physical and cultural heritage, and moderate magnitude effects are predicted for Indigenous health and Indigenous socio-economic conditions. The PDA is within a disturbed context of existing mine sites, and not expected to cause population level effects on traditionally harvested resources. Patterns of access to travel routes and harvesting areas in the Rights LAA will be altered by access restrictions to the PDA including preferred access routes such as the Gordon site access road. Predicted exceedances in inhalation exposures are expected to be infrequent and based on single events and do not represent continuous exposures that would represent potential concerns for Indigenous health. As well, the use of and access to infrastructure and services is at available capacity, which may affect the quality of services provided, and the changes in the economy are unlikely to pose substantial risks or benefits.

The geographic extent for impacts on Métis rights is expected to be moderate because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to extend to the Rights LAA.

The frequency of impacts to Métis rights is expected to be continuous because residual effects to Current Use, Indigenous health, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to occur throughout construction and operation.

The duration and reversibility of impacts to Métis rights is expected to be moderate because residual effects to Current Use, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage are predicted to be long-term and reversible. Residual effects are anticipated to extend through decommissioning/closure. Change in availability and access to traditional resources and areas will extend beyond closure until the Project returns to its natural state. Changes to Indigenous socio-economic conditions are considered reversible, as the Project will be decommissioned, the workforce released, and the areas reclaimed.

Residual effects to Métis rights are characterized as multiple, irregular in frequency and long-term in duration as change to access to harvesting areas and availability of harvested species will occur occasionally and without predictable pattern and persist throughout the construction and operation phase of the Project. Effects to Métis rights are considered irreversible, as residual effects are unlikely to be reversed to baseline conditions.

Alamos did not receive feedback on the exercise of Indigenous rights from Métis Nation – Saskatchewan Eastern Region 1 prior to finalizing this EIS. Alamos is committed to ongoing engagement with Métis Nation – Saskatchewan Eastern Region 1 and will consider any additional information about effects to Métis rights brought forward by Métis Nation – Saskatchewan Eastern Region 1 according to the methodology outlined in Section 19.1.1.3.

19.10 FOLLOW-UP AND MONITORING

Follow-up and monitoring requirements specific to Indigenous peoples have not yet been identified. Similar to Current Use, the current follow-up and monitoring approach for Indigenous peoples will be based on sharing the results of other relevant monitoring with Indigenous communities as part of Alamos's ongoing engagement process for the Project (Chapter 3).

Through the Indigenous engagement process for the Project, Indigenous communities identified potential topics for future monitoring, including:

- Marcel Colomb First Nation and Peter Ballantyne Cree Nation recommended water quality monitoring.
- Manitoba Metis Federation recommended water quality monitoring.
- Manitoba Metis Federation recommended the development of a country foods monitoring program.

Alamos is committed to ongoing engagement with Indigenous communities and through this process will discuss these recommendations and the need for and nature of potential monitoring programs. Alamos will also share the results of monitoring and follow-up programs and discuss the efficacy of proposed mitigation with Indigenous communities. Additionally, a Project-specific Environmental Protection Program will be developed wherein mitigation measures are stipulated for construction, operation, and decommissioning/ closure activities (Chapter 23). As part of an adaptive management plan for follow-up and monitoring, these mitigation measures will be regularly reviewed and updated by Alamos to verify and enhance their effectiveness.

19.11 SUMMARY OF COMMITMENTS

The implementation of the mitigation measures will be the responsibility of Alamos and or contractors. The mechanisms used to require contractors and subcontractors to comply with these measures will include environmental protection plans and contract documents. Mitigation measures proposed are considered to be effective for use in similar applications and environmental conditions. This assessment is based on professional judgment of engineers and scientists based on past experience with similar projects and upon engagement with potentially affected Indigenous peoples. Alamos commits to ongoing engagement with potentially affected Indigenous peoples to discuss the efficacy of mitigation measures.

Mitigation measures that serve to avoid or reduce the environmental effects of the Project on the conditions and factors that support the exercise of Indigenous and treaty rights are anticipated to also reduce Project effects on ability to exercise or practice Indigenous or Treaty rights, including harvesting rights and integral practices, traditions and customs, which depends upon the health of the land to support these practices. However, Alamos recognizes that that Indigenous communities are in the best position to determine the effectiveness of mitigation measures on the ability to exercise their Indigenous or Treaty rights and Alamos is committed to ongoing engagement with Indigenous groups proposed mitigation measures outlined below.

Key mitigation measures which will be implemented may serve to avoid or reduce potential effects on the ability to exercise Indigenous or Treaty rights include:

- Avoidance of plant harvesting sites in the PDA through Project design, timing, and scheduling.
- Incorporation of plant species of interest to Indigenous communities into rehabilitation plans where appropriate and technically feasible.
- Implementation of the mitigation measures outlined for the Vegetation and Wetlands (Chapter 11), Land and Resource Use (Chapter 15), Fish and Fish Habitat (Chapter 10), and Wildlife and Wildlife Habitat (Chapter 12) VCs.
- Mitigation to changes in access to lands and resources currently used for traditional purposes through; timing of Project activities, potential scheduling of construction, signage, and engagement with Indigenous communities to identify potential alternate routes of access.
- Ongoing engagement with Indigenous communities regarding their concerns, mitigation of potential Project effects on traditional land and resource use, and potential monitoring, as well as consideration of mitigation measures proposed by Indigenous communities.
- Ongoing engagement with Indigenous communities involved on the Project, including discussion of development and implementation of Project-specific environmental management and monitoring plans.
- Project design for engaging local land and resource users and for implementing Project construction work schedules and prohibiting Project employees from bringing firearms of fishing gear to work sites.
- Commitments made Chapter 9, Section 9.9.2 to implement surface water monitoring and management plans will also serve to mitigate potential health risks.
- Design for community services, infrastructure and wellbeing, including work site security to offset demands on local police, implementation of a Traffic Management Plan, bussing services for Project employees, and workforce education programs to raise awareness regarding potential worker effects on host communities.
- Development of plan for working with Indigenous-owned businesses to enhance their potential for successfully bidding on Project contracts regarding the supply of goods and services.

- Alamos will continue to work towards potential training and education partnerships with Manitoba Keewatinowi Okimakanak Inc, (MKO) the Northern Manitoba Sector Council (NMSC), and Atoskiwin Training and Employment Centre (ATEC) to provide opportunities for Indigenous people to obtain skills and training required for Project participation.
- Alamos will continue to engage with indigenous communities in supporting the development and promotion of cultural sensitivity training.
- Alamos will work with Indigenous communities to develop training programs oriented to Project operational needs.
- Education of construction contractors for the appropriate protocols if heritage or cultural resources, or objects thought to be heritage or cultural resources, are discovered.
- Training of staff in the recognition of archaeological features and objects such as precontact Indigenous material culture, and 19th and 20th century Euro-Canadian material culture.
- Potential for the hiring of Indigenous field support staff as part of an environmental monitoring team.

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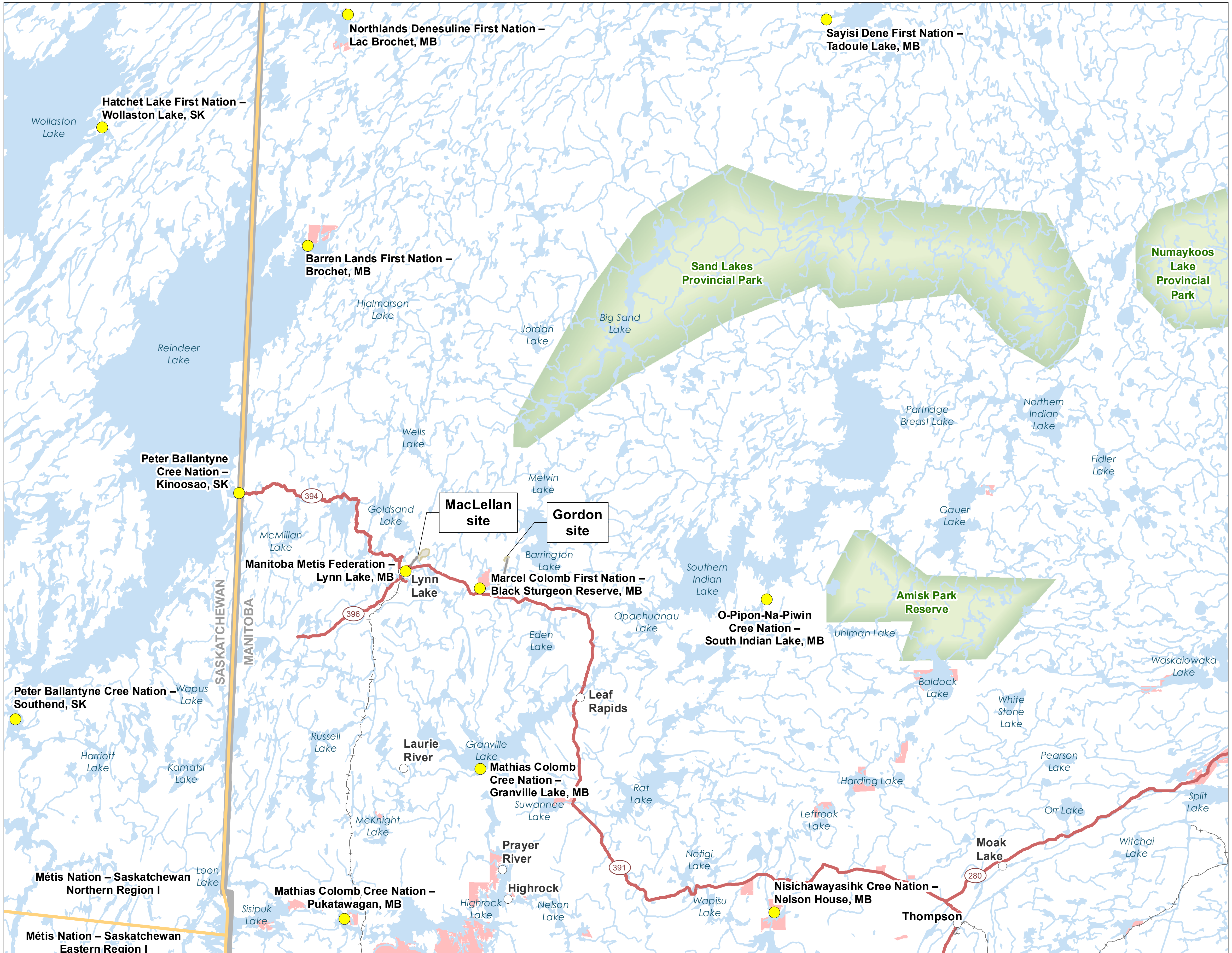


Stantec

Alamos Gold Inc.

Project Infrastructure

- Project Development Area

Communities

- Community
- Indigenous Community

Landbase

- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- First Nation Reserve
- Provincial Park
- Métis Nation - Saskatchewan Regions
- Provincial Border

N

0 20 40 Kilometres

(At original document size of 11x17)
1:1,400,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake,
Manitoba

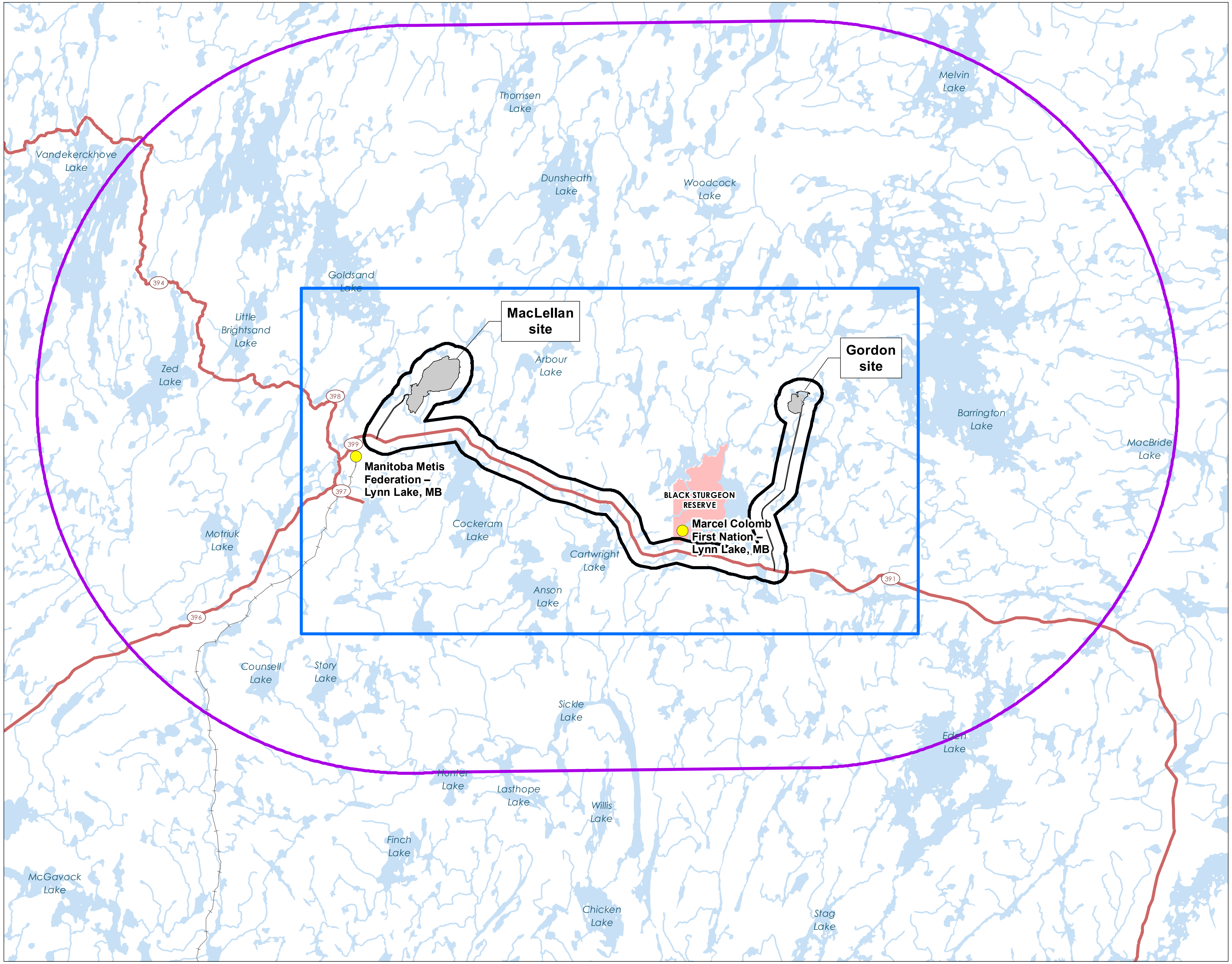
Prepared by ACampigotto on 2020-05-08
Technical Review by AVanBuren on 2020-05-08
Senior GIS Review byGKroupa on 2020-05-08

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
19-1

Title
Community Locations Relative to the Project



Stantec

ALAMOS GOLD INC.

Project Infrastructure

- Project Development Area

Study Area

- Indigenous Health Conditions Local Assessment Area (LAA)
- Indigenous Socio-economic Conditions Local Assessment Area (LAA)
- Indigenous Physical and Cultural Heritage Local Assessment Area (LAA)

Landbase

- Indigenous Community
- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- First Nation Reserve

N

0 5 10 Kilometres

(At original document size of 11x17)
1:320,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

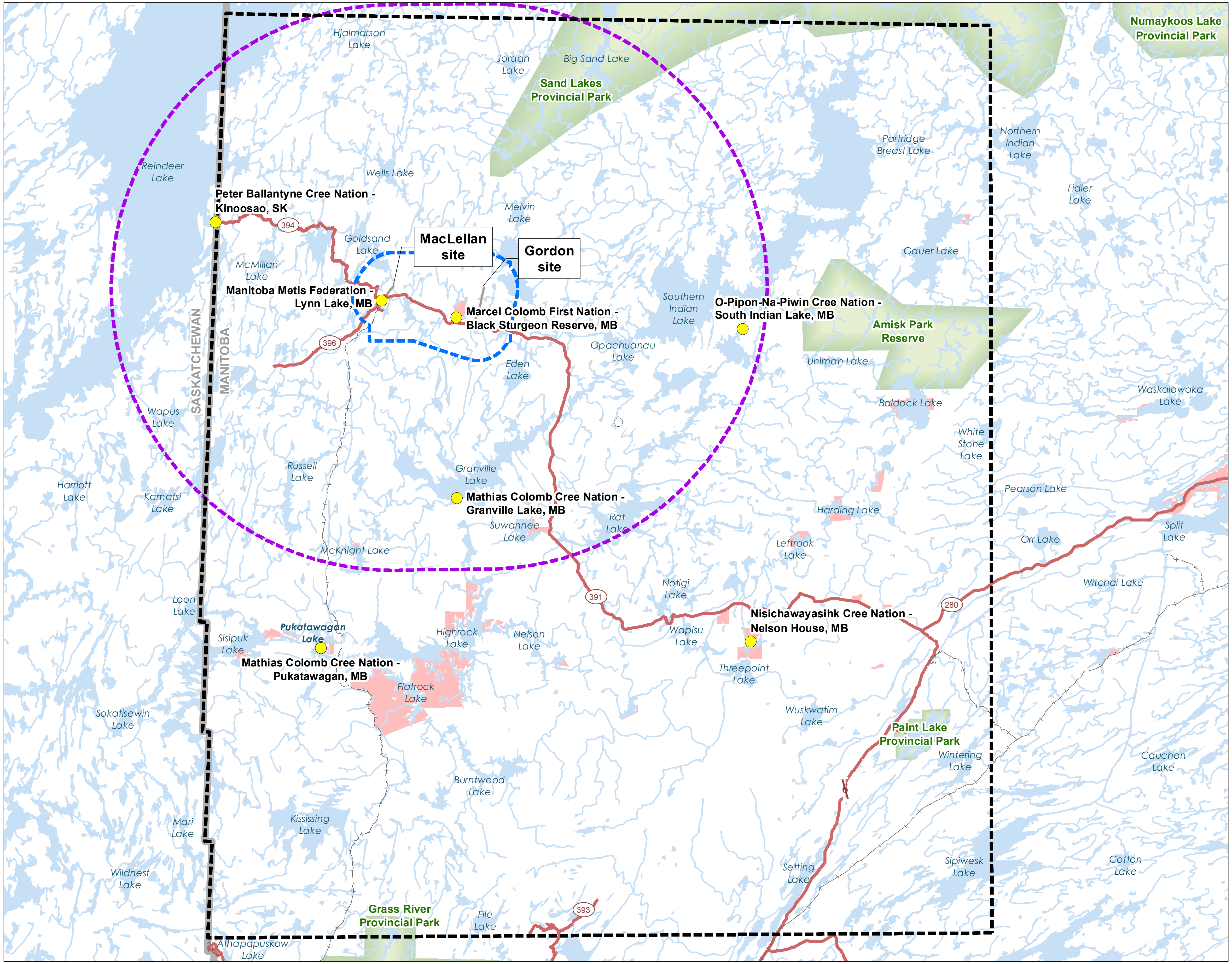
Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-05-08
Technical Review by AVanBuren on 2020-05-08
Senior GIS Review byGKroupa on 2020-05-08

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
19-2

Title
Local Assessment Areas for Indigenous Health Conditions, Socio-economic Conditions, and Physical and Cultural Heritage.



Stantec

Alamos Gold Inc.

Study Area

- Indigenous Health Conditions Regional Assessment Area (RAA)
- Indigenous Socio-economic Conditions Regional Assessment Area (RAA)
- Indigenous Physical and Cultural Heritage Regional Assessment Area (RAA)

Landbase

- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- First Nation Reserve
- Provincial Park
- Provincial Border

N

0 20 40 Kilometres

(At original document size of 11x17)
1:1,400,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

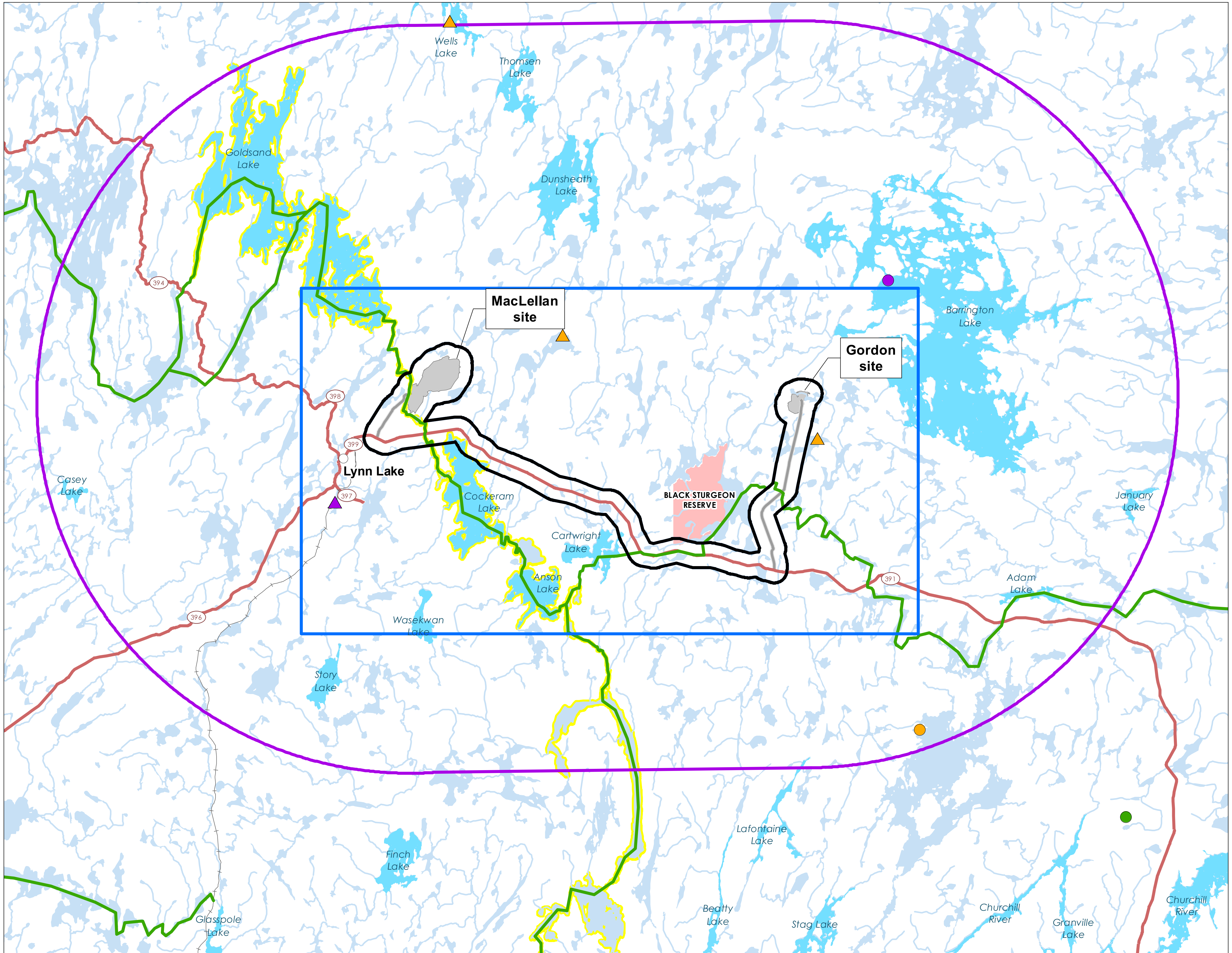
Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-05-08
Technical Review by AVanBuren on 2020-05-08
Senior GIS Review byGKroupa on 2020-05-08

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
19-3

Title
Regional Assessment Areas for Indigenous Health Conditions, Socio-economic Conditions, and Physical and Cultural Heritage.



Project Infrastructure

Project Development Area

Study Area

Indigenous Health Conditions Local Assessment Area (LAA)

Indigenous Socio-economic Conditions Local Assessment Area (LAA)

Indigenous Physical and Cultural Heritage Local Assessment Area (LAA)

Land Use

Permit or Lease Site

- Fish Camp
- Fish Farm
- Forestry
- Traditional Use Cabin
- Trapper Cabin

Recreational and Historical Information

- Canoe Route
- TLRU Travel Routes
- Commercial Fishing Lakes

Landbase

- Highway
- Access Road
- Rail
- Watercourse
- Waterbody
- First Nation Reserve

N

0 5 10 Kilometres

(At original document size of 11x17)
1:320,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake,
Manitoba

Prepared by ACampigotto on 2020-05-08
Technical Review by AVanBuren on 2020-05-08
Senior GIS Review byGKroupa on 2020-05-08

Client/Project 111473008

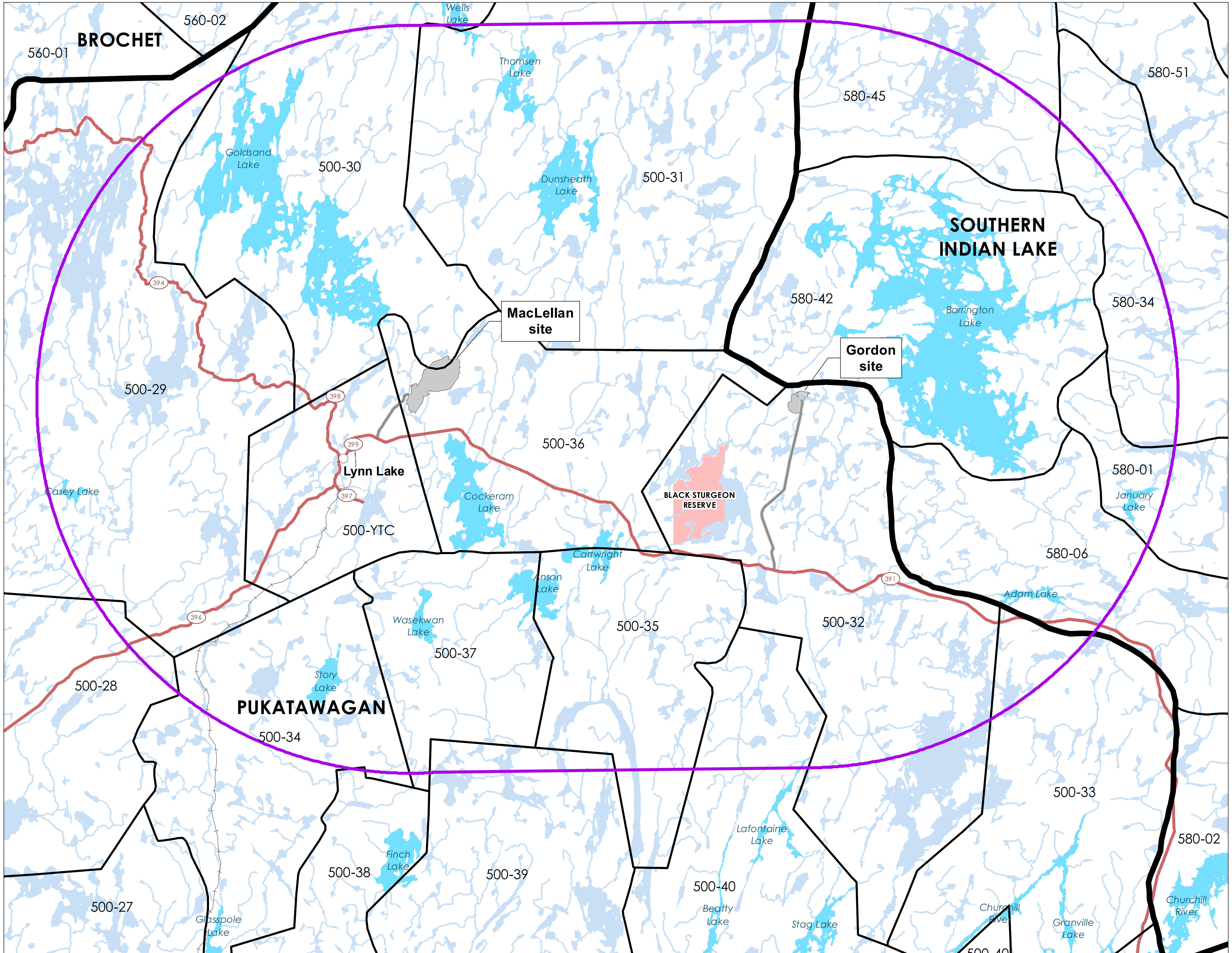
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.

19-4

Title

Land Use and Travel Routes



Stantec

Alamos Gold Inc.

Project Infrastructure

Project Development Area

Study Area

Indigenous Socio-economic Conditions Local Assessment Area (LAA)

Recreational and Historical Information

Commercial Fishing Lakes

Registered Traplines (Sec and Line No.)

Registered Trapline Sections (Name)

Landbase

Highway

Access Road

Rail

Watercourse

Waterbody

First Nation Reserve

N

0 5 10 Kilometres

(At original document size of 11x17)
1:320,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake, Manitoba

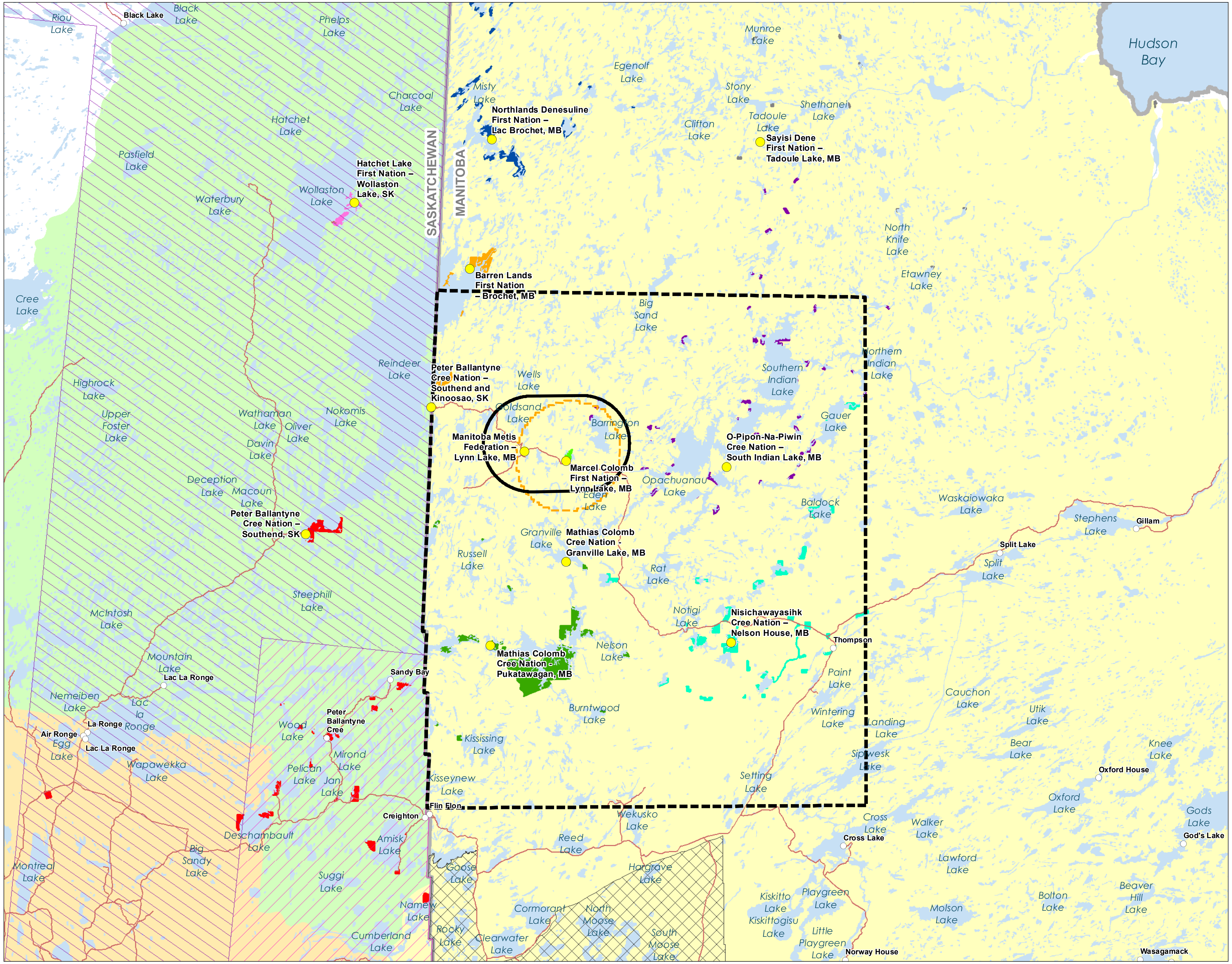
Prepared by ACampigotto on 2020-05-08
Technical Review by AVanBuren on 2020-05-08
Senior GIS Review byGKroupa on 2020-05-08

Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
19-5

Title
Traplines and Commercial Fishing



![Stantec] ![Alamos Gold Inc.]

Study Area
- The Indigenous or Treaty Rights Local Assessment Area (LAA)
- The Indigenous or Treaty Rights Regional Assessment Area (RAA)

Communities
- Indigenous Community

Designated Lands / Management Units

Métis Nation - Saskatchewan Regions
- Eastern Region I
- Northern Region I

First Nation Reserve and Treaty Land Entitlement (TLE) Sites
- Barren Lands First Nation
- Mathias Colomb Cree Nation
- Nisichawayasihk Cree Nation
- Northlands First Nation
- O-Pipon-Na-Piwin Cree Nation
- Sayisi Dene First Nation
- Hatchet Lake First Nation
- Marcel Colomb First Nation
- Peter Ballantyne Cree nation

Treaty Boundaries
- Treaty 5
- Treaty 6
- Treaty 10
- Recognized Areas for Metis Natural Resource Harvesting
- Community Interest Zone (Marcel Colomb First Nation)

Landbase
- Community
- Major Road
- Waterbody
- Provincial Border

N

0 25 50 Kilometres

(At original document size of 11x17)
1:2,500,000

Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Base Data Sources: Government of Manitoba and Government of Canada

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2020-05-08
Technical Review by AVanBuren on 2020-05-08
Senior GIS Review byGKroupa on 2020-05-08

Client/Project 111473008
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
19-6

Title
Treaty and Management Areas