Lynn Lake Gold Project:
MacLellan Mine Plan Amendment
Notice of Alteration / Notice of Change

June 25, 2025

Prepared for:

Prepared by:
Stantec Consulting Ltd.
500-311 Portage Avenue
Winnipeg, MB R3B 2B9

Project/File:
111473084

Stantec

Notice of Alteration Form

Manitoba

File No. : 6074.00	Environment Act Licence No. : 3391

Legal name of the Licensee: Alamos Gold Inc.

Name of the development: Lynn Lake Gold Project MacLellan Gold Mine

Category and Type of development per Classes of Development Regulation:

Mining — Mines, other than pits and quarries

Licensee Contact Person: Mr. Colin Webster, Vice President Sustainability & External Affairs

Mailing address of the Licensee: Brookfield Place, 181 Bay Street, Suite 3910

City: Toronto Province: ON Postal Code: M5J 2T3

Phone Number: (416) 770-3483 Fax: Email: CWebster@alamosgold.com

Name of proponent contact person for purposes of the environmental assessment (e.g. consultant):

Ms. Karen Mathers, Senior Principal, Stantec Consulting Ltd.

Phone: (204) 799-6159	Mailing address: 500-311 Portage Avenue, Winnipeg MB
Fax:	R3B 2B9

Email address: karen.mathers@stantec.com

Short Description of Alteration *(max 90 characters):*

Change in Project components from the licensed Project

Alteration fee attached: Yes: ☐ No: ☑

If No, please explain: Please contact for credit card payment information

Date: 2025-06-24

Signature:

Printed name: Colin Webster

A complete Notice of Alteration **(NoA)** consists of the following components:

- ☑ **Cover letter**
- ☑ **Notice of Alteration Form**
- ☑ **1 electronic copy of the NoA detailed report** (see "Information Bulletin - Alteration to Developments with Environment Act Licences")
- ☑ **$500 Application fee, if applicable** (Cheque, payable to the Minister of Finance)

Submit the complete NoA to:
Director, Environmental Approvals Branch
Environment and Climate Change
Box 35, 14 Fultz Blvd
Winnipeg MB R3Y 0L6
EABDirector@gov.mb.ca

For more information:
Toll-Free: 1-800-282-8069
Phone: 204-945-8321 Fax: 204-945-5229
https://www.gov.mb.ca/sd/permits_licenses_approvals/eal/ licence/index.html

Note: Per Section 14(3) of the Environment Act, Major Notices of Alteration must be filed through submission of an Environment Act Proposal Form (see "Information Bulletin – Environment Act Proposal Report Guidelines")

Executive Summary

As part of the Lynn Lake Gold Project (the Project), Alamos Gold Inc. (Alamos; 'the proponent') plans to operate the MacLellan Gold Mine, (hereinafter referred to as the 'MacLellan site') near the Town of Lynn Lake in northern Manitoba. The MacLellan site is regulated under *Environment Act* Licence No. 3391 and the conditions stipulated therein (March 6, 2023) and a Decision Statement issued under the *Canadian Environmental Assessment Act, 2012* as documented by the Impact Assessment Agency of Canada (IAAC), dated March 5, 2023. The Decision Statement outlines conditions in relation to environmental effects that Alamos must comply with.

This Notice of Alteration (NOA)/Notice of Change (NOC) request has been prepared by Stantec Consulting Ltd. (Stantec) on behalf of Alamos and is submitted to both:

- Manitoba Environment and Climate Change (MECC) in support of a request for a NOA to Licence No. 3391. The MacLellan site is considered a Class 2 Development under the Classes of Development Regulation (MR 164/88); and
- The IAAC to notify it of the change and request an amended Decision Statement in relation to the Lynn Lake Gold Project through submission of a NOC in accordance with conditions 2.16 and 2.17 of the federal Decision Statement.

Alamos understands that the above-noted approvals are required from both regulatory authorities prior to proceeding. This report documents the relevant portions of the currently licensed MacLellan site, the proposed alterations, and the potential environmental effects and planned mitigation measures associated with the proposed alterations. The works proposed are instrumental to the planned construction works and future operation of the MacLellan site.

The proposed alteration encompasses an increase to the mine tonnage, an extended mine life (specifically extended production period), and modifications to the approved MacLellan site, inclusive of the adjustment of footprints of several of the Project components and the addition of a couple new Project components. Those components that have been modified through engineering detailed design since the Project was approved include the mine rock storage area, tailings management area and associated pond, overburden stockpile, topsoil stockpile, worker camp, original equipment manufacturer (OEM) platform, temporary crushing area, ore storage area, explosives mixing plant, process plant, open pit, access road, water management infrastructure (sumps, collection pond, and the siting of the sewage treatment plant). The new Project components include the addition of a satellite pit and additional construction laydown areas.

In accordance with the EIS and the EAP Report, the Project Development Area (PDA), encompasses the immediate area in which Project activities and components occur plus a buffer (between 30- and 50-metre [m], depending on the location) and is the anticipated area of direct physical disturbance associated with the construction and operation of the Project. Overall, the revised PDA (914.8 hectares [ha]) is smaller than what was assessed in the EIS by 23.1 ha (937.9 ha).

The approved EIS and EAP Report included assessments completed to meet regulatory requirements, including assessing project-specific environmental effects. The assessments focused on valued components (VCs), which are environmental components of certain value or interest to regulators, Indigenous Nations, and other parties and were identified based on the biophysical and socio-economic elements that would potentially be affected by the Project, including at the MacLellan site. Biophysical and socio-economic VCs that could be affected through interactions of the environment and the proposed alterations were identified to scope the assessment. The rationale for selecting each VC and potential general interactions between the proposed alteration and the VCs remain as originally described in the EIS prepared for the Project (i.e., Gordon and MacLellan sites) and the EAP Report for the approved MacLellan site. The VCs that were assessed as part of the EIS and EAP Report, are assessed as part of this NOA/NOC. The Project activities and components that are proposed to be altered as part of this NOA/NOC that may interact with the VCs are identified in the respective VC sections.

Potential interactions of the proposed alteration and the environment were evaluated with likely interactions examined to assess residual effects on the assumption of typical mitigation measures representative of best practices and previous construction methods employed at the MacLellan site.

Based on information available to date and as presented in this NOA/NOC, residual effects of the proposed alterations are characterized in the same way as presented in the EIS (Stantec 2020a) and the EAP Report (Stantec 2020b) for the following VCs:

- Atmospheric Environment
- Noise and Vibration
- Vegetation and Wetlands*
- Wildlife and Wildlife Habitat
- Labour and Economy
- Community Services, Infrastructure, and Wellbeing
- Land and Resource Use
- Heritage Resources
- Current Use of Lands and Resources for Traditional Purposes by Indigenous Peoples
- Indigenous Peoples

**The proposed alterations will not result in additional adverse effects on vegetation and wetlands at the MacLellan site and there is no change to the EIS (Stantec 2020a) and the EAP Report (Stantec 2020b) conclusions for vegetation and wetlands, however, the LAA has changed from what was presented in the EIS and EAP Report because of groundwater drawdown and changes in the PDA. The LAA is based on a 100 m buffer around the furthest expected groundwater drawdown contour, a 1 km buffer around the revised PDA extent, and also a 1 km buffer around the PR 391 highway. The changes increase the LAA by 43.5 ha from that presented in the EIS and EAP Report.*

Based on information available to date and as presented in this NOA/NOC, residual effects characterizations in this NOA/NOC differed from the residual effects characterizations in the EIS (Stantec 2020a) and the EAP Report (Stantec 2020b) for the following VCs:

- Groundwater
- Surface Water
- Fish and Fish Habitat
- Human Health

Results of the updated groundwater model do not change the characterization of residual effects to groundwater quality, but do change the magnitude of residual effect to groundwater quantity, which is now high in the PDA and low within the LAA/RAA. However, results of the updated groundwater assessment do not change the significance rating for groundwater from those presented in the EIS, which was not significant.

Results of the updated surface water balance model do not change the characterization of residual effects to surface water quantity (i.e., stream flows and lake levels) from those presented in the EIS. However, the results of the updated surface water quality model do change the characterization of residual effects to surface water quality from those presented in the EIS. This is because of differences in the magnitude, timing, duration, and location of predicted water quality concentrations that exceed water quality guidelines for the protection of freshwater aquatic life and because of the use of more stringent Federal Environmental Quality Guidelines (FEQGs) for screening model results in the NOA/NOC. Whereas water quality guideline exceedances were predicted to occur primarily in the Keewatin River tributary KEE3-B1 during post-closure in the EIS, water quality guideline exceedances were predicted to occur in Minton Lake, tributary KEE3-PAY1 (the Payne Lake outlet), and tributary KEE3-B1 during operation, closure, and post-closure phases in the NOA/NOC.

Results of the updated surface water quality model have increased the magnitude of residual effects to surface water quality from moderate (EIS; Stantec 2020a) to high (this NOA/NOC). This is due to predicted increases in total arsenic, total cobalt, and dissolved copper concentrations in tributary KEE3-B1, tributary KEE3-PAY1, and Minton Lake that extend into post-closure. However, Alamos will reduce the risk to fish and other aquatic resources in these waterbodies during all phases by implementing the SWMMP (Version 0, January 2025), including its adaptive management framework, if necessary. This adaptive management framework includes trigger response thresholds and a list of additional mitigation measures that could be implemented to reduce contaminant loadings from the Project (e.g., passive or active treatment). Therefore, with implementation of the SWMMP (monitoring and adaptive management as required), the residual effects to surface water quality are expected to be similar to the assessment in the EIS and not significant.

Changes to the approved MacLellan site and changes in stream flows and lake levels predicted by the updated surface water balance model water do not change the significance of residual effects to fish habitat at the MacLellan site, which was rated as low in magnitude, local in geographic extent, short-term in duration and reversible in the EIS. This is because alterations to the approved MacLellan site will not result in any additional HADD of fish habitat and none of the predicted changes in stream flow or lake

levels are large enough to reduce the quantity or quality of fish habitat used by any fish species or life stage more than predicted in the EIS. However, predicted changes in the extent of groundwater table drawdown may affect additional fish-bearing swamps at the MacLellan site (if present). Investigation of the fish-bearing status of the additional swamps commenced in spring 2025 and will be continued to be investigated in summer 2025. If required, additional offsets or monitoring will be included in the Fish Habitat Offsetting Plan and Aquatics Effects Monitoring Plan. A change in the fish-bearing status will not result in a negative impact that cannot be managed through the Fisheries Act Authorization and/or Management and Monitoring Plans, as appropriate.

Results of the updated surface water quality model have increased the magnitude of residual effects to fish health, growth, or survival from negligible (EIS; Stantec 2020a) to high (this NOA/NOC). This is due to predicted increases in total cobalt in tributary KEE3-B1 and dissolved copper concentrations in tributary KEE3-PAY1 and Minton Lake that extend into post-closure. However, residual effects to fish health, growth, or survive are expected to remain not significant because Alamos will reduce the risk to fish and other aquatic resources in these waterbodies during all phases by implementing the SWMMP (Version 0, January 2025) and the adaptive management framework therein, if and as necessary.

The residual effects of the proposed alterations to the human health VC are expected to be characterized in the same way as presented in the EIS (Stantec 2020a) and the EAP Report (Stantec 2020b), with the exception of the magnitude and the geographic extent of the residual effects, which are now of negligible to low magnitude and confined to the LAA geographic area. Overall, the effects are not significant.

Overall, the proposed alterations described in this NOA/NOC are not significant and do not appear to warrant any adjustment to either the federal Decision Statement or the provincial Environment Act Licence No 3391. Alamos remains committed to developing and operating the Project inclusive of the proposed alterations in a manner that provides environmental protection for VCs and long-term benefits for the region. The additional mitigation measures identified in Section 3.3, which are beyond those identified in the EIS (Stantec 2020a) and the EAP Report (Stantec 2020b) will be incorporated (change from Version 0 to Version 1) into the applicable Management and Monitoring Plans, which are living documents following approval of this NOA/NOC.

A draft of this NOA/NOC was shared to all Indigenous Nations involved in the Project. This NOA/NOC was also discussed with the Indigenous Nations participating in the Environmental Advisory Committee. No feedback has been received to date. If any feedback is received, Alamos will address it with the respective Indigenous Nation(s) and share this information with the Province and IAAC.

Table of Contents

Notice of Alteration Form ..... **i**
Executive Summary ..... **ii**
Acronyms / Abbreviations ..... **ix**
1 Introduction **1**
1.1 Alteration Overview 1
1.2 The Proponent 2
1.3 Land Ownership and Mineral Rights 3
1.3.1 Existing Land Use 3
1.4 Previous Reports and Supporting Studies 5
1.5 Scope of the Assessment 5
1.5.1 Spatial and Temporal Boundaries 5
1.5.2 Assessment Approach 6
1.6 Engagement 7
1.7 Funding 8
2 Alteration Description **9**
2.1 Purpose and Rationale 9
2.2 Existing Conditions 9
2.3 Proposed Alteration 9
2.4 Alteration Schedule 12
3 Environmental Effects and Mitigation **13**
3.1 Potential Interactions and Valued Components 13
3.2 Residual Effects Criteria 13
3.3 Assessment of Environmental Effects 14
3.3.1 Atmospheric Environment 14
3.3.2 Noise and Vibration 21
3.3.3 Groundwater 28
3.3.4 Surface Water 42
3.3.5 Fish and Fish Habitat 92
3.3.6 Vegetation and Wetlands 125
3.3.7 Wildlife and Wildlife Habitat 133
3.3.8 Labour and Economy 135
3.3.9 Community Services, Infrastructure, and Wellbeing 137
3.3.10 Land and Resource Use 140
3.3.11 Heritage Resources 142
3.3.12 Current Use of Lands and Resources for Traditional Purposes by Indigenous Peoples 144
3.3.13 Human Health 150
3.3.14 Indigenous Peoples 167
4 Conclusions **177**
5 References **180**

List of Tables

Table 1.1 Valued Component Considered in the Environmental Impact Statement and Environmental Act Proposal Report 6
Table 1.2 Environmental Advisory Committee Meeting Details 7
Table 2.1 MacLellan Site Feature Footprint Layout Changes 11
Table 2.2 MacLellan Site Project Development Area Changes 12
Table 3.1 Definition of Terms Used to Characterize Residual Environmental Effects 13
Table 3.2 Applicable Guideline Criteria for Air Quality 15
Table 3.3 Predicted Groundwater Discharge to Lakes and Tributaries and Baseflow in Rivers 34
Table 3.4 Predicted Groundwater Discharge Rates from Mine Rock Storage Area and Tailings Management Facility to the Receiving Environment 39
Table 3.5 Simulated Average Monthly Streamflows at Model Node QM02 50
Table 3.6 Simulated Average Monthly Streamflows at Model Node QM03 51
Table 3.7 Simulated Average Monthly Streamflows at Model Node QM04 52
Table 3.8 Simulated Average Monthly Streamflows at Model Node QM06 53
Table 3.9 Simulated Average Monthly Streamflows at Model Node QM07 54
Table 3.10 Simulated Average Monthly Streamflows at Model Node QM08 55
Table 3.11 Simulated Average Monthly Streamflows at Model Node QM09 56
Table 3.12 Simulated Average Monthly Streamflows at Model Node QM11 57
Table 3.13 Simulated Average Monthly Water Levels at Minton Lake 58
Table 3.14 Simulated Average Monthly Water Levels at Cockeram Lake 59
Table 3.15 Comparison of Updated Water Balance Model Results with EIS Results 62
Table 3.16 MacLellan Site Assessment Nodes 64
Table 3.17 Comparison of Parameters of Potential Concern Predicted in Receiving Environment at the MacLellan Site for the Expected Case between the EIS Model and Updated Model 67
Table 3.18 Predicted Total Arsenic Concentrations, by Phase, at MacLellan Site Model Nodes Associated with Exceedances of Screening Criteria for the Expected and Upper-Case Scenarios 70
Table 3.19 Predicted Total Cobalt Concentrations, by Phase, at MacLellan Site Model Nodes Associated with Exceedances of Screening Criteria for the Expected and Upper-Case Scenarios 71
Table 3.20 Predicted Total Copper Concentrations, by Phase, at the MacLellan Site Model Nodes Associated with Exceedances of Screening Criteria for the Expected and Upper-Case Scenarios 72
Table 3.21 Predicted Dissolved Copper Concentrations, by Phase, at the MacLellan Site Model Nodes Associated with Exceedances of Screening Criteria for the Expected and Upper-Case Scenarios 73
Table 3.22 Predicted Fluoride Concentrations, by Phase, at the MacLellan Site Model Nodes Associated with Exceedances of Screening Criteria for the Expected and Upper-Case Scenarios 74
Table 3.23 Predicted Total Phosphorus Concentrations, by Phase, at the MacLellan Site Model Nodes Associated with Exceedances of Screening Criteria for the Expected and Upper-Case Scenarios 75
Table 3.24 Characterization of Residual Effects on Surface Water Quality 88
Table 3.25 Comparison of Percentage Monthly and Annual Flow Changes in Tributary KEE3-B1 Between the Environmental Impact Statement and the Notice of Alteration/Notice of Change 107
Table 3.26 Comparison of Percentage Monthly and Annual Flow Changes in the Minton Lake Outlet Between the Environmental Impact Statement and the Notice of Alteration/Notice of Change 108

Table 3.27 Comparison of Percentage Monthly and Annual Flow Changes in the Dot Lake Outlet Between the Environmental Impact Statement and the Notice of Alteration/Notice of Change 113
Table 3.28 Comparison of Predicted Change in Water Levels in Minton Lake Between the Environmental Impact Statement and the Notice of Alteration/Notice of Change 116
Table 3.29 Land Cover Classes in the PDA and LAA 129
Table 3.30 Wetlands Potentially Affected by Groundwater Drawdown during Construction and Operation 130
Table 3.31 Modelled Maximum Ground-level Concentrations from MacLellan Site Operation 156
Table 3.32 Maximum Human Health Risks Associated with Inhalation Exposures from MacLellan Site Operation 158
Table 3.33 Receptor Locations where Concentration Ratios of NO_2 Are Greater than Benchmark (CR > 1.0) 159
Table 3.34 Receptor Locations where Concentration Ratios of PM Are Greater than Benchmark (CR > 1.0) 161
Table 3.35 Comparison of Surface Water Concentration to Drinking Water Guidelines 164
Table 3.36 Changes in Model Concentrations at Cockeram Lake – Project Case 166
Table 3.37 Indigenous Health Conditions Effects Pathways 172
Table 3.38 Indigenous Socio-Economic Conditions Effects Pathways 173
Table 3.39 Indigenous Physical and Cultural Heritage Effects Pathways 174

List of Figures

Figure 1.1 Aerial Photograph of the MacLellan Site 4
Figure 2.1 Block model screenshot showing the NOA/NOC design (in cyan) relative to the EIS design (in orange) with dimension differences 10
Figure 3.1 Water Balance and Water Quality Model Nodes 49
Figure 3.2 Aerial view of the Minton Lake outlet. Minton Lake is in lower left with water flowing from left to right (Source: Google Earth™) 110
Figure 3.3 Habitat in Beaver Pond in the Minton Lake Outlet Approximately 300 m Downstream from Minton Lake 111
Figure 3.4 Habitat in One of the Braided Channels in the Minton Lake Outlet Approximately 150 m Downstream from Minton Lake 111
Figure 3.5 Looking Upstream at Habitat in the Dot Lake outlet, July 2016 114
Figure 3.6 Conceptual Site Model for the Human Health Risk Assessment 154

List of Appendices

Appendix A Maps
Appendix B Summary of Light Modelling Results for the Lynn Lake Gold Project Revised 2023 Mine Design
Appendix C Summary of Air Dispersion Model Results for the Lynn Lake Gold Project Revised 2023 Mine Design
Appendix D Lynn Lake Gold Project – Noise and Vibration Impact Assessment Update
Appendix E Groundwater MacLellan Site – Groundwater Model Report
Appendix F Lynn Lake Gold Project: MacLellan Water Balance and Water Quality Model Update for Notice of Alteration / Notice of Change
Appendix G Surface Water Quality Figures

Acronyms / Abbreviations

%	percent
%HA	percent highly annoyed
<	less than
>	greater than
≤	less than or equal to
µg/m³	microgram per cubic metre
µg/m³	microgram per square metre
AAQC	Ambient Air Quality Criteria
AEMP	Aquatic Effects Monitoring Plan
Alamos; 'the proponent'	Alamos Gold Inc.
AQMMP	Air Quality Management and Monitoring Plan
BC MOE	British Columbia Ministry of Environment
BC	British Columbia
BLM	biotic ligand model
BMP	Best Management Practice
CAAQS	Canadian Ambient Air Quality Standards
CAC	criteria air contaminants
$CaCO_3$	Calcium carbonate
CCME	Canadian Council of Ministers of the Environment
CCREM	Canadian Council of Resource and Environment Ministers
CEA Agency	Canadian Environmental Assessment Agency
CEAA 2012	*Canadian Environmental Assessment Act, 2012*
CEMI	Centre for Excellence in Mining Innovation
cm	centimetre
CO	carbon monoxide
COPC	chemical of potential concern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CR	concentration ratio
CSM	conceptual site model
CWQG-FAL	Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life
d/y	days per year
dB	decibel
dBA	A-weighted decibel

dBL	linear decibel
DFO	Fisheries and Oceans Canada
DOC	dissolved organic carbon
DPM	diesel particulate matter
EAP	Environment Act Proposal
ECCC	Environment and Climate Change Canada
EEM	environmental effects monitoring
EIS	Environmental Impact Statement
ESCP	Erosion and Sediment Control Plan
ESEA	*Endangered Species and Ecosystems Act*
ETMA	East Tailings Management Area
FDS	final discharge point
FEQG	Federal Environmental Quality Guidelines
FTA	Federal Transit Administration
g/m²	grams per square metre
GCDWQ	Guidelines for Canadian Drinking Water Quality
GDP	gross domestic product
GHG	greenhouse gas
GMMP	Groundwater Management and Monitoring Plan
h/y	hour per year
ha	hectare
HADD	harmful alteration, disruption, or destruction
HC_5	hazardous concentration
HCN	Hydrogen Cyanide
HCN	hydrogen cyanide
HCRPP	Heritage and Cultural Resources Protection Plan
HH	human health
HHRA	human health risk assessment
HQ	hazard quotient
HRB	Historic Resources Branch
HRIA	Heritage Resource Impact Assessment
Hz	Hertz
IAAC	Impact Assessment Agency of Canada
in/s	inch per second
IR	Information Request

kg	kilogram
km	kilometre
km/h	kilometres per hour
km^2	square kilometre
L/day	litres per day
LAA	Local Assessment Area
L_d	daytime equivalent sound level
L_{dn}	day-night average sound level
L_{eq}	equivalent sound level
LFN	low frequency noise
LLGP, the Project	Lynn Lake Gold Project
LLJV	Lynn Lake Joint Venture
L_n	nighttime equivalent sound level
m	metre
m/s	metres per second
m^3/d	cubic metres per day
m^3/h	cubic metres per hour
m^3/s	cubic metres per second
MacLellan site	MacLellan Gold Mine
MAD	mean annual discharge
masl	metres above sea level
MCC	Manitoba Climate and Conservation
MDMER	Metal and Diamond Mining Effluent Regulation
MECC	Manitoba Environment and Climate Change
MECP	Manitoba Environment, Climate and Parks
mg/L	milligram per litre
MHHL	Manitoba Health and Healthy Living
MHSAL	Manitoba Health Seniors and Active Living
MINR	Manitoba's Department of Indigenous and Northern Relations
mm	millimetre
mm/s	millimetre per second
Mm^3	cubic megametre
MNL	mitigation noise level
MRSA	mine rock storage area
ms	milliseconds

MSD	Manitoba Sustainable Development
Mt	metric tonne
MWQSOG	Manitoba Water Quality Standards, Objectives, and Guidelines
MWQSOG-FAL	Manitoba Water Quality Standards, Objectives, and Guidelines for Protection of Freshwater Aquatic Life
NAG	non-acid generating
NO	nitrous oxide
NO_2	nitrogen dioxide
NOA	Notice of Alteration
NOC	Notice of Change
ºC	degrees Celsius
OEHHA	Office of Environmental Health Hazard Assessment
OEM	Original Equipment Manufacturer
OMECP	Ontario Ministry of Environment, Conservation, and Parks
OSA	ore storage area
PAG	potentially acid generating
PAH	polycyclic aromatic hydrocarbon
PDA	Project Development Area
PM	particulate matter
PM_{10}	particulate matter less than 10 microns
$PM_{2.5}$	particulate matter less than 2.5 microns
POPC	parameter of potential concern
ppb	parts per billion
ppm	parts per million
PR	Provincial Road
Q1	first quarter
Q4	fourth quarter
RAA	Regional Assessment Area
rms	root mean square
ROW	Right of Way
SAR	species at risk
SARA	*Species at Risk Act*
SO_2	sulphur dioxide
SOCC	Species of Conservation Concern
SRB	sulphate-reducing bacteria

Stantec	Stantec Consulting Ltd.
STP	sewage treatment plant
SWMMP	Surface Water Management and Monitoring Plan
t/d	tonnes/day
the Project	Lynn Lake Gold Project
TIA	Tailings Impoundment Areas
TK	traditional knowledge
TMF	tailings management facility
TMR	technical modelling report
TRV	toxicological reference values
TSP	total suspended particulate
TSS	total suspended solids
US EPA	United States Environmental Protection Agency
VC	valued component
VdB	Vibration Velocity in Decibel Scale
VOC	volatile organic compounds
VWMP	Vegetation and Weed Management Plan
WHO	World Health Organization
WRAP	Western Regional Air Partnership

1 Introduction

1.1 Alteration Overview

As part of the Lynn Lake Gold Project (the Project), Alamos Gold Inc. (Alamos; 'the proponent') plans to operate the MacLellan Gold Mine, (hereinafter referred to as the 'MacLellan site') near the Town of Lynn Lake in northern Manitoba (Map 1; Appendix A). Alamos is seeking approval to proceed with alterations to the approved MacLellan site. The proposed alterations include modifications to the mine rock storage area (MRSA), tailings management facility (TMF), overburden stockpile, topsoil stockpile, camp area, ore storage area (OSA), as well as some refinements to the site general water management system. The proposed alterations also include the addition of a satellite open pit and construction laydown areas. The mine life has also extended. The proposed alterations are further described in Section 2.

The MacLellan site is regulated under *Environment Act* Licence No. 3391 and the conditions stipulated therein (March 6, 2023) and a Decision Statement issued under the *Canadian Environmental Assessment Act, 2012* as documented by the Impact Assessment Agency of Canada (IAAC), dated March 5, 2023. The Decision Statement outlines conditions in relation to environmental effects that Alamos must comply with.

Provincially, Section 14(1) of *The Environment Act* requires a proponent to notify the Director (for Class 1 and 2 developments) if the proponent intends to alter a licensed development so that it no longer conforms to licence conditions or has the potential to change the environmental effects (Manitoba Environment, Climate and Parks (MECP 2022; now Manitoba Environment and Climate Change or [MECC]). The key consideration for assessing a proposed alteration and preparing and submitting a Notice of Alteration (NOA) from what was assessed in the environmental assessment phase is the significance of the environmental and human health effects as a result of the proposed alteration and whether there is sufficient detail to allow the Director to determine whether the effects of the proposed alteration are significant, insignificant, or nonexistent (MECP 2022).

Federally, per the following Decision Statement conditions, Alamos is required to prepare and submit a Notice of Change (NOC) to IAAC for the proposed alteration (as a separate parallel filing):

> *Change to the Designated Project*
>
> > *2.16 If the Proponent is proposing to carry out the Designated Project in a manner other than described in condition 1.8, the Proponent shall notify the Agency in writing in advance of carrying out those proposed activities. As part of the notification, the Proponent shall provide:*
> >
> > *2.16.1 a description of the proposed change(s) to the Designated Project and the environmental effects that may result from the change(s);*

2.16.2 any modified or additional measure to mitigate any environmental effect that may result from the change(s) and any modified or additional follow-up requirement; and

2.16.3 an explanation of how, taking into account any modified or additional mitigation measure referred to in condition 2.16.2, the environmental effects that may result from the change(s) may differ from the environmental effects of the Designated Project identified during the environmental assessment.

2.17 The Proponent shall submit to the Agency any additional information required by the Agency about the proposed change(s) referred to in condition 2.16, which may include the results of consultation with Indigenous groups and relevant authorities on the proposed change(s) and environmental effects referred to in condition 2.16.1 and the modified or additional mitigation measures and follow-up requirements referred to in condition 2.16.2.

This NOA/NOC request has been prepared by Stantec Consulting Ltd. (Stantec) on behalf of Alamos and is submitted to both:

- MECC in support of a request for a NOA to Licence No. 3391. The MacLellan site is considered a Class 2 Development under the Classes of Development Regulation (MR 164/88); and
- The IAAC to notify it of the change and request an amended Decision Statement in relation to the Lynn Lake Gold Project through submission of a NOC.

Alamos understands that the above-noted approvals are required from both regulatory authorities prior to proceeding.

This report documents the relevant portions of the currently licensed MacLellan site, the proposed alterations, and the potential environmental effects and planned mitigation measures associated with the proposed alterations. The works proposed would be instrumental to the planned construction works and future operation of the MacLellan site.

1.2 The Proponent

For the purposes of development licensing, the proponent is Alamos. For further information regarding the MacLellan site, please contact the following:

Mr. Colin Webster
Vice President Sustainability & External Affairs
Alamos Gold Inc.
Brookfield Place, 181 Bay Street, Suite 3910
Toronto, ON M5J 2T3
Email: CWebster@alamosgold.com

This NOA/NOC was prepared by Stantec. The local contact is:

Ms. Karen Mathers, M.Sc., P.Geo. FGC, PMP.
Senior Principal, Environmental Services
Stantec Consulting Ltd.
500-311 Portage Avenue
Winnipeg, MB R3B 2B9
Telephone: (204) 799-6159
Email: karen.mathers@stantec.com

1.3 Land Ownership and Mineral Rights

The historical MacLellan site has not been in operation since 1989, with little reclamation taking place. Alamos is the current holder of the rights to those historical mining claims and mineral leases. Since approval of the LLGP in March 2023, Alamos has transferred further relevant mineral claims to leases at the MacLellan site. This included the conversion of one claim to a mineral lease where the proposed pit overlaps and was outside the historical mineral leases. Alamos also has the surface rights for the Project Development Area (PDA) and the majority of the MacLellan site access road.

1.3.1 Existing Land Use

The MacLellan site formerly operated as an underground gold and silver mine between 1986 and 1989. Construction of the MacLellan site in relation to *Environment Act* Licence No. 3391 and the federal Decision Statement started on February 3, 2025. The MacLellan site currently consists of a 4.6-kilometre (km) gravel access road, abandoned pole line, and infrastructure from the former underground mine (including a head frame, hoist house and shaft, access ramp, and maintenance and storage buildings). The present-day condition (March 24, 2025) of the MacLellan site is shown below in the aerial photograph. As shown, clearing of the PDA, road reconstruction, historic building demolition and other site preparations activities are underway.

Figure 1.1 Aerial Photograph of the MacLellan Site

1.4 Previous Reports and Supporting Studies

The Project (including the Gordon and MacLellan sites) was subject to an environmental assessment prepared under *The Environment Act* as well as the *Canadian Environmental Assessment Act, 2012*. An Environmental Impact Statement (EIS) for the Lynn Lake Gold Project (Stantec 2020a) and an Environment Act Proposal (EAP) Report for the MacLellan site (Stantec 2020b) were prepared. The Environmental Approvals Branch of MECC issued a licence for the MacLellan site (Licence No. 3391) on March 6, 2023. A federal Decision Statement was also issued for the Project (Gordon and MacLellan sites) subject to conditions on March 5, 2023.

1.5 Scope of the Assessment

1.5.1 Spatial and Temporal Boundaries

1.5.1.1 Spatial Boundaries

For the purposes of this NOA/NOC, the PDA for the MacLellan site refers to the immediate area that Project activities and components occur in, plus a buffer, and is the anticipated area of direct physical disturbance (Map 2; Appendix A).

The Local Assessment Area (LAA) and Regional Assessment Area (RAA) spatial boundaries for this NOA/NOC are consistent with the various identified valued component (VC) spatial boundaries as previously defined (Stantec 2020a and 2020b).

- The LAA for the MacLellan site encompasses the area in which environmental effects (direct or indirect) associated with the Project can be predicted or measured for assessment. The LAA encompasses the PDA and is selected in consideration of the geographic extent of effects (Stantec 2020a and 2020b).
- The RAA for the MacLellan site is the area established for context for the determination of significance of project-specific effects. The RAA encompasses both the PDA and LAA and is VC-specific (Stantec 2020a and 2020b).

1.5.1.2 Temporal Boundaries

For the purposes of this NOA/NOC, the temporal boundaries consist of the following Project phases:

- Construction (i.e., site preparation, physical construction/equipment installation, pre-production, and commissioning) is expected to take approximately 3 years to complete (Year -3, Year -2, Year -1). Some limited pre-production may occur during this period.

- Operation (i.e., ore and mine rock extraction, processing, and waste management) will follow construction and is expected to take approximately 17 years to complete (Years 1 to 17).
- Decommissioning/closure will begin at the cessation of operation. Closure, which is defined as the period of active reclamation measures - is scheduled to begin in Year 17 at the MacLellan site. Closure is expected to take approximately 5 to 6 years to complete. Closure will be followed by post-closure, which is the time period during which active reclamation measures are complete, but monitoring is still required as the site conditions may still be in flux and changing. Pit filling (based on the re-modelling results described in this NOA/NOC) is expected to take 40 years under average climatic conditions. Permanent closure will be considered to be complete when surface water quality is within the pertinent guidelines and discharge to the environment from the pit lake will be allowed. Monitoring will cease at this point.

1.5.2 Assessment Approach

The approved EIS and EAP Report (Stantec 2020a and 2020b) included assessments completed to meet regulatory requirements, including assessing project-specific environmental effects. The assessments focused on VCs, which are environmental components of certain value or interest to regulators, Indigenous Nations, and other parties and were identified based on the biophysical and socio-economic elements that would potentially be affected by the Project, including at the MacLellan site. The VCs considered include those listed in Table 1.1.

Table 1.1 Valued Component Considered in the Environmental Impact Statement and Environmental Act Proposal Report

Valued Components	
Atmospheric Environment	Noise and Vibration
Groundwater	Surface Water
Fish and Fish Habitat	Vegetation and Wetlands
Wildlife and Wildlife Habitat	Labour and Economy
Community Services, Infrastructure, and Wellbeing	Land and Resource Use
Heritage Resources	Current Use of Lands and Resources for Traditional Purposes by Indigenous Peoples
Human Health	Indigenous Peoples

The effects of those portions of the approved Project that are now proposed to be completed (i.e., the subject works) on these VCs were integrally assessed in the EAP Report and EIS and described in terms of direction, magnitude, geographic extent, frequency, duration, reversibility, and context according to the terms provided (Stantec 2020a and 2020b). The environmental effects of the proposed alterations will be mitigated as described in the EIS and EAP Report. This NOA/NOC presents an updated assessment of the proposed alterations to consider whether there are changes to the conclusions of the EIS and EAP Report (Stantec 2020a 2020b).

1.6 Engagement

The MacLellan site is located on unoccupied Provincial Crown land within an area that is a former mine site. As previously noted, construction at the MacLellan site started on February 3, 2025. In relation to the proposed alterations (see Section 2), details were discussed during the past Environmental Advisory Committee meetings detailed in Table 1.2.

Table 1.2 Environmental Advisory Committee Meeting Details

EAC Meeting	Attending Indigenous Nations
Meeting #1 – October 23, 2023 (virtual)	Manitoba Métis Federation, Nisichawayasihk Cree Nation, Marcel Colomb First Nation, Mathias Colomb Cree Nation, O-Pipon-Na-Piwin Cree Nation, Métis Nation – Saskatchewan
Meeting #2 – January 22, 2024 (virtual)	Marcel Colomb First Nation, Manitoba Métis Federation, Peter Ballantyne Cree Nation, Métis Nation Saskatchewan, O-Pipon-Na-Piwin Cree Nation
Meeting #3 – April 22, 2024 (virtual)	Marcel Colomb First Nation, Métis Nation Saskatchewan
Meeting #4 – August 12, 2024 (virtual)	Marcel Colomb First Nation, Métis Nation Saskatchewan, O-Pipon-Na-Piwin Cree Nation, Nisichawayasihk Cree Nation
Meeting #5 – October 21, 2024 (virtual)	Marcel Colomb First Nation, Métis Nation Saskatchewan
Meeting #6 – January 20, 2025 (virtual)	Marcel Colomb First Nation, Métis Nation Saskatchewan
Meeting #7 – May 23, 2025 (in person)	Marcel Colomb First Nation, Nisichawayasihk Cree Nation, Northlands Denesuline First Nation, O-Pipon-Na-Piwin Cree Nation

The meeting on May 23, 2025 included site visits, construction updates, and an outlook on future development changes/plans. Alamos' Independent Environmental Monitor also participated in the in-person 7th meeting, providing an introduction and overview of her role and responsibilities. These added in-person activities and discussions were followed by a formal Environmental Advisory Committee meeting, which was also accessible virtually for Indigenous Nations that were not able to attend in-person.

The minutes, presentations and shared documents related to each Environmental Advisory Committee meeting noted in Table 1.2 were (and will continue to be) shared with all 13 Nations involved in the Project even if they do not attend a meeting.

A draft of this NOA/NOC was shared with all Indigenous Nations involved in the Project. No feedback has been received to date. If any feedback is received, Alamos will address it with the respective Indigenous Nation(s) and share this information with the Province and IAAC.

Based on the above, all Indigenous Nations involved with the Project have been made aware of the proposed alterations.

In addition, Alamos has ongoing engagement with Marcel Colomb First Nation – specifically through additional subcommittees (in relation to the signing of the Impacts Benefits Agreement in summer 2023), which were formed for full integration of Traditional Knowledge throughout all of Alamos' work within Marcel Colomb First Nation's Community Interest Zone.

More recently and similarly, Alamos has signed an Impacts Benefit Agreement with Mathias Colomb Cree Nation in winter 2025. Sub-committees are being developed but engagement has been ongoing through the EAC and Nation specific engagement efforts.

No formal public engagement is planned beyond the placement of the NOA/NOC on the respective MECC and IAAC public registries for public review and comment as required.

1.7 Funding

Alamos will provide funding for the subject works described in this NOA/NOC.

2 Alteration Description

2.1 Purpose and Rationale

The purpose of the proposed alteration is to encompass the modifications to the approved MacLellan site, inclusive of the adjustment of footprints of several of the Project components and the addition of several new Project components in comparison with the description of the MacLellan site originally included in the EIS (Stantec 2020a) and the EAP Report (Stantec 2020b).

2.2 Existing Conditions

The existing conditions at the MacLellan site remain as originally described in the EIS (Stantec 2020a) prepared for the Project (i.e., Gordon and MacLellan sites) and the EAP Report prepared for the approved MacLellan site (Stantec 2020b).

2.3 Proposed Alteration

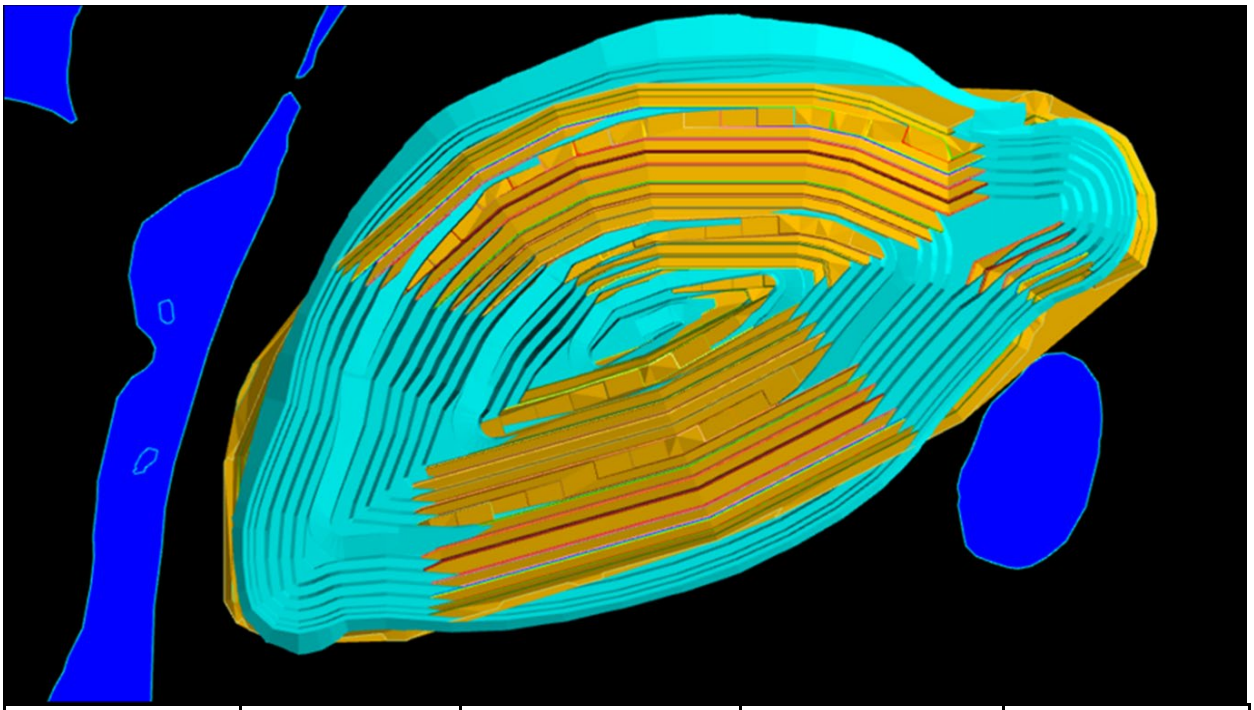
The presently licensed MacLellan site is presented in Map 3, Appendix A. Since the EIS (Stantec 2020a) and the EAP Report (Stantec 2020b) were developed, the:

- Overall mined tonnage has increased, largely due to a lower cut-off grade and altered open pit dimensions, but also due to the addition of a new satellite pit (Figure 2.1).
- The overall mine life of the Project has been adjusted (in relation to the first bullet above) to 17 years for the MacLellan site. This continues to include 3 years of construction and 11 years of mining operation, but now also includes an additional 6 years of continued production (mill operation only). Closure follows with progressive remediation during the production-only years, and active and post-closure thereafter. Closure will be in accordance with the approved Closure Plan for the MacLellan site (Stantec 2025).
- Footprints of several of the Project components have been adjusted or refined during detailed engineering design, including the MRSA, the TMF and TMF pond, the overburden stockpile, topsoil stockpile, worker camp, OEM platform, temporary crushing area, OSA, explosives mixing plant, process plant, construction laydown areas, access road, and water management structures (i.e., sumps, collection pond, sewage treatment plant).

The adjusted site layout is shown in Map 2, Appendix A. Table 2.1 lists the proposed alterations to the footprint layout (in comparison with that presented in the EIS [Stantec 2020a]) for the MacLellan site.

An update of the light assessment for the Project based on the adjusted site layout is presented in the Summary of Light Modelling Results for the Lynn Lake Gold Project Revised 2023 Mine Design (Appendix B).

Figure 2.1 Block model screenshot showing the NOA/NOC design (in cyan) relative to the EIS design (in orange) with dimension differences



Feature	Surface Area (m^2)	Approximate Length (m)	Approximate Width (m)	Maximum Depth (masl)
Open Pit - NOA/NOC design	713,764	1,350	750	-60
Open Pit – EIS design	660,526	1,390	650	-90

As shown above, the NOA/NOC design is longer and wider than the EIS design. The EIS design was deeper due to a more aggressive overall slope angle and because there was a smaller distance being maintained between the EIS pit limits and the neighbouring waterbodies (e.g., 65m away from the Keewatin at its closest point, and only 12m away from the East Pond at its closest point). The NOA/NOC design has a more gradual overall slope angle and is 90m away from the Keewatin at its closest point, and 36m away from the East Pond at its closest point.

Table 2.1 MacLellan Site Feature Footprint Layout Changes

Mine Feature	EIS Footprint Layout Area (ha)	Proposed Footprint Layout Area (ha)
Borrow Pit (removed during detailed design)	3.84	n/a
Worker Camp (additional surrounding area added to allow for fire break and potential future recreational area)	3.28	4.15
Explosives Magazine (moved with satellite pit addition to maintain appropriate distance from blasting)	0.09	0.09
Explosives Mixing Plant (moved with satellite pit addition to maintain appropriate distance from blasting)	1.0	0.81
OEM Platform/OEM Platform 1 & 2 (enlarged during detailed design)	2.49	3.19
Open Pit (enlarged during detailed design to access additional resources)	66.05	71.38
Satellite Pit* (added during detailed design to access additional resources)	n/a	4.58
Crushed Rockfill Storage (removed)	1.96	n/a
Temporary Crushing Area/Facilities (reduced during detailed design)	2.86	1.73
Processing Plant (enlarged during detailed design)	5.85	16.47
Sewage Treatment Plant (STP) (previously described but now sited)	n/a	0.15
Stormwater Pond (modified by detailed design – see Collection Pond)	0.55	n/a
Collection Pond (modified by detailed design)	1.82	8.97
Sump (modified by detailed design – see Sump 1 and 2)	1.67	n/a
Sump 1 (modified by detailed design)	n/a	4.01
Sump 2 (modified by detailed design)	n/a	0.33
Tailings Dump Pond (removed)	0.13	n/a
TMF (adjusted during detailed design)	53.69	221.80
TMF Pond (adjusted during detailed design)	183.22	26.88
MRSA (modified by detailed design)	339.44	279.41
Overburden Stockpile (modified by detailed design)	18.18	24.24
OSA (modified by detailed design)	8.67	9.05
1 Day Emergency Stockpile (removed)	0.98	n/a
NAG Stockpile* (added during detailed design)	n/a	15.35
Topsoil Stockpile (modified during detailed design)	5.04	4.91
Construction Laydown Areas* (adjustments made during detailed design)	0.32	8.93
Construction Temporary Facilities (removed during detailed design – replaced by additional laydown areas)	0.33	n/a
Freshwater Pumping Station (adjusted during detailed design)	0.02	0.07
Access road (widened during detailed design to properly allow for power distribution line right-of-way)	27.3	37.01

Note:
* new feature within revised PDA; n/a – not applicable; ha = hectares

In accordance with the EIS (Stantec 2020a) and the EAP Report (Stantec 2020b), the PDA encompasses the immediate area in which Project activities and components occur plus a buffer (between 30 and 50 m depending on the area) and is the anticipated area of direct physical disturbance associated with the construction and operation of the Project. The Project activities footprint and PDA for both the proposed layout and the existing layout are presented in Table 2.2. The MacLellan site access road is included in the PDA totals.

Table 2.2 MacLellan Site Project Development Area Changes

Scenario	Area (ha)
EIS Layout Footprint	701.5
EIS PDA	937.9
Proposed Layout Footprint	703.4
Proposed PDA	914.8

As previously noted, construction of the MacLellan site in relation to *Environment Act* Licence No. 3391 and the federal Decision Statement started on February 3, 2025. This construction has commenced within the boundaries of the EIS-approved PDA and in accordance with Project approval terms and conditions.

With approval of this NOA/NOC, the Project components will be constructed, operated, and closed as described in the EIS (Stantec 2020a), but in the reconfigured mine layout (see Map 2, Appendix A). This will occur to the adjusted schedule but in continued accordance with the current Project approval requirements, already-committed mitigation measures, and developed Management and Monitoring Plans (Version 0 finalized and shared in January 2025), which include detailed Adaptive Management approaches (as required).

2.4 Alteration Schedule

The proposed schedule for the alteration described in this NOA/NOC aligns with the Project phases described in Section 1.5.1.2. As noted, the MacLellan mine life is extended from that presented in the EIS (Stantec 2020a) on account of the increased mine tonnage.

3 Environmental Effects and Mitigation

3.1 Potential Interactions and Valued Components

Biophysical and socio-economic VCs that could be affected by the Project were defined in the EIS prepared for the Project (i.e., Gordon and MacLellan sites) (Stantec 2020a). The rationale for selecting each VC and potential general interactions between the Project and the VCs remain as originally described in the EIS and the EAP Report for the approved MacLellan site (Stantec 2020b).

The VCs identified in Table 1.1 were assessed as part of the EIS and EAP Report (Stantec 2020a and 2020b) and are re-assessed as part of this NOA/NOC because of the increased mine tonnage, mine life extension, and adjusted or refined components. The Project activities and components that are proposed to be altered as part of this NOA/NOC that may interact with the VCs are identified in the respective VC sections.

3.2 Residual Effects Criteria

Terms used to characterize the residual environmental effects are summarized in Table 3.1.

Table 3.1 Definition of Terms Used to Characterize Residual Environmental Effects

Characterization	Description	Quantitative Measure or Qualitative Categories
Direction	The long-term trend of the residual effect	**Positive**— an improvement in the VC compared with existing conditions and trends **Adverse**— a decline in the VC compared with existing conditions and trends **Neutral**— no change in the VC from existing conditions and trends
Magnitude	The amount of change in the VC relative to existing conditions	**Negligible**— no measurable change **Low**— a change that falls within the level of natural variability **Moderate**— a measurable change which is unlikely to affect the VC **High**— a measurable change which is likely to affect the VC
Geographic Extent	The geographic area in which an environmental effect occurs	**PDA**— residual effects are restricted to the PDA **LAA**— residual effects extend into the LAA **RAA**— residual effects extend to other adjacent areas of the property into the RAA
Frequency	When the residual effect occurs and how often	**Single event**— residual effect occurs once throughout the life of the dewatering work **Multiple irregular event**— residual effect occurs sporadically and intermittently (no set schedule) throughout **Multiple regular event**— residual effect occurs repeatedly and regularly throughout **Continuous**— residual effect occurs continuously throughout the life of the dewatering work

Characterization	Description	Quantitative Measure or Qualitative Categories
Duration	The period of time required until VC returns to existing condition, or the effect can no longer be measured or otherwise perceived	**Short-term**— residual effect restricted to a duration of 2 weeks **Medium-term**— residual effect extends to 1 year **Long-term**— residual effect extends for longer than 1 year
Reversibility	Whether the VC can return to existing condition after the proposed alteration activity ceases	**Reversible**— the effect is likely to be reversed after activity completion and decommissioning **Irreversible**— the effect is unlikely to be reversed even after decommissioning
Ecological and Socio-economic Context	Existing condition and trends in the area where environmental 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

3.3 Assessment of Environmental Effects

This section presents the assessment of environment effects for the VCs identified in Table 1.1 as having potential interactions with the proposed alterations. This assessment is based on the EIS (Stantec 2020a) prepared for the Project (i.e., Gordon and MacLellan sites) and the EAP Report for the approved MacLellan site (Stantec 2020b).

3.3.1 Atmospheric Environment

The atmospheric environment includes air quality and greenhouse gases (GHGs). As outlined in Appendix C, the Project activities and components that are proposed to be altered that may interact with the atmospheric environment and were therefore assessed as part of this NOA/NOC, include but are not limited to the PDA layout, processing plant and TMF, general infrastructure, major equipment list, and mine production capacity.

3.3.1.1 Regulatory and Guideline Setting

3.3.1.1.1 Guideline Criteria

The applicable regulatory criteria for air quality include the Manitoba Ambient Air Quality Criteria (AAQC; Manitoba Sustainable Development, now MECC (MSD2005]), Ontario's Ambient Air Quality Criteria (OMECP 2012) in the absence of Manitoba AAQC for specific substances of interest, and the Canadian Ambient Air Quality Standards (CAAQS, Canadian Council of Ministers of the Environment [CCME] 2017). These are provided in Table 3.2. The Manitoba AAQC include two concentration levels: Maximum Acceptable Level Concentrations and Maximum Desirable Level Concentrations. The more stringent Maximum Desirable Levels are used in the air quality assessment. In the absence of specific Manitoba AAQC for dustfall, the Ontario 30-day and annual average AAQC were used.

The CAAQS were developed as part of the Air Quality Management System (CCME 2012a) with the objective of driving continuous improvement of air quality in Canada. The CCME describes the process for selecting monitoring stations, measuring pollutant concentrations, and determining achievement of the CAAQS (CCME 2019; CCME 2012b). Determining achievement of the CAAQS is based upon the measured air quality concentrations at community monitoring stations with comparison with the CAAQS and assigning air quality status to one of four management levels (CCME 2019; CCME 2012b). The four air quality management levels require progressively more rigorous actions by jurisdictions as air quality approaches or exceeds the CAAQS, thereby allowing proactive management actions to be undertaken to reduce emissions and avoid exceedances of the CAAQS (CCME 2019).

The CCME guidance on determining achievement of the CAAQS (CCME 2019) states that:

“CAAQS were not developed as facility level regulatory standards. Rather, they are used by provinces and territories to guide air zone management actions intended to reduce ambient concentrations below the CAAQS and prevent CAAQS exceedances.”

In this context, predicted ambient concentrations due to the Project are compared with the CAAQS for information purposes and do not imply compliance with the AAQC at the “Project Boundary.”

Table 3.2 Applicable Guideline Criteria for Air Quality

Substance	Averaging Period	Manitoba Ambient Air Quality Criteria [a] (µg/m³)		Ontario Ambient Air Quality Criteria [b] (µg/m³)	2025 Canadian Ambient Air Quality Standards [c] (µg/m³)
		Maximum Acceptable Level Concentration	Maximum Desirable Level Concentration		
Gaseous Criteria Air Contaminants (CAC)					
NO_2	1-hour	**400**	—	400	**79 (42 ppb) [d]**
	24-hour	**200**	—	200	—
	Annual	100	**60**	—	**23 (12 ppb) [e]**
CO	1-hour	35,000	**15,000**	36,200	—
	8-hour	15,000	**6,000**	15,700	—
SO_2	1-hour	900	**450**	690	**170 (65 ppb) [f]**
	24-hour	300	**150**	275	—
	Annual	60	**30**	55	**10 (4.0 ppb) [g]**
Other Gaseous Species					
HCN	1-hour	**40**	—	—	—
	24-hour	—	—	**8**	—
	Annual	**3**	—	—	—

Substance	Averaging Period	Manitoba Ambient Air Quality Criteria [a] (µg/m³)		Ontario Ambient Air Quality Criteria [b] (µg/m³)	2025 Canadian Ambient Air Quality Standards [c] (µg/m³)
		Maximum Acceptable Level Concentration	Maximum Desirable Level Concentration		
Particulate Matter CAC					
TSP	24-hour	**120**	—	120	—
	Annual	70 [h]	**60** [h]	60 [h]	—
PM_{10}	24-hour	**50**	—	50	—
$PM_{2.5}$	24-hour	30	—	30	**27** [i]
	Annual	—	—	—	**8.8** [j]
Dustfall	30-day	—	—	**7 g/m²**	—
	Annual	—	—	**4.6 g/m²** [h]	—
Metals					
Arsenic	24-hour	**0.3**	—	0.3	—
Cadmium	24-hour	**2**	—	0.025	—
	Annual	—	—	0.005	—
Copper	24-hour	**50**	—	50	—
Lead	24-hour	**2**	—	0.5	—
	30-day	**0.7**	—	0.2	—
Nickel	24-hour	**2**	—	0.2	—
	Annual	—	—	0.04	—
Zinc	24-hour	**120**	—	120	—

NOTES:

[a] Manitoba Ambient Air Quality Criteria (MSD 2005)

[b] Ontario Ambient Air Quality Criteria (OMECP 2012)

[c] Canadian Ambient Air Quality Standards (CCME 2017)

[d] The 1-hour CAAQS for NO_2 is referenced to the three-year average of the annual 98th percentile of the NO_2 daily maximum 1- hour average concentrations (effective 2025) (CCME 2017).

[e] The annual CAAQS for NO_2 is referenced to the arithmetic average over a single calendar year of all 1-hour average NO_2 concentrations (effective 2025) (CCME 2017).

[f] The 1-hour CAAQS for SO_2 is referenced to the three-year average of the annual 99th percentile of the SO_2 daily maximum 1- hour average concentrations (effective 2025) (CCME 2017).

[g] The annual CAAQS for SO_2 is referenced to the arithmetic average over a single calendar year of all 1-hour average SO_2 concentrations (effective 2025) (CCME 2017).

[h] Annual geometric mean

[i] The CAAQS for 24-hour $PM_{2.5}$ is referenced to the annual 98th percentile of daily 24-hour average concentrations, averaged over three years (effective 2020) (CCME 2017).

[j] The CAAQS for annual $PM_{2.5}$ is referenced to the three-year mean of annual average concentrations (effective 2020) (CCME 2017).

"—" not available

Values in **BOLD** text represent the ambient air quality criteria that are used for the EIS and EAP Report (Stantec 2020a and 2020b)

ppb = parts per billion; µg/m³ = microgram per cubic metre

3.3.1.1.2 IAAC Decision Statement

As per the IAAC Decision Statement, Alamos is required to adhere to the following conditions with respect to the air quality:

> *6.1 The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, measures to mitigate emissions of dust and fugitive particulates within the Project development areas, taking into account the standards and criteria set out in the Canadian Council of Ministers of the Environment's Canadian Ambient Air Quality Standards and Manitoba's Ambient Air Quality Criteria. The Proponent shall implement these measures from construction through decommissioning. In doing so, the Proponent shall:*
>
> > *6.1.1 apply dust suppressants, including water, that do not contain chemicals and have the least potential for adverse environmental effects, on haul and access roads during periods when dust generation is expected or occurring, including periods of drought and high winds;*
> >
> > *6.1.2 locate all stationary machinery and equipment used for processing ore indoors, where technically and economically feasible, including the crushing plant and conveyors feeding into the ore milling and processing plant;*
> >
> > *6.1.3 ensure all equipment and vehicles used, including equipment and vehicles operated by third-party contractors, are serviced and maintained in accordance with the manufacturer's maintenance guidelines to meet or exceed applicable emission standards, including Tier 4 emission standards for off-road equipment with off-road diesel engines, pursuant to the Off-Road Compression-Ignition (Mobile and Stationary) and Large Spark-Ignition Engine Emission Regulations and Off-Road Compression-Ignition Engine Emission Regulations;*
> >
> > *6.1.4 develop and implement policies to reduce the fuel consumption of equipment and vehicles operating in the Project development areas, including no-idling and limited cold start policies; and*
> >
> > *6.1.5 establish speed limits on the roads located in the Project development areas, taking into account the recommended speed limits in Environment and Climate Change Canada's Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities and by requiring and ensuring that speed limits are respected, including by installing signs indicating speed limits.*

3.3.1.2 Environmental Effects

The dispersion modelling methodology used to assess the potential effects of the 2023 design changes on air quality is identical to the methodology used in the EIS (Stantec 2020a). The details of CALPUFF model setup, CALMET meteorological data, receptor grid, nitric oxide (NO) to nitrogen dioxide (NO_2) conversion, and particulate matter deposition can be found in the Air Quality TMR, Volume 5 Appendix A in the EIS (Stantec 2020a).

The model predicted 1-hour and 8-hour average concentrations are based on the maximum hourly emission rates. The model predicted 24-hour, monthly and average concentrations are based on the daily average emission rates that consider the actual operating hours per day for each mining activity. Baseline concentrations are added to the model predicted maximum concentrations to account for other existing emission sources (natural and anthropogenic) that are not directly included in the model simulation. The model predicted maximum concentrations with the baseline contribution are compared with the Manitoba AAQC and the CAAQS. The CAAQS are reference values for regional air quality management and are applicable to measured ambient concentrations at human receptor locations away from the industrial facility boundaries. The maximum predicted concentrations in the LAA are compared with the CAAQS in this context and do not imply compliance with the AAQC at the Project Boundary. The maximum predicted concentrations are based on areas along and outside the new adjusted Project Boundary (i.e., locations where public access is not restricted). The predicted maximum concentrations and dustfall for the MacLellan site are presented in the Summary of Air Dispersion Model Results for the Lynn Lake Gold Project Revised 2023 Mine Design memo (Appendix C).

3.3.1.2.1 Maximum NO_2 Concentrations

The maximum predicted 1-hour NO_2 concentration, 435 micrograms per cubic metre (µg/m³), is greater than the Manitoba AAQC (400 µg/m³). The maximum predicted 24-hour and annual NO_2 concentrations are 72.9 and 7.91 µg/m³, respectively and are less than the Manitoba AAQC and the annual CAAQS. The maximum predicted 1-hour average NO_2 concentration in the metric of the CAAQS (186 µg/m³) is greater than the 1-hour CAAQS (79 µg/m³). The maximum predicted NO_2 concentrations at HH receptors for all averaging periods are less than the Manitoba AAQC. The maximum predicted NO_2 concentrations are greater than the 1-hour CAAQS at six HH receptors (receptors ID 82, 85, 86, 117, 123, and 156 in EIS technical modelling report (TMR) Appendix E Table E-2 (Stantec 2020a).

The maximum predicted 1-hour NO_2 concentration, 435 µg/m³, is 8% greater than maximum predicted value in the EIS TMR (Stantec 2020a) and the maximum frequency of exceedance stays the same at 1 hour per year (h/y). The maximum predicted 1-hour CAAQS NO_2 concentration is 27% greater than maximum predicted value in the EIS TMR (Stantec 2020a) and the maximum frequency of exceedance decreases from 79 days per year (d/y) to 70 d/y.

3.3.1.2.2 Maximum CO Concentrations

The maximum predicted 1-hour carbon monoxide (CO) concentration is 15,406 µg/m³ and is 3% greater than the Manitoba AAQC. The maximum predicted 8-hour CO concentration is 4,567 µg/m³. The predicted concentrations are 10 to 16% higher than the than maximum predicted values in EIS TMR (Stantec 2020a).

3.3.1.2.3 Maximum SO_2 Concentrations

The maximum predicted 1-hour, 24-hour, and annual sulphur dioxide (SO_2) concentration are 437, 44.6, and 2.18 µg/m³, respectively, and are less than the Manitoba AAQC and annual CAAQS. The maximum predicted 1-hour average SO_2 concentration in the metric of the CAAQS (256 µg/m³) is greater than the 1-hour CAAQS (170 µg/m³). The maximum predicted SO_2 concentrations at HH receptors for all averaging periods are less than the Manitoba AAQC and CAAQS.

The maximum predicted 1-hour SO_2 CAAQS concentration, 256 µg/m³, is 74% greater than maximum predicted value in the EIS TMR (Stantec 2020a) and the maximum frequency of exceedance increases from 0 d/y to 3 d/y. The increase is attributable to an increase in the blasting frequency and the amount of explosives used per blast associated with the 2023 design.

3.3.1.2.4 Maximum HCN Concentrations

The maximum predicted 1-hour, 24-hour, and annual hydrogen cyanide (HCN) concentrations are 17.6, 6.79, and 0.553 µg/m³, respectively, and are less than the Manitoba AAQC and the 24-hour Ontario AAQC. The maximum predicted HCN concentrations at HH receptors for all averaging periods are less than the ambient criteria.

3.3.1.2.5 Maximum TSP Concentrations

The maximum predicted 24-hour total suspended particulate (TSP) concentration, 437 µg/m³, is greater than the Manitoba AAQC (120 µg/m³). The maximum predicted annual TSP concentration, 14.1 µg/m³, is less than the Manitoba AAQC. The maximum predicted TSP concentrations are greater than the Manitoba 24-hour AAQC at three HH receptors (receptors ID 85, 86, and 117 in EIS TMR Appendix E Table E-2 (Stantec 2020a).

The maximum predicted TSP concentrations are 1% to 15% less than the maximum predicted TSP concentrations EIS TMR (Stantec 2020a). The maximum frequency of exceedance decreases from 64 d/y to 50 d/y.

3.3.1.2.6 Maximum PM_{10} Concentrations

The maximum predicted 24-hour particulate matter less than 10 microns (PM_{10}) concentration, 247 µg/m³, is greater than the Manitoba AAQC (50 µg/m³). The maximum predicted PM_{10} concentrations are greater than the Manitoba 24-hour AAQC at six HH receptors (receptors ID 82, 85, 86, 117, 123, and 156 in EIS TMR Appendix E Table E-2 (Stantec 2020a).

The maximum predicted PM_{10} concentration is 21% less than the maximum predicted PM_{10} concentrations in the EIS TMR (Stantec 2020a). The maximum frequency of exceedance decreases from 89 d/y to 70 d/y.

3.3.1.2.7 Maximum $PM_{2.5}$ Concentrations

The maximum predicted 24-hour and annual particulate matter less than 2.5 microns ($PM_{2.5}$) concentrations are 18.6 µg/m³ and 5.57 µg/m³, respectively, and are less than the CAAQS. The maximum predicted $PM_{2.5}$ concentrations at HH receptors for all averaging periods are less than the CAAQS.

The maximum predicted $PM_{2.5}$ concentrations are 11% to 23% less than the maximum predicted $PM_{2.5}$ concentrations in the EIS TMR (Stantec 2020a).

3.3.1.2.8 Maximum Dustfall

The maximum predicted 30-day and annual average dustfall are 5.57 grams per square metre (g/m²)/30-day and 3.95 g/m²/30-day and are less than the Ontario AAQC. The maximum predicted 30-day and annual average dustfall at HH receptors are less than the dustfall criteria.

The maximum predicted dustfall values are 1% to 3% greater than the maximum predicted dustfall concentrations in the EIS TMR (Stantec 2020a).

3.3.1.3 Summary of Mitigation Measures

Mitigation measures will be implemented to manage and reduce Project emissions during construction and operation as described in the EIS (Stantec 2020a). As described in the developed Air Quality Management and Monitoring Plan (Version 0, January 2025), ambient air quality and meteorology monitoring will be implemented to provide an understanding of meteorological conditions and off-site ambient concentrations, and to determine the need for additional mitigation. The air quality monitoring program will include continuous meteorological monitoring (wind speed and wind direction), continuous (real time) monitoring of particulate matter (TSP, PM_{10}, $PM_{2.5}$) and dustfall monitoring. Based on the current wind conditions and measured ambient concentration levels, appropriate and effective mitigation options will be implemented to reduce Project emissions. This emissions mitigation management is referred to as “adaptive management”.

Mitigation measures to reduce air and GHG emissions that were incorporated in the Project design are described in the Air Quality Management and Monitoring Plan and Greenhouse Gas Management Plan (both Version 0, January 2025). Emission mitigation measures during Project construction and operation

are based on standard BMPs for the reduction of air emissions from construction activities (Environment and Climate Change Canada [ECCC] 2005) and mining activities (Centre for Excellence in Mining Innovation [CEMI] 2010). These are described in detail in the plans. Additional mitigation measures will be implemented on an if and as-required basis as discussed in the adaptive management aspects of the plans.

3.3.1.4 Residual Effects

Compared with the results in the EIS, the air quality effects from the Project activities marginally increased at some receptors. When there is an increase in the model predicted concentrations, the associated increase in the frequency of exceedance is low. In conclusion, the results of the updated air quality assessment (Appendix C) do not change the characterization of residual effects, or the significance ratings summarized as presented in the EIS (Stantec 2020a).

Consistent with the EIS, after applying the mitigation measures, the residual air quality effects at the receptors during the operation phase are adverse, low to high magnitude, confined to the LAA geographic area, medium-term duration, irregular and reversible.

3.3.2 Noise and Vibration

Noise and vibration resulting from the Project have the potential to affect human health and well-being, land and resource use, wildlife and wildlife habitat, and fish and fish habitat (Stantec 2020a). As outlined in Appendix D, the Project activities and components that are proposed to be altered that may interact with the noise and vibration VC and were therefore assessed as part of this NOA/NOC, include but are not limited to the PDA layout, processing plant and TMF, general infrastructure, major equipment list, and mine production capacity.

3.3.2.1 Regulatory and Guideline Setting

3.3.2.1.1 Guideline Criteria

Noise

The Province of Manitoba Guidelines for Sound Pollution (Province of Manitoba n.d.) provides environmental sound level objectives for the assessment of noise in the outdoor environment. The highest desirable level for residential areas is 55 A-weighted decibels (dBA) during the daytime (7:00 AM to 10:00 PM) and 45 dBA during the nighttime (defined as 10:00 PM to 7:00 AM).

Federally, Health Canada's Guidance for Evaluation Human Health Effects in Impact Assessment: Noise (Health Canada Noise Guidance 2023e) provides noise targets for annoyance, sleep disturbance, and low-frequency noise effects. Health Canada's approach to noise assessment is based on several international standards and technical publications. This document and the technical standards and publications that it references can be used as guidance for noise assessments.

The Health Canada Noise Guidance uses daytime or nighttime equivalent sound levels (L_d and L_n, respectively), adjusted day-night average sound levels (L_{dn}), and percent highly annoyed (%HA) to quantify noise effects for activities with a duration of more than 12 months. The daytime sound level (L_d) is a 15-hour time average over the daytime period from 7:00 AM to 10:00 PM. The nighttime sound level (L_n) is a 9-hour time average over the nighttime period from 10:00 PM to 7:00 AM. The adjusted day-night average sound level (L_{dn}) is a 24-hour time-averaged L_{eq}, with a 10-decibel (dB) penalty applied to nighttime hours and adjustments made for certain characteristics of sound such as tonality or impulsiveness.

Based on Health Canada Noise Guidance, the noise target for the highest change in %HA is 6.5%. Impulsive and tonal characteristics of source noise are accounted for in the %HA calculations because their presence can increase annoyance. If the change in %HA is exceeded, effects are considered to be of concern and may require mitigation.

For activities with a duration of less than 12 months, Health Canada Noise Guidance considers the mitigation noise level (MNL) to assess noise effects. The MNL was used as a target for reducing noise annoyance effects related to short-term construction activities such as pile driving. If the noise effects from the activities exceed the MNL, the implementation of mitigation measures is recommended to reduce the effect. The MNL of 47 dBA (L_{dn}) for a quiet suburban or rural community is applicable.

Target for sleep disturbance as being an indoor sound level of no more than 30 dBA L_{eq} for continuous noise during the sleep period. Health Canada Noise Guidance recommends that an outdoor-to-indoor transmission loss with windows at least partially open is 15 dBA and fully closed windows are assumed to reduce outdoor sound levels by approximately 27 dBA. The corresponding outdoor sound level targets for sleep disturbance is 45 dBA and 57 dBA for partially open windows and fully closed windows, respectively. More recently, the World Health Organization (WHO 2009) has published nighttime noise guidelines that are intended to protect the public, including the most vulnerable groups, from adverse health effects associated with sleep disturbance due to nighttime noise. The recommended annual average is 40 dBA L_n to be considered outdoors.

Sounds with strong low frequency noise (LFN) content may result in noise-induced rattles within buildings, resulting in greater annoyance. Health Canada Noise Guidance recommends that the energy sum of the linear sound levels in the 16, 31.5 and 63-Hertz (Hz) octave bands not exceed 70 dBL.

Vibration

Manitoba does not have provincial guidelines for vibration. Provincially, the Ontario Ministry of Environment, Conservation, and Parks (OMECP) provides guidance on blast-related vibration which is referenced herein in absence of Manitoba guidance. The OMECP Guidelines on Information Required for the Assessment of Blasting Noise and Vibration (OMECP 1985) guidance recommends the following vibration targets:

- Standard targets - ground vibration of 12.5 millimetre per second (mm/s) and air overpressure of 128 dBL.
- Cautionary targets - ground vibration of 10 mm/s and air overpressure of 120 dBL.

The cautionary targets of 10 mm/s and 120 dBL are the most conservative blast-related vibration targets in this assessment. These targets will be applied to all receptors outside the PDA.

Federally, Health Canada Noise Guidance only provides threshold for air overpressure effect. The guidance recommends that little or no public annoyance is expected to result from any number of daytime sonic booms per day if their measured or predicted peak value is below 125-10 logN (dBL) where N is number of blasts per day. For one blast per day, the limit is 125 dBL. At receptors inside the PDA, such as the worker camp, the Health Canada overpressure target of 125 dBL will be used.

For non-blast-related construction activities, there is no Manitoba or federal construction vibration guidance available for remote locations or smaller population centers. As published codes and guidance for non-blast-related vibration levels are limited, the United State Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (FTA 2018) is referenced for the ground-borne vibration target.

Structural damage targets for ground-borne vibration are expressed in terms of Peak Particle Velocity levels in inch per second (in/s) or mm/s. The structural damage target at a residential building due to ground-borne vibration effect is the Peak Particle Velocity of 0.2 in/s or 5 mm/s for non-engineered timber and masonry buildings. The human annoyance target for frequent ground-borne vibration is 72 VdB (Vibration Velocity in Decibel Scale). Annoyance target for ground-borne vibration is expressed in terms of root mean square (rms) velocity levels in VdB.

3.3.2.1.2 IAAC Decision Statement

As per the IAAC Decision Statement, Alamos is required to adhere to the following conditions with respect to noise and vibration:

> *6.2 The Proponent shall implement measures, during all phases of the Designated Project, to avoid exceedances of the thresholds for noise and vibration, identified in Health Canada's Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise at sensitive receptors identified in the human health and ecological risk assessment in Volume 5 of the Environmental Impact Statement. In doing so, the Proponent shall: develop, prior to construction, a protocol for receiving and addressing feedback related to the exposure to noise and vibration generated by the Designated Project. The Proponent shall provide the protocol to the Agency and Indigenous groups prior to construction, and make the protocol publicly available online. As part of the protocol, the Proponent shall:*
>
> > *6.2.1.1 identify how a person may provide feedback, how the Proponent will handle the feedback received, including ranking and responding to feedback received according to the anticipated level of impacts, and how the Proponent may implement modified or additional mitigation measures(s) and/or follow-up requirement(s) in response to the feedback received;*
> >
> > *6.2.1.2 record any feedback received as soon as feasible, no later than 48 hours after receiving the feedback; and*

6.2.1.3 implement, as soon as technically feasible, any modified or additional mitigation measure and/or follow-up requirement that the Proponent deems necessary to respond to the feedback received.

6.5 The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and determine the effectiveness of mitigation measures as it pertains to noise and vibration from the Designated Project on the health of Indigenous peoples. The Proponent shall implement the follow-up program during all phases of the Designated Project. As part of the follow-up program, the Proponent shall:

6.5.1 monitor noise and vibration levels at receptors identified in Volume 1 Chapter 7 Tables 7-7 to 7-10 of the Environmental Impact Statement, and at any other human receptors identified in consultation with Indigenous groups.

3.3.2.2 Environmental Effects

3.3.2.2.1 Noise

During construction, noise emission from activities such as site preparation, utility and infrastructure development, and processing facility construction will result in a change in noise levels. During operation, noise emitted from the processing facility and mobile equipment (e.g., haul trucks) will result in a change in noise levels. In the decommissioning/closure phase, noise emissions from excavation and reclamation activities will result in a change in noise levels.

The assessment considered noise effects during construction phase and operation. The time period from Q1 Year -2 to Q4 Year -1 was chosen for the construction phase at the MacLellan site because it represents a worst-case scenario of equipment usage during activities such as bulk earth work. Year 5 of the MacLellan site operation was chosen because it represented the production year with the highest mining rate. The operation scenario includes noise emissions from the MacLellan site during the worst-case years.

Details on methods and results are presented in the Lynn Lake Gold Project – Noise and Vibration Impact Assessment Update memo (Appendix D).

During the construction phase the predicted Project L_d and L_n sound levels at all residential receptors near MacLellan site are below the Manitoba noise guideline (i.e., Manitoba Guidelines for Sound Pollution) target of 55 dBA daytime and 45 dBA nighttime. During the operation phase the predicted Project L_d and L_n sound levels at all residential receptors near MacLellan site are below the Manitoba noise guideline target of 55 dBA daytime and 45 dBA nighttime.

For the construction and operation phases, change in %HA associated with the Project is compared with the threshold of 6.5%HA advised by Health Canada Noise Guidance. The change of %HA at a receptor is based on the difference between the baseline %HA and total (Project and Baseline) %HA.

At the MacLellan site, the changes in %HA at all receptors are below the 6.5% target for the construction phase. The changes in %HA associated with the Project operation phase at the MacLellan site are below the 6.5% target for the operation phase. The results indicate compliance with the Health Canada Noise Guidance.

As a target for the low frequency noise (LFN) issue, Health Canada Noise Guidance recommends that the energy sum of the linear sound levels in the 16, 31.5 and 63-Hz octave bands at a receptor location not exceed 70 dBL. Potential for LFN noise effect is low at receptors near the MacLellan site because the predicted sound level results are below the target of 70 dBL.

The outdoor nighttime annual sound level of 40 dBA was used as the sleep disturbance noise target for this updated assessment, based on the WHO Night Guidelines for Europe (WHO 2009). The L_n results indicate that the nighttime equivalent sound levels from the Project are below 40 dBA at all residential receptors. No noise-related sleep disturbances of residential receptors are expected from the Project construction and operation during the nighttime period.

It is assumed that a minimum of 30-dB noise reduction is expected for the worker camp building walls with the windows closed. Air conditioning units are recommended for the worker camp building such that exterior windows and doors can be closed during summer season. The WHO (1999) recommends a target for sleep disturbance as being an indoor sound level of no more than 30 dBA. The predicted daytime or nighttime sound level at the worker camp and 59.7 dBA outdoor during the operation phase.

The operation phase noise level inside the worker camp is predicted to be 29.7 dBA. The indoor level predicted is based on a building transmission loss of 30 dBA with the exterior windows and doors closed. Therefore, the predicted result during the operation phase is below the WHO 1999 indoor sound level target of 30 dBA. No noise-related sleep disturbances of workers are expected from the Project during the daytime and nighttime periods.

3.3.2.2.2 Vibration

In the construction phase, activities such as site preparation, utility and infrastructure development, and processing facility construction will result in a change in vibration levels. Project construction activities such as earthworks, piling, and drilling were considered to cause potential vibration effects. During the operation phase, blasting activities at the MacLellan site will result in ground-borne vibration and air overpressure. The vibration effects from ground vibration and air overpressure on human receptors were considered. In the decommissioning/closure phase, excavation and reclamation activities will result in a change in vibration levels.

During the construction phase, heavy equipment such as excavators, compactors, piling equipment, and haul trucks will be used. The ground-borne vibration effect due to high impact piling equipment, excavator, compactor, and large bulldozer were assessed at receptors closest to the construction activities. These pieces of equipment were selected in this assessment because they typically produce higher vibration levels than other construction equipment.

The greatest distance that will result in a structural damage vibration level target of 0.2 in/s or 5 mm/s (FTA 2018) is 29 m for impact pile driving, 8 m for a compactor or excavator, 4.5 m for a bulldozer, and 4.5 m for drilling. Vibration beyond these distances from the activities are not expected to cause structural damage.

This distance is expected to be less for other heavy equipment required for construction that have lower vibratory emissions. The closest receptor to potential construction activities at the MacLellan site is located at a distance more than 2 km (ID 85 and ID 86). These receptors are located at a sufficient distance such that structural damage due to construction equipment vibration is unlikely.

The greatest distance at which the vibration levels are above the human annoyance target of 72 VdB (FTA 2018) is 280 m for impact pile driving, 71 m for a compactor or excavator, 42 m for a bulldozer, and 42 m for drilling. This distance is expected to be less for other heavy equipment required for construction that have lower vibratory emissions. The closest receptors to potential construction activities at the MacLellan site are both located at more than 2 km. These receptors are located at sufficient distances such that annoyance due to construction equipment vibration is unlikely. The predicted vibration levels at the closest receptor for the MacLellan site is below the annoyance target of 72 VdB.

During the operation phase, the primary vibration effects are ground vibration and air overpressure due to blasting activities within the open pit at the MacLellan site. Given the same distance from a blast to the receptor, the primary factor affecting vibration is the explosive charge per delay. The highest explosive charge specification in the blast design is 230 kilograms (kg) per hole per delay for the MacLellan sites. However, the explosive charge could be reduced during operation due to site conditions.

The closest receptor ID 86 is approximately 2.4 km from the MacLellan site open pit. Receptor ID 86 is a potential First Nations' traditional land user.

The highest blast charge of 230 kg will result in ground-borne vibration below the vibration target of 10 mm/s at all receptors for the MacLellan site. The predicted air overpressures are below the vibration target of 120 dBL at all receptors, with the exception of the worker camp at the MacLellan site. The predicted air overpressure at this receptor is 127 dBL. This level is also above the Health Canada target of 125 dBL for one blast per day. To meet the Health Canada target of 125 dBL, the blast charge reduction to 85 kg per hole per delay is required. The reduced blast charge of 85 kg can be implemented initially to achieve the overpressure level of 125 dBL at the worker camp. Reduced blast charge of 85 kg can be increased if the distance between the blast and the worker camp is more than 750 m, and if monitoring results indicate an air overpressure level below 125 dBL at the worker camp.

The primary factor in the blasting plan that influences the air overpressure is the charge-weight per delay. Charge weight dictates the amount of energy release. Decreasing the charge-weight per delay will effectively reduce the overpressure effect. The blasting plan will consider distance to receptors and will size the charges to avoid exceeding regulatory targets at receptors.

Other mine-plan factors such as depth of burial, volume of displaced rock, delay time interval, and type of explosive will also affect the overpressure. A deeply buried or heavily confined charge will cause mostly ground vibration. Lightly confined blasts will transfer most blast energy to atmosphere. Blasts that displace a large volume of rock create high air overpressure with low frequency content.

Air overpressure monitoring can be conducted at nearby receptors during a blast event to confirm vibrations are below regulatory targets. With mitigation measures, the overpressures are predicted to meet the most conservative target of 120 dBL at all receptors outside the PDA and 125 dBL at the worker camp.

3.3.2.3 Summary of Mitigation Measures

3.3.2.3.1 Noise

The mitigation measures for noise are identical to the mitigation measures recommended in the EIS (Stantec 2020a) and described in the Noise and Vibration Management and Monitoring Plan (Version 0, January 2025).

The operational sound levels listed in the Noise and Vibration Impact Assessment EIS TMR (Volume 5, Appendix C, Stantec 2020a) and Memo of Lynn Lake Gold Project – Noise and Vibration Impact Assessment Update (Stantec 2024) are the estimated equipment sound power levels used in the acoustic modelling; it is assumed that these acoustical specifications are achievable by the suppliers. If the sound power level cannot be achieved, additional mitigation measures may be required. This will be addressed by the adaptive management framework described in the Noise and Vibration Management and Monitoring Plan (Version 0, January 2025).

3.3.2.3.2 Vibration

In an adaptive management approach, mitigation measures will be implemented as needed (with monitoring will help to confirm effectiveness) as described in the Noise and Vibration Management and Monitoring Plan and Blasting Management and Monitoring Plan (both Version 0, January 2025).

3.3.2.4 Residual Effects

The Noise and Vibration Impact Assessment Update memo summarizes the noise and vibration assessment results based on the Project 2023 design changes for the MacLellan site. The predicted results are different from the EIS results (Stantec 2020a). The Project 2023 design marginally increases both noise and vibration effects at some receptors in comparison with the EIS (Stantec 2020a). However, the assessment update results indicate that the Project will remain compliant with the applicable noise and vibration thresholds at all receptors. The Project residual environment effects characterization on noise and vibration remain the same as the 2020 assessment for the MacLellan site:

- Noise
  - After the application of mitigation, the residual noise effects at the receptors during the construction phase are adverse, low to moderate in magnitude, short-term, continuous, and reversible.
  - After the application of mitigation, the residual noise effects at the receptors during operation are adverse, low to moderate in magnitude, medium-term, continuous, and reversible.

- Vibration
  - The residual vibration effects at the receptors during the construction phase are adverse, negligible to low magnitude, short-term, regular event frequency, and reversible.
  - After applying the mitigation measures, the residual vibration effects at the receptors during the operation phase are adverse, negligible to moderate in magnitude, medium-term, regular event frequency, and reversible.

3.3.3 Groundwater

Groundwater includes domestic, commercial, and industrial groundwater-source water supplies, and the groundwater component of freshwater ecosystems, including stream flow, vegetation, and wetlands. The Project activities and components that are proposed to be altered that might interact with groundwater and were therefore assessed as part of this NOA/NOC, include: adjustment of the footprint of the MRSA, and open pit.

3.3.3.1 Regulatory and Guideline Setting

3.3.3.1.1 Federal

The assessment of potential Project-related effects on groundwater quantity and quality included consideration of the following federal legislation, policies, and guidelines:

- *The Fisheries Act* restricts or controls the deposit of deleterious substances into waters or locations frequented by fish unless authorized by regulation. The Metal and Diamond Mining Effluent Regulation (MDMER) define unionized ammonia, arsenic, copper, cyanide, lead, nickel, zinc, total suspended solids (TSS), and radium 226 as deleterious substances and Schedule 4 of the MDMER imposes limits on their concentrations in effluent at the final discharge point to the receiving body of water. The MDMER defines effluent as seepage containing any deleterious substances that flows over, through, or out of the site of the mine.
- The Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life (CWQG-FAL) which are used conservatively as screening criteria for areas where groundwater is anticipated to discharge to surface water.
- Federal Environmental Quality Guidelines (FEQG) are recommended chemical thresholds that identify the concentration below which there is a low likelihood of direct adverse effects from the chemical on aquatic life exposed via water or sediment, or where chemicals may bioaccumulate in wildlife that may consume aquatic life. FEQGs are developed by ECCC to support federal environmental quality monitoring, risk assessment and risk management activities on substances for which the CCME guidelines do not yet exist or are not reasonably expected to be updated in the near future. The FEQGs are used conservatively as a screening criteria for areas where groundwater is anticipated to discharge to surface water. Where the CWQG-FAL and the FEQGs differ, the more recent update for the given parameter is used.

- Guidelines for Canadian Drinking Water Quality which are based on current published scientific research related to health effects, aesthetic effects, and operational conditions of various parameters in drinking water.

3.3.3.1.2 Provincial

The assessment of potential Project-related effects on groundwater quantity and quality included consideration of the following provincial legislation, policies, and guidelines:

- *The Mines and Minerals Act* and Mine Closure Regulation under Part 14 of *The Mines and Minerals Act* sets out standards for mine closure.
- *The Environment Act* contains general provisions associated with Class 1, 2, and 3 developments that can be used to protect surface water and groundwater quality.
- *The Water Protection Act* is the principal statute governing water management and water quality in Manitoba. The Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOG) for use under Part 2 of *The Water Protection Act* sets out prescribed water quality standards for a number of activities, including drinking water, freshwater aquatic life, and common classes of discharge.

3.3.3.1.3 IAAC Decision Statement

As per the IAAC Decision Statement, Alamos is required to adhere to the following conditions with respect to groundwater:

> *3.7 The Proponent shall collect contact water and seepage from the Project development areas, including seepage and recharge from the tailings management facility, mine rock storage areas, overburden and ore stockpiles, and seepage input to groundwater that flows into the open pits, and tret it, as necessary, before releasing it into the receiving environment during all phases of the Designated Project to ensure that any deposits are made in accordance with the Metal and Diamond Mining Effluent Regulations and the pollution prevention provisions of the Fisheries Act. When treating contact water and seepage, the Proponent shall take into account Manitoba's Water Quality Standards, Objectives, and Guidelines, the Canadian Council of Ministers of the Environment's Canadian Water Quality Guidelines of the Protection for Aquatic Life, and Environment and Climate Change Canada's Federal Environmental Quality Guidelines.*
>
> *3.12 The Proponent shall develop, prior to construction and in consultation with Indigenous groups, Fisheries and Oceans Canada, Environment and Climate Change Canada and any other relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and determine the effectiveness of the mitigation measures as they pertain to adverse environmental effects of the Designated Project on water quality, taking into account Environment and Climate Change Canada's Metal Mine Technical Guidance for Environmental Effects*

Monitoring. The Proponent shall implement the follow-up program during all phases of the Designated Project. As part of the follow-up program, the Proponent shall:

3.12.3 monitor, beginning during construction, water quality in groundwater near the open pits, Farley Lake, Gordon Lake, the Keewatin River, the unnamed tributary of the Keewatin River, Minton Lake, the unnamed lakes northeast of Minton Lake, Payne Lake, Pump Lake, and Susan Lake, up and down gradient from the tailings management facility, mine rock storage areas, ore and overburden stockpiles, and seepage collection systems. Monitoring shall be conducted for all contaminants that may have adverse effects on fish and fish habitat, including antimony, arsenic, iron, sodium, sulphate, and uranium at the Gordon site and aluminum, antimony, arsenic, cobalt, total cyanide, iron, lead, nitrate, nitrite, sodium, and sulphate at the MacLellan site;

3.13 The Proponent shall develop, prior to construction and in consultation with Indigenous groups, Fisheries and Oceans Canada, Environment and Climate Change Canada and any other relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and determine the effectiveness of the mitigation measures as they pertain to adverse environmental effects of the Designated Project on water quantity. The Proponent shall implement the follow-up program during all phases of the Designated Project. As part of the follow-up program, the Proponent shall:

3.13.2 monitor, during all phases of the Designated Project, groundwater levels, gradients and hydraulic conductivity of all hydrogeological units, as identified in the groundwater model in Volume 5 Appendix F and G of the Environmental Impact Statement, with well depths ranging from near surface to a minimum of 115 meters below ground to characterize contaminant transport via groundwater at the depth of the groundwater model for the Designated Project. Monitoring wells shall be installed near the open pits, the tailings management facility, mine rock storage areas, ore and overburden stockpiles, and fish bearing wetlands within the local assessment areas that intersect the Project development areas; and

3.3.3.2 Environmental Effects

3.3.3.2.1 Groundwater Quantity

A groundwater model was constructed and used to predict the effects of the Project, as per the NOA/NOC mine plan, on groundwater quantity. Details of the modelling and model results are presented in Appendix E.

Construction

During construction, the Project activities and components that might interact with groundwater quantity and result in an environmental effect include site preparation, construction of mine components (TMF and MRSA), utilities and infrastructure, and dewatering of the open pit and satellite pit. As part of this NOA/NOC, there were no additional activities identified for the construction phase of the Project beyond that noted in the EIS.

The environmental effects resulting from site preparation and temporary dewatering for foundations and installation of infrastructure remain consistent with the EIS.

The predicted drawdown contours at the end of construction (pre-production period) are presented on Map 16, Appendix E. Dewatering of the open pit and satellite pit is anticipated to result in the drawdown of the water table up to 1 m within 500 m of the open pit and satellite pit. Additional drawdown is observed to extend about 500 m to the east of the MRSA and 300 m south of the MRSA due to the intersection of the seepage collection ditch with the water table and reduced recharge through the MRSA during construction compared with baseline conditions. Mounding of the water table (increase in the water table) associated with the TMF is generally limited to within the footprint of the TMF and reaches a predicted maximum of 12 m. The extent of drawdown and the resulting effects have slight variations compared with the EIS. The extent of drawdown of the water table due to open pit dewatering extends an additional 300 m compared with the EIS whereas the extent of mounding of the water table due to the TMF is smaller and limited to the TMF footprint in this model iteration compared with the EIS. Seepage collection ditching was not modelled in the EIS so effects of the seepage collection ditching on the groundwater table were not presented.

The corresponding changes in groundwater discharge to surface water features at the end of the construction period were predicted using the groundwater flow model and are presented in Table 3.3. The change in groundwater discharge to lakes and tributaries due to dewatering of the satellite pit and open pit at the end of construction are relatively small (less than 0.001 m^3/s for lakes and 0.002 m^3/s for tributaries) to negligible, except for East Pond. East Pond is located directly adjacent to the open pit and is predicted to be passively dewatered during the development of the MacLellan open pit. The direction of groundwater flow into (discharge) or out of (recharge) each watercourse and lake are predicted to remain consistent between baseline and construction. Groundwater discharge to Payne Lake is predicted to increase at the end of construction due to mounding of the water table in association with the TMF. The changes to baseflow rates for the Keewatin River (generally less than 0.1 m^3/s) and the Lynn River (less than 0.01 m^3/s) are very small (less than 2% change) in comparison with the anticipated baseflow in these streams under baseline conditions. The overall anticipated effect on flow rates in the surface water features is evaluated in the effects assessment for surface water (Section 3.3.4).

Operation

During operation, the Project activities and components that might interact with groundwater quantity and result in an environmental effect include open pit mining, storage/stockpiling of mine rock (MRSA), storage of tailings (TMF), and water management. The Project activities are consistent with the EIS; however, the size of the infrastructure has been updated in this assessment of effects to be consistent with the NOA/NOC mine plan as described in Section 2.

The predicted drawdown contours at the end of operation are presented on Map 20, Appendix E. The 1 m drawdown contour is predicted to extend approximately 1 km north, 1 km east, 2 km south, and 2 km west of the open pit and satellite pit. The 1 m drawdown associated with intersection of the seepage collection ditch with the water table extends about 500 m to the east of the MRSA. Mounding of the water table due to the TMF extends about 1 km west of the TMF.

Table 3.3 presents the comparison of baseline groundwater discharge rates with effects of dewatering at the end of operation period. The decrease in groundwater discharge to lakes and tributaries are small (less than 0.001 m^3/s) to negligible except for Dot Lake and the Keewatin River tributary KEE3-B1. The groundwater discharge to Dot Lake is predicted to decrease by 0.004 m^3/s at the end of operation compared with baseline conditions, which represents a 15% decrease. Groundwater discharge to Payne Lake is predicted to increase by 0.002 m^3/s (13% increase) due to mounding of the water table associated with the TMF. The groundwater discharge to the Keewatin River tributary KEE3-B1 is predicted to decrease by 0.008 m^3/s (73% decrease in groundwater discharge). The tributary of the Keewatin River is located close to the open pit where drawdown due to dewatering is predicted to be greater. Changes to baseflow rates for the Keewatin River (generally less than 0.1 m^3/s) and the Lynn River (less than 0.01 m^3/s) are very small (2% or less) in comparison with the anticipated baseflow in these streams for baseline conditions. The overall anticipated effect on flow rates in the surface water features is evaluated in the effects assessment for surface water (Section 3.3.4).

Decommissioning/Closure

Following completion of mine operation, dewatering of the open pit and satellite pit will cease and water levels will begin to rise until they stabilize. The MRSA will be covered and vegetated and reach a steady state infiltration rate which is greater than the construction and operation infiltration rate for the MRSA. The TMF pond will be drained into the open pit and the TMF covered resulting in reduced recharge compared with operation due to the placement of cover and fine texture of the tailings. The seepage collection ditch will be decommissioned and rehabilitated. Ore will continue to be stockpiled after mining ceases, but this stockpile is not considered an enhanced recharge feature and has a similar recharge rate as to the baseline model. The Project activities are consistent with the EIS; however, the size of the infrastructure has been updated in this assessment of effects to be consistent with the NOA/NOC mine plan as described in Section 2.

At a pit lake stage of 332 metres above sea level (masl), the open pit and satellite pit are predicted to become “flow through” lakes with groundwater flowing into the lakes on the upgradient side and out on the downgradient side. Map 23, Appendix E presents the predicted groundwater drawdown contours in closure when the pit lake has formed and the TMF, MRSA, and seepage collection ditch have been

rehabilitated. The water table is predicted to have returned to near baseline conditions in the direct vicinity of the open pit, TMF, and MRSA. Areas of drawdown are predicted within the pits compared with baseline because recharge is removed from the pits. This is conservative to assess effects and was conducted to predict the groundwater inflow rate to the pit without the influence of precipitation to support the surface water balance modelling. Drawdown in the vicinity of the TMF and MRSA are due to reduced recharge compared with baseline. The footprint of East Pond is assumed to be filled by groundwater at closure.

Table 3.3 presents the comparison of baseline groundwater discharge rates in closure compared with baseline conditions. Groundwater discharge to surface water is predicted to return to near baseline once the pit is full (less than 0.001 m^3/s change) except for Minton Lake and the Keewatin River tributary KEE3-B1. Groundwater discharge to Minton Lake is predicted to decrease by 0.0017 m^3/s at the end of closure compared with baseline condition, which represents a 4% decrease. Surface from the Keewatin River tributary KEE3-B1 that recharges groundwater is predicted to increase by 0.0019 m^3/s compared with baseline conditions, which represents a 16% increase. Changes to baseflow rates for the Keewatin River (generally less than 0.1 m^3/s) and the Lynn River (less than 0.01 m^3/s) are very small (2% or less) in comparison with the anticipated baseflow in these streams for baseline conditions. The overall anticipated effect on flow rates in the surface water features is evaluated in the effects assessment for surface water (Section 3.3.4).

Comparison with the EIS

The drawdown due to open pit dewatering is larger than presented in the EIS. The drawdown cone extends an additional 1 km to the east and an additional 2 km to the south and west. The larger drawdown cone than the EIS is the result of a higher dewatering rate, a higher calibrated hydraulic conductivity of the hydrostratigraphic layers, and lower calibrated recharge rate. The assessment of drawdown within this updated model is more conservative than the EIS.

Groundwater discharge to lakes at the end of operation is similar to that presented in the EIS except for Dot and Minton lakes. A negligible effect to groundwater discharge to Dot Lake was presented in the EIS whereas in this model update a 15% decrease in groundwater discharge (about 0.004 m^3/s change) compared with baseline conditions is predicted. The decrease in groundwater discharge at the end of operation in this model iteration is the result of the larger drawdown cone (due to greater calibrated hydraulic conductivity of the hydrostratigraphic units). For Minton Lake, an increase in groundwater discharge was predicted at the end of operation in the EIS compared with baseline conditions. The increase in groundwater discharge was associated with a smaller drawdown cone and mounding of the water table associated with the MRSA during the operation period. In this model iteration, the drawdown cone extends closer to Minton Lake and, based on refined modelling of the “wetting up” of the MRSA, increased recharge of the MRSA was predicted to occur in closure, not operation. Therefore, in this model iteration, a 2% decrease in groundwater discharge to Minton Lake is predicted at the end of operation compared with baseline conditions. In the EIS closure scenario, the groundwater discharge to Minton Lake, Payne Lake, Lake 2, and Lake 3 were predicted to increase compared with baseline with negligible effect to Dot Lake. In this model iteration, the change in groundwater discharge in closure compared with baseline is negligible for lakes except for Minton and Payne lakes which are predicted to have up to 4% decrease in closure compared with baseline conditions.

Table 3.3 Predicted Groundwater Discharge to Lakes and Tributaries and Baseflow in Rivers

Receiver	Net Groundwater Discharge to Receiver (m^3/s)						
	Baseline[1]	**End of Construction[1]**	**Change from Baseline[2]**	**End of Operation[1]**	**Change From Baseline[2]**	**Closure[1]**	**Change from Baseline[2]**
Predicted Groundwater Discharge to Lakes and Tributaries (m^3/s)							
Dot Lake	0.0278	0.0275	-0.0002	0.0237	-0.0041	0.0277	-0.0001
Minton Lake	0.0373	0.0366	-0.0007	0.0363	-0.0010	0.0356	-0.0017
Payne Lake	0.0150	0.0153	0.0002	0.0170	0.0020	0.0145	-0.0005
Lake 2	0.0051	0.0051	negligible	0.0051	negligible	0.0051	negligible
Lake 3	0.0124	0.0124	negligible	0.0124	negligible	0.0123	negligible
Tributary of Keewatin River connecting with East Pond (KEE3-A1)	0.0011	0.0011	negligible	0.0008	-0.0003	0.0010	-0.0001
Tributary of Keewatin River (KEE3-B1)	0.0117	0.0101	-0.0017	0.0031	-0.0086	0.0098	-0.0019
Watercourse from East Pond to Tributary of Keewatin River (KEE3-B2-A1)	-0.0001	-0.0021	-0.0020	-0.0036	-0.0035	-0.0016	-0.0015
Watercourse connecting Payne Lake and Keewatin River (KEE3-Pay1)	0.0090	0.0089	-0.0001	0.0098	0.0008	0.0085	-0.0005
Predicted Baseflow in Rivers (m^3/s)							
Keewatin River Gauging Station QM01	4.06	4.06	N/A	4.06	N/A	4.06	NA
Keewatin River Gauging Station QM02 Including contribution from Payne Lake and Payne Lake Rivers (KEE3-Pay1 and Kee3-Pay2)	4.10	4.07	-0.03	4.07	-0.03	4.07	-0.03

Receiver	Net Groundwater Discharge to Receiver (m^3/s)						
	Baseline[1]	End of Construction[1]	Change from Baseline[2]	End of Operation[1]	Change From Baseline[2]	Closure[1]	Change from Baseline[2]
Keewatin River Gauging Station QM10 Including contribution from Dot Lake and Dot Lake Rivers (KEE3-DOT1 and KEE3-DOT3)	4.13	4.07	-0.06	4.07	-0.07	4.07	-0.06
Keewatin River Gauging Station QM03	4.14	4.08	-0.06	4.07	-0.07	4.08	-0.06
Keewatin River Gauging Station QM06 Including Contribution from East Pond, East Pond Rivers (KEE3-B2, KEE3-B2-3, KEE3-B2-A1, KEE3-B1-2, and KEE3-B1), and Keewatin River Tributary KEE3-A1	4.18	4.09	-0.09	4.08	-0.10	4.09	-0.09
Lynn River Gauging Station QM05 Including Contributions from Lake LYN-B2 and River LYN2-A1	1.45	1.44	-0.01	1.44	-0.01	1.44	-0.01

Notes:
1 – Positive value represents flow from groundwater to receiver
2 – Change presented is predicted flow in the Mining Period minus flow simulated in Baseline
N/A – Baseflow at gauging station is an input parameter and does not change from baseline during model simulations

The predicted groundwater discharge to tributaries and rivers are predicted to be similar between the EIS and this iteration of the model except for:

- KEE3-A1: Groundwater discharge in closure for the EIS was predicted to increase whereas a negligible change in closure is predicted in this model iteration compared with baseline conditions.
- KEE3-B1: The change in groundwater discharge in operation and closure for the EIS was predicted as negligible whereas this model iteration, a decrease in groundwater discharge in operation (73%) and closure (4%) compared with baseline conditions is predicted.
- KEE3-PAY1: The groundwater discharge was predicted to decrease in operation in the EIS whereas in this model iteration an increase in groundwater discharge is predicted compared with baseline conditions. The increase in groundwater discharge in operation is the result of mounding of the water table associated with the TMF resulting in an increased horizontal hydraulic gradient toward the creek.

Overall, the changes in groundwater discharge to surface water compared with baseline conditions are small, generally less than 0.01 m^3/s compared with the overall flow in the features for both the EIS and this model iteration.

3.3.3.2.2 Groundwater Quality

The effects assessment for groundwater quality involved an evaluation of seepage quality from mine infrastructure and predicting the fate of seepage from the mine infrastructure. The predicted seepage quality from the MRSA and TMF was assessed in the EIS and remains consistent with the EIS for this NOA/NOC. As described in Chapter 8.0 of the EIS (Section 8.4.3.3 of the EIS), indicator parameters of groundwater seepage from the MRSA were identified as nitrate+nitrite, sulphate, antimony, and arsenic and indicator parameters of groundwater seepage from the TMF were identified as total cyanide, sulphate, antimony, arsenic, cobalt, iron, and sodium. An indicator parameter for groundwater quality was defined as a parameter in source seepage from the MRSA or TMF that has a concentration elevated above the drinking water guidelines (Guidelines for Canadian Drinking Water Quality [GCDWQ] and MWQSOG Drinking Water) or GW3.

For this NOA/NOC, the assessment of effects to groundwater quality focused on the fate of recharge from the MRSA, and TMF for each phase of mine life, particularly the groundwater flow path, discharge rate, and travel times. A groundwater model was constructed and used to predict the fate of recharge from the mine components, as defined per the NOA/NOC mine plan. Details of the modelling and model results are presented in Appendix E.

Construction

Construction of the initial phases of the TMF and MRSA will commence in construction which is consistent with the EIS. Seepage from the MRSA and TMF have the potential to affect groundwater quality. The historical MRSA will be removed in construction and placed within the new MRSA. Therefore, the effect of the historical MRSA on groundwater quality throughout the Project life is not assessed, which is consistent with the EIS.

The groundwater flow model was used to predict the flow pathway, discharge location, and flux of water recharging the groundwater flow systems from beneath the MRSA and TMF at the end of construction, when dewatering of the open pit and satellite pit has commenced. Detailed methods and results of the groundwater flow modelling are provided in Appendix E.

Table 3.4 provides a summary of the discharge fluxes and advective travel times of recharge originating from the MRSA and TMF at the end of construction. A portion of seepage from the MRSA and TMF is predicted to be captured by the seepage collection ditch. Seepage from both facilities not captured by the seepage collection ditch is predicted to remain in groundwater and not discharge to natural surface water features at the end of construction. The flow path of seepage from the MRSA and TMF is confined to the footprint of the MRSA and TMF where there are no groundwater supply wells. The effect of the changes in mass loading to surface water receivers on surface water quality is assessed in Section 3.3.4.

Operation

During operation, seepage from the MRSA, and TMF have the potential to affect groundwater quality. As the footprint of the MRSA, and TMF have changed as part of this NOA/NOC, the groundwater flow model was used to predict the flow pathway, discharge location, and flux of water recharging the groundwater flow systems from beneath the MRSA, and TMF at the end of operation when the open pit and satellite pit is fully dewatered. Detailed methods and results of the groundwater flow modelling are provided in Appendix E.

Table 3.4 provides a summary of the discharge fluxes and advective travel times of recharge originating from the MRSA, and TMF at the end of operation. The majority of seepage from the MRSA is predicted to be captured by the seepage collection ditch (59%) or open pit (10%). Approximately 10% of seepage from the MRSA is predicted to discharge to Minton Lake and 9% of seepage discharges to the tributaries of Keewatin River with a mean advective travel times of 13 years and 4 years, respectively. Discharge to remaining receptors is small in magnitude (much less than 0.001 cubic metres per second [m^3/s]) and less than 1% of the total seepage from the MRSA. Approximately 10% of seepage from the MRSA remains in groundwater at the end of the operation period. At the end of operation, nearly 100% of seepage from the OSA is predicted to be captured by the open pit.

The majority of seepage from the TMF is captured by the open pit or satellite pit (34%) or seepage collection ditch (23%). Approximately 8% of seepage from the TMF discharges to Payne Lake and 9% of seepage from the TMF discharges to Minton Lake with mean travel times of 13 years. Discharge to remaining receptors is small in magnitude (less than 0.001 m^3/s) and less than 5% of the total seepage from the TMF. Approximately 18% of seepage from the TMF remains in groundwater at the end of operation.

There are no known groundwater users located within the predicted flow path of seepage from the MRSA, or TMF. The effect of the changes in mass loading to surface water receivers on surface water quality is assessed in Section 3.3.4.

Decommissioning/Closure

During decommissioning/closure, as the open pits fills, groundwater levels will slowly recover, and the groundwater flow patterns will return to near baseline conditions once the open pit has filled. The groundwater flow model was used to predict the flow pathway, discharge location, and flux of water recharging the groundwater flow systems from beneath the MRSA, and TMF in closure. Detailed methods and results of the groundwater flow modelling is provided in Appendix E.

In closure, the MRSA is covered and revegetated. The rate of recharge through the MRSA was based on modelling conducted as part of the EIS that predicted the recharge rate from the base of the MRSA at different phases of wetting up. The wetting up time is the time to reach a steady-state saturation condition in the MRSA, where the volume of water infiltrating into the MRSA from precipitation will result in an equal amount of recharge from the base of the MRSA. The MRSA is predicted to be wet up 25 years after the start of closure. Therefore, the recharge rate from the MRSA was increased in closure groundwater model simulations compared with operation groundwater model simulations. The TMF was simulated with the TMF pond removed and tailings drained and therefore the recharge through the TMF is less in closure than in operation.

Table 3.4 provides a summary of the discharge fluxes and advective travel times of recharge originating from the MRSA, and TMF in closure, when the open pit and satellite pit have filled to a steady state stage. Approximately 27% of seepage from the MRSA is predicted to be captured by the open pit. About 26% of seepage from the MRSA is predicted to discharge to Minton Lake and about 23% of seepage from the MRSA is predicted to discharge to tributaries of Minton Lake with mean advective travel times of 2 years and 8 years, respectively. Discharge to remaining receptors is small in magnitude (much less than 0.001 m^3/s) and less than 5% of the total seepage from the MRSA. Approximately 18% of seepage from the MRSA remains in groundwater. Ninety-nine percent (99%) of seepage from the MRSA is predicted to be captured by the open pit.

Approximately 39% of seepage from the TMF is captured by the open pit or satellite pit. A portion of seepage from the TMF is predicted to discharge to Minton Lake (27%) or tributaries of Minton Lake (15%, with mean advective travel times of 104 years and 90 years, respectively. Approximately 11% of seepage from the TMF discharges to Payne Lake with a mean travel time of 61 years. Discharge to remaining receptors is small in magnitude (much less than 0.001 m^3/s) and less than 4% of the total seepage from the TMF. Less than 1% of seepage from the TMF remains in groundwater.

There are no known groundwater users located within the predicted flow path of seepage from the MRSA, or TMF. The effect of the changes in mass loading to surface water receivers on surface water quality is assessed in Section 3.3.4.

Table 3.4 Predicted Groundwater Discharge Rates from Mine Rock Storage Area and Tailings Management Facility to the Receiving Environment

Source	Receptor	Baseline				End of Construction				End of Operation				Closure (Pit Lake)			
		Discharge (m^3/s)	Travel Time (years)			Discharge (m^3/s)	Travel Time (years)			Discharge (m^3/s)	Travel Time (years)			Discharge (m^3/s)	Travel Time (years)		
			Min	Mean	Max		Min	Mean	Max		Min	Mean	Max		Min	Mean	Max
Historical MRSA	East Pond Tributary (KEE3-B2-A1)	6.1E-05	15	19	31	-	-	-	-	-	-	-	-	-	-	-	-
MRSA	Seepage Collection Ditch	-	-	-	-	4.2E-05	<1	1.5	2	1.1E-03	1	2	12	-	-	-	-
	Open Pit	-	-	-	-	-	-	-	-	2.0E-04	<1	3	10	1.0E-03	1	1	18
	Payne Lake	-	-	-	-	-	-	-	-	1.5E-05	<1	13	>13				
	Tributaries of the Keewatin River (KEE3-B2, KEE3-B2-3, KEE3-B2-A1, KEE3-B1-2, and KEE3-B1)	-	-	-	-	-	-	-	-	1.7E-04	<1	4	12	2.0E-04	<1	7	35
	Minton Lake	-	-	-	-	-	-	-	-	1.9E-04	<1	13	>13	9.8E-04	1	2	16
	Tributaries of Minton Lake (COC2-LOB2MIN5-5, COC2LOB2MIN5-2, COC2LOB2MIN5-3, COC2LOB2-MIN5-4, COC2LOB2-MIN5-5, COC2LOB2-MIN3)	-	-	-	-	-	-	-	-	-	-	-	-	8.7E-04	<1	8	25
	Open Pit	-	-	-	-	-	-	-	-	2.5E-04	2	2	3	2.5E-04	<1	<1	<1
TMF	Seepage Collection Ditch	-	-	-	-	3.5E-06	2	2	>2	8.7E-04	2	12	>13	-	-	-	-
	Open Pit	-	-	-	-	-	-	-	-	1.3E-03	2	9	>13	9.7E-04	6	56	122
	Tributaries of the Keewatin River (KEE3-B2, KEE3-B2-3, KEE3-B2-A1, KEE3-B1-2, and KEE3-B1)	-	-	-	-	-	-	-	-	5.3E-05	4	12	>13	9.3E-05	23	112	193
	Minton Lake	-	-	-	-	-	-	-	-	3.3E-04	13	13	>13	6.8E-04	13	104	>200
	Tributaries of Minton Lake (COC2-LOB2MIN5-5, COC2LOB2MIN5-2, COC2LOB2MIN5-3, COC2LOB2-MIN5-4, COC2LOB2-MIN5-5, COC2LOB2-MIN3)	-	-	-	-	-	-	-	-	2.2E-05	13	13	>13	3.8E-04	19	90	>200
	Payne Lake	-	-	-	-	-	-	-	-	3.0E-04	13	13	>13	2.6E-04	5	61	110
	Tributaries of Payne Lake (KEE3-PAY1 and KEE3-PAY2)	-	-	-	-	-	-	-	-	1.9E-04	4	9	>13	5.3E-05	28	51	143
	Keewatin River	-	-	-	-	-	-	-	-	8.4E-05	6	11	>13	-	-	-	-
	Cockeram Lake	-	-	-	-	-	-	-	-	-	-	-	-	2.4E-05	133	153	197

Comparison with the EIS

Receptors of groundwater seepage from mine infrastructure remained consistent with the EIS except for the Keewatin River and Payne Lake. In the EIS, a small portion of seepage from the MRSA was predicted to discharge to the Keewatin River, which is not predicted in this model iteration. In this model iteration, a small portion of seepage from the MRSA is predicted to discharge to Payne Lake, which was not predicted in the EIS. Overall, the effectiveness of the seepage collection ditches is slightly better in this model iteration than the EIS resulting in slightly less seepage from the TMF, and slightly less seepage from the MRSA to Minton Lake and tributaries of the Keewatin River.

Predictions of travel time of seepage from mine infrastructure also changed relative to the EIS. The porosity of the shallow, upper, intermediate, and deep bedrock in the EIS groundwater flow model was 0.0001. In this model update, the porosity of the shallow bedrock was set to 0.06 while the porosity for the upper, intermediate, and deep bedrock layers was set to 0.0001. These porosity values reflect discussions and sensitivity analysis completed through the information requests (IRs) subsequent to the submission of the EIS (IR-IAAC-83, IR-IAAC-R2-72). In addition, subsequent to the EIS, the travel times for MacLellan were presented as years and subsequent to the EIS it was discovered the travel times were actually days, which means travel times in the EIS should have been presented as tens of years instead of thousands of years. The porosity does not affect the flux, or specific discharge, of groundwater through the rock, the porosity only affects the predicted timing of seepage from the mine infrastructure discharging to the receiver. As a result, the predicted travel times of seepage from mine infrastructure decreases from tens to thousands of years in the EIS to a few years to tens of years in this model update. The predictions of seepage rates and travel times from mine infrastructure is conservative in that processes along the groundwater flow path such as dispersion and geochemical reactions were not simulated and would serve to increase groundwater flow travel times and decrease concentrations along the groundwater flow path.

3.3.3.3 Summary of Mitigation Measures

The mitigation measures for groundwater quantity and quality are identical to the mitigation measures recommended in the EIS (Stantec 2020a) and described in the Groundwater Management and Monitoring Plan (GMMP; Version 0, January 2025). No additional mitigation measures are required in relation to this NOA/NOC. Alamos is committed to the follow-up and monitoring, and adaptive management (if and as required) that is described in this plan.

3.3.3.4 Residual Effects

3.3.3.4.1 Groundwater Quantity

During construction, residual environmental effects related to dewatering the open pit and satellite pit as well as operation of the TMF are predicted to occur through the construction phase and extend into the operation and decommissioning/closure phases. The changes to groundwater quantity and flow were characterized in the EIS as adverse, medium-term, continuous, and irreversible. The magnitude was high within the PDA and moderate within the LAA/RAA, as the change in groundwater level was anticipated to be greater than 5 m. Timing (i.e., natural seasonal variations in precipitation) may affect dewatering rates,

particularly during the spring period when higher groundwater levels are expected; however, these variations would not be considered a Project related effect. The groundwater quantity in the LAA/RAA is disturbed with respect to ecological context. The results of the updated groundwater assessment for this NOA/NOC do not change the characterization of these residual effects for construction.

At the end of operation, the lowering of water levels through continued dewatering of the open pits and the operation of the TMF and MRSA (including seepage collection ditches) will result in a change in groundwater quantity and flow at the MacLellan site. The changes were characterized in the EIS as adverse, medium-term, continuous, irreversible, and confined to the LAA/RAA. The magnitude was high within the PDA and low within the LAA/RAA. The magnitude will be reduced during decommissioning/closure as the open pit fills to form a pit lake. Timing (i.e., natural seasonal variations in precipitation) may affect dewatering rates due to natural seasonal variations, particularly during the spring period when higher groundwater levels are expected; however, these variations would not be considered a Project-related effect. The groundwater quantity in the LAA/RAA is disturbed with respect to ecological context. The results of the updated groundwater assessment for this NOA/NOC results in a change in the characterization of magnitude to high within the LAA/RAA as the 5 m drawdown cone for the open pit extends outside the PDA. The remainder of the characterizations of residual effects from the EIS remain valid for this NOA/NOC.

In closure, once the pit lakes have formed and the TMF and MRSA have been rehabilitated, the drawdown will return to near baseline conditions except in the immediate vicinity of mine infrastructure. The changes in groundwater levels in closure were characterized in the EIS as adverse, long-term, continuous, irreversible, and will be confined to the LAA/RAA. The magnitude was low within the PDA and decreased to negligible in the LAA/RAA as the change in groundwater level was less than 1 m. Timing may affect water levels (i.e., natural seasonal variations), particularly during the spring period when higher groundwater levels are expected, but this is not considered a Project-related effect. From an ecological context, the areas where the water level changes occur are disturbed for groundwater availability. The results of the updated groundwater assessment for this NOA/NOC do not change the characterization of these residual effects for closure except for magnitude. In consideration of the proposed alterations, magnitude is high within the PDA and low within the LAA/RAA as the change in groundwater level is more than 1 m.

Compared with the results of the EIS, the effects of the Project on groundwater remained similar, except for the extent of the drawdown cone which was larger in this model iteration. In conclusion, the results of the updated groundwater assessment do not change the characterization of residual effects except for magnitude and do not change the significance ratings summarized for groundwater as presented in the EIS.

3.3.3.4.2 Groundwater Quality

The residual effect on groundwater quality during construction was characterized in the EIS as positive, as no new source of groundwater mass loading was introduced during construction and the historical MRSA was relocated where seepage is captured by the seepage collection ditch. The residual effect was deemed short-term, continuous, irreversible, and was confined to the PDA. The magnitude was moderate

because water quality and loading from the relocation of the historical MRSA are predicted to result in temporary improvements to groundwater quality within the LAA/RAA relative to baseline conditions. No existing or foreseeable groundwater users are located in the areas with groundwater quality that exceeds the GCDWQ or MWQSOG (drinking water). The ecological context of the LAA/RAA is disturbed based on existing parameter loadings from historical mining activities. The results of the updated groundwater assessment for this NOA/NOC do not change the characterization of these residual effects for construction.

The effects on groundwater quality during operation were characterized in the EIS as adverse, long-term, continuous, irreversible, are confined to the LAA/RAA, and mainly to the PDA. The magnitude was moderate because water quality and loading for some parameters were predicted to increase but not affect existing groundwater supply users. For parameters predicted to increase in concentrations relative to baseline conditions, they are expected to remain below the GW3 at the point of discharge as the parameters undergo precipitation and adsorption reactions along the groundwater flow path. No existing or foreseeable groundwater users were located in the areas with groundwater quality that exceeds the GCDWQ or MWQSOG (drinking water). The ecological context of the LAA/RAA was disturbed based on existing parameter loadings from historical mining activities. The results of the updated groundwater assessment for this NOA/NOC do not change the characterization of these residual effects for operation.

The effects on groundwater quality during closure were characterized in the EIS as adverse, long-term, continuous, irreversible, are confined to the LAA/RAA, and mainly to the PDA. The magnitude was moderate as water quality and loading for some parameters are predicted to increase in concentrations relative to baseline conditions. No existing or foreseeable groundwater users are located in the areas with groundwater quality that exceeds the GCDWQ or MWQSOG (drinking water). The ecological context of the LAA/RAA was disturbed based on existing parameter loadings from historical mining activities. The results of the updated groundwater assessment for this NOA/NOC do not change the characterization of these residual effects for operation.

Compared with the results of the EIS, the effects of the Project on groundwater quality remained similar. In conclusion, the results of the updated groundwater assessment do not change the characterization of residual effects, or the significance ratings summarized for groundwater as presented in the EIS.

3.3.4 Surface Water

Surface water includes surface water quantity and quality in freshwater waterbodies and watercourses. Surface water is important as a source of potable water for humans, important to wildlife and freshwater aquatic biota as habitat, and important for supporting commercial, recreational, traditional, and industrial activities.

The Project activities and components that are proposed to be altered that may interact with surface water as part of this NOA/NOC include adjustments to the MRSA, TMF, overburden stockpile, topsoil stockpile, and process plant, as well as the addition of a satellite pit, construction laydown areas, and detailed freshwater intake lines and effluent locations. The assessment of potential effects of these proposed changes to the approved MacLellan site on surface water quantity and quality included

assessment of potential changes in surface water run-off and potential changes in groundwater to surface waterbodies and watercourses.

3.3.4.1 Regulatory and Guideline Setting

3.3.4.1.1 Federal

The assessment of potential Project related effects on surface water quantity and quality included consideration of the following federal legislation, policies, and guidelines:

- *The Fisheries Act* restricts or controls the deposit of deleterious substances into waters or locations frequented by fish unless authorized by regulation.
- The MDMER defines unionized ammonia, arsenic, copper, cyanide, lead, nickel, zinc, TSS, and radium 226 as deleterious substances and Schedule 4 of the MDMER imposes limits on their concentrations in effluent at the final discharge point (FDS) to the receiving body of water. The MDMER requires environmental effects monitoring (EEM) for mines that discharge mine effluent to the receiving environment.
- The CWQG-FAL are intended to be protective of all forms of aquatic life and all aspects of the aquatic life cycle during acute and/or chronic exposure regimes. The guidelines were used to identify parameters of potential concern (POPCs).
- Guidelines for Canadian Drinking Water Quality which are based on current published scientific research related to health effects, aesthetic effects, and operational conditions of various parameters in drinking water.
- The Framework for Assessing Ecological Flow Requirements to Support Fisheries in Canada (Fisheries and Oceans 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.
- Federal Environmental Quality Guidelines (FEQG) are recommended chemical thresholds that identify the concentration below which there is a low likelihood of direct adverse effects from the chemical on aquatic life exposed via water or sediment, or where chemicals may bioaccumulate in wildlife that may consume aquatic life. FEQGs are developed by ECCC to support federal environmental quality monitoring, risk assessment and risk management activities on substances for which the CCME guidelines do not yet exist or are not reasonably expected to be updated in the near future.

3.3.4.1.2 Provincial

The assessment of potential Project related effects on surface water quantity and quality included consideration of the following provincial legislation, policies, and guidelines:

- *The Drinking Water Safety Act* addresses construction, operation, and monitoring of drinking water systems in Manitoba.
- *The Environment Act* contains general provisions associated with Class 1, 2, and 3 developments that can be used to protect surface water quality. It also requires provincial assessment and licensing for proposed alteration to streams in Manitoba.
- *The Water Protection Act* is the principal statue governing water management and water quality in Manitoba. The MWQSOG for use under Part 2 of *The Water Protection Act* sets out prescribed water quality standards for a number of activities, including drinking water, freshwater aquatic life, and common classes of discharge.
- *The Water Rights Act* is the legislative mechanism governing allocation of water resources and construction of water control works within Manitoba.
- *The Mines and Minerals Act* and Mine Closure Regulation under Part 14 of *The Mines and Minerals Act* sets out standards for mine closure.
- *The Public Health Act* is intended to enable the delivery of public health services to protect and promote the health and wellbeing of the people of Manitoba. Regulations can be enacted under *The Public Health Act* with regard to pollution of wells, groundwater, surface water, and springs, as well as construction, provision, maintenance, and operation of potable and wastewater systems.
- *The Water Resources Conservation Act* requires that any removal of water from Manitoba's water basins be conducted in quantities that would not, individually or collectively, have significant adverse effects on the ecological integrity of Manitoba's water resources or their associated ecosystems.

3.3.4.1.3 IAAC Decision Statement

As per the IAAC Decision Statement, Alamos is required to adhere to the following conditions with respect to surface water:

> 3.7 *The Proponent shall collect contact water and seepage from the Project development areas, including seepage and recharge from the tailings management facility, mine rock storage areas, overburden and ore stockpiles, and seepage input to groundwater that flows into the open pits, and treat it, as necessary, before releasing it into the receiving environment during all phases of the Designated Project to ensure that any deposits are made in accordance with the Metal and Diamond Mining Effluent Regulations and the pollution prevention provisions of the Fisheries Act. When treating contact water and seepage, the Proponent shall take into account Manitoba's Water Quality Standards, Objectives, and Guidelines, the Canadian Council of Ministers of the Environment's Canadian Water Quality Guidelines of the Protection for Aquatic Life, and Environment and Climate Change Canada's Federal Environmental Quality Guidelines.*

3.10 The Proponent shall manage, during all phases of the Designated Project and in consultation with Environment and Climate Change Canada and any other relevant authorities, acid-generating and metal-leaching and potentially acid-generating and metal-leaching tailings and waste, Including from the tailings management facility, mine rock storage areas and ore stockpiles. In doing so, the Proponent shall:

3.10.1 characterize, prior to construction, the acid rock drainage and metal-leaching potential of overburden and other mine rock to be used for construction;

3.10.2 only use materials that are not acid-generating, non-potentially acid-generating and non-metal-leaching during construction, including for earthworks and grading, unless not technically or economically feasible, if not technically or economically feasible, the Proponent shall preclude water and oxygen ingress into the materials used;

3.10.3 conduct geochemical testing of generated waste rock and tailings during operation to Identify potentially acid-generating and metal-le aching waste material and verify the magnitude and onset of potential acid rock drainage in waste rock and tailings;

3.10.4 taking into account results of geochemical testing referred to in condition 3.10.3. implement measures to delay onset and magnitude of acid rock drainage in waste rock, Including blending potentially acid generating with non-potentially acid generating during operation; and

3.10.5 cover all acid-generating, potentially acid-generating, and potentially metal-leaching tailings and waste, including waste in the tailings management facility and mine rock storage areas, during decommissioning with an oxygen-limiting barrier in a manner determined by a qualified individual.

3.11 The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, and implement and maintain during all phases of the Designated Project, measures to control erosion and sedimentation within the Project development areas in a manner consistent with the Fisheries Act and its regulations, and taking into account Environment and Climate Change Canada's Environmental Code of Practice for Metal Mines, and Fisheries and Oceans Canada's Measures to Protect Fish and Fish Habitat. The Proponent shall submit these measures to the Agency before implementing them. As part of these measures, the Proponent shall:

3.11.1 install intake pipes pointing upwards and away from sediment; and

3.11.2 equip contact water discharge pipes with diffusers.

3.12 The Proponent shall develop, prior to construction and in consultation with Indigenous groups, Fisheries and Oceans Canada, Environment and Climate Change Canada and any other relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and determine the effectiveness of the mitigation measures as they pertain to adverse environmental effects of the Designated Project on water quality, taking into account Environment

and Climate Change Canada's Metal Mine Technical Guidance for Environmental Effects Monitoring. The Proponent shall implement the follow-up program during all phases of the Designated Project. As part of the follow-up program, the Proponent shall:

3.12.1 determine, in consultation with Indigenous groups, Environment and Climate Change Canada, and any other relevant authorities, the location and extent of mixing zones in water bodies that may be affected by the Designated Project;

3.12.2 monitor water quality in the East and Wendy pit lakes, newly formed pit lakes, tailings management facility, mine rock storage areas, contact water collection ponds, and receiving water bodies and watercourses upstream and downstream of the Project development areas, including at the edge and downstream of the edge of mixing zones identified pursuant to condition 3.12.1, Arbor Lake, Burge Lake, Cockeram Lake, Ellystan Lake, Farley Creek, Farley Lake, Gordon Lake, the Hughes River, the Keewatin River, the unnamed tributary of the Keewatin River, Minton Lake, Payne Lake, Susan Lake and Swede Lake, for all contaminants that may have adverse effects on fish and fish habitat, including aluminum, antimony, arsenic, calcium, copper, cyanide, fluoride, hexavalent chromium, iron, magnesium, methylmercury, phosphorus, selenium, and total and dissolved cadmium. Monitoring shall be conducted as follows:

3.12.2.1 beginning during construction and continuing through decommissioning, except in the East and Wendy pit lakes, and the newly formed pit lakes; and

3.12.2.2 beginning during construction in the East and Wendy pit lakes, and beginning during decommissioning and continuing through post-closure in the newly formed pit lakes, until water quality is stable and improving and any contact water or seepage potentially released meets the Canadian Council of Ministers of the Environment's Canadian Water Quality Guidelines of the Protection for Aquatic Life and Manitoba's Water Quality, Standards, Objectives, and Guidelines pursuant to condition 3.7;

3.12.4 monitor, during construction and operation, total suspended solids and turbidity in fish bearing water bodies where Designated Project activities are undertaken in or near water frequented by fish; and

3.12.5 develop, in consultation with relevant authorities, and implement modified or additional mitigation measures, if the results of monitoring conducted pursuant to condition 3.12.2, 3.12.3 and 3.12.4 demonstrate any unanticipated effects attributable to the Designated Project, taking into account the Canadian Council of Ministers of the Environment's Canadian Water Quality Guidelines of the Protection for Aquatic Life or Manitoba's Water Quality Standards, Objectives, and Guidelines, whichever is most protective of fish and fish habitat, and predicted concentrations identified in Volume 1 Chapter 9 of the Environmental Impact Statement.

3.13 The Proponent shall develop, prior to construction and in consultation with Indigenous groups, Fisheries and Oceans Canada, Environment and Climate Change Canada and any other relevant authorities, a follow-up program to verify the accuracy of the environmental assessment

and determine the effectiveness of the mitigation measures as they pertain to adverse environmental effects of the Designated Project on water quantity. The Proponent shall implement the follow-up program during all phases of the Designated Project. As part of the follow-up program, the Proponent shall:

3.13.1 monitor, during all phases of the Designated Project, surface water instantaneous flows, lake levels and pH levels within Arbor Lake, Burge Lake, Cockeram Lake, Ellystan Lake, Farley Creek, Farley Lake, Gordon Lake, the Keewatin River, the unnamed tributary of the Keewatin River, Minton Lake, Payne Lake, Susan Lake, Swede Lake, fish-bearing wetlands within the local assessment areas, the East and Wendy pit lakes, newly formed pit lakes, the tailings management facility, and contact water collection ponds to verify the environmental assessment predictions identified in Volume 2 Chapter 10 of the Environmental Impact Statement and Appendix A Attachment IAAC-48 of the Proponent's IR Responses Round 1, Package 1 (Canadian Impact Assessment Registry Reference Number 80140, document #54);

3.13.2 monitor, during all phases of the Designated Project, groundwater levels, gradients and hydraulic conductivity of all hydrogeological units, as identified in the groundwater model in Volume 5 Appendix F and G of the Environmental Impact Statement, with well depths ranging from near surface to a minimum of 115 meters below ground to characterize contaminant transport via groundwater at the depth of the groundwater model for the Designated Project. Monitoring wells shall be installed near the open pits, the tailings management facility, mine rock storage areas, ore and overburden stockpiles, and fish bearing wetlands within the local assessment areas that intersect with the Project development areas; and

3.13.3 develop, in consultation with relevant authorities, and implement modified or additional mitigation measures, if the results of monitoring conducted pursuant to condition 3.13.1 and3.13.2 demonstrate unanticipated effects attributable to the Designated Project.

3.15 The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and the effectiveness of the mitigation measures as they pertain to acid rock drainage and metal leaching into the receiving environment from the Project development areas, including from the mine rock storage areas, ore stockpiles, and the tailings management facility. The Proponent shall implement the follow-up program during all phases of the Designated Project. In doing so, the Proponent shall:

3.15.1 verify that the covers installed at the mine rock storage areas and tailings management facility pursuant to condition 3.10.5 perform and continue to perform as predicted in Volume 1 Chapter 5 of the Environmental Impact Statement during all phases of the Designated Project, including post-closure.

3.3.4.2 Environmental Effects

3.3.4.2.1 Surface Water Quantity

Assessment Methods

The EIS surface water balance model was updated to reflect the changes presented in Section 2 and results of the NOA/NOC groundwater modelling presented in Section 3.3.3. Details of the updated NOA/NOC water balance, including the results, are presented in Appendix F.

A schematic diagram of flow pathways and model nodes (Appendix F) is shown in Figure 3.1 Summary results, including the effects of the Project on streamflows (at different model nodes) and lake levels, are presented in Table 3.5 to Table 3.14.

Figure 3.1 Water Balance and Water Quality Model Nodes

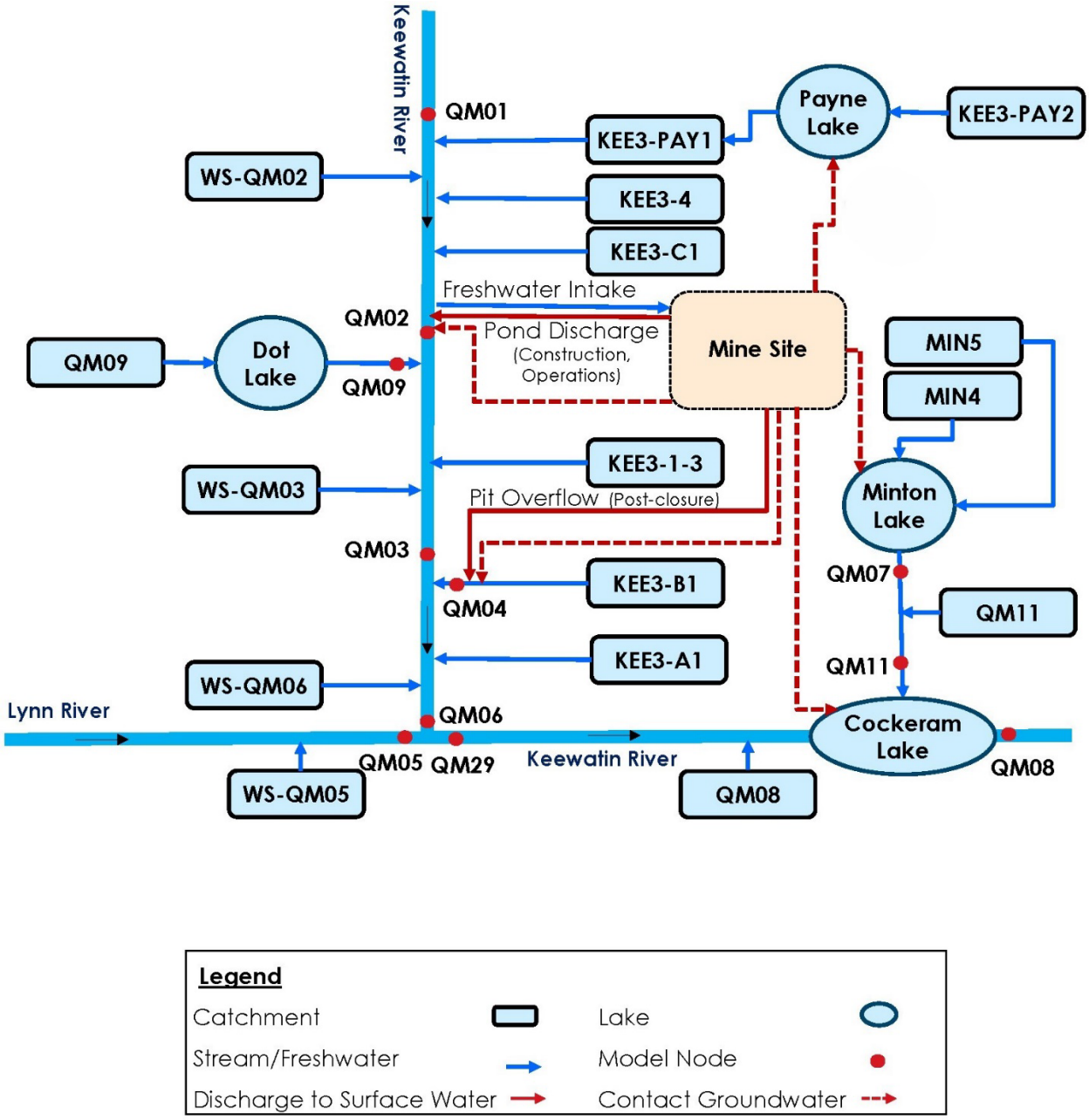


Table 3.5 Simulated Average Monthly Streamflows at Model Node QM02

Month	Existing Condition	Construction			Operation			During Pit Filling			After Pit Filling		
	Flow (m^3/s)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)
Jan	7.050	7.050	0.000	0%	7.067	0.017	0%	7.049	-0.001	0%	7.047	-0.003	0%
Feb	5.873	5.873	0.000	0%	5.883	0.010	0%	5.872	-0.001	0%	5.870	-0.003	0%
Mar	4.842	4.841	-0.001	0%	4.850	0.008	0%	4.840	-0.002	0%	4.839	-0.003	0%
Apr	5.794	5.835	0.041	1%	5.887	0.093	2%	5.792	-0.002	0%	5.791	-0.003	0%
May	16.690	16.795	0.105	1%	16.819	0.129	1%	16.690	0.000	0%	16.690	0.000	0%
Jun	16.480	16.535	0.055	0%	16.539	0.059	0%	16.477	-0.003	0%	16.470	-0.010	0%
Jul	11.820	11.905	0.085	1%	11.902	0.082	1%	11.820	0.000	0%	11.820	0.000	0%
Aug	10.550	10.625	0.075	1%	10.621	0.071	1%	10.550	0.000	0%	10.550	0.000	0%
Sep	11.200	11.275	0.075	1%	11.278	0.078	1%	11.200	0.000	0%	11.200	0.000	0%
Oct	11.140	11.165	0.025	0%	11.183	0.043	0%	11.130	-0.010	0%	11.130	-0.010	0%
Nov	10.590	10.600	0.010	0%	10.618	0.028	0%	10.590	0.000	0%	10.590	0.000	0%
Dec	9.060	9.065	0.005	0%	9.082	0.022	0%	9.058	-0.002	0%	9.057	-0.003	0%
Annual	10.115	10.155	0.040	0%	10.169	0.054	1%	10.114	-0.002	0%	10.112	-0.003	0%

Note:
0.0% and 0.000 m^3/s in the Table represent < 0.1% and <0.001 m^3/s, respectively.

Table 3.6 Simulated Average Monthly Streamflows at Model Node QM03

Month	Existing Condition	Construction			Operation			During Pit Filling			After Pit Filling		
	Flow (m^3/s)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)
Jan	7.113	7.111	-0.002	0%	7.123	0.010	0%	7.105	-0.008	0%	7.105	-0.008	0%
Feb	5.925	5.924	-0.002	0%	5.929	0.004	0%	5.918	-0.007	0%	5.919	-0.006	0%
Mar	4.885	4.883	-0.002	0%	4.887	0.002	0%	4.878	-0.007	0%	4.879	-0.006	0%
Apr	5.845	5.885	0.039	1%	5.932	0.087	1%	5.838	-0.007	0%	5.839	-0.006	0%
May	16.840	16.935	0.095	1%	16.954	0.114	1%	16.820	-0.020	0%	16.820	-0.020	0%
Jun	16.630	16.680	0.050	0%	16.672	0.042	0%	16.610	-0.020	0%	16.610	-0.020	0%
Jul	11.930	12.005	0.075	1%	11.999	0.069	1%	11.920	-0.010	0%	11.920	-0.010	0%
Aug	10.650	10.715	0.065	1%	10.703	0.053	1%	10.640	-0.010	0%	10.640	-0.010	0%
Sep	11.300	11.370	0.070	1%	11.367	0.067	1%	11.290	-0.010	0%	11.290	-0.010	0%
Oct	11.240	11.255	0.015	0%	11.270	0.030	0%	11.220	-0.020	0%	11.220	-0.020	0%
Nov	10.690	10.690	0.000	0%	10.706	0.016	0%	10.680	-0.010	0%	10.680	-0.010	0%
Dec	9.141	9.143	0.002	0%	9.155	0.014	0%	9.130	-0.011	0%	9.131	-0.010	0%
Annual	10.207	10.241	0.034	0%	10.250	0.043	0%	10.195	-0.012	0%	10.196	-0.011	0%

Note:
0.0% in the Table represents < 0.1%.

Table 3.7 Simulated Average Monthly Streamflows at Model Node QM04

Month	Existing Condition	Construction			Operation			During Pit Filling			After Pit Filling		
	Flow (m^3/s)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)
Jan	0.030	0.025	-0.005	-17%	0.011	-0.019	-64%	0.010	-0.020	-66%	0.035	0.005	16%
Feb	0.025	0.021	-0.005	-19%	0.009	-0.016	-64%	0.009	-0.017	-66%	0.028	0.002	9%
Mar	0.021	0.016	-0.004	-21%	0.008	-0.013	-64%	0.007	-0.014	-65%	0.025	0.004	18%
Apr	0.025	0.019	-0.006	-24%	0.009	-0.016	-64%	0.009	-0.016	-66%	0.123	0.098	391%
May	0.072	0.053	-0.019	-26%	0.026	-0.046	-64%	0.029	-0.043	-60%	0.193	0.121	168%
Jun	0.071	0.051	-0.020	-28%	0.025	-0.046	-64%	0.026	-0.045	-64%	0.085	0.014	20%
Jul	0.051	0.035	-0.016	-31%	0.018	-0.033	-64%	0.019	-0.031	-62%	0.092	0.041	81%
Aug	0.045	0.030	-0.015	-33%	0.016	-0.029	-64%	0.017	-0.028	-62%	0.079	0.033	73%
Sep	0.048	0.031	-0.017	-36%	0.017	-0.031	-64%	0.019	-0.030	-61%	0.098	0.050	103%
Oct	0.048	0.030	-0.018	-38%	0.017	-0.031	-64%	0.018	-0.030	-62%	0.074	0.026	54%
Nov	0.046	0.027	-0.019	-41%	0.016	-0.029	-64%	0.017	-0.029	-64%	0.047	0.001	3%
Dec	0.039	0.022	-0.017	-43%	0.014	-0.025	-64%	0.014	-0.025	-64%	0.041	0.002	5%
Annual	0.044	0.030	-0.013	-30%	0.016	-0.028	-64%	0.016	-0.027	-63%	0.077	0.033	78%

Table 3.8 Simulated Average Monthly Streamflows at Model Node QM06

Month	Existing Condition	Construction			Operation			During Pit Filling			After Pit Filling		
	Flow (m^3/s)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)
Jan	7.168	7.161	-0.007	0%	7.158	-0.010	0%	7.140	-0.028	0%	7.165	-0.003	0%
Feb	5.971	5.965	-0.007	0%	5.958	-0.013	0%	5.947	-0.024	0%	5.966	-0.005	0%
Mar	4.922	4.917	-0.005	0%	4.912	-0.010	0%	4.902	-0.020	0%	4.920	-0.002	0%
Apr	5.890	5.924	0.034	1%	5.961	0.071	1%	5.866	-0.024	0%	5.981	0.091	2%
May	16.970	17.050	0.080	0%	17.037	0.067	0%	16.904	-0.066	0%	17.074	0.104	1%
Jun	16.750	16.790	0.040	0%	16.753	0.003	0%	16.692	-0.058	0%	16.753	0.003	0%
Jul	12.020	12.085	0.065	1%	12.054	0.034	0%	11.974	-0.046	0%	12.052	0.032	0%
Aug	10.730	10.780	0.050	0%	10.760	0.030	0%	10.692	-0.038	0%	10.753	0.023	0%
Sep	11.390	11.440	0.050	0%	11.422	0.032	0%	11.349	-0.041	0%	11.426	0.036	0%
Oct	11.320	11.330	0.010	0%	11.328	0.008	0%	11.282	-0.038	0%	11.335	0.015	0%
Nov	10.770	10.755	-0.015	0%	10.758	-0.012	0%	10.731	-0.039	0%	10.762	-0.008	0%
Dec	9.211	9.197	-0.015	0%	9.200	-0.011	0%	9.176	-0.035	0%	9.204	-0.007	0%
Annual	10.284	10.308	0.024	0%	10.300	0.016	0%	10.246	-0.038	0%	10.308	0.023	0%

Note:
0.0% in the Table represents < 0.1%.

Table 3.9 Simulated Average Monthly Streamflows at Model Node QM07

Month	Existing Condition	Construction			Operation			During Pit Filling			After Pit Filling		
	Flow (m^3/s)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)
Jan	0.064	0.056	-0.008	-12%	0.047	-0.017	-26%	0.047	-0.017	-27%	0.047	-0.017	-27%
Feb	0.053	0.046	-0.007	-13%	0.039	-0.014	-27%	0.039	-0.014	-27%	0.039	-0.015	-28%
Mar	0.044	0.038	-0.006	-14%	0.032	-0.012	-27%	0.032	-0.012	-28%	0.032	-0.012	-28%
Apr	0.053	0.045	-0.008	-15%	0.039	-0.014	-27%	0.038	-0.014	-27%	0.038	-0.015	-28%
May	0.151	0.127	-0.024	-16%	0.113	-0.039	-25%	0.112	-0.039	-26%	0.112	-0.039	-26%
Jun	0.150	0.124	-0.025	-17%	0.111	-0.038	-26%	0.111	-0.039	-26%	0.111	-0.039	-26%
Jul	0.107	0.088	-0.019	-18%	0.080	-0.028	-26%	0.079	-0.028	-26%	0.079	-0.028	-26%
Aug	0.096	0.077	-0.018	-19%	0.071	-0.025	-26%	0.071	-0.025	-26%	0.070	-0.025	-27%
Sep	0.102	0.081	-0.020	-20%	0.075	-0.026	-26%	0.075	-0.027	-26%	0.075	-0.027	-26%
Oct	0.101	0.080	-0.021	-21%	0.075	-0.026	-26%	0.075	-0.026	-26%	0.074	-0.027	-26%
Nov	0.096	0.075	-0.021	-22%	0.071	-0.025	-26%	0.071	-0.025	-26%	0.071	-0.026	-27%
Dec	0.082	0.063	-0.019	-23%	0.061	-0.021	-26%	0.060	-0.022	-26%	0.060	-0.022	-27%
Annual	0.092	0.075	-0.017	-18%	0.068	-0.024	-26%	0.068	-0.024	-26%	0.067	-0.024	-27%

Table 3.10 Simulated Average Monthly Streamflows at Model Node QM08

Month	Existing Condition	Construction			Operation			During Pit Filling			After Pit Filling		
	Flow (m^3/s)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)
Jan	10.690	10.670	-0.020	0%	10.659	-0.031	0%	10.641	-0.049	0%	10.664	-0.026	0%
Feb	8.901	8.888	-0.013	0%	8.874	-0.027	0%	8.862	-0.039	0%	8.882	-0.019	0%
Mar	7.338	7.326	-0.013	0%	7.315	-0.023	0%	7.305	-0.033	0%	7.323	-0.015	0%
Apr	8.781	8.807	0.025	0%	8.838	0.057	1%	8.742	-0.039	0%	8.857	0.076	1%
May	25.300	25.355	0.055	0%	25.327	0.027	0%	25.194	-0.106	0%	25.363	0.063	0%
Jun	24.980	24.985	0.005	0%	24.941	-0.039	0%	24.872	-0.108	0%	24.935	-0.045	0%
Jul	17.920	17.960	0.040	0%	17.931	0.011	0%	17.852	-0.068	0%	17.923	0.003	0%
Aug	16.000	16.035	0.035	0%	16.000	0.000	0%	15.932	-0.068	0%	15.994	-0.006	0%
Sep	16.980	17.010	0.030	0%	16.983	0.003	0%	16.912	-0.068	0%	16.992	0.012	0%
Oct	16.880	16.865	-0.015	0%	16.858	-0.022	0%	16.812	-0.068	0%	16.865	-0.015	0%
Nov	16.060	16.015	-0.045	0%	16.018	-0.042	0%	15.991	-0.069	0%	16.023	-0.038	0%
Dec	13.730	13.695	-0.035	0%	13.699	-0.031	0%	13.671	-0.059	0%	13.703	-0.027	0%
Annual	15.334	15.338	0.004	0%	15.324	-0.010	0%	15.269	-0.065	0%	15.331	-0.003	0%

Note:
0.0% in the Table represents < 0.1%.

Table 3.11 Simulated Average Monthly Streamflows at Model Node QM09

Month	Existing Condition	Construction			Operation			During Pit Filling			After Pit Filling		
	Flow (m^3/s)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)
Jan	0.040	0.040	0.000	0%	0.037	-0.003	-7%	0.037	-0.003	-7%	0.039	-0.001	-2%
Feb	0.033	0.033	0.000	0%	0.031	-0.003	-8%	0.031	-0.003	-8%	0.033	-0.001	-2%
Mar	0.027	0.027	0.000	0%	0.025	-0.003	-10%	0.025	-0.003	-10%	0.027	-0.001	-2%
Apr	0.033	0.033	0.000	0%	0.030	-0.003	-9%	0.030	-0.003	-8%	0.032	-0.001	-2%
May	0.095	0.095	0.000	0%	0.092	-0.003	-3%	0.092	-0.003	-3%	0.094	-0.001	-1%
Jun	0.093	0.093	0.000	0%	0.091	-0.003	-3%	0.091	-0.003	-3%	0.093	-0.001	-1%
Jul	0.067	0.067	0.000	0%	0.064	-0.003	-4%	0.064	-0.003	-4%	0.066	-0.001	-1%
Aug	0.060	0.060	0.000	0%	0.057	-0.003	-5%	0.057	-0.003	-5%	0.059	-0.001	-1%
Sep	0.064	0.063	0.000	0%	0.061	-0.003	-5%	0.061	-0.003	-4%	0.063	-0.001	-1%
Oct	0.063	0.063	0.000	0%	0.060	-0.003	-5%	0.060	-0.003	-4%	0.063	-0.001	-1%
Nov	0.060	0.060	0.000	0%	0.057	-0.003	-5%	0.057	-0.003	-5%	0.059	-0.001	-1%
Dec	0.051	0.051	0.000	0%	0.048	-0.003	-6%	0.049	-0.003	-5%	0.051	-0.001	-1%
Annual	0.057	0.057	0.000	0%	0.054	-0.003	-6%	0.055	-0.003	-6%	0.057	-0.001	-1%

Note:
0.0% and 0.000 m^3/s in the Table represent < 0.1% and < 0.001 m^3/s, respectively.

Table 3.12 Simulated Average Monthly Streamflows at Model Node QM11

Month	Existing Condition	Construction			Operation			During Pit Filling			After Pit Filling		
	Flow (m^3/s)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)
Jan	0.439	0.432	-0.008	-2%	0.422	-0.017	-4%	0.422	-0.017	-4%	0.422	-0.017	-4%
Feb	0.366	0.359	-0.007	-2%	0.352	-0.014	-4%	0.351	-0.015	-4%	0.351	-0.015	-4%
Mar	0.302	0.295	-0.006	-2%	0.290	-0.012	-4%	0.289	-0.012	-4%	0.289	-0.012	-4%
Apr	0.361	0.353	-0.008	-2%	0.347	-0.014	-4%	0.347	-0.014	-4%	0.346	-0.015	-4%
May	1.040	1.016	-0.025	-2%	1.001	-0.039	-4%	1.001	-0.039	-4%	1.000	-0.040	-4%
Jun	1.027	1.001	-0.026	-3%	0.989	-0.038	-4%	0.988	-0.039	-4%	0.988	-0.039	-4%
Jul	0.737	0.717	-0.019	-3%	0.709	-0.028	-4%	0.709	-0.028	-4%	0.708	-0.028	-4%
Aug	0.658	0.639	-0.018	-3%	0.633	-0.025	-4%	0.632	-0.025	-4%	0.632	-0.025	-4%
Sep	0.698	0.677	-0.021	-3%	0.672	-0.026	-4%	0.671	-0.027	-4%	0.671	-0.027	-4%
Oct	0.694	0.672	-0.022	-3%	0.668	-0.026	-4%	0.667	-0.026	-4%	0.667	-0.027	-4%
Nov	0.660	0.639	-0.021	-3%	0.635	-0.025	-4%	0.635	-0.025	-4%	0.635	-0.025	-4%
Dec	0.564	0.545	-0.019	-3%	0.543	-0.021	-4%	0.543	-0.022	-4%	0.542	-0.022	-4%
Annual	0.630	0.614	-0.017	-3%	0.606	-0.024	-4%	0.606	-0.024	-4%	0.606	-0.024	-4%

Table 3.13 Simulated Average Monthly Water Levels at Minton Lake

Month	Existing Condition	Construction		Operation		During Pit Filling		After Pit Filling	
	Level (m)	Level (m)	Change from Existing (m)	Level (m)	Change from Existing (m)	Level (m)	Change from Existing (m)	Level (m)	Change from Existing (m)
Jan	330.06	330.04	-0.02	330.01	-0.05	330.01	-0.05	330.01	-0.05
Feb	330.03	330.00	-0.02	329.98	-0.05	329.98	-0.05	329.98	-0.05
Mar	330.00	329.97	-0.02	329.95	-0.04	329.95	-0.04	329.95	-0.05
Apr	330.02	330.00	-0.03	329.98	-0.05	329.98	-0.05	329.98	-0.05
May	330.25	330.20	-0.05	330.17	-0.08	330.17	-0.08	330.17	-0.08
Jun	330.25	330.20	-0.05	330.17	-0.07	330.17	-0.08	330.17	-0.08
Jul	330.16	330.12	-0.04	330.10	-0.06	330.10	-0.07	330.10	-0.07
Aug	330.14	330.09	-0.04	330.08	-0.06	330.08	-0.06	330.08	-0.06
Sep	330.15	330.10	-0.05	330.09	-0.06	330.09	-0.06	330.09	-0.06
Oct	330.15	330.10	-0.05	330.09	-0.06	330.09	-0.06	330.09	-0.06
Nov	330.14	330.09	-0.05	330.08	-0.06	330.08	-0.06	330.08	-0.06
Dec	330.11	330.05	-0.05	330.05	-0.06	330.05	-0.06	330.05	-0.06
Annual	330.12	330.08	-0.04	330.06	-0.06	330.06	-0.06	330.06	-0.06

Table 3.14 Simulated Average Monthly Water Levels at Cockeram Lake

Month	Existing Condition	Construction		Operation		During Pit Filling		After Pit Filling	
	Level (m)	Level (m)	Change from Existing (m)	Level (m)	Change from Existing (m)	Level (m)	Change from Existing (m)	Level (m)	Change from Existing (m)
Jan	312.13	312.13	0.00	312.13	0.00	312.13	0.00	312.13	0.00
Feb	312.11	312.11	0.00	312.11	0.00	312.11	0.00	312.11	0.00
Mar	312.08	312.08	0.00	312.08	0.00	312.08	0.00	312.08	0.00
Apr	312.10	312.10	0.00	312.10	0.00	312.10	0.00	312.11	0.00
May	312.29	312.29	0.00	312.29	0.00	312.29	0.00	312.29	0.00
Jun	312.29	312.29	0.00	312.28	0.00	312.28	0.00	312.28	0.00
Jul	312.22	312.22	0.00	312.22	0.00	312.22	0.00	312.22	0.00
Aug	312.20	312.20	0.00	312.20	0.00	312.20	0.00	312.20	0.00
Sep	312.21	312.21	0.00	312.21	0.00	312.21	0.00	312.21	0.00
Oct	312.21	312.21	0.00	312.21	0.00	312.21	0.00	312.21	0.00
Nov	312.20	312.20	0.00	312.20	0.00	312.20	0.00	312.20	0.00
Dec	312.17	312.17	0.00	312.17	0.00	312.17	0.00	312.17	0.00
Annual	312.18	312.18	0.00	312.18	0.00	312.18	0.00	312.18	0.00

Note:
0.00 m in the Table represents < 0.01 m.

Construction

There were no additional Project activities identified in this NOA/NOC that might interact with surface water quantity for the construction phase of the Project beyond those noted in the EIS.

Similar to the EIS, during construction, the Project activities and components that might interact with surface water quantity and result in an environmental effect include site preparation; construction of mine components; construction of utilities, infrastructure, and other facilities; and construction of water development and control (including dewatering of the open pit satellite pit).

Site preparation activities involve vegetation removal, topsoil stripping, ground compaction, and the decommissioning and removal of existing historical buildings, and will result in reduced infiltration and evapotranspiration and increased runoff.

Construction of the mine components, utilities, infrastructure, and other facilities will involve vegetation removal, topsoil stripping, ground compaction, and building construction, which will result in reduced infiltration and evapotranspiration and increased runoff. Construction of the TMF will reduce the effective contributing catchment area of Payne Lake, Minton Lake, and other downstream waterbodies and watercourses. Collection of contact runoff from the MRSA, plant site area, open pit and satellite pit into the collection pond and its discharge into the Keewatin River can potentially alter natural flow pathways and change the streamflow in the tributaries and the mainstem of the Keewatin River.

Construction and operation of the freshwater intake in the Keewatin River are not anticipated to result in substantial changes to water quantity; however, water development and control activities will alter surface water quantity. Dewatering of the existing underground workings and the development and dewatering of the open pit and satellite pit may affect adjacent surface water features.

Operation

There were no additional Project activities identified in this NOA/NOC that might interact with surface water quantity for the operation phase of the Project beyond those noted in the EIS.

Similar to the EIS, during operation, the Project activities and components that might interact with surface water quantity and result in an environmental effect include the storage and stockpiling of ore and overburden; ore milling and processing; site water management (including dewatering, mine water collection and storage, process water supply, and water intake from the Keewatin River); tailings management; and operation of utilities, infrastructure, and other facilities. These activities will affect runoff, evapotranspiration, and infiltration characteristics, change effective contributing catchment areas, and modify natural flow pathways.

Development and use of the MRSA, overburden storage area, and OSAs will affect local runoff, evapotranspiration, and infiltration characteristics, change effective contributing catchment areas (as addressed in the construction phase), and modify local groundwater pathways and levels.

Milling and processing of ore will require water input that will be met by the recycling of contact water from the TMF and dewatering of the open pit and satellite pit. These sources will supply adequate water, except for the freshwater make-up requirement during the first year of operation, as well as 16.5 cubic metres per hour (m^3/h) freshwater requirement for gland seal water and reagent preparation (Appendix F).

Water management (i.e., open pit and satellite pit dewatering, ongoing mine water collection and storage, and discharge of site surface water and groundwater via water management infrastructure) might interact with surface water quantity. Contact water from the open pit, satellite pit, MRSA, stockpiles, and plant site area will be routed to the collection pond, which will discharge to the Keewatin River. Similar to the EIS, these changes to local drainage patterns will affect the quantity and timing of flows in downstream waterbodies.

Decommissioning/Closure

There were no additional Project activities identified in this NOA/NOC that might interact with surface water quantity for the decommissioning/closure phase of the Project beyond those noted in the EIS.

Similar to the EIS, during closure, the Project activities and components that might interact with surface water quantity and result in an environmental effect include the removal and reclamation of Project infrastructure/infrastructure areas, reestablishment of drainage patterns to the extent feasible, and the filling of the open pit and satellite pit. Removal of Project infrastructure and reclamation of land will decrease runoff while increasing infiltration and evapotranspiration.

Once mining is completed and dewatering is terminated, the open pit and satellite pit will begin to fill through groundwater inflow, direct precipitation, surface water runoff, and water from the TMF and collection pond. This will affect groundwater levels and flow in adjacent surface water features.

Updated NOA/NOC water balance and water quality model results demonstrate that filling of the open pit will take approximately 40 years under average climate conditions. Once the open pit is filled, discharge from the pit lake will flow east and increase streamflow in Keewatin River tributary KEE3-B1 (model node QM04), which flows into the Keewatin River.

Comparison with EIS

The EIS model used an estimated open pit volume of 52 cubic megametre (Mm^3), resulting in a pit filling period of 21 years. In contrast, the updated model used the detailed design volume of 95.8 Mm^3 and estimated a 40-year pit filling period.

Both the EIS model results and the updated NOA/NOC model results (Table 3.5 to Table 3.14) indicate the following effects (Table 3.15):

- Changes in average monthly streamflows between project-affected and existing conditions at QM02, QM03, QM06, QM08, and QM11 will be lower than 10%.
- Changes in average monthly streamflows between project-affected and existing conditions at QM04 and QM07 will be greater than 10%.
- Changes in average monthly water levels between project-affected and existing conditions at Minton Lake will be lower than 0.10 m.
- Changes in average monthly water levels between project-affected and existing conditions at Cockeram Lake will be lower than 0.01 m.

While the EIS model results (Stantec 2020) did not predict streamflow changes at QM09, the updated NOA/NOC results predict up to a 10% flow reduction at this modelling node (Table 3.15). This streamflow reduction is attributed to baseflow reduction in Dot Lake (see Section 3.3.3; Appendix E).

Table 3.15 Comparison of Updated Water Balance Model Results with EIS Results

Model Node	Decrease/Increase in Monthly Streamflow or Lake Level from Existing Condition			
	EIS Results		Updated NOA/NOC Results (Table 3.5 to Table 3.14)	
	decrease from existing condition	Increase from existing condition	decrease from existing condition	Increase from existing condition
QM02	–	–	–	2%
QM03	–	2%	–	1%
QM04	64%	89% (800%)[a]	66%	391%
QM06	1%	2%	–	2%
QM07	31%	3%	28%	–
QM08	–	1%	–	1%
QM09	–	–	10%	–
QM11	1%	1%	4%	–
Minton Lake	0.06 m	–	0.08 m	–
Cockeram Lake	–	–	–	–

Notes:

– Lower than 1% change in streamflow or 0.01m in lake level

[a] The summary tables and appendices from the EIS reports indicate that streamflow could increase by up to 89% following pit filling. However, a significantly higher 800% increase was deemed not applicable due to a modelling artifact that affected the representation of very small flows.

3.3.4.2.2 Surface Water Quality

Assessment Methods

The EIS surface water quality model was updated to reflect the modifications to the approved MacLellan site presented in Section 1, results of the NOA/NOC groundwater modelling presented in Section 3.3.3., and updates to the mine rock and ore volumes and geochemical source terms since submission of the EIS.

As in the EIS, the updated NOA/NOC water quality model included two scenarios: an “Expected Case” scenario based on average climate conditions, average baseline water quality in the receiving environment, average groundwater quality, and average geochemical source term concentrations from the open pit, tailings, ore, and mine rock, and an ”Upper-Case” scenario based on average climate conditions paired with 95th percentile baseline water quality in the receiving environment, and 95th percentile geochemical source terms. However, like the EIS, only the Expected Case scenario predictions were used to identify POPCs and to assess residual effects on surface water quality in the receiving environment. Results from the Upper-Case scenario were provided only to show potential extreme changes in the predicted water quality parameters even though the likelihood of these predictions occurring during any mine phase is very low.

The updated surface water quality model utilized the same assessment nodes (Table 3.16 and Map 4, Appendix A) and approach as the EIS surface water quality model except for the modifications listed below. A detailed description of the modifications to the surface water quality model is presented in Appendix F.

- An updated mine rock and ore production schedule was incorporated. Overall, the total quantity of mine rock was comparable to the EIS model. However, the updated estimate of potentially acid generating (PAG) mine rock was 41% of the total mine rock, which was greater than in the EIS model (28%). In addition, the updated estimate of ore was 39.7 metric tonnes (Mt) which was 48% greater than the estimate in the EIS model (26.8 Mt).
- In the updated model, a scaling factor for progressive closure was applied at the start of reclamation activities (e.g., placement of soil cover) in the later stage of operation. The scaling factor was gradually decreased from 1 to 0.5 for the Expected Case scenario and from 1 to 0.85 for the Upper-Case scenario during decommissioning/closure when reclamation activities would occur and were kept at 0.5 and 0.85, respectively, in post-closure. In comparison, a scaling factor of 0.85 was applied in the post-closure phase in the EIS model for both Expected Case and Upper-Case scenarios. The scaling factor used in the updated model was considered more representative than the scaling factor used in the EIS model to reflect a reduction in mass loads due to progressive closure activities.
- The percentages of total residual nitrogen from blasting activities used for the Expected Case and Upper-Case scenarios in the updated model were 1% and 3%, respectively, which were greater than the value of 0.2% used for the Expected Case and Upper-Case scenarios in the EIS model. The percentage of total residual nitrogen used in the updated model was considered more representative than the value used in the EIS model.

- The travel times of the seepages in the updated model were not differentiated between the Expected Case or the Upper-Case scenarios as in the EIS model. In the updated model, uncertainty related to seepage travel time was addressed by interpolating the predicted flow rate. The seepage flow rate arriving at different receiving environment nodes was set to increase linearly from 0 m^3/s to the predicted flow rate at the end of construction, operation, and decommissioning/closure phases.
- Particulate in the groundwater seepage was not expected to be transported through the aquifer. Thus, total parameter loadings from groundwater to surface water was set equal to the dissolved concentrations in groundwater.
- In the updated model, it was assumed that discharges from the pit lake to Keewatin River tributary KEE3-B1 after filling with water and discharges from the collection pond to the Keewatin River carry a suspended sediment load equivalent to 10 mg/L (TSS concentration) whereas, in the EIS model, a mass load equivalent of 15 mg/L of TSS was added to seepage from the MRSA and ore stockpile to represent the potential contribution of particulates to the predicted total water quality parameter concentrations. The approach used in the updated model was considered more representative than the approach used in the EIS to evaluate the potential effects of particulates in discharges to the receiving environment.

Like the EIS, POPCs were identified for instances in which at least a single month's predicted concentration exceeded modelled baseline by at least 20% while also exceeding the applicable guideline(s). However, unlike the EIS which relied only on the long-term and short-term CWQG-FAL and Manitoba Water Quality Standards, Objectives, and Guidelines for Protection of Freshwater Aquatic Life (MWQSOG-FAL) to identify POPCs, the assessment of the proposed alterations to the approved MacLellan site used the more recently published FEQGs in addition the CWQG-FAL and MWQSOG-FAL for those parameters for which FEQGs existed (i.e., total aluminum, total cobalt, dissolved copper, total hexavalent chromium, total iron, dissolved lead, dissolved strontium, and total vanadium). The FEQGs were equivalent to long-term water quality guidelines and, because the FEQGs were more recent and based on the current state of science compared with CWQG-FALs and MWQSOG-FALs, only the FEQG was used to identify POPCs in this updated assessment for parameters which had an FEQG.

Table 3.16 MacLellan Site Assessment Nodes

Assessment Node Name	Corresponding Water Quality Site	Assessment Node Description
KEE3-PAY1	AQM31	Tributary to Keewatin River; downstream of Payne Lake; adjacent to TMF
QM02	AQM4	Keewatin River, downstream of confluence with KEE3-PAY1
QM03	AQM7	Keewatin River; First node downstream of collection pond discharge
KEE3-B1	AQM18	Small tributary to Keewatin River; Within PDA; Southeast 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	Southeast of MRSA and TMF
QM10	AQM10	South Cockeram River; downstream of Minton Lake
QM08	AQM11	South Cockeram Lake; downstream of QM10

Construction

There are no new Project components or activities proposed to the approved MacLellan site during the construction phase that were not assessed or modelled in the EIS. Like the EIS, construction activities that continue to have the potential to affect surface water quality in the receiving environment are:

- site preparation (i.e., tree clearing, grading, and grubbing)
- construction of mine components (e.g., TMF, MRSA, ore stockpile, overburden and topsoil stockpiles, processing facility, roads)
- construction of water management infrastructure (e.g., collection ditches, sumps, and ponds)

Site preparation activities will involve vegetation removal, topsoil stripping, ground compaction, decommissioning and removal of existing buildings, and preparation of foundations for the various mine components. These activities have the potential to result in increased sediment loading to waterbodies and watercourses downstream or downslope of the PDA. Water management infrastructure will be constructed to collect contact water run-off and divert it to collection ponds where it will be discharged to the Keewatin River during construction.

Operation

There are no new Project components or activities proposed to the approved MacLellan site during the operation phase that were not assessed or modelled in the EIS. Like the EIS, operation activities that continue to have the potential to affect surface water quality in the receiving environment are:

- Discharge of contact water from the collection pond to the Keewatin River
- Groundwater seepage from the TMF to Keewatin River tributary KEE3-B1, Payne Lake, the Payne Lake outlet (KEE3-PAY1)
- Groundwater seepage from the MRSA to Keewatin River tributary KEE3-B1 and to Minton Lake.

As described in the EIS, contact water from the MRSA, the processing facility, and the ore, overburden, and topsoil stockpiles will be diverted to a collection pond during operation. Contact water in the open pit will be pumped to the TMF. Runoff from part of the MRSA will be collected and pumped to the TMF.

Decommissioning/Closure

There were no new Project components or activities proposed to the approved MacLellan site during the decommissioning/closure phase that were not assessed or modelled in the EIS. Like the EIS, decommissioning/closure activities that continue to have the potential to affect surface water quality in the receiving environment are:

- Groundwater seepage from the TMF to Keewatin River tributary KEE3-B1 and the Payne Lake outlet (KEE3-PAY1)
- Groundwater seepage from the MRSA to Keewatin River tributary KEE3-B1 and to Minton Lake
- Overflow from the open pit to Keewatin River tributary KEE3-B1

During decommission/closure, Project infrastructure will be removed, natural drainage pathways will be established to the extent feasible, and the water intake and effluent pipes will be removed from the Keewatin River. Collection ponds will be dewatered and decommissioned and contact water ditches and sumps will be decommissioned or realigned to direct contact water to the open pit by gravity. Water in the TMF pond will also be directed to the open pit during decommissioning.

Updated water balance model results predict that the open pit will take approximately 40 years to fill under average climate conditions. Once the open pit is filled, water in the pit lake will flow east into Keewatin River tributary KEE3-B1 and then into the Keewatin River downstream of the PDA. Because most of the water in tributary KEE3-B1 will be comprised of overflow from the pit lake, water quality in tributary KEE3-B1 is expected to be near identical to water quality in the upper layer of the stratified pit lake.

Like the existing pit lakes at the Gordon site, the pit lake at the MacLellan site is expected to become meromictic (i.e., chemically and thermally stratified) in time, with denser, more saline (i.e., higher concentrations of dissolved metals and salts), and less oxygenated water in the lower monimolimnion and less dense, less saline, and more oxygenated water in the upper mixolimnion. The chemocline separating these two zones exists between 10 m and 15 m depth in the existing pit lakes at the Gordon site. A similar chemocline depth is expected to develop in the pit lake at the MacLellan site.

Comparison with the EIS

Six water quality parameters were identified as POPCs in the updated NOA/NOC water quality model for the Expected Case scenario: total arsenic, total cobalt, total copper, dissolved copper, fluoride, and total phosphorus (Table 3.17). These six POPCs were carried forward in the residual effects assessment and were assessed according to the methods described in Section 9.4.2.1 of the EIS. These six POPCs were also assessed for their potential to cause acute or chronic toxicological effects to fish and other aquatic biota in Section 3.3.5 of this assessment.

Five of these six POPCs were predicted to occur in Keewatin River tributary KEE3-B1 during post-closure when water in the pit lake will be discharging to the downstream receiving environment; only dissolved copper is not identified as a POPC in Keewatin River tributary KEE3-B1 in post-closure. Total arsenic, total copper, and fluoride were also identified as POPCs in Keewatin River tributary KEE3-B1 during post-closure in the EIS.

Table 3.17 Comparison of Parameters of Potential Concern Predicted in Receiving Environment at the MacLellan Site for the Expected Case between the EIS Model and Updated Model

Parameter of Potential Concern (POPC)	Assessment Node Associated with Identification of POPC	EIS				NOA/NOC			
		Phase Associated with Identification of POPC				Phase Associated with Identification of POPC			
		Construction	Operation	Closure	Post-Closure	Construction	Operation	Closure	Post-Closure
Total Aluminum	KEE3-B1	-	-	-	x	-	-	-	-
	Keewatin River (QM06)	-	-	-	x	-	-	-	-
Total Arsenic	KEE3-B1	-	-	-	x	-	x	x	x
	Minton Lake	-	-	-	-	-	x	-	-
Total Cadmium	KEE3-B1	-	-	-	x	-	-	-	-
	Minton Lake	-	-	-	x	-	-	-	-
Dissolved Cadmium	KEE3-B1	-	-	-	x	-	-	-	-
Total Cobalt	KEE3-PAY1	-	-	-	-	-	x	x	x
	KEE3-B1	-	-	-	-	-	-	-	x
	Minton Lake	-	-	-	-	-	x	x	-
Total Copper	KEE3-B1	-	-	-	x	-	-	-	x
Dissolved Copper	KEE3-PAY1	-	-	-	-	-	x	x	x
	Minton Lake	-	-	-	-	-	x	x	x
Fluoride	KEE3-B1	-	-	-	x	-	-	-	x
Total Phosphorus	KEE3-B1	-	-	-	-	-	-	-	x

Notes:
- no POPC predicted
x POPC predicted

Differences in POPCs identified for this NOA/NOC and the EIS were:

- Total aluminum is not identified as a POPC at any model node, during any mine phase, for the NOA/NOC; by comparison, total aluminum was identified as a POPC in Keewatin River tributary KEE3-B1 and in the Keewatin River downstream of tributary KEE3-B1 confluence during post-closure in the EIS. The reason for exclusion of total aluminum as a POPC in the NOA/NOC is because total aluminum concentrations were never predicted to exceed the hardness-dependent FEQG at any node, during any mine phase in the NOA/NOC, but were originally predicted to exceed the pH-dependent CWQG-FAL and MWQSOG-FAL in the EIS.
- Total arsenic is identified as a POPC in Keewatin River tributary KEE3-B1 during operation, closure, and post-closure and in Minton Lake during operation for the NOA/NOC; by comparison, total arsenic was identified as a POPC in Keewatin River tributary KEE3-B1 only during post-closure in the EIS and not in Minton Lake during any mine phase. The reason for inclusion of total arsenic as a POPC in Keewatin River tributary KEE3-B1 during operation and closure and in Minton Lake during operation is due to shorter travel time of groundwater seepages from the MRSA and the TMF predicted by the updated NOA/NOC groundwater modelling (presented in Section 3.3.3) compared with those used in the EIS model.
- Total cadmium is not identified as a POPC at any model node, during any mine phase, for the NOA/NOC; by comparison, total cadmium was identified as a POPC in Keewatin River tributary KEE3-B1 and Minton Lake during post-closure in the EIS. The reason for exclusion of total cadmium as a POPC in the NOA/NOC is because of the predicted reduction in groundwater seepage from the MRSA to Minton Lake and various Keewatin River tributaries, including Keewatin River tributary KEE3-B1, compared with the EIS model.
- Dissolved cadmium is not identified as a POPC at any model node, during any mine phase, for the NOA/NOC; by comparison, dissolved cadmium was identified as a POPC in Keewatin River tributary KEE3-B1 during post-closure in the EIS. The reason for exclusion of dissolved cadmium as a POPC in the NOA/NOC is the same as for total cadmium.
- Total cobalt is identified as a POPC in Keewatin River tributary KEE3-B1 during post-closure, in the Payne Lake outlet (KEE3-PAY1) during operation, closure, and post-closure phases, and in Minton Lake during operation and closure for the NOA/NOC but not in the EIS. The reason for inclusion of total cobalt as a POPC in the NOA/NOC is because of the use of the total cobalt FEQG to screen POPCs; there was no CWQG-FAL or MWQSOG for total cobalt to use to screen POPCs during the EIS.
- Dissolved copper is identified as a POPC in the Payne Lake outlet (KEE3-PAY1) and Minton Lake during operation, closure, and post-closure phases for the NOA/NOC but not in the EIS. The reason for inclusion of dissolved copper as a POPC in the NOA/NOC is because of the use of the dissolved copper FEQG to screen POPCs; there was no CWQG-FAL for dissolved copper and the biotic ligand model (BLM) used to calculate the FEQG resulted in a lower guideline concentration than the hardness-dependent equation in the MWQSOG-FAL used in the EIS.
- Total phosphorus is identified as a POPC in Keewatin River tributary KEE3-B1 during post-closure for the NOA/NOC but not in the EIS. The reason for inclusion of total phosphorus as a POPC in the NOA/NOC is because of the predicted increase in total phosphorus concentration in the open pit overflow discharge.

Like the EIS, no POPCs were identified during the construction phase for this NOA/NOC. This is because there is no effluent discharge and no change in groundwater quantity or quality predicted to occur during construction. No POPCs were identified in the Keewatin River downstream of the PDA for this NOA/NOC. Total aluminum was identified as a POPC in the Keewatin River in the EIS, but total aluminum is not identified as a POPC for this NOA/NOC for the reasons explained above.

Parameters of Potential Concern

Predicted concentrations for total arsenic, total cobalt, total copper, dissolved copper, fluoride, and phosphorus (i.e., the six POPCs identified for the Expected Case scenario) during construction, operation, closure, and post-closure phases at the MacLellan site are summarized in Table 3.18 to Table 3.23, respectively. Each table includes predicted mean and maximum concentrations, summarized by phase, at each assessment node associated with the POPC for the Expected Case as well as the magnitude of the predicted maximum concentration above the baseline concentration and the appropriate water quality guideline and the percentage of months in each phase that the parameter concentration is predicted to exceed the appropriate guideline. Similar statistics are provided for the predicted POPC concentrations for the Upper-Case scenario. Details of the surface water quality modelling and model results are presented in Appendix F. Graphical representations of predicted POPC concentrations in the receiving environment over time are provided in Appendix G.

POPCs were predicted to occur in Keewatin River tributary KEE3-B1, in the Payne Lake outlet, and in Minton Lake during operation, closure, and post-closure phases. Descriptions of these waterbodies and explanations for why POPCs were predicted to occur are provided below:

- Tributary KEE3-B1 is a small fish-bearing tributary to the Keewatin River. This stream currently drains East Pond to the Keewatin River. During operation, East Pond is predicted to passively dewater due to the hydraulic gradient that will develop between the open pit and East Pond as the size and depth of the open pit increased. Flows in tributary KEE3-B1 were predicted to decline during operation due to loss of outflow from East Pond and diversion of run-off from other headwater tributaries in the water management infrastructure. Project-related changes to water quality in tributary KEE3-B1 in the updated model were associated with groundwater seepage from the MRSA and TMF from operation to post-closure, as well as post-closure overflow from the pit lake and collection pond.
- Minton Lake is a fish-bearing waterbody located southeast of the proposed MRSA and TMF. Minton Lake currently receives most of its inflow from a headwater tributary draining an area to the northwest of the lake. Minton Lake drains into an unnamed lake to the east which eventually drains to the Cockeram River and Cockeram Lake. Predicted changes to water quality in Minton Lake in the updated model were associated with groundwater seepage from the MRSA and TMF from operation to post-closure.
- Tributary KEE3-PAY1 is the outlet of Payne Lake, a small fish-bearing lake located to the north of the proposed MRSA and TMF. KEE3-PAY1 is a tributary to Keewatin River with its confluence upstream of the MacLellan site. Project-related changes to water quality in tributary KEE3-PAY1 in the updated model were associated with groundwater seepage from the MRSA and TMF from operation to post-closure.

Table 3.18 Predicted Total Arsenic Concentrations, by Phase, at MacLellan Site Model Nodes Associated with Exceedances of Screening Criteria for the Expected and Upper-Case Scenarios

Model Scenario	Node	Phase	Number of Years in Phase	Long-term CWQG-FAL (mg/L)	Modelled Baseline		Project Predictions		Magnitude of Exceedance of POPC Screening Criteria		Percent of Months in Exceedance of Guideline
					Phase Mean (mg/L)	Phase Max (mg/L)	Phase Mean (mg/L)	Phase Max (mg/L)	Max fold Change: Project vs. Baseline	Max fold Exceedance of Long-term CWQG-FAL	
Expected Case	KEE3-B1	Construction	2	0.005	0.0010	0.0011	0.0010	0.0011	-	-	-
		Operation	18	0.005	0.0010	0.0011	0.0025	0.0069	6.3	1.4	9%
		Closure	5	0.005	0.0010	0.0011	0.0019	0.0051	4.6	1.0	2%
		Post-Closure	77	0.005	0.0010	0.0011	0.0061	0.0109	12.9	2.2	56%
	Minton Lake	Construction	2	0.005	0.0006	0.0006	0.0006	0.0006	-	-	-
		Operation	18	0.005	0.0006	0.0006	0.0018	0.0050	8.1	1.0	0.5%
		Closure	5	0.005	0.0006	0.0006	0.0027	0.0048	-	-	-
		Post-Closure	77	0.005	0.0006	0.0006	0.0021	0.0024	-	-	-
Upper Case	KEE3-B1	Construction	2	0.005	0.0013	0.0014	0.0013	0.0014	-	-	
		Operation	18	0.005	0.0013	0.0014	0.0025	0.0061	4.4	1.2	6%
		Closure	5	0.005	0.0013	0.0014	0.0024	0.0054	3.9	1.1	2%
		Post-Closure	77	0.005	0.0013	0.0014	0.0078	0.0144	13.8	2.9	56%
	Minton Lake	Construction	2	0.005	0.0007	0.0007	0.0007	0.0007	-	-	-
		Operation	18	0.005	0.0007	0.0007	0.0018	0.0047	-	-	-
		Closure	5	0.005	0.0007	0.0007	0.0030	0.0047	-	-	-
		Post-Closure	77	0.005	0.0007	0.0007	0.0023	0.0026	-	-	-

Note: CWQG-FAL = Canadian Water Quality Guideline - Freshwater Aquatic Life
Note: Maximum magnitudes and frequencies of exceedances only shown for nodes and phases in which at least a single month exceeded baseline by at least 20% and the applicable guideline
Note: Maximum fold exceedance of applicable guidelines based on predicted phase maximum concentration
Note: - = not applicable; values not provided for phases not associated with an identification of the POPC
Note: Max Fold Change Project vs Baseline: the maxima presented is the maximum magnitude difference of prediction versus baseline across all model time steps (i.e. modelled months).

Table 3.19 Predicted Total Cobalt Concentrations, by Phase, at MacLellan Site Model Nodes Associated with Exceedances of Screening Criteria for the Expected and Upper-Case Scenarios

Model Scenario	Node	Phase	Number of Years in Phase	Long-term FEQG (mg/L)	Modelled Baseline		Project Predictions		Magnitude of Exceedance of POPC Screening Criteria		Percent of Months in Exceedance of Guideline
					Phase Mean (mg/L)	Phase Max (mg/L)	Phase Mean (mg/L)	Phase Max (mg/L)	Max fold Change: Project vs. Baseline	Max fold Exceedance of Long-term FEQG	
Expected Case	KEE3-PAY1	Construction	2	0.000778	0.000223	0.000260	0.000223	0.000258	-	-	-
		Operation	18	0.000778	0.000223	0.000260	0.001030	0.001600	7.6	2.1	68%
		Closure	5	0.000778	0.000223	0.000260	0.001090	0.001490	6.7	1.9	95%
		Post-Closure	77	0.000778	0.000223	0.000260	0.000305	0.000852	3.5	1.1	1%
	KEE3-B1	Construction	2	0.00143 - 0.00175	0.0000882	0.000093	0.000088	0.000093	-	-	-
		Operation	18	0.00143 - 0.00175	0.0000882	0.000093	0.000419	0.001170	-	-	-
		Closure	5	0.00143 - 0.00175	0.0000882	0.000093	0.000450	0.000984	-	-	-
		Post-Closure	77	0.00143 - 0.00175	0.0000882	0.000093	0.002110	0.004290	51.7	3.0	55%
	Minton Lake	Construction	2	0.000778	0.0000905	0.0000916	0.000091	0.000092	-	-	-
		Operation	18	0.000778	0.0000905	0.0000916	0.000429	0.000981	10.9	1.3	18%
		Closure	5	0.000778	0.0000905	0.0000916	0.000741	0.000958	10.6	1.2	37%
		Post-Closure	77	0.000778	0.0000905	0.0000916	0.000406	0.000635	-	-	-
Upper Case	KEE3-PAY1	Construction	2	0.000778	0.0002920	0.000342	0.000293	0.000342	-	-	-
		Operation	18	0.000778	0.0002920	0.000342	0.001640	0.002590	9.4	3.3	80%
		Closure	5	0.000778	0.0002920	0.000342	0.001760	0.002420	8.4	3.1	100%
		Post-Closure	77	0.000778	0.0002920	0.000342	0.000410	0.001360	4.6	1.8	6%
	KEE3-B1	Construction	2	0.00143 - 0.00175	0.000100	0.000100	0.000100	0.000100	-	-	-
		Operation	18	0.00143 - 0.00175	0.000100	0.000100	0.000593	0.001650	16.5	1.2	6%
		Closure	5	0.00143 - 0.00175	0.000100	0.000100	0.000752	0.001540	15.4	1.1	2%
		Post-Closure	77	0.00143 - 0.00175	0.000100	0.000100	0.004830	0.009610	96.1	6.7	56%
	Minton Lake	Construction	2	0.000778	0.000104	0.000105	0.000104	0.000105	-	-	-
		Operation	18	0.000778	0.000104	0.000105	0.000630	0.001480	14.3	1.9	32%
		Closure	5	0.000778	0.000104	0.000105	0.001230	0.001480	14.3	1.9	100%
		Post-Closure	77	0.000778	0.000104	0.000105	0.000730	0.001140	11.1	1.5	14%

Note: The FEQG long term guideline for total cobalt is hardness -dependent (exp{(0.414[ln(hardness)] – 1.887})
Note: Maximum magnitudes and frequencies of exceedances only shown for nodes and phases in which at least a single month exceeded baseline by at least 20% and the applicable guideline
Note: Maximum fold exceedance of applicable guidelines based on predicted phase maximum concentration
Note: - = not applicable; values not provided for phases not associated with the identification of the POPC
Note: Max Fold Change Project vs Baseline: the maxima presented is the maximum magnitude difference of prediction versus baseline across all model time steps (i.e. modelled months).

Table 3.20 Predicted Total Copper Concentrations, by Phase, at the MacLellan Site Model Nodes Associated with Exceedances of Screening Criteria for the Expected and Upper-Case Scenarios

Model Scenario	Node	Phase	Number of Years in Phase	Long-term CWQG-FAL (mg/L)	Modelled Baseline		Project Predictions		Magnitude of Exceedance of POPC Screening Criteria		Percent of Months in Exceedance of Guideline
					Phase Mean (mg/L)	Phase Max (mg/L)	Phase Mean (mg/L)	Phase Max (mg/L)	Max fold Change: Project vs. Baseline	Max fold Exceedance of Long-term CWQG-FAL	
Expected Case	KEE3-B1	Construction	2	0.004	0.0003	0.0003	0.0003	0.0003	-	-	-
		Operation	18	0.004	0.0003	0.0003	0.0004	0.0007	-	-	-
		Closure	5	0.004	0.0003	0.0003	0.0005	0.0007	-	-	-
		Post-Closure	77	0.004	0.0003	0.0003	0.0022	0.0041	15.1	1.0	1%
Upper Case	KEE3-B1	Construction	2	0.004	0.0005	0.0007	0.0005	0.0007	-	-	-
		Operation	18	0.004	0.0005	0.0007	0.0006	0.0011	-	-	-
		Closure	5	0.004	0.0005	0.0007	0.0007	0.0011	-	-	-
		Post-Closure	77	0.004	0.0005	0.0007	0.0037	0.0072	25.8	1.8	56%

Note: CWQG-FAL = Canadian Water Quality Guideline - Freshwater Aquatic Life

Note: The long-term guideline for total copper is hardness dependent. Monthly mean baseline hardness was used to calculate the total copper guideline value for each month. At hardness >180 mg/L, the guideline is 0.004 mg/L; at hardness between 82 and 180 mg/L, the guideline (in mg/L) is 0.001*0.2*[exp(0.8545*(ln(Hardness))-1.465)]

Note: Maximum magnitudes and frequencies of exceedances only shown for nodes and phases in which at least a single month exceeded baseline by at least 20% and the applicable guideline

Note: Maximum fold exceedance of applicable guidelines based on predicted phase maximum concentration

Note: - = not applicable; values not provided for phases not associated with the identification of the POPC

Note: Max Fold Change Project vs Baseline: the maxima presented is the maximum magnitude difference of prediction versus baseline across all model time steps (i.e. modelled months).

Table 3.21 Predicted Dissolved Copper Concentrations, by Phase, at the MacLellan Site Model Nodes Associated with Exceedances of Screening Criteria for the Expected and Upper-Case Scenarios

Model Scenario	Node	Phase	Number of Years in Phase	Long-term MWQSOG-FAL (mg/L)	Short-term MWQSOG-FAL (mg/L)	Long-term FEQG (mg/L)	Modelled Baseline		Project Predictions		Max fold Change: Project vs. Baseline	Magnitude of Exceedance of POPC Screening Criteria			Percent of Months in Exceedance of Guideline
							Phase Mean (mg/L)	Phase Max (mg/L)	Phase Mean (mg/L)	Phase Max (mg/L)		Max fold Exceedance of Long-term MWQSOG-FAL	Max fold Exceedance of Short-term MWQSOG-FAL	Max fold Exceedance of Long-term FEQG	
Expected Case	KEE3-PAY1	Construction	2	0.000925 - 0.00247	0.0011 - 0.00325	0.000218 - 0.00186	0.000217	0.000233	0.000217	0.000233	-	-	-	-	-
		Operation	18	0.000925 - 0.00247	0.0011 - 0.00325	0.000218 - 0.00186	0.000217	0.000233	0.00055	0.000765	3.7	-	-	3.3	34%
		Closure	5	0.000925 - 0.00247	0.0011 - 0.00325	0.000218 - 0.00186	0.000217	0.000233	0.000712	0.000748	3.6	-	-	3.3	42%
		Post-Closure	77	0.000925 - 0.00247	0.0011 - 0.00325	0.000218 - 0.00186	0.000217	0.000233	0.000492	0.000724	3.5	-	-	3.2	31%
	Minton Lake	Construction	2	0.0018 - 0.00333	0.00229 - 0.00451	0.000254 - 0.00275	0.000502	0.000518	0.000503	0.000518	-	-	-	-	-
		Operation	18	0.0018 - 0.00333	0.00229 - 0.00451	0.000254 - 0.00275	0.000502	0.000518	0.000637	0.000850	1.6	-	-	3.1	38%
		Closure	5	0.0018 - 0.00333	0.00229 - 0.00451	0.000254 - 0.00275	0.000502	0.000518	0.000816	0.000855	1.7	-	-	3.1	50%
		Post-Closure	77	0.0018 - 0.00333	0.00229 - 0.00451	0.000254 - 0.00275	0.000502	0.000518	0.000859	0.001070	2.1	-	-	3.9	57%
Upper Case	KEE3-PAY1	Construction	2	0.000925 - 0.00247	0.0011 - 0.00325	0.000218 - 0.00186	0.000281	0.000296	0.000282	0.000296	-	-	-	-	-
		Operation	18	0.000925 - 0.00247	0.0011 - 0.00325	0.000218 - 0.00186	0.000281	0.000296	0.000616	0.000839	3.0	-	-	3.6	37%
		Closure	5	0.000925 - 0.00247	0.0011 - 0.00325	0.000218 - 0.00186	0.000281	0.000296	0.000776	0.000821	2.9	-	-	3.6	42%
		Post-Closure	77	0.000925 - 0.00247	0.0011 - 0.00325	0.000218 - 0.00186	0.000281	0.000296	0.000665	0.000797	2.8	-	-	3.5	36%
	Minton Lake	Construction	2	0.0018 - 0.00333	0.00229 - 0.00451	0.000254 - 0.00275	0.000822	0.000851	0.000825	0.000847	-	-	-	-	-
		Operation	18	0.0018 - 0.00333	0.00229 - 0.00451	0.000254 - 0.00275	0.000822	0.000851	0.000977	0.001250	1.5	-	-	4.7	64%
		Closure	5	0.0018 - 0.00333	0.00229 - 0.00451	0.000254 - 0.00275	0.000822	0.000851	0.001210	0.001260	1.5	-	-	4.8	75%
		Post-Closure	77	0.0018 - 0.00333	0.00229 - 0.00451	0.000254 - 0.00275	0.000822	0.000851	0.001390	0.001490	1.8	-	-	5.6	82%

Note: MWQSOG-FAL = Manitoba Standards, Objectives, and Guidelines - Freshwater Aquatic Life; FEQG = Federal Environmental Quality Guidelines
Note: The MWQSOG-FAL guidelines are hardness-dependent: Long-term (0.001*[exp(0.8545[ln(Hardness)]-1.702]*[0.960]); and short-term (0.001*((exp(0.9422*(ln(Hardness))-1.70))*(0.96)))
Note: The FEQG long term guideline uses a Biotic Ligand Model. See ECCC (2021)
Note: Maximum magnitudes and frequencies of exceedances only shown for nodes and phases in which at least a single month exceeded baseline by at least 20% and the applicable guideline
Note: Maximum fold exceedance of applicable guidelines based on predicted phase maximum concentration
Note: - = not applicable; values not provided for phases not associated with the identification of the POPC
Note: Max Fold Change Project vs Baseline: the maxima presented is the maximum magnitude difference of prediction versus baseline across all model time steps (i.e. modelled months).

Table 3.22 Predicted Fluoride Concentrations, by Phase, at the MacLellan Site Model Nodes Associated with Exceedances of Screening Criteria for the Expected and Upper-Case Scenarios

Model Scenario	Node	Phase	Number of Years in Phase	Long-term CWQG-FAL (mg/L)	Modelled Baseline		Project Predictions		Magnitude of Exceedance of POPC Screening Criteria		Percent of Months in Exceedance of Guideline
					Phase Mean (mg/L)	Phase Max (mg/L)	Phase Mean (mg/L)	Phase Max (mg/L)	Max fold Change: Project vs. Baseline	Max fold Exceedance of Long-term CWQG-FAL	
Expected Case	KEE3-B1	Construction	2	0.12	0.04	0.04	0.04	0.04	-	-	-
		Operation	18	0.12	0.04	0.04	0.05	0.06	-	-	-
		Closure	5	0.12	0.04	0.04	0.05	0.06	-	-	-
		Post-Closure	77	0.12	0.04	0.04	0.10	0.17	5.8	1.4	51%
Upper Case	KEE3-B1	Construction	2	0.12	0.05	0.05	0.05	0.05	-	-	-
		Operation	18	0.12	0.05	0.05	0.06	0.09	-	-	-
		Closure	5	0.12	0.05	0.05	0.06	0.08	-	-	-
		Post-Closure	77	0.12	0.05	0.05	0.23	0.43	11.2	3.5	56%

Note: CWQG-FAL = Canadian Water Quality Guideline - Freshwater Aquatic Life
Note: Maximum magnitudes and frequencies of exceedances only shown for nodes and phases in which at least a single month exceeded baseline by at least 20% and the applicable guideline.
Note: Maximum fold exceedance of applicable guidelines based on predicted phase maximum concentration
Note: - = not applicable; values not provided for phases not associated with the identification of the POPC
Note: Max Fold Change Project vs Baseline: the maxima presented is the maximum magnitude difference of prediction versus baseline across all model time steps (i.e. modelled months).

Table 3.23 Predicted Total Phosphorus Concentrations, by Phase, at the MacLellan Site Model Nodes Associated with Exceedances of Screening Criteria for the Expected and Upper-Case Scenarios

Model Scenario	Node	Phase	Number of Years in Phase	Long-term MWQSOG-FAL (mg/L)	Modelled Baseline		Project Predictions		Magnitude of Exceedance of POPC Screening Criteria		Percent of Months in Exceedance of Guideline
					Phase Mean (mg/L)	Phase Max (mg/L)	Phase Mean (mg/L)	Phase Max (mg/L)	Max fold Change: Project vs. Baseline	Max fold Exceedance of Long-term CWQG-FAL and MWQSOG-FAL	
Expected Case	KEE3-B1	Construction	2	0.025	0.021	0.026	0.021	0.026	-	-	-
		Operation	18	0.025	0.021	0.026	0.021	0.026	-	-	-
		Closure	5	0.025	0.021	0.026	0.021	0.026	-	-	-
		Post-Closure	77	0.025	0.021	0.026	0.023	0.029	1.3	1.2	36%
Upper Case	KEE3-B1	Construction	2	0.025	0.027	0.040	0.027	0.040	-	-	-
		Operation	18	0.025	0.027	0.040	0.027	0.040	-	-	-
		Closure	5	0.025	0.027	0.040	0.028	0.040	-	-	-
		Post-Closure	77	0.025	0.027	0.040	0.053	0.081	5.1	3.3	93%

Note: MWQSOG-FAL = Manitoba Standards, Objectives, and Guidelines - Freshwater Aquatic Life.
Note: Maximum magnitudes and frequencies of exceedances only shown for nodes and phases in which at least a single month exceeded baseline by at least 20% and the applicable guideline.
Note: Maximum fold exceedance of applicable guidelines based on predicted phase maximum concentration
Note: - = not applicable; values not provided for phases not associated with the identification of the POPC
Note: Max Fold Change Project vs Baseline: the maxima presented is the maximum magnitude difference of prediction versus baseline across all model time steps (i.e. modelled months).

Total Arsenic

Total arsenic is identified as a POPC for the Expected Case scenario in tributary KEE3-B1 during operation, closure and post-closure, and in Minton Lake during operation in the updated NOA/NOC water quality model (Table 3.15). Project-related changes to total arsenic concentrations in tributary KEE3-B1 and Minton Lake during operation were associated with groundwater seepage from the MRSA and TMF while changes to total arsenic concentrations in tributary KEE3-B1 in closure and post-closure were associated with groundwater seepage from the MRSA and TMF and overflow from the pit lake and collection pond, respectively.

For the Expected Case scenario, maximum predicted total arsenic concentrations in tributary KEE3-B1 and Minton Lake in the updated NOA/NOC water quality model were:

- 0.0069 mg/L in tributary KEE3-B1 in operation, which is 1.4 times the long-term CWQG-FAL (0.0050 mg/L) and approximately six times the modelled maximum baseline concentration (Table 3.18; Figure G-1, Appendix G)
- 0.0051 mg/L in tributary KEE3-B1 in closure, which is just above the long-term CWQG-FAL (0.0050 mg/L) and approximately 4.6 times the modelled maximum baseline concentration (Table 3.18; Figure G-1, Appendix G)
- 0.0109 mg/L in tributary KEE3-B1 in post-closure, which is approximately 2.2 times the long-term CWQG-FAL (0.0050 mg/L), and approximately 13 times the modelled maximum baseline concentration (Table 3.18; Figure G-1, Appendix G)
- 0.0050 mg/L in Minton Lake in operation, which is at the long term CWQG-FAL (0.005 mg/L) but approximately 8 times the modelled maximum baseline concentration (Table 3.18; Figure G-3, Appendix G).

Total arsenic concentrations in tributary KEE3-B1 were predicted to exceed the CWQG-FAL in only 9% of months during operation and in only 2% of months during closure (Figure G-1, Appendix G). Total arsenic concentrations in tributary KEE3-B1 were not predicted to exceed the CWQG-FAL for the first half of post-closure when the open pit will be filling with water. However, total arsenic concentrations in tributary KEE3-B1 were predicted to exceed the CWQG-FAL for perpetuity once the open pit is filled with water and discharging to the receiving environment.

Total arsenic concentrations in Minton Lake were predicted to increase during operation but were predicted to exceed the CWQG-FAL in only one month at end of operation, which is <1% of all months during operation (Figure G-3, Appendix G). Total arsenic concentrations in Minton Lake were predicted to decrease below the CWQG-FAL during closure due to a decrease in the predicted total arsenic concentration in the MRSA and the TMF seepages and, therefore, a decrease in the total arsenic load from the MRSA and TMF groundwater seepage reporting to Minton Lake. Total arsenic concentrations in Minton Lake were predicted to stabilize below the CWQG-FAL for perpetuity during post-closure.

For the Upper-Case scenario, predicted maximum total arsenic concentrations in tributary KEE3-B1 and Minton Lake in the updated NOA/NOC water quality model were:

- 0.0061 mg/L in tributary KEE3-B1 during operation, which is approximately 1.2 times the long-term CWQG-FAL (0.0050 mg/L), and approximately four times the modelled baseline (Table 3.18; Figure G-2, Appendix G).
- 0.0054 mg/L in tributary KEE3-B1 during closure, which is just over the long-term CWQG-FAL (0.0050 mg/L), and approximately 3.9 times the modelled baseline (Table 3.18; Figure G-2, Appendix G).
- 0.0144 mg/L in tributary KEE3-B1 during post-closure, which is approximately 3 times the long-term CWQG-FAL (0.0050 mg/L), and approximately 14 times the modelled baseline (Table 3.18; Figure G-2, Appendix G).
- 0.0047 mg/L in Minton Lake during operation and closure, which is below the long-term CWQG-FAL (0.0050 mg/L) and, therefore, is not identified as a POPC for these or any other mine phase (Table 3.18; Figure G-4, Appendix G).

Total arsenic was only identified as a POPC in tributary KEE3-B1 during post-closure in the EIS (Table 3.15). During this phase, the maximum predicted total arsenic concentration in tributary KEE3-B1 was 0.0227 mg/L for the Expected Case scenario. This maximum predicted total arsenic concentration is two times higher than the maximum total arsenic concentration predicted to occur in tributary KEE3-B1 during any phase for this NOA/NOC.

Maximum predicted total arsenic concentrations exceeded baseline concentrations by more than 20% and the CWQG-FAL in tributary KEE3-B1 during operation (0.0891 mg/L), closure (0.1200 mg/L), and post-closure (0.0785 mg/L) for the Upper-Case scenario in the EIS. These predicted total arsenic concentrations in tributary KEE3-B1 were 14 times, 22 times, and five times higher than the maximum total arsenic concentrations predicted in tributary KEE3-B1 during operation, closure, and post-closure phases, respectively, for this NOA/NOC.

Total arsenic was not identified as a POPC in Minton Lake during any mine phase, in either scenario, in the EIS. Total arsenic is identified as a POPC in Minton Lake during operation for this NOA/NOC due to the shorter groundwater travel times predicted by the updated groundwater model. However, total arsenic is not identified as a POPC in Minton Lake during operation in the Upper-Case scenario for this NOA/NOC. This is because arsenic leaching rates for the Upper-Case scenario kinetic tests are lower than the arsenic leaching rates for the Expected Case scenario. This is due to natural geological differences in the arsenic content of composite samples with >1% sulphur content (32.9 parts per million [ppm]) versus the composite samples representative of the average mine rock (55.2 ppm).

Seasonal Trends for Total Arsenic

Seasonal trends in predicted monthly mean total arsenic concentrations during construction, operation, closure, and post-closure in Tributary KEE3-B1 are shown in comparison with predicted monthly mean arsenic concentrations during these same phases in the Keewatin River (QM06) and Cockeram Lake (QM08) in Figure G-5 (Appendix G).

For the Expected Case and Upper-case scenarios, the mean monthly total arsenic concentrations were predicted to gradually increase during the winter in tributary KEE3-B1 during operation, closure, and post-closure, with peak concentrations occurring in April. Mean monthly total arsenic concentrations were then predicted to decrease in spring (May and June) followed by a gradual increase during the summer (July and August), fall (September and October), and into winter. Similar seasonal trends were observed in Minton Lake during all mine phases. Although predicted mean monthly total arsenic concentrations were an order of magnitude lower in the Keewatin River and in Cockeram Lake compared with tributary KEE3-B1, seasonal trends in total arsenic concentrations in the Keewatin River and Cockeram Lake were like those predicted in tributary KEE3-B1.

Similar seasonal trends in total arsenic concentrations were predicted in tributary KEE3-B1, the Keewatin River, and in Cockeram Lake in the EIS. Annual peaks in total arsenic concentrations in April were attributed to the month of the year when stream flows were lowest and the influence of groundwater seepage was highest, while annual lows in total arsenic concentrations in May and June were attributed to when stream flows were highest, and the influence of groundwater seepage was lowest.

Total Cobalt

Total cobalt is identified as a POPC for the Expected Case scenario in tributary KEE3-B1 during post-closure, in the Payne Lake outlet (KEE3-PAY1) during operation, closure, and post-closure phases, and in Minton Lake during operation and closure in the updated NOA/NOC water quality model (Table 3.17). Project-related changes in total cobalt concentrations in tributary KEE3-B1 in post-closure were associated with discharges from the open pit once it is full and discharging to the receiving environment. Project-related changes in total cobalt concentrations in tributary KEE3-PAY1 and in Minton Lake were associated with groundwater seepage from the MRSA and TMF.

Total cobalt was not identified as a POPC in tributary KEE3-B1, the Payne Lake outlet, or Minton Lake in the EIS because the EIS did not use the total cobalt FEQG to screen the total cobalt concentrations predicted by the EIS surface water quality model and because there were no CWQG-FAL or MWQSOG for total cobalt.

For the Expected Case scenario, maximum predicted total cobalt concentrations in tributary KEE3-PAY1, tributary KEE3-B1, and Minton Lake were:

- 0.00160 mg/L in tributary KEE3-PAY1 during operation, which is approximately two times the hardness-dependent FEQG and 7.6 times the modelled maximum baseline concentration (Table 3.19, Figure G-6, Appendix G).
- 0.00149 mg/L in tributary KEE3-PAY1 during closure, which is approximately two times the hardness-dependent FEQG and 6.7 times the modelled maximum baseline concentration (Table 3.19, Figure G-6, Appendix G).
- 0.00085 mg/L in tributary KEE3-PAY1 during post-closure, which is 1.1 times the hardness-dependent FEQG and 3.5 times the modelled maximum baseline concentration (Table 3.19, Figure G-6, Appendix G).
- 0.00429 mg/L in tributary KEE3-B1 during post-closure, which is approximately three times the hardness-dependent FEQG, and approximately 52 times the modelled maximum baseline concentration (Table 3.19; Figure G-8, Appendix G).
- 0.00098 mg/L in Minton Lake during operation, which is approximately 1.3 times the hardness-dependent FEQG, and approximately 11 times the modelled maximum baseline concentration (Table 3.19; Figure G-10, Appendix G).
- 0.00096 mg/L in Minton Lake during closure, which is approximately 1.2 times the hardness-dependent FEQG, and approximately 11 times the modelled maximum baseline concentration (Table 3.19; Figure G-10, Appendix G).

For the Expected Case scenario, total cobalt concentrations in tributary KEE3-PAY1 were predicted to increase during operation and then gradually decrease during closure and into post-closure (Figure G-6, Appendix G). Total cobalt concentrations in tributary KEE3-PAY1 were predicted to exceed the hardness-dependent FEQG in 68% of all months during operation, 95% of all months during closure, but only 1% of all months during post-closure. Total cobalt concentrations in tributary KEE3-PAY1 were predicted to approach baseline total cobalt concentrations by the end of the modelled post-closure phase duration (i.e., 77 years).

For the Expected Case scenario, total cobalt concentrations in tributary KEE3-B1 were not predicted to exceed the hardness-dependent FEQG until the open pit filled with water and discharged to the receiving environment during post-closure (Figure G-8, Appendix G).

For the Expected Case scenario, total cobalt concentrations in Minton Lake were predicted to increase during operation and then gradually decrease during closure (Figure G-10, Appendix G). Total concentrations in Minton Lake were predicted to exceed the hardness-dependent FEQG in 18% of all months during operation and 37% of all months during closure. Total cobalt concentrations were predicted to stabilize below the hardness-dependent total cobalt FEQG for perpetuity during post-closure.

For the Upper Case, maximum predicted total cobalt concentrations in tributary KEE3-PAY1, tributary KEE3-B1 and Minton Lake were:

- 0.00259 mg/L in tributary KEE3-PAY1 during operation, 0.00242 mg/L during closure, and 0.00136 mg/L during post-closure, which range between approximately one and three times the long-term FEQG and between approximately four and ten times the modelled maximum baseline concentrations for their respective mine phases (Table 3.19; Figure G-7, Appendix G).
- 0.00165 mg/L in tributary KEE3-B1 during operation, 0.00154 mg/L during closure, and 0.00961 mg/L during post-closure, which are approximately 1.2, 1.1, and 6.7 times the hardness-dependent FEQG, and approximately 16 times, 15 times, and 96 times the modelled maximum baseline concentration (Table 3.19; Figure G-9, Appendix G).
- 0.00148 mg/L in Minton Lake during operation and closure, which is approximately two times the hardness-dependent FEQG and 14 times the modelled maximum baseline concentrations, and 0.00114 mg/L during post-closure, which is 1.5 times the hardness-dependent FEQG and approximately 11 times the modelled maximum baseline concentration (Table 3.19; Figure G-11, Appendix G).

Seasonal Trends for Total Cobalt

Seasonal trends in predicted monthly mean total cobalt concentrations during construction, operation, closure, and post-closure in Tributary KEE3-PAY1, Tributary KEE3-B1 and Minton Lake are shown in comparison with predicted monthly mean cobalt concentrations during these same phases in the Keewatin River (QM06) and Cockeram Lake (QM08) in Figure G-12 (Appendix G).

For the Expected and Upper-Case scenarios, mean monthly total cobalt concentrations during operation and closure phases were predicted to gradually increase during the winter (November to April) in tributary KEE3-B1, reaching a maximum in April (Figure G-12, Appendix G). Mean monthly total cobalt concentrations in tributary KEE3-B1 were then predicted to decrease during the spring freshet (May and June), followed by a gradual increase in mean monthly total cobalt concentrations through the summer and fall into early winter. Seasonal increases in total cobalt were predicted to occur during winter for the operation and closure phases because of reduced surface flows and dilution capacity while run-off is captured in water management infrastructure or in the open pit, respectively. In post-closure, mean monthly total cobalt concentrations in tributary KEE3-B1 were predicted to follow a similar pattern as operation and closure phases for the Expected Case and Upper-Case scenarios, albeit at nearly two- and three-times higher concentrations than during operation, and closure phases, respectively.

For the Expected and Upper-Case scenarios, mean monthly total cobalt concentrations during operation and closure phases in tributary KEE3-PAY1 and Minton Lake were predicted to gradually increase during the winter, peaking in April, followed by a gradual decrease in mean monthly total cobalt concentrations during and after the spring freshet until early winter. Seasonal increases in total cobalt concentrations in winter were predicted to occur because of groundwater discharging to the tributary during low surface flow conditions (Figure G-12, Appendix G).

A similar seasonal pattern in mean monthly total cobalt concentrations is predicted in the Keewatin River (Figure G-12, Appendix G). Mean monthly total cobalt concentrations in Cockeram Lake are predicted to spike in May and June during all mine phases; this is a similar pattern to existing conditions.

Total Copper

Total copper is identified as a POPC for the Expected Case scenario only in tributary KEE3-B1 during post-closure in the updated NOA/NOC water quality model (Table 3.17). Project-related changes in total copper concentrations in tributary KEE3-B1 in post-closure were associated with discharges from the open pit once it is full and discharging to the receiving environment.

Predicted maximum total copper concentrations in tributary KEE3-B1 were:

- 0.0041 mg/L in KEE3-B1 during post-closure for the Expected Case scenario, which is just over the long-term CWQG-FAL (0.0040 mg/L), and approximately 15 times the modelled maximum baseline concentration (Table 3.20; Figure G-13 Appendix G).
- 0.0072 mg/L in KEE3-B1 during post-closure for the Upper-Case scenario, which is 1.8 times the long-term CWQG-FAL (0.0040 mg/L), and approximately 26 times the modelled maximum baseline concentration (Table 3.20; Figure G-14, Appendix G).

For the Expected Case scenario, total copper concentrations in tributary KEE3-B1 were predicted to exceed the long-term CWQG-FAL only after the open pit has filled with water and is discharging to the receiving environment. Total copper concentrations in tributary KEE3-B1 were then predicted to decrease to the end of the modelled post-closure phase and remain near, but not over, the long-term CWQG-FAL. In total, total copper concentrations in tributary KEE3-B1 were predicted to exceed the long-term CWQG-FAL in 1% of all months in the post-closure phase.

Total copper was also identified as a POPC in tributary KEE3-B1 during post-closure in the EIS. The maximum total copper concentration in tributary KEE3-B1 during post-closure was originally predicted to be 0.0059 mg/L, a concentration approximately 1.5 times higher than the long-term CWQG-FAL, 17 times higher than the modelled maximum baseline concentration, and 1.4 times higher than the maximum total copper concentrations predicted by the updated NOA/NOC water quality model.

Seasonal Trends for Total Copper

Seasonal trends in predicted total copper concentrations in tributary KEE3-B1 compared with predicted total copper concentrations in the Keewatin River (QM06) and Cockeram Lake (QM08) during construction, operation closure, and post-closure phases are shown in Figure G-15 (Appendix G).

Seasonal trends in predicted total copper concentrations in tributary KEE3-B1 were similar in all of the mine phases for the Expected Case and Upper-Case scenarios. Total copper concentrations in tributary KEE3-B1 were predicted to increase during the winter (November to April) due to reduced surface flow run-off and dilution capacity in the tributary and greater influence of groundwater seepage. Total copper concentrations were predicted to decrease during the spring freshet (May and June), due to higher surface run-off and lower influence of groundwater seepage, and then gradually increase during the

summer (July and August) and fall (September and October) due again to decreased surface water run-off compared with groundwater seepage inflow. The same seasonal trends in total copper concentrations in tributary KEE3-B1 were also predicted in the EIS.

Dissolved Copper

Dissolved copper is identified as a POPC for the Expected Case scenario in the Payne Lake outlet (tributary KEE3-PAY1) and in Minton Lake during operation, closure, and post-closure phases by the updated NOA/NOC water quality model (Table 3.17). Predicted changes in dissolved copper concentrations in tributary KEE3-PAY1 and Minton Lake during operation, closure, and post-closure were associated with groundwater seepage from the MRSA and TMF.

Dissolved copper was not identified as a POPC at any location, or during any mine phase, for the EIS. This was because dissolved copper concentrations were not predicted to exceed the hardness-dependent MWQSOG and because the FEQG for dissolved copper was not used to screen POPCs in the EIS.

For the Expected Case scenario, maximum predicted dissolved copper concentrations in tributary KEE3-PAY1 and Minton Lake are:

- 0.000765 mg/L, 0.000748 mg/L, and 0.000724 mg/L in tributary KEE3-PAY1 during operation, closure, and post-closure, respectively, which are approximately 3.3, 3.3, and 3.2 times the FEQG, respectively, and approximately 3.7, 3.6, and 3.5 times higher than the modelled maximum baseline concentrations predicted during operation, closure, and post-closure, respectively (Table 3.21; Figures G-16, G-18, G-20, G-22, Appendix G).
- 0.000850 mg/L, 0.000855 mg/L, and 0.001070 mg/L in Minton Lake during operation, closure, and post-closure, respectively, which are approximately 3.1, 3.1, and 3.9 times the FEQG, respectively, and approximately 1.6, 1.7, and 2.1 times the modelled maximum baseline concentrations predicted during operation, closure, and post-closure, respectively (Table 3.21; Figures G-24, G-26, G-28, G-30, Appendix G).

For the Expected Case scenario, dissolved copper concentrations in tributary KEE3-PAY1 were predicted to increase during the first 12 years of operation and then gradually decrease during the last seven years of operation, through closure, and through the first 45 years of post-closure (Figure G-16, Appendix G). After Year 69, dissolved copper concentrations in tributary KEE3-PAY1 were predicted to decrease more rapidly due to a decrease in the predicted dissolved copper concentration in the MRSA and the TMF seepages. Dissolved copper concentrations were predicted to approach modelled baseline dissolved copper concentrations by the end of the modelled post-closure phase. Dissolved copper concentrations in tributary KEE3-PAY1 were predicted to exceed the BLM-derived FEQG in 34% of months during operation, 42% of months during closure, and 31% of months during post-closure (Table 3.21).

For the Expected Case scenario, dissolved copper concentrations in Minton Lake were predicted to gradually increase during operation, closure, and through the first 45 years of post-closure (Figure G-18, Appendix G). Like in tributary KEE3-PAY1, dissolved copper concentrations in Minton Lake were predicted to decrease in Year 70 due to a decrease in the predicted dissolved copper concentration in the

MRSA and the TMF seepages. Dissolved copper concentrations were predicted to stabilize at approximately 0.00065 mg/L by the end of the modelled post-closure phase, a concentration higher than modelled baseline concentrations but lower than the FEQG. Dissolved copper concentrations in Minton Lake were predicted to exceed the FEQG in 38% of months during operation, 50% of months during closure, and 57% of months during post-closure (Table 3.21).

For the Upper-Case scenario, maximum dissolved copper concentrations tributary KEE3-PAY1 and Minton Lake were:

- 0.000839 mg/L, 0.000821 mg/L, and 0.000797 mg/L in tributary KEE3-PAY1 during operation, closure, and post-closure, respectively, which are approximately 3.6, 3.6, and 3.5 times the FEQG, respectively, and approximately 3.0, 2.9, and 2.8 times higher than the modelled maximum baseline concentrations predicted during operation, closure, and post-closure, respectively (Table 3.21; Figures G-17, G-19, G-21, Appendix G).
- 0.001250 mg/L, 0.001260 mg/L, and 0.001490 mg/L in Minton Lake during operation, closure, and post-closure, respectively, which are approximately 4.7, 4.8, and 5.6 times the FEQG, respectively, and approximately 1.5, 1.5, and 1.8 times the modelled maximum baseline concentrations predicted during operation, closure, and post-closure, respectively (Table 3.21; Figures G-25, G-27, G-29, G-31, Appendix G).

Seasonal Trends for Dissolved Copper

Seasonal trends in predicted dissolved copper concentrations in tributary KEE3-PAY1 and Minton Lake compared with seasonal trends in the Keewatin River (QM06) and Cockeram Lake (QM08) are illustrated in Figure G-32 (Appendix G). Seasonal trends in predicted dissolved copper concentrations were similar between the Expected Case and Upper-Case scenarios. Therefore, only seasonal trends for the Expected Case scenario are discussed below.

Dissolved copper concentrations in tributary KEE3-PAY1 were predicted to be relatively constant across seasons within construction, operation, closure, and post-closure phases. However, during operation, closure and post-closure phases, dissolved copper concentrations were predicted to be slightly higher in April when surface flows were lowest and the influence of groundwater seepage on surface water quality is highest (Figure G-32, Appendix G).

Dissolved copper concentrations were predicted to increase during the winter, and peak in April, in Minton Lake during all mine phases. Seasonal increases in winter were predicted to occur because of groundwater seepage during a period of decreasing surface flow conditions. Dissolved copper concentrations in Minton Lake were predicted to decrease in May and June due to the diluting effect of increased snowmelt run-off (Figure G-32, Appendix G).

Fluoride

Fluoride is identified as a POPC only in Keewatin River tributary KEE3-B1, and only during post-closure, for the Expected Case scenario (Table 3.17). Project-related changes to fluoride concentrations in tributary KEE3-B1 during post-closure are associated with overflow from the pit lake.

For the Expected Case scenario, the maximum fluoride concentration in tributary KEE3-B1 during post-closure is:

- 0.17 mg/L, which is approximately 1.4 times the long-term CWQG-FAL (0.12 mg/L) and 5.8 times modelled baseline in post-closure (Table 3.22; Figure G-33, Appendix G).

For the Expected Case scenario, fluoride concentrations in tributary KEE3-B1 were predicted to increase above the CWQG-FAL once the pit lake is filled and discharging to the receiving environment (Figure G-22, Appendix G). Fluoride concentrations in tributary KEE3-B1 were predicted to remain above the CWQG-FAL for the duration of the modelled post-closure phase. Fluoride concentrations in tributary KEE3-B1 were predicted to exceed the CWQG-FAL in 51% of months during post-closure (Table 3.22).

For the Upper-Case scenario, the maximum fluoride concentration in tributary KEE3-B1 during post-closure is:

- 0.43 mg/L in KEE3-B1, which is approximately 3.5 times the long-term CWQG-FAL and MWQSOG-FAL (0.12 mg/L), and 11 times the modelled baseline in post-closure (Table 3.22; Figure G-34, Appendix G).

Fluoride was also identified as a POPC in tributary KEE3-B1 during post-closure in the EIS, and for the same reason that it was also identified as a POPC for this NOA/NOC. In the EIS, maximum fluoride concentrations in tributary KEE3-B1 during post-closure was 0.21 mg/L for the Expected Case scenario, a concentration approximately 1.7 times higher than the long-term CWQG-FAL and 4.7 times higher than the modelled baseline concentration. Fluoride concentrations in tributary KEE3-B1 were predicted to exceed the CWQG-FAL in 30% of months during post-closure for the Expected Case scenario in the EIS.

Seasonal Trends for Fluoride

Seasonal trends in predicted fluoride concentrations in tributary KEE3-B1 compared with the Keewatin River (QM06), and Cockeram Lake (QM08) are provided for the construction, operation, closure, and post-closure phases in Figure G-35 (Appendix G).

Fluoride concentrations in tributary KEE3-B1 during construction, operation and closure were predicted to gradually increase during the winter (November to April) as surface run-off volumes decrease and the influence of groundwater seepage on water quality increases. Fluoride concentrations in tributary KEE3-B1 were predicted to decrease in spring (May and June) when surface run-off volumes increase, followed by a gradual increase during the summer and fall into winter. Similar, but smaller, seasonal trends were predicted to occur in tributary KEE3-B1 during post-closure when water quality in the latter half of the post-closure period is driven by water quality in the pit lake. Similar seasonal trends for fluoride were predicted to occur in tributary KEE3-B1 in the EIS.

Total Phosphorus

Total phosphorus is identified as a POPC only in Keewatin River tributary KEE3-B1, and only during post-closure, for the Expected Case scenario (Table 3.17). Project-related changes to total phosphorus concentrations in tributary KEE3-B1 during post-closure were associated with overflow from the pit lake.

For the Expected Case, the maximum total phosphorus concentration in tributary KEE3-B1 during post-closure is:

- 0.029 mg/L, which is approximately 1.2 times the long-term MWQSOG-FAL (0.025 mg/L) and 1.3 times modelled baseline (Table 3.23; Figure G-36, Appendix G).

For the Expected Case scenario, total phosphorus concentrations in tributary KEE3-B1 were predicted to exceed the long-term MWQSOG-FAL at least once per year during construction, operation, closure, and the first 33 years of post-closure (Figure G-36, Appendix G). However, total phosphorus is not identified as a POPC during construction, operation, and closure because total phosphorus concentrations did not also exceed baseline concentrations by more than 20%; exceedance of the long-term MWQSOG-FAL during these mine phases is reflective of existing conditions and not Project-related effects.

Total phosphorus concentrations in tributary KEE3-B1 were predicted to exceed the CWQG-FAL and the modelled baseline concentrations by more than 20% (i.e., a POPC) only during summer months (July and August) after Year 71 when the pit lake is discharging to the receiving environment (Figure G-36, Appendix G).

For the Upper-Case scenario, the maximum total phosphorus concentration in tributary KEE3-B1 during post-closure is:

- 0.081 mg/L, which is approximately 3.3 times the long-term MWQSOG-FAL (0.025 mg/L), and 5 times the modelled baseline (Table 3.23; Figure G-37, Appendix G).

Total phosphorus was not identified as a POPC in tributary KEE3-B1 or any other location, during any mine phase, at the MacLellan site in the EIS. The increased total phosphorus concentrations predicted to occur in tributary KEE3-B1 during post-closure by the updated model were due to higher mass loads from the increased beach tailings areas in the TMF compared with the EIS.

Seasonal Trends for Total Phosphorus

Seasonal trends in predicted total phosphorus concentrations in Keewatin River tributary KEE3-B1 are compared with seasonal trends in predicted total phosphorus concentrations in the Keewatin River (QM06) and Cockeram Lake (QM08) during construction, operation, closure, and post-closure phases in Figure G-38 (Appendix G).

Seasonal trends in total phosphorus concentrations in tributary KEE3-B1, the Keewatin River, and Cockeram Lake were similar for the Expected Case and Upper-Case scenarios, therefore, only the seasonal trends for the Expected Case are discussed here. Total phosphorus concentrations in tributary KEE3-B1 were predicted to be highest during the summer (July and August), lowest in fall (September and October), and intermediate during the winter (November to April). Seasonal increases of total phosphorus were predicted to occur due to reduced surface flows and dilution capacity.

3.3.4.3 Summary of Mitigation Measures

The mitigation measures for surface water quantity and quality are identical to the mitigation measures recommended in the EIS (Stantec 2020a) and described in the Surface Water Management and Monitoring Plan (SWMMP; Version 0, January 2025). No additional mitigation measures are required in relation to this NOA/NOC. Alamos is committed to the follow-up and monitoring, and adaptive management (if and as required) that is described in this plan.

3.3.4.4 Residual Effects

3.3.4.4.1 Surface Water Quantity

The Project will result in changes to surface water quantity within the LAA. High-magnitude changes in water quantity are predicted at two headwater sub-catchments, with monthly streamflow reduction of 66% at KEE3-B1 (QM04) and 28% at the Minton Lake outlet (QM07). These predictions align with the EIS estimates of 64% at KEE3-B1 (QM04) and 31% at the Minton Lake outlet (QM07).

Changes at KEE3-B1 (QM04) and the Minton Lake outlet (QM07) begin during construction due to the development of mine infrastructure within the PDA and the subsequent reduction in effective catchment area. These changes will continue through closure. The timing of changes is expected to occur continuously throughout the year. The pit filling period (both the 21-year estimate in the EIS and the updated 40-year estimate are considered long-term for effects assessment considerations.

While changes generally cause a reduction in streamflow for each phase, once the open pit and satellite pit are filled, overflow from the formed pit lake will increase streamflow at KEE3-B1. Changes in streamflow at other model nodes are predicted to be up to 10% at the Dot Lake outflow (QM09) and up to 3% at all other model nodes. The changes in streamflow are considered negligible in magnitude at Cockeram Lake (QM08), meaning changes are expected to be contained within the LAA.

Predicted changes in water quantity are associated with watercourses and waterbodies that have either previously been or may continue to be influenced by historical anthropogenic disturbances, including the historical MacLellan mine.

In summary, like the EIS, residual effects of the Project on surface water quantity during the construction, operation and decommissioning/closure phases are characterized as adverse in direction, negligible magnitude at the downstream end of the LAA, continuous, short-term, medium-term, and long-term during the construction, operation, and decommissioning/closure phases, respectively, and reversible during the construction and operation phases, and irreversible when the open pit and satellite pit are filled. Project-induced changes to surface water quantity have the potential to cause adverse effects on fish through changes in fish habitat (Section 3.3.5).

3.3.4.4.2 Surface Water Quality

Potential changes in surface water quality large enough to result in exceedances of provincial or federal water quality guidelines were also predicted to occur in tributary KEE3-B1 and Minton Lake in the EIS. The proposed alterations to the approved MacLellan site are predicted to result in large enough changes to surface water quality in the Keewatin River tributary KEE3-B1, the Payne Lake outlet (KEE3-PAY1), and Minton Lake within the LAA to result in exceedances of provincial or federal water quality guidelines for the protection of freshwater aquatic life during at least one mine phase. Updates to the groundwater and surface water quality models that address the proposed alterations to the MacLellan site and apply the FEQGs during parameter screening for this NOA/NOC resulted in changes to the magnitude and frequency of guideline exceedances, the location and timing of guideline exceedances, and the some of the water quality parameters now considered POPCs compared with the EIS. These changes were:

- ~50% decrease in the maximum predicted total arsenic concentration but an approximately six times increase in average predicted total arsenic concentration in tributary KEE3-B1 during post-closure compared with the EIS.
- ~30% decrease in the maximum predicted total copper concentration but an approximately 6.5 times increase in average predicted total copper concentration in tributary KEE3-B1 during post-closure compared with the EIS.
- ~18% decrease in the maximum predicted fluoride concentration but an approximately 2.3 times increase in average predicted fluoride concentration in tributary KEE3-B1 during post-closure compared with the EIS.
- Inclusion of total arsenic as a POPC in Minton Lake during operation in the NOA/NOC.
- Inclusion of phosphorus as a POPC in tributary KEE3-B1 during post-closure in the NOA/NOC.
- Inclusion of total cobalt as a POPC in tributary KEE3-B1 during post-closure and in tributary KEE3-PAY1 and Minton Lake during operation in the NOA/NOC.
- Inclusion of dissolved copper as a POPC in tributary KEE3-PAY1 and Minton Lake during operation, closure, and post-closure in the NOA/NOC.
- Exclusion of total aluminum, total cadmium, and dissolved cadmium as POPCs in tributary KEE3-B1, Minton Lake, and the Keewatin River from the NOA/NOC.

For these reasons, characterization of residual effects to surface water quality are different than the characterization of residual effects to surface water quality in the EIS. Updated characterization of residual effects to surface water quality at the MacLellan site due to the combination of updated groundwater and surface water model predictions that address the proposed alterations to the MacLellan site and use of the FEQGs during parameter screening is provided in Table 3.24. Characterization of residual effects to surface water quality were separated by waterbody because of the differences in the number, timing, duration, and magnitude of POPCs that were predicted to occur in the tributary KEE3-B1, tributary KEE3-PAY1, and Minton Lake.

Table 3.24 Characterization of Residual Effects on Surface Water Quality

Waterbody	Project Phase	Residual Effects Characterization							
		Direction	Magnitude	Geographic Extent	Duration	Timing	Frequency	Reversibility	Ecological and Socio-economic Context
Tributary KEE3-B1	C	A	N	LAA	ST	N/A	R	R	D
	O	A	M	LAA	MT	A	R	R	D
	AC	A	L	LAA	ST	A	S	R	D
	PC	A	H	LAA	LT	A	C	IR	D
Tributary KEE3-PAY1	C	A	N	LAA	ST	N/A	R	R	UD
	O	A	H	LAA	MT	A	R	R	UD
	AC	A	H	LAA	MT	A	R	R	UD
	PC	A	H	LAA	LT	A	R	R	UD
Minton Lake	C	A	N	LAA	ST	N/A	R	R	UD
	O	A	H	LAA	MT	A	R	R	UD
	AC	A	H	LAA	MT	A	R	R	UD
	PC	A	H	LAA	LT	A	R	R	UD

KEY

See Table 9.5 in Chapter 9.0 of the EIS for definitions of quantitative measures and/or qualitative categories for each residual effect characterization

Project Phase
C: Construction
O: Operation
AC: Active Closure
PC: Post-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
N/A: Not applicable

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:
D: Disturbed
U: Undisturbed

Negligible residual effects to surface water quality are predicted to occur in tributary KEE3-B1, tributary KEE3-PAY1, and Minton Lake during construction. This is because there are no activities during construction that will affect groundwater seepage or that will require discharge of contact water effluent to the receiving environment.

For all locations and all mine phases, residual effects to surface water quality are not predicted to extend beyond the LAA. This is because no POPCs are predicted to occur in the Keewatin River, in the Cockeram River, or in Cockeram Lake; POPCs are not predicted to extend beyond the two small tributaries of the Keewatin River and a Minton Lake, a headwater lake in the Cockeram River watershed.

A discussion of the characterization of residual effects based on the alterations to the approved MacLellan site and the results of the updated modelling, by waterbody, are provided in the following sections.

Tributary KEE3-B1

The ecological context for tributary KEE3-B1 is rated as disturbed. This is because tributary KEE3-B1 is the outlet channel for East Pond, a small lake downslope from the former MacLellan mine infrastructure and a waterbody known to have elevated concentrations of arsenic, sulphate, alkalinity, and dissolved and total manganese compared with other waterbodies in the Lynn Lake area (Stantec 2017a).

The magnitude of residual effects to surface water quality in tributary KEE3-B1 during operation is rated as moderate. This is because maximum total arsenic concentrations are predicted to be up to 1.4 times higher than the CWQG-FAL. The duration and frequency of the residual effect of total arsenic during operation are rated medium-term and a multiple regular event, respectively, because exceedances of the CWQG-FAL are predicted to occur repeatedly in the last eight years of operation. During closure, the magnitude, duration, and frequency of residual effects on surface water quality in tributary KEE3-B1 is rated as low, short-term, and a single event. This is because the maximum total arsenic concentration in tributary KEE3-B1 is predicted to be just slightly above the CWQG-FAL and only in the first year of closure.

The magnitude, duration, frequency, and reversibility of residual effects to surface water quality in tributary KEE3-B1 during post-closure are rated as high, long-term, continuous, and irreversible. This is because, without treatment, maximum and average total arsenic, total cobalt, and fluoride concentrations are predicted to exceed their respective water quality guidelines for perpetuity once the pit lake is full and discharging to the receiving environment.

Water quality predictions in tributary KEE3-B1 during post-closure do not include the ameliorating effects of passive treatment options that Alamos may implement to reduce total arsenic, total cobalt, and fluoride concentrations in the open pit as it is filling with water (see Section 3.3.4.2). These options include, but are not limited to, controlled pit stratification and pit fertilization. Controlled pit stratification would involve managing pit in-flows during closure such as directing only TMF pond water and TMF and MRSA seepage to the open pit during the initial stages of pit filling so that this higher density, higher concentrated water is more likely to remain sequestered at the bottom of the pit. Once exhausted, other sources of contact water and natural run-off would be used to fill the remaining volume of the pit.

Pit fertilization would involve controlled fertilization amendments to increase algae production in the pit as it fills with water. These algae incorporate metals and other water quality constituents into their cells (though direct cellular uptake or sorption to cell walls) as they grow and reproduce. When these algae die in winter, they fall out of suspension and sink to the bottom of the pit. As organic carbon from the algae sinks to the bottom, the biological oxygen demand in the bottom layer of the filling pit lake increases and dissolved oxygen concentrations decrease. Lower dissolved oxygen concentrations promote production of sulphate-reducing bacteria (SRB) which thrive in anoxic environments. Sulphides from the SRB promote further metal removal through metal-sulphide precipitation in the anoxic bottom layer of the filling pit lake.

Pit fertilization has been shown to be an effective mitigation measure to reduce metal concentrations in pit lakes, including those in northern climates. In Canada, examples include the Colomac Gold Mine in the Northwest Territories, the Island Copper Mine near Port Hardy, British Columbia (BC), the Equity Silver Mine near Houston, BC, and the Rabbit Lake Uranium Mine in northern Saskatchewan. Details about these pit fertilization examples were provided previously during the EIS Technical Review Phase (in Alamos' response to IAAC-R2-30).

Total phosphorus concentrations in tributary KEE3-B1 were also predicted to be elevated in tributary KEE3-B1 during post-closure, indicating that total phosphorus concentrations in the pit lake were also predicted to be elevated. Phosphorus is one of three nutrients, the others being nitrogen and dissolved organic carbon, that influence the rate of primary production in freshwater ecosystems. Therefore, elevated total phosphorus concentrations in the pit lake may, at least partially, mitigate the concentration of metals in the open pit as it fills with water.

It will be important to consider the biological, chemical, and physical environment of the pit lake at the MacLellan site when developing the fertilization program, should water quality monitoring in the open pit determine that passive treatment is required. This will include determining the ratios between phosphorus, nitrogen, and dissolved organic carbon in the pit water so that the nutrients limiting algal growth can be amended appropriately. Alamos will implement a water quality monitoring program in the open pit over the 40 years that the pit is expected to require to fill with water. This program will be used to determine if pit fertilization will be required and what form such a program would take.

Tributary KEE3-PAY1

The ecological context for tributary KEE3-PAY1 is rated as undisturbed. This is because tributary KEE3-PAY1 is the outlet channel for Payne Lake, a small lake sufficiently north of the historic MacLellan site to be unaffected by past mining activities.

The magnitude of residual effects to surface water quality in tributary KEE3-PAY1 is rated as high during operation and closure. This is because concentrations of total cobalt and dissolved copper were predicted to exceed their respective FEQGs for most months during these mine phases. The magnitude of residual effects to surface water quality in tributary KEE3-PAY1 is also rated as high during post-closure. However, this is due solely to dissolved copper concentrations which are predicted to exceed the FEQG for at least 45 years after reclamation activities have concluded. Total cobalt and dissolved copper concentrations in tributary KEE3-PAY1 are predicted to fall below their respective FEQGs and approach

baseline concentrations during post-closure. For this reason, residual effects to surface water quality in tributary KEE3-PAY1 are considered reversible.

Alamos has developed a SWMMP that includes monitoring water quality in Payne Lake and in the Payne Lake outlet (KEE3-PAY1) and a GMMP that includes monitoring groundwater seepage quantity and quality between the TMF and tributary KEE3-PAY1. If during any mine phase, surface water quality data collected in tributary KEE3-PAY1 or groundwater quality data collected in monitoring wells established between the TMF and tributary KEE3-PAY1 shows that dissolved copper, or any other parameter, is exceeding, or trending toward exceeding, provincial and/or federal water quality guidelines for the protection of freshwater aquatic life, Alamos will initiate the adaptive management plan outlined in the GMMP. This adaptive management plan includes a hierarchical process of determining if the elevated water quality concentration(s) observed in the monitoring data are due to the Project and, if so, the steps that will be taken to reduce the effect. Mitigation measures to reduce the effect of groundwater seepage on water quality in tributary KEE3-PAY1 may include installation of pump-back wells to reduce or eliminate the volume of groundwater seepage reaching tributary KEE3-PAY1.

Minton Lake

The ecological context for Minton Lake is rated as undisturbed. This is because Minton Lake is a small lake sufficiently east of the historic MacLellan site to be unaffected by past mining activities.

The magnitude of residual effects to surface water quality in Minton Lake is rated as high during operation and closure. This is because concentrations of total cobalt and dissolved copper were predicted to exceed their respective FEQGs for most months during these mine phases; arsenic concentrations in Minton Lake were predicted to be elevated during operation but only just reach the CWQG-FAL for <1% of all months during operation. The magnitude of residual effects to surface water quality in Minton Lake is also rated as high during post-closure. However, this is due solely to dissolved copper concentrations which were predicted to exceed the FEQG for at least 45 years after reclamation activities have concluded. Total cobalt and dissolved copper concentrations in Minton Lake are predicted to fall below their respective FEQGs during post-closure. For this reason, residual effects to surface water quality in tributary Minton Lake are considered reversible.

The same adaptive management plan and mitigation measures that apply to tributary KEE3-PAY1 will also apply to Minton Lake should surface water quality monitoring or groundwater quality monitoring show that that total cobalt or dissolved copper, or any other parameter, are exceeding, or trending toward exceeding, provincial and/or federal water quality guidelines for the protection of freshwater aquatic life.

Comparison with the EIS

Residual effects to surface water quality at the MacLellan site were characterized by mine phase, not by location, as in the EIS. This was because most changes in surface water quality were predicted to occur in tributary KEE3-B1. During construction and operation, changes in surface water quality in the EIS were characterized as low magnitude, local in geographic extent, medium-term, and reversible. During post-closure, changes in surface water quality in the EIS were characterized as medium in magnitude, local in geographic extent, long-term, and irreversible.

3.3.5 Fish and Fish Habitat

Fish and fish habitat are valued by Indigenous Nations, 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 local communities, contribute to biodiversity, and are indicators of aquatic ecosystem health. Alterations to the MRSA, TMF, and open pit at the MacLellan site have the potential to alter water quantity, water quality, and groundwater table predictions in streams, lakes, and wetlands downstream and adjacent to the MacLellan site. These changes could affect fish community composition, population abundance and individual fish health due to acute or chronic toxicological effects from changes in water quality, changes in habitat quality or quantity due to changes in stream flow or groundwater table drawdown, or indirectly through effects to lower trophic communities that fish rely on as the basis of the food web. The alterations to the MRSA, TMF, and open pit footprints described in this NOA/NOC will not affect any additional streams or lakes at the MacLellan site.

3.3.5.1 Regulatory and Guideline Setting

3.3.5.1.1 Federal Guideline Criteria

The assessment of potential effects of the proposed alterations on fish and fish habitat at the MacLellan site included consideration of the federal legislation, regulations, and guidelines described below.

Fisheries Act

The *Fisheries Act* provides 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) prohibits any work, undertaking or activity, other than fishing, that results in the death of fish.
- Section 35(1) 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) 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.

Metal and Diamond Mining Effluent Regulation

The MDMER, promulgated under the *Fisheries Act*, regulates the deposit of deleterious mine effluents, tailings, and mine rock into waters frequented by fish and is administered by 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.
- (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 cubic metres per day (m^3/d) based on effluent deposited from all final discharge points of the MacLellan Gold 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
- the concentrations of deleterious substances do not exceed concentration limits identified in Schedule 4 of the MDMER at the final discharge point(s).

Under the MDMER, all mines and recognized closed mines are required to conduct acute lethality testing of final effluent, effluent characterization, and EEM in the downstream receiving environment in three-year cycles.

Species at Risk Act

The *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 2025) or listed by the Manitoba Conservation Data Centre (MB CDC 2015).

DFO's 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, the Framework for Assessing Ecological Flow Requirements to Support Fisheries in Canada (DFO 2013) recommends that assessment of alterations to the natural flow regime 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.
- 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.
- Cumulative flow alterations greater than 10% of instantaneous discharge or that results in flows less than 30% of MAD, require a more rigorous level of assessment to evaluate potential impacts on ecosystem functions which support fisheries.

Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life

The CWQG-FAL are intended to protect all forms of freshwater aquatic life and all aspects of their aquatic life cycle, including the most sensitive life stage of the most sensitive species over the long-term from anthropogenic stressors such as chemical inputs or changes to physical components. CWQG-FALs provide science-based benchmarks for a nationally consistent level of protection for aquatic life in Canada. CWQG-FALs are developed by the CCME, an inter-governmental forum comprised of federal and provincial ministries of the environment.

Federal Environmental Quality Guidelines

FEQGs are recommended chemical thresholds that identify the concentration below which there is a low likelihood of direct adverse effects from the chemical on aquatic life exposed via water or sediment, or where chemicals may bioaccumulate in wildlife that may consume aquatic life. Use of FEQGs is voluntary unless prescribed by regulation of binding agreements. FEQGs are not effluent limits or are they "never-to-be-exceeded" values. FEQGs are developed by ECCC to support federal environmental quality monitoring, risk assessment and risk management activities on substances for which the CCME guidelines do not yet exist or are not reasonably expected to be updated in the near future.

3.3.5.1.2 Provincial Guideline Criteria

The assessment of potential effects of the proposed alterations on fish and fish habitat at the MacLellan site included consideration of the provincial legislation, regulations, and guidelines described below.

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 square kilometres (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 Water Rights Act

The Water Rights Act, administered by MECC, 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 licence 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 MECC, provides for the protection of freshwater biota and human and wildlife consumers of fish. The MWQSOG lists water quality and tissue residue guidelines, which are set out in the *Water Quality Standards, Objectives, and Guidelines Regulation*.

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 Mines and Minerals 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.

3.3.5.1.3 IAAC Decision Statement

As per the IAAC Decision Statement, Alamos is required to adhere to the following conditions with respect to fish and fish habitat at the MacLellan site:

> *3.1 The Proponent shall develop, prior to construction and to the satisfaction of Fisheries and Oceans Canada and in consultation with Indigenous groups, and implement an offsetting plan to mitigate residual effects to fish and fish habitat associated with carrying out of the Designated Project. The Proponent shall share the proposed plan with Indigenous groups at least 30 days prior to formal submission to Fisheries and Oceans Canada, and submit the approved plan to the Agency prior to implementation*
>
> *3.2 The Proponent shall, for any fish habitat offsetting measure proposed in any offsetting plan referred to in condition 3.1 that may cause adverse environmental effects not considered in the environmental assessment, develop and implement, following consultation with Indigenous groups and relevant authorities, measures to mitigate those effects. The Proponent shall submit these measures to the Agency before implementing them.*
>
> *3.3 The Proponent shall install exclusion screens on intake pipes prior to their operation, taking into account Fisheries and Oceans Canada's "Freshwater Intake End-of-Pipe Fish Screen Guideline", and in a manner consistent with the Fisheries Act and its regulations.*
>
> *3.7 The Proponent shall collect contact water and seepage from the Project development areas, including seepage and recharge from the tailings management facility, mine rock storage areas, overburden and ore stockpiles, and seepage input to groundwater that flows into the open pits, and treat it, as necessary, before releasing it into the receiving environment during all phase of the Designated Project to ensure that any deposits are made in accordance with the Metal and Diamond Mining Effluent Regulation and the pollution prevention provisions of the Fisheries Act. When treating contact water and seepage, the Proponent shall take into account Manitoba's "Water Quality Standards, Objectives, and Guidelines", the Canadian Council of Ministers of the Environment's "Canadian Water Quality Guidelines for the Protection of Aquatic Life", and Environment and Climate Change Canada's "Federal Environmental Quality Guidelines".*
>
> *3.8 the Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, measures to protect fish and fish habitat when undertaking activities in or near fish-bearing water bodies, in a manner that complies with any authorization issued under the Fisheries Act for the Designated Project. The Proponent shall implement these measures during all phases of the Designated Project. In doing so, the Proponent shall:*
>
> > *3.8.1 Salvage and relocated fish prior to conducting any Designated Project activity requiring the removal of fish habitat, including dewatering*

3.8.2 Conduct activities in or near fish-bearing water bodies in accordance with Fisheries and Oceans Canada's "Manitoba Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat" and "Measures to Protect Fish and Fish Habitat", unless otherwise authorized by relevant authorities

3.8.3 Maintain, during all phases of the Designated Project, a buffer of undisturbed vegetation of at least 30 metres from the high-water mark, as follows:

3.8.3.1 around fish-bearing water bodies, including wetlands, within and adjacent to the Project development areas that are not required to be removed for construction of the Designated Project, in a manner that complies with any authorization issued under the Fisheries Act

3.8.3.2 around wetlands, within and adjacent to the project development areas that are not required to be removed for construction of the designated Project, unless not technically or economically feasible. If work within 30 metres of wetlands is required, the Proponent shall use weight-distributing materials under heavy machinery to limit soil compaction and give preference to using existing access roads to access areas near wetlands

3.9 The Proponent shall identify in consultation with Indigenous groups, prior to conducting the salvage and relocation of fish referred to in condition 3.8.1, opportunities for Indigenous groups to take part in, and determine their interest to take part in, the salvage and relocation of fish

3.11 The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, and implement and maintain during all phases of the Designated Project, measures to control erosion and sedimentation within the Project development areas in a manner consistent with the Fisheries Act and its regulations, and taking into account Environment and Climate Change Canada's "Environmental Code of Practice for Metal Mines", and Fisheries and Oceans Canada's "Measures to Protect Fish and Fish Habitat". The Proponent shall submit these measures to the Agency before implementing them. As part of these measures, the Proponent shall:

3.11.1 install intake pipes point upward and away from sediment

3.11.2 equipment contact water discharge pipes with diffusers

3.12 the Proponent shall develop, prior to construction and in consultation with Indigenous groups, Fisheries and Oceans Canada, Environment and Climate Change Canada, and any other relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and determine the effectiveness of the mitigation measures as they pertain to adverse environmental effects of the Designated Project on water quality, taking into account Environment and Climate Change Canada's "Metal Mine Technical Guidance for Environmental Effects Monitoring". The Proponent shall implement the follow-up program during all phases of the Designated Project. As part of the follow-up program, the Proponent shall:

3.12.1 determine, in consultation with Indigenous groups, Environment and Climate Change Canada, and any other relevant authorities, the location and extent of mixing zones in water bodies that may be affected by the Designated Project.

3.12.2 monitor water quality in the East and Wendy pit lakes, newly formed pit lakes, tailings management facility, mine rock storage areas, contact water collection ponds, and receiving water bodies and watercourses upstream and downstream of the Project development areas, including at the edge and downstream of the edge of mixing zones identified pursuant to condition 3.12.1, Arbor Lake, Burge Lake, Cockeram Lake, Ellystan Lake, Farley Creek, Farley Lake, Gordon Lake, the Hughes River, the Keewatin River, the unnamed tributary of the Keewatin River, Minton Lake, Payne Lake, Susan Lake, and Swede Lake, for all contaminant that may have adverse effects on fish and fish habitat, including aluminum, antimony, arsenic, calcium, copper, cyanide, fluoride, hexavalent chromium, iron, magnesium, methylmercury, phosphorus, selenium, and total and dissolved cadmium. Monitoring shall be conducted as follows:

3.12.2.1 beginning during construction and continuing through decommissioning, except in the East and Wendy pit lakes, and the newly formed pit lakes; and

3.12.2.2 beginning during construction in the East and Wendy pit lakes, and beginning during decommissioning and continuing through post-closure in the newly formed pit lakes, until water quality is stable and improving and any contact water or seepage potentially released meets the Canadian Council of Ministers of the Environment's "Canadian Water Quality Guidelines for the Protection of Aquatic Life" and Manitoba's "Water Quality Standards, Objectives, and Guidelines" pursuant to condition 3.7

3.12.4 monitor, during construction and operation, total suspended solids and turbidity in fish-bearing water bodies where Designated Project activities are undertaken in or near waters frequented by fish

3.12.5 develop, in consultation with relevant authorities, and implement modified or additional mitigation measures, if the results of monitoring conducted pursuant to condition 3.12.2, 3.12.3, and 3.12.4 demonstrate any unanticipated effects attributable to the Designated Project, taking into account the Canadian Council of the Ministers of the Environment's "Canadian Water Quality Guidelines for the Protection of Aquatic Life" or Manitoba's "Water Quality Standards, Objectives, and Guidelines", whichever is most protective of fish and fish habitat, and predicted concentrations identified in Volume 1, Chapter 9 of the environment Impact Statement

3.13 the Proponent shall develop, prior to construction and in consultation with Indigenous groups, Fisheries and Oceans Canada, Environment and Climate Change Canada and any other relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and determine the effectiveness of the mitigation measures as they pertain to adverse environmental effects of the Designated Project on water quantity. The Proponent shall implement the follow-up program during all phases of the Designated Project. As part of the follow-up program, the Proponent shall:

> *3.13.1 monitor, during all phases of the Designated Project, surface water instantaneous flows, lake levels and pH levels in Arbor Lake, Burge Lake, Cockeram Lake, Ellystan Lake, Farley Creek, Farley Lake, Gordon Lake, the Keewatin River, the unnamed tributary of the Keewatin River, Minton Lake, Payne Lake, Susan Lake, fish-bearing wetlands within the local assessment areas, the East and Wendy pit lakes, newly formed pit lakes, the tailings management facility, and contact water collection ponds to verify the environmental assessment predictions identified in Volume 2 Chapter 10 of the Environmental Impact Assessment and Appendix A Attachment IAAC-48 of the Proponent's IR Responses Round 1, Package 1 (Canadian Impact Assessment Registry Reference Number 80140, document #54*
>
> *3.13.3 develop, in consultation with relevant authorities, and implement modified or additional mitigation measures, if the results of monitoring conducted pursuant to condition 3.13.1 and 3.13.2 demonstrate unanticipated effects attributable to the Designated Project*

3.14 The Proponent shall develop, prior to construction and in consultation with Indigenous groups, Fisheries and Oceans Canada, Environment and Climate Change Canada and any other relevant authorities, a follow-up program to determine the effectiveness of the mitigation measures and verify the accuracy of the environmental assessment predictions identified in Volume 2 Chapter 10 of the Environmental Impact Statement as they pertain to adverse environmental effects of the Designated Project on fish and fish habitat, taking into account Environment and Climate Change Canada's Metal Mine Technical Guidance for Environmental Effects Monitoring. The Proponent shall implement the follow-up program during all phases of the Designated Project. As part of the follow-up program, the Proponent shall:

> *3.14.1 monitor, during all phases of the Designated Project, water temperature in Farley Creek, Farley Lake, Gordon Lake, the Hughes River, the Keewatin River, Minton Lake, the new diversion channel, and any additional locations identified in consultation with relevant authorities, taking into account predictions in Volume 2 Chapter 10 of the Environmental Impact Statement*

3.14.2 monitoring total invertebrate density, taxon richness, Simpson's Evenness Index, Bray-Curtis Index, and chlorophyll a to characterize benthic invertebrate, plankton and periphyton communities in Farley Creek, Farley Lake, Gordon Lake, the Hughes River, the Keewatin River, Minton Lake, the new diversion channel, and any additional locations identified in consultation with Indigenous groups and relevant authorities, for the detection of project-related changes I nutrient and contaminant levels, taking into account predictions in Volume 2 Chapter 10 of the Environment Impact Statement

3.14.3 identify, in consultation with Indigenous groups, Fisheries and Oceans Canada and any other relevant authorities, fish species to monitor, including species used for traditional purposes by Indigenous groups. Species shall include northern pike (Esox lucius), lake whitefish (Coregonus clupeaformis), and white sucker (Catostomus commersoni)

3.14.4 monitor, starting prior to construction and during all phases of the Designated Project, fish habitat quality and quantity ends points for all species identified pursuant to condition 3.14.3, in Farley Creek, Farley Lake, Gordon Lake, the Keewatin River, Minton Lake, the new diversion channel, fish-bearing wetlands within and downstream of the Project development areas, and any additional locations identified in consultation with Indigenous groups and relevant authorities

3.3.5.2 Environmental Effects

The proposed alterations to the approved MacLellan site may adversely affect fish and fish habitat due to changes in fish habitat and/or changes in fish health, growth, or survival. The potential for the proposed alterations to adversely affect fish habitat and/or fish health, growth, or survival is described in the sections below.

3.3.5.2.1 Change in Fish Habitat

The proposed alterations to the approved MacLellan site may affect fish habitat in the following ways:

1. alteration of flows in streams downstream of the PDA due to diversion or capture of run-off from their upstream catchment areas during all mine phases.
2. alteration of water levels in lakes downstream of the PDA due to diversion of capture of run-off from their upstream catchment areas and in fish-bearing wetlands due to changes to the groundwater table during all mine phases.
3. alteration of flows in the Keewatin River due to water withdrawals during construction and operation.

Overall, the PDA will be smaller than the PDA proposed in the EIS (Table 2.2). The proposed alterations to Project components footprints identified in Table 2.1, even those that will be larger than proposed in the EIS (e.g., open pit, TMF), will not result in new HADD of fish habitat that has not already been accounted for in Alamos' fish habitat offsetting plan and will not trigger any need to designate any "waters frequented by fish" as a Tailings Impoundment Areas (TIA) under Schedule 2 of the MDMER.

Construction

During construction, the MacLellan site will be cleared of trees, topsoil will be removed and stockpiled, overburden will be removed from the open pit area and stockpiled, foundations will be prepared for the worker camp, processing facility, explosives magazine, explosives mixing plant, the TMF starter dam, the MRSA, and OSAs, and freshwater supply infrastructure (i.e., pumphouse and intake) will be constructed. Contact water collection ditches, sumps, and collection ponds will be built around and within the perimeter of the TMF, MRSA, processing facility, worker camp, OSAs, overburden stockpile, topsoil stockpile, and open pit. Non-contact water diversion ditches and sumps will be built upslope from all mine infrastructure.

Collectively, construction of these mine infrastructure and water management components will alter the upstream catchment areas, alter infiltration and evapotranspiration rates, and alter run-off reporting to Minton Lake, Payne Lake, Keewatin River tributary KEE3-B1, and the Keewatin River. This has the potential to alter the magnitude, timing, and frequency of flows in streams and water levels in lakes, effects that have the potential to affect the quantity and quality of fish habitat used by different fish species and life stages (e.g., spawning) at different times of the year.

Operation

During operation, mining will progressively increase the size and depth of the open pit and, consequently, increase the size and height of the MRSA, TMF, and OSAs. Non-contact water will continue to be diverted around the MacLellan site while contact water will continue to be collected and conveyed to the collection pond. Freshwater will be withdrawn from the Keewatin River for dust suppression, truck washes, safety showers, fire suppression, and make-up water in the processing facility.

As the open pit gets larger and deeper, the hydraulic gradients between the pit and nearby ponds and streams and between the pit and the local groundwater table will increase (i.e., water will want to move toward the pit via gravity). The open pit will be 450 m below the surrounding ground at the conclusion of operation; this is when the hydraulic gradients will be largest. The increase in hydraulic gradient created by mining in the open pit has the potential to reduce flows in streams and lower water levels in ponds, lakes, and fish-bearing wetlands within the zone of groundwater table drawdown. Streams, ponds, and fish-bearing wetlands closest to the open pit are expected to be completely dewatered at the end of operation.

Decommissioning/Closure

During decommissioning/closure, buildings and equipment will be removed, disturbed areas will be recontoured, collection ditches, sumps, and ponds will be recontoured or backfilled, roads will be reclaimed, water intakes and effluent pipes will be removed from the Keewatin River, and the MRSA and TMF will be reclaimed. Prior to their decommissioning, contact water in the collection ditches, sumps and ponds and water in the TMF pond will be diverted to the open pit. Together with direct precipitation and run-off from its surrounding catchment area, contact water and TMF pond water are expected to fill the open pit with water in approximately 40 years. Once filled, run-off from the open pit will drain to the east through a concrete spillway into tributary KEE3-B1. Flow in tributary KEE3-B1 will drain into the Keewatin River downstream of the MacLellan site.

Decommissioning/closure of the MacLellan site, particularly, reclamation of the water management infrastructure and establishment of permanent site drainage will result in permanent alteration of the catchment areas of Minton Lake, Payne Lake, and tributary KEE3-B1 compared with their pre-mine condition. This has the potential to alter the magnitude, timing, and frequency of flows in streams and water levels in lakes and ponds compared with pre-mine conditions. Diversion of contact water, TMF pond water, and catchment area run-off to the open pit will eventually restore flows in tributary KEE3-B1, the groundwater table elevation, and water levels in ponds and fish-bearing wetlands.

3.3.5.2.2 Change in Fish Heath, Growth, or Survival

The proposed alterations to the approved MacLellan site may affect fish health, growth, or survival in the following ways:

1. Change in water quality in the Keewatin River downstream of the effluent pipe during operation.
2. Change in water quality in the Keewatin River and the unnamed Keewatin River tributary KEE3-B1 due to overflow from the pit lake during post-closure once the open pit has filled with water.
3. Change in water quality in Minton Lake, Payne Lake, or the Payne Lake outlet due to seepage from the TMF and/or MRSA.

Construction

During construction, the main activities that could affect fish health, growth, or survival are clearing of trees, and the grubbing and grading of the areas where mine infrastructure will be built. These activities have the potential to increase sediment loading to the streams, ponds, and lakes downstream and downslope of the mine infrastructure. Similarly, construction of the water management infrastructure has the potential to increase sediment loading to streams, ponds, and lakes. Increases in sediment to streams, ponds, and lakes can affect fish health, growth, and survival by covering fish eggs, irritating gills, and increasing turbidity of the water, a change that can reduce periphyton and phytoplankton production and reduce the ability of fish to detect prey and predators.

Operation

As mining progresses, the volume of mine rock added to the MRSA, the volume of tailings added to the TMF, and the volume of ore added to the OSAs will increase. These increases have the potential to increase the volume of contact water run-off and/or seepage reporting to streams, ponds, or lakes downstream or downslope of these facilities and to the surrounding groundwater table. Sources of contamination include metal leachate from the OSAs, mine rock and open pit, supernatant from the TMF pond (including cyanide and/or ammonia from ore processing), and blasting residues from the open pit.

Contact water and seepage from the TMF, MRSA, open pit, OSAs, overburden stockpile, topsoil stockpile, worker camp, and processing facility and associated buildings will be collected in collection ditches and sumps and conveyed to a collection pond. Collected water in the collection pond will be discharged into the Keewatin River upstream of the mine access road bridge crossing if it meets effluent limits identified in Schedule 4 of the MDMER.

Discharge of mine effluent into the Keewatin River and any seepage that is not captured in collection ditches around the perimeters of the MRSA, TMF, OSAs, or overburden stockpile has the potential to affect fish health, growth, and survival by altering water quality in streams, ponds, or lakes downstream or downslope of these facilities. This can result in acute or chronic toxicological effects on fish health, growth, or survival depending on the magnitude, frequency, and duration of the exposure to the contaminant(s) in the receiving environment, the sensitivity of organisms to the contaminant(s), and whether there are other water quality parameters in the effluent or receiving environment that may exacerbate or reduce the toxicity of the contaminant (e.g., hardness, pH).

Decommissioning/Closure

During decommissioning/closure, buildings and equipment will be removed, disturbed areas will be recontoured, collection ditches, sumps, and ponds will be recontoured or backfilled, roads will be reclaimed, water intakes and effluent pipes will be removed from the Keewatin River, and the MRSA and TMF will be reclaimed. These activities have the potential to increase sediment loading in streams, ponds, and lakes downstream and downslope of these facilities. The potential effects of increased sediment loading on fish were described previously.

Prior to their decommissioning, contact water in the collection ditches, sumps and ponds will be diverted to the open pit and water in the TMF pond will be diverted to the open pit. Together with direct precipitation and run-off from its surrounding catchment area, contact water and TMF pond water are expected to fill the open pit with water in approximately 40 years. Once filled, run-off from the open pit will drain to the east through a concrete spillway into tributary KEE3-B1 and then into the Keewatin River. If the concentration of metals, nutrients, or other contaminants are elevated in the pit water, acute or chronic toxicological effects to fish, fish eggs, periphyton, or benthic invertebrates in tributary KEE3-B1 and the Keewatin River may occur depending on the magnitude, frequency, and duration of exposure to the contaminant(s) before the quality of pit water stabilizes and improves.

3.3.5.3 Summary of Mitigation Measures

The principal mitigation measure for reducing or eliminating potential effects to fish and fish habitat due to the proposed alterations to the MacLellan site was to continue to avoid placing any new or expanded mine infrastructure footprint(s) on top of any fish-bearing stream, lake, or wetland. This was true for the EIS and remains as such for this NOA/NOC.

Other mitigation measures for reducing or eliminating potential effects to fish and fish habitat due to the proposed alterations at MacLellan site are identical to mitigation measures included in Chapter 10.0 of the EIS (Stantec 2020a), included as conditions of the federal Decision Statement, and part of the GMMP, and SWMMP (both Version 0, January 2025). They include mitigation measures designed to reduce or eliminate potential changes in groundwater seepage and groundwater table drawdown, and potential changes in stream flows and lake levels.

Mitigation measures specific to avoiding or reducing potential effects to fish health, growth and survival at the MacLellan site are discussed in the Aquatic Effects Monitoring Plan (AEMP; Version 0, January 2025). These mitigation measures and the adaptive management framework described in the AEMP continue to apply to the alterations discussed in this NOA/NOC. The only additional potential mitigation measure that will be added to the list in the Adaptive Management section is:

- Installing and operating groundwater pump-back wells between the TMF and Minton and Payne Lakes should surface water quality monitoring and/or groundwater quality monitoring show that groundwater seepage is causing water quality in Minton Lake, Payne Lake, or the Payne Lake outlet (tributary KEE3-PAY1) to exceed, or trending to exceed, provincial or federal water quality guidelines for the protection of freshwater aquatic life.

This addition will be made to the AEMP after NOA/NOC approval (changing the AEMP from Version 0 to Version 1).

3.3.5.4 Residual Effects

3.3.5.4.1 Change in Fish Habitat

Potential changes in fish habitat due to the proposed alterations to the approved MacLellan site are limited to potential effects caused by predicted changes in stream flows, lake levels, and groundwater table elevations; none of the proposed alterations would result in additional HADD of fish habitat under the altered PDA that hasn't already been accounted for in the fish habitat offset plan included in the *Fisheries Act* Authorization application submitted to DFO.

Potential changes in fish habitat due to changes in stream flows or water levels in ponds, lakes, or fish-bearing wetlands caused by changes in upstream catchment areas, water withdrawals from the Keewatin River, and/or changes in the groundwater table were predicted using a GoldSim™ water balance model. Details of this model are described in a technical modelling report appended to this NOA/NOC (Appendix F). In brief, the water balance model incorporated baseline hydrology data collected in the Keewatin River and other streams near the MacLellan site since 2015, climate data (e.g., precipitation, humidity) obtained from the Lynn Lake airport and the meteorological station installed by Alamos at the MacLellan site since 2015, and predicted changes in groundwater quantities predicted by a groundwater model (see Appendix E for details) to predict monthly changes in stream flows and water levels in lakes during each mine phase.

Change in Stream Flows

The proposed alterations to the approved MacLellan site are predicted to alter monthly or annual flows in the Keewatin River downstream of the MacLellan site (i.e., model node QM02 at the access road bridge crossing; QM03 upstream of the KEE3-B1 confluence; QM06 upstream of the Lynn River confluence; and QM08 at the Cockeram Lake outlet) by <2% during all mine phases. These predicted flow changes in the Keewatin River are the same magnitude as those predicted in the Keewatin River for the EIS. Flow changes of this magnitude are expected to have a negligible effect on fish habitat and its utilization by fish in the Keewatin River and are not assessed further.

The proposed alterations to the approved MacLellan site are predicted to alter stream flows by at least 10% of baseline in the Keewatin River tributary KEE3-B1 (i.e., QM04), the Minton Lake outlet (i.e., QM08), and the Dot Lake outlet (i.e., QM09) during some or all mine phases. The effects of these flow changes in fish habitat and its utilization by fish are described below.

Tributary KEE3-B1

During construction when natural run-off patterns will be altered by construction of diversion ditches, collection ditches, sumps, and collection ponds, flows in tributary KEE3-B1 are predicted to be reduced by between 17% and 43% in winter (November-April), between 26% and 28% in spring (May and June), between 31% and 33% in summer (July and August), and between 36% and 38% in fall (September and October) (Table 3.25). These predicted flow reductions are larger in winter and smaller during the open-water months than originally predicted for the EIS; flow in tributary KEE3-B1 was assumed to be zero in winter for the EIS.

Monthly and annual flows in tributary KEE3-B1 are predicted to be reduced by approximately 64% during operation when most of the natural run-off reporting to tributary KEE3-B1 is diverted or captured by the water management infrastructure and groundwater table drawdown is at its maximum and during decommissioning/closure phases when the open pit is filling with water. These flow reductions are the same as originally predicted for the EIS (Table 3.25).

Due to the magnitude of predicted flow reductions during construction, operation, and decommissioning/closure phases, Alamos continues to assume that fish habitat, and use of fish habitat in tributary KEE3-B1 by fish, will be adversely affected for approximately 60 years (3 years of construction, 17 years of operation, and 40 years to fill the open pit) and, therefore, constitutes a HADD of fish habitat requiring authorization by DFO. Alamos has included the affected habitat in tributary KEE3-B1 in its accounting of habitat losses and has developed a fish habitat offset plan that will counterbalance this unavoidable loss to the satisfaction of DFO.

During post-closure when the open pit is filled and overflowing into tributary KEE3-B1, flows in tributary KEE3-B1 are predicted to be between 3% and 391% higher than baseline during winter (November to April), between 20% and 168% higher than baseline in spring (May and June), between 73% and 83% than baseline in summer (July and August) and between 54% and 103% higher than baseline in fall (September and October). Except for June and October, flow alterations in tributary KEE3-B1 are predicted to be greater during post-closure than originally predicted for the EIS (Table 3.25). Higher flows in tributary KEE3-B1 compared with baseline during post-closure are due to the larger catchment area reporting to tributary KEE3-B1 once the closure plan drainage is constructed.

Larger flows in tributary KEE-B1 post-closure, particularly those during spring freshet, are expected to result in a wider, deeper, and potentially more braided channel between the open pit and the Keewatin River than currently exists between East Pond and the Keewatin River. However, changes in fish habitat in tributary KEE3-B1 are expected to be moderated by the low gradient (<1%) of the channel, the buffering effect of the wetland areas that exist on either side of the main channel, and the beaver dams that will persist or will be reconstructed once flows return. For these reasons, fish habitat in tributary KEE3-B1 is expected to be used by brook sticklebacks and juvenile northern pike in similar densities and for the same life stages as is currently utilized by these species; water quality is more likely to limit fish use of tributary KEE3-B1 than physical habitat post-closure (see Section 3.3.4 for discussion of water quality effects).

Minton Lake Outlet

During construction, flows in the Minton Lake outlet are predicted to decrease between 12% and 15% during late winter (January to April), between 16% and 24% during the open-water months (May to October) and between 22% and 23% in early winter (November and December) (Table 3.26). Flows in the Minton Lake outlet are predicted to be reduced by approximately 27% in all months, of all years, during operation and decommission/closure. These flow reductions are due to the reduction of the Minton Lake catchment area caused by construction and operation of the TMF, MRSA and associated water management infrastructure. Flows in the Minton Lake outlet are predicted to remain approximately 27% lower than baseline during post-closure due to the permanent diversion of run-off from the TMF and MRSA toward the open pit and the tributary KEE3-B1 watershed.

The predicted flow reductions in the Minton Lake outlet for this NOA/NOC are larger than originally predicted for the EIS (Table 3.26). However, the differences are smaller during the open-water months (May to October), than during the winter months (November to April).

Table 3.25 Comparison of Percentage Monthly and Annual Flow Changes in Tributary KEE3-B1 Between the Environmental Impact Statement and the Notice of Alteration/Notice of Change

Month	Existing Condition (m^3/s)	Construction		Operation		Decommissioning		Post-Closure	
		Change from Existing (EIS)	Change from Existing (NOA/NOC)	Change from Existing (EIS)	Change from Existing (NOA/NOC)	Change from Existing (EIS)	Change from Existing (NOA/NOC)	Change from Existing (EIS)	Change from Existing (NOA/NOC)
Jan	0.030	0%	-17%	0%	-64%	0%	-66%	0%	+16%
Feb	0.025	0%	-19%	0%	-64%	0%	-66%	0%	+9%
Mar	0.021	0%	-21%	0%	-64%	0%	-65%	0%	+18%
Apr	0.025	0%	-24%	0%	-64%	0%	-66%	0%	+391%
May	0.072	-64%	-26%	-64%	-64%	-64%	-60%	+35%	+168%
Jun	0.071	-64%	-28%	-64%	-64%	-64%	-64%	+52%	+20%
Jul	0.051	-64%	-31%	-64%	-64%	-64%	-62%	+43%	+81%
Aug	0.045	-64%	-33%	-64%	-64%	-64%	-62%	+33%	+73%
Sep	0.048	-64%	-36%	-64%	-64%	-64%	-61%	+63%	+103%
Oct	0.048	-64%	-38%	-64%	-64%	-64%	-62%	+90%	+54%
Nov	0.046	0%	-41%	0%	-64%	0%	-64%	0%	+3%
Dec	0.039	0%	-43%	0%	-64%	0%	-64%	0%	+5%
Annual	0.044	-64%	-30%	-63%	-64%	-63%	-63%	+76%	+78%

Note:
flow predictions are based on “average” climate scenario

Table 3.26 Comparison of Percentage Monthly and Annual Flow Changes in the Minton Lake Outlet Between the Environmental Impact Statement and the Notice of Alteration/Notice of Change

Month	Existing Condition (m^3/s)	Construction		Operation		Decommissioning		Post-Closure	
		Change from Existing (EIS)	Change from Existing (NOA/NOC)	Change from Existing (EIS)	Change from Existing (NOA/NOC)	Change from Existing (EIS)	Change from Existing (NOA/NOC)	Change from Existing (EIS)	Change from Existing (NOA/NOC)
Jan	0.064	-3%	-12%	-8%	-26%	-11%	-27%	-12%	-27%
Feb	0.053	0%	-13%	-4%	-27%	-8%	-27%	-9%	-28%
Mar	0.044	+3%	-14%	+1%	-27%	-5%	-28%	-6%	-28%
Apr	0.053	+5%	-15%	+3%	-27%	-4%	-27%	-4%	-28%
May	0.151	-21%	-16%	-21%	-25%	-24%	-26%	-24%	-26%
Jun	0.150	-23%	-17%	-23%	-26%	-25%	-26%	-25%	-26%
Jul	0.107	-23%	-18%	-23%	-26%	-25%	-26%	-25%	-26%
Aug	0.096	-28%	-19%	-28%	-26%	-31%	-26%	-31%	-27%
Sep	0.102	-27%	-20%	-27%	-26%	-29%	-26%	-29%	-26%
Oct	0.101	-24%	-21%	-24%	-26%	-25%	-26%	-25%	-26%
Nov	0.096	-18%	-22%	-18%	-26%	-20%	-26%	-20%	-27%
Dec	0.082	-14%	-23%	-14%	-26%	-17%	-26%	-17%	-27%
Annual	0.092	-19%	-19%	**-20%**	**-26%**	**-22%**	**-26%**	-22%	**-27%**

Note:
flow predictions are based on “average” climate scenario

Flow reductions predicted to occur in the Minton Lake outlet during all four mine phases for this NOA/NOC are not expected to result in a HADD of fish habitat or result in a measurable change in fish utilization of habitat in the Minton Lake outlet channel for the following reasons:

- Habitat in the Minton Lake outlet is comprised of a series of low gradient (<1%), braided channels flowing through a thickly vegetated floodplain with an average wetted width of 55 m (Figure 3.2).
- There are numerous beaver dams in the Minton Lake outlet that control water levels and hydraulic conditions (i.e., water depths and water velocities) upstream and downstream of the dams (Figure 3.3).
- There are no gravel rifles, the habitat type most sensitive to flow changes, in the Minton Lake outlet that would be used by White Suckers for spawning in spring.
- Because of the beaver dams and low channel gradient, the density and distribution of aquatic vegetation in the Minton Lake Outlet is unlikely to change enough to measurably reduce the availability or suitability of spawning habitat in the Minton Lake Outlet for Northern Pike and Yellow Perch in spring.
- Most large-bodied fish (juveniles and adults) will overwinter in Minton Lake or the unnamed lake downstream of Minton Lake instead of in the Minton Lake outlet.
- Fish passage in the Minton Lake Outlet may become more difficult for large-bodied fish species (i.e., Northern Pike, Yellow Perch, White Sucker) due to the predicted flow reductions, but there are no known obligatory spawning or foraging migrations between Minton Lake and the unnamed lake downstream of Minton Lake and movement of large-bodied fish over or through beaver dams will likely continue to be possible during high flow years.
- None of the predicted flow reductions would result in monthly flows <30% of MAD, one of the two flow threshold identified in DFO's "Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada" (DFO 2013)[1].

This rationale is the same rationale used to assess the potential effects of flow changes in Farley Creek due to pit dewatering in the EIS.

[1] Flows predicted by the water balance model are on a monthly time-step and, therefore, are not directly comparable to the instantaneous flow thresholds recommended in DFO's "Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada" (DFO 2013), Nevertheless, DFO's thresholds are used here as a "course filter" for assessing the relative magnitude of predicted flow reductions in the Minton Lake outlet.

Figure 3.2 Aerial view of the Minton Lake outlet. Minton Lake is in lower left with water flowing from left to right (Source: Google Earth™)

Figure 3.3 Habitat in Beaver Pond in the Minton Lake Outlet Approximately 300 m Downstream from Minton Lake

Figure 3.4 Habitat in One of the Braided Channels in the Minton Lake Outlet Approximately 150 m Downstream from Minton Lake

Dot Lake Outlet

During operation and decommissioning/closure, flows in the Dot Lake Outlet are predicted to be reduced by between 5% and 10% in winter (November to April), 3% in spring (May and June), 5% in summer (July and August), and 5% in fall (September and October). These predicted flow reductions are based on the results of the updated groundwater model which now predicts the effects of the open pit on the groundwater table extending to the west of the Keewatin River; no effects of the Project on flows in the Dot Lake outlet were predicted to occur in the EIS. Flows in the Dot Lake outlet are predicted to be 1% to 2% lower than baseline during post-closure after the open pit has filled with water and the groundwater table has recovered to pre-mine levels.

Ripe and spent Northern Pike were captured moving in the lower 100 m of the Dot Lake outlet in spring 2016 (Stantec 2017b). Juvenile and adult White Suckers and Longnose Suckers have also been captured in the Dot Lake outlet. However, Brook Sticklebacks were the most numerous fish species captured in the Dot Lake outlet in 2015 and 2016 (Stantec 2017b), presumably downstream migrants from Dot Lake.

Predicted flow reductions in the Dot Lake outlet for this NOA/NOC are not expected to result in a HADD of fish habitat or result in a measurable change in fish utilization in the Dot Lake outlet for the following reasons:

- None of the predicted flow reductions would result in monthly flows >10% different than baseline monthly flows or <30% of MAD, the two flow thresholds identified in DFO's "Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada" (DFO 2013)[2]
- The largest flow reductions are predicted to occur in winter (November to April), a period when few, if any, fish or fish eggs would be present in the Dot Lake Outlet; water in the Dot Lake Outlet freezes to the bottom in winter and large and small-bodied fish overwinter in the Keewatin River
- Water depths in the Dot Lake Outlet are generally too shallow in summer to provide suitability habitat for large-bodied fish under current conditions (Figure 3.5).

[2] Flows predicted by the water balance model are on a monthly time-step and, therefore, are not directly comparable to the instantaneous flow thresholds recommended in DFO's "Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada" (DFO 2013), Nevertheless, DFO's thresholds are used here as a "course filter" for assessing the relative magnitude of predicted flow reductions in the Dot Lake outlet.

Table 3.27 Comparison of Percentage Monthly and Annual Flow Changes in the Dot Lake Outlet Between the Environmental Impact Statement and the Notice of Alteration/Notice of Change

Month	Existing Condition (m^3/s)	Construction		Operation		Decommissioning		Post-Closure	
		Change from Existing (EIS)	Change from Existing (NOA/NOC)	Change from Existing (EIS)	Change from Existing (NOA/NOC)	Change from Existing (EIS)	Change from Existing (NOA/NOC)	Change from Existing (EIS)	Change from Existing (NOA/NOC)
Jan	0.040	0%	0%	0%	-7%	0%	-7%	0%	-2%
Feb	0.033	0%	0%	0%	-8%	0%	-8%	0%	-2%
Mar	0.027	0%	0%	0%	-10%	0%	-10%	0%	-2%
Apr	0.033	0%	0%	0%	-9%	0%	-8%	0%	-2%
May	0.095	0%	0%	0%	-3%	0%	-3%	0%	-1%
Jun	0.093	0%	0%	0%	-3%	0%	-3%	0%	-1%
Jul	0.067	0%	0%	0%	-4%	0%	-4%	0%	-1%
Aug	0.060	0%	0%	0%	-5%	0%	-5%	0%	-1%
Sep	0.064	0%	0%	0%	-5%	0%	-4%	0%	-1%
Oct	0.063	0%	0%	0%	-5%	0%	-4%	0%	-1%
Nov	0.060	0%	0%	0%	-5%	0%	-5%	0%	-1%
Dec	0.051	0%	0%	0%	-6%	0%	-5%	0%	-1%
Annual	0.057	0%	0%	0%	**-6%**	0%	**-6%**	0%	-1%

Note:
flow predictions are based on “average” climate scenario

Figure 3.5 Looking Upstream at Habitat in the Dot Lake outlet, July 2016

Change in Water Levels

The proposed alterations to the approved MacLellan site are predicted to alter monthly and annual water in Cockeram Lake by <0.01 m (Table 3.14), the same change predicted in the EIS. These predicted changes are not considered large enough to negatively affect fish habitat or its utilization by fish and, therefore, are not discussed further. Potential effects of predicted changes in water levels are restricted to Minton Lake and potential fish-bearing wetlands discussed in the sections below.

Minton Lake

Water levels in Minton Lake are predicted to decrease by an annual average of 0.04 m during construction and 0.06 m during operation, decommissioning/closure, and post-closure phases (Table 3.28). These predicted reductions in water level are due to the combined effects of predicted changes in groundwater and surface water inflows created by construction, operation, and decommissioning of the TMF and MRSA; the same reasons that water levels in Minton Lake were also predicted to decrease in the EIS.

Predicted water level reductions in Minton Lake are larger than originally predicted for the EIS (Table 3.28). However, the largest predicted difference is 0.04 m (May of operation, decommissioning/ closure, and post-closure) and most differences in water levels between the NOA/NOC and EIS are predicted to be <0.03 m.

The predicted changes in Minton Lake water levels during construction, operation, decommissioning/ closure, and post-closure phases are not expected to cause substantive changes in the littoral habitat area in Minton Lake. This is because water levels in Minton Lake are highly dependent on the height and permanence of beaver dams in the Minton Lake outlet and beaver activity in the Minton Lake outlet is expected to remain unchanged during any Project phase; the water balance model used to predict water level changes in Minton Lake did not consider effects of beaver dams. Therefore, the quantity and distribution of aquatic vegetation that currently supports northern pike, yellow perch, and brook stickleback spawning, rearing and foraging is not expected to measurably change from baseline.

The predicted water depth reductions in winter are not expected to reduce the quantity or quality of overwintering habitat in Minton Lake for northern pike, yellow perch, 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 6 centimetres (cm). These assessments are the same as those originally proposed in the EIS.

Table 3.28 Comparison of Predicted Change in Water Levels in Minton Lake Between the Environmental Impact Statement and the Notice of Alteration/Notice of Change

Month	Existing Condition (masl)	Change in Water Level (m)							
		Construction		Operation		Decommissioning		Post-Closure	
		Change from Existing (EIS)	Change from Existing (NOA/NOC)	Change from Existing (EIS)	Change from Existing (NOA/NOC)	Change from Existing (EIS)	Change from Existing (NOA/NOC)	Change from Existing (EIS)	Change from Existing (NOA/NOC)
Jan	330.06	0.00	-0.02	-0.01	-0.05	-0.01	-0.05	-0.01	-0.05
Feb	330.03	0.00	-0.02	0.00	-0.05	-0.01	-0.05	-0.01	-0.05
Mar	330.00	0.00	-0.02	0.00	-0.04	-0.01	-0.04	-0.01	-0.05
Apr	330.02	0.00	-0.03	0.00	-0.05	0.00	-0.05	0.00	-0.05
May	330.25	-0.03	-0.05	-0.04	-0.08	-0.04	-0.08	-0.04	-0.08
Jun	330.25	-0.05	-0.05	-0.05	-0.07	-0.05	-0.08	-0.05	-0.08
Jul	330.16	-0.03	-0.04	-0.03	-0.06	-0.04	-0.07	-0.04	-0.07
Aug	330.14	-0.04	-0.04	-0.04	-0.06	-0.05	-0.06	-0.05	-0.06
Sep	330.15	-0.05	-0.05	-0.05	-0.06	-0.06	-0.06	-0.06	-0.06
Oct	330.15	-0.05	-0.05	-0.05	-0.06	-0.05	-0.06	-0.05	-0.06
Nov	330.14	-0.03	-0.05	-0.03	-0.06	-0.04	-0.06	-0.04	-0.06
Dec	330.11	-0.02	-0.05	-0.02	-0.06	-0.02	-0.06	-0.02	-0.06
Annual	330.12	-0.03	-0.04	**-0.03**	-0.06	**-0.03**	-0.06	-0.03	-0.06

Note:
water level predictions are based on “average” climate scenario

Fish-Bearing Wetlands

The predicted zone of groundwater table drawdown at the MacLellan site has expanded to the north, south, east, and west of the open pit compared with the zone of groundwater table drawdown predicted for the EIS. Based on spectral analysis of satellite imagery, these areas include treed and shrubby swamps that may be fish-bearing if connected hydraulically to fish-bearing lakes, ponds, or streams during the year (Map 5, Appendix A). Alamos will investigate these potentially fish-bearing swamps in spring and summer of 2025 to determine which, if any, are fish-bearing. Alamos will use the same methods it used to validate the presence of fish-bearing swamps within the originally predicted zone of groundwater table drawdown at the MacLellan site in 2022.

Any fish-bearing swamps identified within the updated zone of groundwater table drawdown will be assumed to be dry by the end of operation and will be considered a HADD of fish habitat requiring authorization by DFO. These same assumptions were used in paragraph 35(2)(b) *Fisheries Act* Authorization application submitted to DFO in 2024. If additional fish-bearing swamps are identified within the updated zone of groundwater table drawdown, Alamos will work with Participating Indigenous Nations, the Province of Manitoba, and DFO to identify additional offsets that are commensurate with the quantity and quality of habitat affected.

3.3.5.4.2 Change in Fish Health, Growth, or Survival

Potential changes in fish health, growth, or survival due to changes in water quality caused by effluent discharge to the Keewatin River, seepage from the TMF, MRSA, ore storage areas, overburden stockpile, and topsoil stockpile, and overflow from the pit lake were predicted using a GoldSim™ mass balance model. Details of this model are described in a technical modelling report appended to this NOA/NOC (Appendix F). In brief, the mass balance model incorporated baseline hydrology and water quality data collected in the Keewatin River and other streams and lakes near the MacLellan site since 2015, climate data (e.g., precipitation, humidity) obtained from the Lynn Lake airport and the meteorological station installed by Alamos at the MacLellan site since 2015, groundwater quality and quantity data from a groundwater monitoring program that Alamos has conducted since 2015, a groundwater model that predicted changes to groundwater quality and quantity due to the Project (see Appendix E for details), and geochemistry data collected from mine rock, tailings, and overburden samples since 2015 to predict monthly water quality in the Keewatin River, tributary KEE3-B1, Payne Lake, Minton Lake, the Cockeram River, and Cockeram Lake during each mine phase. The mass balance model included the effect of contaminant loadings from the Lynn River to the Keewatin River; the Lynn River drains the former East Tailings Management Area (ETMA), a known source of contamination to the Keewatin River that is not part of the Lynn Lake Gold Project.

Potential effects on fish health, growth, or survival due to predicted changes in water quality in the downstream receiving environment were assessed using the surface water quality model predictions for the Expected Case scenario (see Section 3.3.4.1). A summary of model nodes used in the surface water quality model at the MacLellan site are shown in Table 3.16. Assessment of potential effects of each POPC identified by screening the predicted water quality concentrations against baseline water quality and the available provincial and federal water quality guidelines for the protection of freshwater aquatic biota on fish health, growth, and survival is provided in the sections below.

Potential Effects due to Total Arsenic

Total arsenic concentrations are predicted to exceed baseline concentrations by at least 20% and the CWQG-FAL (0.005 mg/L) at the following locations, during the following mine phases:

- the Keewatin River tributary KEE3-B1 during operation, closure, and post-closure
- Minton Lake during operation.

In tributary KEE3-B1, maximum total arsenic concentrations are predicted to exceed the CWQG-FAL by 1.4 times and 2.2 times the long-term CWQG-FAL during operation and post-closure (0.007 mg/L and 0.011 mg/L, respectively).

Although higher than the CWQG-FAL, predicted maximum total arsenic concentrations in tributary KEE3-B1 during operation and post-closure are not expected to result in adverse effects to fish health, growth, or survival for the same reasons that predicted maximum total arsenic concentrations in tributary KEE3-B1 during post-closure (0.023 mg/L or 4.5 times the CWQG-FAL) were not predicted to adversely affect fish health, growth, or survival in the EIS, namely:

- The CWQG-FAL for total arsenic 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 CWQG-FAL guideline derivation, fish and aquatic invertebrates are less sensitive to arsenic than aquatic plants or algae (CCME 2001). Adverse effects in fish and other non-algal aquatic biota are typically observed at arsenic concentrations between 0.3 mg/L and 1 mg/L (CCME 2001). These concentrations are at least one order of magnitude higher (10 times) than the maximum total arsenic concentration of 0.011 mg/L predicted to occur in tributary KEE3-B1 during any mine phase.
- The bioavailability of arsenic to aquatic organisms is attenuated by phosphorus because arsenic competes with phosphorus at biological binding sites (Reuther 1992) but the CWQG-FAL for arsenic does not account for this antagonistic relationship (i.e., it is not phosphorus-dependent).
- Total phosphorus concentrations in tributary KEE3-B1 are predicted to be elevated during post-closure (see Section 3.3.4.1), which would likely reduce potential risks to fish health, growth, or survival for the reasons above.

Maximum total arsenic concentrations are predicted to be at the CWQG-FAL (0.005 mg/L) in tributary KEE3-B1 during closure and in Minton Lake during operation. Because of this, and for the reasons above, predicted total arsenic concentrations in these waterbodies, during these mine phases, are not considered a risk to fish health, growth, or survival.

Potential Effects due to Total Cobalt

Total cobalt concentrations are predicted to exceed baseline concentrations by at least 20% and the hardness-dependent FEQG at the following locations, during the following mine phases:

- The Payne Lake outlet (Keewatin River tributary KEE3-PAY1) during operation, closure, and post-closure.
- Minton Lake during operation and closure.
- The Keewatin River tributary KEE3-B1 during post-closure.

In tributary KEE3-PAY1, maximum total cobalt concentrations are predicted to exceed the FEQG by 2.1 times, 1.9 times, and 1.1 times during operation (0.0016 mg/L), closure (0.0015 mg/L), and post-closure (0.0009 mg/L), respectively. However, total cobalt concentrations in tributary KEE3-PAY1 are predicted to fall below, and stay below, the FEQG after the first year of post-closure. In Minton Lake, maximum total cobalt concentrations are predicted to exceed the FEQG by 1.3 times and 1.2 times during operation (0.0010 mg/L) and closure (0.0010 mg/L), respectively. However, total cobalt concentrations are not predicted to exceed the FEQG in Minton Lake at any time during post-closure.

Although higher than the FEQG, predicted maximum total cobalt concentrations in tributary KEE3-PAY1 during operation, closure, and post-closure and in Minton Lake during operation and post-closure are not expected to result in adverse effects to fish health, growth, or survival for the following reasons:

- The FEQG is derived using a species sensitivity distribution with the amphipod *Hyalella azteca* as the most sensitive species to cobalt and fish amongst the least sensitive species to cobalt.
- The highest total cobalt concentrations predicted in tributary KEE3-PAY (0.0016 mg/L) and Minton Lake (0.0010 mg/L) are below the chronic effect concentration of 0.0022 mg/L for *Hyalella azteca*, the most sensitive species to total cobalt, at a normalized hardness of 100 mg/L.
- Research conducted after the FEQG was derived in 2017 showed chronic effect concentrations for total cobalt of 0.023 mg/L and 0.167 mg/L for the algae *Pseudokirchneriella subcapitata* and the midge *Chironomus tentans* associated with a water hardness of 27 and 34 mg/L, respectively, and a hazardous concentration (HC_5) for 5% of species in the species sensitivity distribution of 0.0018 mg/L (Stubblefield et al. 2020). Hardness values in this study were similar to hardness values in tributary KEE3-PAY 1 and Minton Lake (7 mg/L to 30 mg/L) and, therefore, the chronic effect concentrations and the HC_5 in this study are likely more applicable to fish and aquatic biota in tributary KEE3-PAY1 and Minton Lake than the hardness-dependent total cobalt FEQG which is recommended only for waters with hardness values between 52 mg/L and 396 mg/L (ECCC 2017). Predicted maximum total cobalt concentrations in tributary KEE3-PAY1 (0.0016 mg/L) and Minton Lake (0.0010 mg/L) are below the chronic effect concentrations and the HC_5 calculated by these authors.

In tributary KEE3-B1, maximum total cobalt concentrations are predicted to exceed the FEQG by 3.0 times during post-closure (0.0043 mg/L) and are predicted to remain elevated at this level for perpetuity (Figure G-8; Appendix G). This predicted maximum total cobalt concentration is twice as high as the effect concentration of 0.0022 mg/L for *Hyalella azteca* at a normalized hardness of 100 mg/L, and

2.3 times higher than the HC_5 proposed by Stubblefield et al. (2020). However, it is lower than the hardness-normalized chronic effect concentrations for other invertebrates and aquatic plant species (ECCC 2021) and fish (> 0.3000 mg/L). These data suggest that predicted maximum total cobalt concentrations in tributary KEE3-B1 during post-closure may affect the organisms that recolonize tributary KEE3-B1 after the pit lake is discharging to the receiving environment differently; some organisms, like amphipods, may be more adversely affected than fish, such as brook sticklebacks and northern pike. However, any effect on lower trophic communities would indirectly affect the growth and survival of the fish that colonize tributary KEE3-B1 because the lower trophic communities form the prey base for the fish community.

Average water hardness in the open pit is predicted to exceed 550 mg/L at post-closure. This is greater than the water hardness range recommended for using the hardness-derived FEQG for total cobalt (52 mg/L to 396 mg/L). However, the high-water hardness concentrations predicted in the pit lake may ameliorate the total cobalt toxicity in tributary KEE3-B1 during post-closure.

To mitigate potential adverse effects of total cobalt on fish and other aquatic biota in tributary KEE3-B1 once the pit lake over-flows during post-closure, Alamos will monitor water quality in the open pit during the 40 years estimated to fill the pit with water and, if total cobalt and hardness concentrations in the pit water are found to exceed the FEQG, or are trending to exceed the FEQG during this period, then Alamos will implement an adaptive management plan that could include measures such as controlled pit stratification and/or pit fertilization to lower total cobalt concentrations before water in the pit lake overflowed into tributary KEE3-B1 (see Section 3.3.4.3 for details).

Potential Effects due to Total Copper

Total copper concentrations are predicted to exceed baseline concentrations by at least 20% and the long-term CWQG-FAL only in Keewatin River tributary KEE3-B1 but only during post-closure after the open pit has filled with water and is overflowing into tributary KEE3-B1. Total copper concentrations in tributary KEE3-B1 are predicted to reach a maximum of 0.0041 mg/L during post-closure, which just exceeds the hardness-dependent long-term CWQG-FAL of 0.0040 mg/L. Additionally, these exceedances are predicted to occur in <1% of months during the modelled post-closure phase and are predicted to decrease over time.

The CWQG-FAL for total copper is 0.0040 mg/L at water hardness values greater than 180 mg/L (Canadian Council of Resource and Environment Ministers [CCREM] 1987), such as water hardness present in tributary KEE3-B1 (>225 mg/L). The CWQG-FAL incorporates a five-fold safety factor (i.e., the equation is multiplied by 0.2) because the effect of water hardness on the chronic toxicity of copper was inconclusive (CCREM 1987). However, research on copper toxicity to freshwater aquatic biota since the CWQG-FAL was developed in 1987 has established that copper toxicity decreases with increasing water hardness (United States Environmental Protection Agency [US EPA] 2007 and British Columbia Ministry of Environment [BC MOE] 2019b); the BLM model used to derive the FEQG for dissolved copper includes water hardness for this reason. This suggests that the five-fold safety factor used in the long-term total copper CWQG-FAL is overly conservative. Together, with the relatively small magnitude and frequency of guideline exceedances, predicted maximum total copper concentrations in tributary KEE3-B1 during post-

closure are not expected to cause adverse effects to fish health, growth, or survival. Additionally, total copper concentrations in tributary KEE3-B1 would be expected to be lower than currently predicted by the surface water quality model if Alamos needed to implement passive treatment (e.g., pit fertilization) to lower concentrations of any other metal or metalloid in the open pit before it overflows into tributary KEE3-B1.

Potential Effects due to Dissolved Copper

Dissolved copper concentrations are predicted to exceed baseline concentrations by at least 20% and the BLM derived FEQG at the following locations, during the following mine phases:

- The Payne Lake outlet (Keewatin River tributary KEE3-PAY1) during operation, closure, and post-closure.
- Minton Lake during operation, closure, and post-closure.

In tributary KEE3-PAY1, maximum dissolved copper concentrations are predicted to exceed the FEQG by 3.3 times, 3.3 times, and 3.2 times during operation (0.0008 mg/L), closure (0.0007 mg/L), and post-closure (0.0007 mg/L), respectively. However, by the end of the modelled post-closure phase, dissolved copper concentrations in tributary KEE3-PAY1 are predicted to exceed the FEQG in only one month per year (January) (Figure G-22, Appendix G). In Minton Lake, maximum dissolved copper concentrations are predicted to exceed the FEQG by 3.1 times, 3.1 times, and 3.9 times during operation (0.0009 mg/L), closure (0.0009 mg/L), and post-closure (0.0011 mg/L), respectively. However, by the end of the modelled post-closure phase, dissolved copper concentrations in Minton Lake are predicted to exceed the FEQG in 40% of all months (Figure G-30, Appendix G).

Dissolved copper is the more bioavailable and, therefore, toxicologically relevant form of copper, and its uptake is a function of water hardness (i.e., copper uptake is inversely proportional to water hardness as Calcium carbonate [$CaCO_3$]). Other factors that influence copper bioavailability include dissolved organic carbon (DOC), pH, alkalinity, and water temperature. These parameters are variables in the BLM used to calculate the dissolved copper FEQG (ECCC 2021).

The species sensitivity distribution normalized to temperature of 20 degrees Celsius (ºC), pH of 7.5, DOC of 0.5 mg/L and hardness of 50 mg/L $CaCO_3$, identified *Lymnea stagnalis* as the most sensitive species to dissolved copper (ECCC 2021). Fish and aquatic plants are generally least sensitive to dissolved copper, except for white sturgeon (*Acipencer transmontanus*) and the common duckweed (*Lemna minor*) (ECCC 2021). A HC_5 of 0.0004 mg/L, normalized to temperature of 20ºC, pH of 7.5, DOC of 0.5 mg/L and hardness of 50 mg/L, was derived from the species sensitivity distribution (ECCC 2021). The maximum predicted dissolved copper concentrations in tributary KEE3-PAY1 and Minton Lake during operation, closure, and post-closure phases are greater than the derived HC_5 of 0.0004 mg/L.

Although maximum predicted dissolved copper concentrations in tributary KEE3-PAY1 and Minton Lake may pose a risk to fish health, growth, and survival, the maximum predicted dissolved copper concentrations in tributary KEE3-PAY 1 and Minton Lake are below the chronic effect concentrations for most fish, plant, and invertebrate species used in the species sensitivity distribution (>0.001 mg/L; ECCC 2021). Additionally, maximum predicted dissolved copper concentrations in tributary KEE3-PAY1 and

Minton Lake are below the chronic toxicity concentrations used in the FEQG derivation at water hardnesses below 30 mg/L, the water hardness range in tributary KEE3-PAY1 and Minton Lake (7 mg/L to 30 mg/L):

- Chronic effect concentrations of 0.0300 mg/L and 0.0820 mg/L were determined for the amphipod *Hyalella azteca* in water with hardnesses of 10 mg/L and 22 mg/L, respectively (ECCC 2021).
- A chronic effect concentration of 0.0022 mg/L was determined for Chinook Salmon (*Oncorhynchus tshawytscha*) in water with a hardness of 24 mg/L (ECCC 2021).
- Chronic effect concentrations varied between 0.0022 mg/L and 0.0055 mg/L for green algae (*Raphidocelis subcapitata*) in water with a hardness of 15 mg/L (ECCC 2021).

All of these chronic effect concentrations are higher than the maximum dissolved copper concentrations predicted to occur in tributary KEE3-PAY1 and Minton Lake during operation, closure, and post-closure phases. Additionally, these chronic effect concentrations are based on lower DOC concentrations than the DOC concentrations reported in tributary KEE3-PAY1 and Minton Lake. Higher DOC concentrations generally lower the bioavailability and toxicity of dissolved copper, as has been demonstrated in water flea *Daphnia magna* (Kramer et al. 2004, De Schamphelaere and Janssen 2004).

The information above indicates that the potential toxicity of dissolved copper in tributary KEE3-PAY1 and Minton Lake will depend on hardness, pH, temperature, and DOC, parameters that may or may not be affected by groundwater seepage from the TMF, and that comparison of the maximum dissolved copper concentrations predicted in tributary KEE3-PAY1 and Minton Lake during operation, closure, and post-closure to HC_5 and BLM-derived FEQG may be conservative.

To mitigate potential effects of elevated dissolved copper concentrations on fish health, growth, and survival in tributary KEE3-PAY1 and Minton Lake during operation, closure, and post-closure phases, Alamos will implement a surface water quality monitoring program to determine if dissolved copper concentrations are increasing in tributary KEE3-PAY 1 and Minton Lake and a GMMP to determine if dissolved copper concentrations are increasing in seepage from the TMF and/or MRSA. The adaptive management plan within the GMMP includes a hierarchical process determining if any increases in groundwater quality are due to the Project, and if so, the types of mitigation measures that could be implemented. Mitigation options include implementation of groundwater pump-back wells to pump any seepage not captured in the existing collection ditches and sumps back to the TMF pond.

Potential Effects due to Fluoride

Fluoride concentrations are predicted to exceed baseline concentrations by at least 20% and the long-term CWQG-FAL only in the Keewatin River tributary KEE3-B1 during post-closure once the open pit has filled with water and discharges to the receiving environment. Fluoride concentrations in tributary KEE3-B1 are predicted to reach a maximum of 0.17 mg/L during post-closure, which exceeds the long-term CWQG-FAL of 0.12 mg/L (CCME 2002). Exceedances of the fluoride CWQG-FAL are predicted to occur until the end of the modelled post-closure phase (Figure G-33, Appendix G).

Despite these exceedances, predicted fluoride concentrations in tributary KEE3-B1 during post-closure are not expected to result in adverse effects to fish health, growth, or survival for the following reasons:

- The CWQG-FAL for fluoride 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 2002). The safety factor was used because this study was based on acute lethality instead of sublethal effects on growth or reproduction after chronic exposure.
- the CWQG-FAL for fluoride is not dependent on other water chemistry parameters; however, the CCME (2002) notes that fluoride toxicity 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 2002, Camargo 2003). 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 (such as those predicted to occur in the pit lake at the MacLellan site).

Potential Effects due to Phosphorus

Phosphorus concentrations are predicted to exceed baseline concentrations by at least 20% and the long-term MWQSOG-FAL only in the Keewatin River tributary KEE3-B1 during post-closure once the open pit has filled with water and discharges to the receiving environment. Phosphorus concentrations in tributary KEE3-B1 are predicted to reach a maximum of 0.029 mg/L during post-closure, which exceeds the long-term MWQSOG-FAL of 0.025 mg/L (CCME 2002). Exceedances of the phosphorus MWQSOG-FAL are predicted to occur until the end of the modelled post-closure phase (Figure G-36, Appendix G).

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 (i.e., a shift in trophic status due to increased production of photosynthetic algae). A moderate increase in trophic status can be beneficial in nutrient-poor systems. However, decomposition of phytoplankton and periphyton associated with increases in nutrients (such as phosphorus, nitrogen, or dissolved carbon) can lead to decreased oxygen concentrations in winter, which can affect the survival of fish (CCME 2004).

Although the maximum concentration of phosphorus in tributary KEE3-B1 during post-closure is predicted to exceed the long-term MWQSOC-FAL guideline, the maximum predicted concentration (0.029 mg/L), the long-term MWQSOC-FAL (0.025 mg/L) and the baseline maximum concentration (0.026 mg/L) are within the meso-eutrophic range of 0.020 to 0.035 mg/L, as defined for lakes in the Canadian Guidance Framework for the Management of Freshwater Ecosystems (CCME 2004). In addition, the average concentration of 0.023 mg/L during post-closure is predicted to be below the MWQSOC-FAL guideline of 0.025 mg/L. For these reasons, potential adverse effects on fish health, growth, or survival of fish in the

tributary KEE3-B1 due to predicted increases in phosphorus concentrations during post-closure are not expected to occur.

Comparison with the EIS

In the EIS, total aluminum, total arsenic, total and dissolved cadmium, total copper, and fluoride are identified as POPCs in the Keewatin River tributary KEE3-B1 during post-closure. Total aluminum and total and dissolved cadmium are not identified as POPCs in tributary KEE3-B1 or any other waterbody for this NOA/NOC. Maximum predicted concentrations in tributary KEE3-B1 for the NOA/NOC are equal to or lower than the maximum predicted concentrations previously reported in the EIS for total arsenic (0.0109 mg/L vs 0.0230 mg/L), total copper (0.0041 mg/L vs 0.0059 mg/L), and fluoride (0.169 mg/L vs 0.21 mg/L). Negligible residual effects on fish health, growth, or survival of fish from exposure to predicted total arsenic, total copper, and fluoride concentrations in tributary KEE3-B1 during post-closure are expected in the EIS (Stantec 2020a) and, therefore, are also expected to be negligible for this NOA/NOC. However, without mitigation, predicted total cobalt concentrations in tributary KEE3-B1 during post-closure may pose a high magnitude, long-term, irreversible residual effect to fish health, growth, and survival in tributary KEE3-B1.

In the EIS, total cadmium was the only POPC identified in Minton Lake during post-closure. However, the maximum predicted total cadmium concentration in Minton Lake was only predicted to exceed the CWQG-FAL by 1.1 times and in <10% of all months in post-closure. This was predicted to result in a negligible residual effect to fish health, growth, and survival in Minton Lake in the EIS. In this NOA/NOC, total cadmium is not identified as a POPC in Minton Lake during any phase. However, total arsenic and total cobalt are identified as POPCs in Minton Lake during operation while dissolved copper is identified as a POPC in Minton Lake during operation, closure, and post-closure phases. Therefore, without mitigation, a high magnitude, long-term effect on fish health, growth, and survival in Minton Lake is predicted based principally on elevated dissolved copper concentrations in post-closure. This effect is expected to be reversible because dissolved copper concentrations in Minton Lake are predicted to continually decrease after Year 70 (Figure G-24, Appendix G). However, residual effects due to elevated dissolved copper concentrations are not predicted to extend to Cockeram Lake or beyond the LAA.

No POPCs are identified in tributary KEE3-PAY1 in any phase in the EIS. In this NOA/NOC, total cobalt is identified as a POPC in tributary KEE3-PAY1 during operation while dissolved copper is identified as a POPC in tributary KEE3-PAY1 during operation, closure, and post-closure. Therefore, without mitigation, a high magnitude, long-term effect on fish health, growth, and survival in tributary KEE3-PAY1 (the Payne Lake outlet) is predicted based principally on elevated dissolved copper concentrations in operation, closure, and post-closure phases. However, this effect is expected to be reversible because dissolved copper concentrations in tributary KEE3-PAY are predicted to continually decrease after Year 70 (Figure G-24, Appendix G). Residual effects due to elevated dissolved copper concentrations in tributary KEE3-PAY1 are not expected to extend into the Keewatin River.

3.3.6 Vegetation and Wetlands

The vegetation and wetlands VC includes native plant communities, wetlands, plant species and communities of conservation concern, and traditional use plant species (Stantec 2020a). The proposed alterations that may interact with the vegetation and wetlands VC and were therefore assessed as part of this NOA/NOC, include but are not limited to the PDA layout.

3.3.6.1 Spatial Boundaries

PDA – As outlined in Section 2.3, the PDA encompasses the immediate area in which Project activities and components occur plus a buffer and is the anticipated area of direct physical disturbance associated with the construction and operation of the Project. The PDA has changed from what was presented in the EIS and has now decreased by 23.1 ha.

LAA – The LAA (3,613.9 ha) has changed from what was presented in the EIS because of groundwater drawdown and changes in the PDA. The LAA is based on a 100 m buffer around the furthest expected groundwater drawdown contour, a 1 km buffer around the revised PDA extent, and also a 1 km buffer around the PR 391 highway. The changes increase the LAA by 43.5 ha from that presented in the EIS.

3.3.6.2 Regulatory and Guideline Setting

3.3.6.2.1 Guideline Criteria

The assessment of potential Project-related environmental effects on vegetation and wetlands includes the consideration of the federal *Species at Risk Act.*

Provincial legislation considered in the assessment of potential Project-related environmental effects on vegetation and wetlands includes the following:

- *The Water Rights Act*
- *The Conservation Agreements Act*
- *The Ecological Reserves Act*
- *The Endangered Species and Ecosystems Act*
- *The Environment Act*
- *The Forest Act*
- *The Forest Health Protection Act*
- *The Wildfires Act*
- *The Mines and Minerals Act*
- *The Noxious Weeds Act*

3.3.6.2.2 IAAC Decision Statement

As per the IAAC Decision Statement, Alamos is required to adhere to the following conditions with respect to vegetation and wetlands:

> *3.8.3 maintain, during all phases of the Designated Project, a buffer of undisturbed vegetation of at least 30 meters from the high-water mark, as follows:*
>
> > *3.8.3.1 around fish-bearing water bodies, including wetlands, within and adjacent to the Project development areas that are not required to be removed for construction of the Designated Project, in a manner that complies with any authorization issued under the Fisheries Act; and*
> >
> > *3.8.3.2 around wetlands, within and adjacent to the Project development areas that are not required to be removed for construction of the Designated Project, unless not technically or economically feasible. If work within 30 meters of wetlands is required, the Proponent shall use weight-distributing materials under machinery to limit soil compaction and give preference to using existing access roads to access areas near wetlands.*
>
> *3.13 The Proponent shall develop, prior to construction and in consultation with Indigenous groups, Fisheries and Oceans Canada, Environment and Climate Change Canada and any other relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and determine the effectiveness of the mitigation measures as they pertain to adverse environmental effects of the Designated Project on water quantity. The Proponent shall implement the follow-up program during all phases of the Designated Project. As part of the follow-up program, the Proponent shall:*
>
> > *3.13.1 monitor, during all phases of the Designated Project, surface water instantaneous flows, lake levels and pH levels within Arbor Lake, Burge Lake, Cockeram Lake, Ellystan Lake, Farley Creek, Farley lake, Gordon Lake; the Keewatin River, the unnamed tributary of the Keewatin River, Minton lake, Payne lake, Susan lake, Swede lake, fish-bearing wetlands within the local assessment areas, the East and Wendy pit lakes, newly formed pit lakes, the tailings management facility, and contact water collection ponds to verify the environmental assessment predictions identified in Volume 2 Chapter 10 of the Environmental Impact Statement and Appendix A Attachment IAAC-48 of the Proponent's IR Responses Round 1, Package 1 (Canadian Impact Assessment Registry Reference Number 80140, document 11S4);*
> >
> > *3.13.2 monitor, during all phases of the Designated Project, groundwater levels, gradients and hydraulic conductivity of all hydrogeological units, as identified in the groundwater model in Volume 5 Appendix F and G of the Environmental Impact Statement, with well depths ranging from near surface to a minimum of 115 meters below ground to characterize contaminant transport via groundwater at the depth of the groundwater model for the Designated Project. Monitoring wells shall be installed near the open pits, the tailings management facility, mine rock storage areas, ore and*

overburden stockpiles, and fish-bearing wetlands within the local assessment areas that intersect with the Project development areas;

3.14.4 monitor, starting prior to construction and during all phases of the Designated Project, fish habitat quality and quantity end points for all species identified pursuant to condition 3.14,3, in Farley Creek, Farley lake, Gordon lake, the Keewatin River, Minton lake, the new diversion channel, fish-bearing wetlands within and downstream of the Project development areas, and any additional locations identified in consultation with Indigenous groups and relevant authorities.

5.2.2 provide opportunities to Indigenous groups, prior to construction and at times determined in consultation with each Indigenous group, to:

5.2.2.1 harvest and transplant, during seasons where plants can be Identified and harvested, plant species used for traditional purposes from areas that will be cleared of vegetation

5.4 The Proponent shall develop, prior to construction, and implement, during all phases of the Designated Project, a protocol for inspecting and cleaning vehicles, machinery and equipment associated with the Designated Project that have come from other worksites in order to limit the introduction and spread of weed species within the Project development areas.

5.6 The Proponent shall, when Implementing measures to limit the introduction and spread of weed species within the Project development areas, use measures other than broadcast spraying when applying herbicides to mitigate effects to plant species used for traditional purposes by Indigenous groups, unless the Proponent determines that these measures are ineffective at controlling the introduction and spread of weed species.

5.7 The Proponent shall undertake, in consultation with Indigenous groups and relevant authorities, progressive reclamation of areas disturbed by the Designated Project, in doing so, the Proponent shall:

5.7.1 identify, in consultation with Indigenous groups, plant species native to the local assessment areas and plant species used for traditional purposes, to use for revegetation

6.3 The Proponent shall develop, prior to construction and in consultation with Indigenous groups, Health Canada, Environment and Climate Change Canada and any other relevant authorities, a follow-up program to verify the accuracy of the environmental assessment as it pertains to adverse environmental effects from the Designated Project on air quality and country foods as it relates to the health of Indigenous peoples, taking into account available Indigenous knowledge provided by Indigenous groups related to current use of lands and resources for traditional purposes. The Proponent shall Implement the follow-up program during all phases of the Designated Project. As part of the implementation of the follow-up program, the Proponent shall:

6.3.1 identify, in consultation with Indigenous groups, the species of fish, vegetation and wildlife consumed as country foods that may be adversely affected by the Designated Project and the locations where these species shall be monitored

3.3.6.3 Environmental Effects

Construction

Consistent with the EIS, vegetation clearing during construction will result in portions of native plant communities being lost or altered. As described in Section 11.4 of the EIS, it was assumed that all vegetation within the PDA would be removed during construction. Overall, the revised PDA is smaller than what was assessed in the EIS, even with the addition of several new Project components, including a satellite pit and construction laydown areas. The land cover within the PDA remains similar with dense conifer forest dominating 25.8% of the PDA, followed by treed bog (19.9%), open conifer forest (18.2%), and sparse open conifer forest (11.0%) (Table 3.29). The relative proportions of these cover classes have not changed from the EIS.

Both construction and operation may indirectly alter the native plant communities as a result of the introduction and/or establishment of invasive species. This effect has not changed from the EIS.

Indirect effects on wetlands from groundwater drawdown may include a change in wetland class, change in plant species composition, and a change in decomposition rate for those wetlands influenced by groundwater such as fens and swamps.

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 500 m of the open pit and satellite pit (Map 6, Appendix A). Additional drawdown is expected to extend about 500 m to the east of the MRSA and 300 m south of the MRSA. Groundwater drawdown during construction and operation may alter the class, plant species composition and decomposition rates of 114.4 ha of fen and 138.9 ha of swamp wetland area (Table 3.30). The relative proportions of wetlands have not changed from the EIS.

Construction will not affect any known occurrences of plant species of conservation concern (SOCC) as there were no observations of plant SOCC within the PDA during baseline field surveys. 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. This effect is consistent with what was presented in the EIS.

Table 3.29 Land Cover Classes in the PDA and LAA

Cover Type	Land Cover Class	EIS Results				Updated NOA/NOC Results			
		PDA		LAA		PDA		LAA	
		Area (ha)	Proportion (%)	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)
Anthropogenic	Development	72.5	7.7	143.9	4.1	71.9	7.9	172.6	4.8
Anthropogenic Subtotal		***72.5***	***7.7***	***143.9***	***4.1***	***71.9***	***7.9***	***172.6***	***4.8***
Native Upland	Conifer Dense	220.3	23.5	696.3	19.8	235.7	25.8	717.1	19.7
	Conifer Open	169.8	18.1	469.2	13.3	166.4	18.2	488.7	13.5
	Conifer Sparse	98.3	10.5	295.8	8.4	100.3	11.0	313.3	8.6
	Shrubland	2.0	0.2	29.0	0.8	2.0	0.2	27.3	0.8
Native Upland Subtotal		***490.4***	***52.3***	***1,490.3***	***42.4***	***504.4***	***55.1***	***1,546.4***	***42.6***
Water	Water	4.2	0.4	299.6	8.5	0.1	0.0	307.1	8.5
Water Subtotal		**4.2**	**0.4**	**299.6**	**8.5**	***0.1***	***0.0***	***307.1***	***8.5***
Wetland	Bog Shrubby	41.9	4.5	207.7	5.9	40.7	4.4	205.1	5.6
	Bog Treed	199.5	21.3	773.9	22.0	182.3	19.9	794.8	21.9
	Fen Graminoid	5.0	0.5	32.2	0.9	4.3	0.5	28.2	0.8
	Fen Pattern	5.1	0.5	15.9	0.5	6.4	0.7	16.2	0.4
	Fen Shrubby	21.6	2.3	114.4	3.3	19.9	2.2	111.6	3.1
	Fen Treed	15.0	1.6	61.6	1.8	15.4	1.7	67.7	1.9
	Swamp Shrubby	12.1	1.3	36.8	1.0	7.7	0.8	37.5	1.0
	Swamp Treed	70.6	7.5	342.4	9.7	61.6	6.7	344.8	9.5
Wetland Subtotal		***370.8***	**39.5**	***1,584.9***	**45.0**	***338.4***	***37.0***	***1,605.8***	***44.2***
Total		**937.9**	**100.0**	**3,518.5**	**100.0**	**914.8**	**100.0**	**3,631.9**	**100.0**

Table 3.30 Wetlands Potentially Affected by Groundwater Drawdown during Construction and Operation

Wetland Class	Area (ha)	Proportion (%)
Fen Graminoid	6.1	2.4
Fen Pattern	6.1	2.4
Fen Shrubby	75.8	29.9
Fen Treed	26.4	10.4
Swamp Shrubby	15.9	6.3
Swamp Treed	123.1	48.6
TOTAL	**253.4**	**100.0**

Operation

Consistent with the EIS, road use, drilling, blasting and rock removal from open pit mines during operation will generate dust and likely result in dust deposition on surrounding native plant communities. The AQMMP was developed for Project construction and operation to monitor and manage the ambient air quality near the Project. Dust from the haul road(s) is the largest source of particulate emissions and therefore more frequent road watering will be implemented. In addition, to mitigate effects due to dust, automatic alerts will be sent to notify environmental representatives of high winds (i.e., wind speed greater than 5 metres per second (m/s) or 18 km/h or Beaufort 3 gentle breeze) and dry conditions (less than 2 millimetres [mm] of precipitation has occurred in the previous 24 hours and the temperature is greater than 15°C), which will trigger the implementation of additional dust mitigation measures.

Operation at the MacLellan site may affect two known plant SOCC occurrences in the LAA: northern woodsia (*Woodsia alpina*) and shrubby willow (*Salix arbusculoides*). 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. This effect 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 and there are a variety of habitats the species can grow in. However, seed production information on northern woodsia is unavailable; therefore, it is assumed that the loss of this occurrence is irreversible. This effect is consistent with what was presented in the EIS.

Operation may indirectly alter the native plant communities as a result of the introduction and/or establishment of invasive species. The baseline conditions reported in the EIS and supporting documents note the presence of one Tier 3 weed species, common dandelion (*Taraxacum officinale*), within the PDA. Since the Project is located in a remote northern area of Manitoba surrounded by native plant communities, weed species are less likely to be encountered. In accordance with the Vegetation and Weed Management Plan (VWMP), the following mitigation measures (in order of priority) will be used to reduce the introduction and spread of weed species during Project construction, operation, and decommissioning/closure:

1. Keeping equipment free of soil and debris as equipment can spread propagules (e.g., seeds, rhizomes). Equipment and personnel (e.g., boots and clothing) will arrive at the 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 within the construction footprint until it has been cleaned, re-inspected, and deemed suitable for use. Random inspections of equipment and personnel may also be completed. Cleaning stations will be established at the construction site. Cleaning stations will be lined with an impermeable liner to isolate the cleaning station from the surrounding area so that the water can be easily removed by hydrovac.
2. Monitoring topsoil and subsoil piles for regulated weed species establishment.
3. Monitoring newly disturbed areas for encroachment of weed species.
4. Controlling infestations of regulated weed species.
    a. 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.
5. Revegetating disturbed land with native vegetation.
6. Using certified clean seed.
7. Applying corrective measures to avoid the growth of regulated weed infestations.

Decommissioning/Closure

Consistent with the EIS, areas disturbed by the Project will be reclaimed during decommissioning/closure, 13 years post-construction. Areas of Project disturbance, other than the open pit, TMF and the existing access road, will be reclaimed to native plant cover. Reclaimed native upland will be revegetated by seeding with native plant species, including commercially available plant species of interest to Indigenous Nations. The goals of revegetation are to control erosion, improve aesthetics, and assist in returning the PDA to a self-sustaining community dominated by native plant species that are in similar dominant plant abundance to the surrounding upland and representative of early successional development as outlined in the VWMP. The VWMP does not specifically target the restoration of existing conditions in the PDA. The VWMP targets the establishment of native plants; however, the abundance and distribution are expected to differ from existing conditions. With mitigation and reclamation, the Project will result in an increase in 553.5 ha of reclaimed native upland (MRSA and areas of the PDA), 248.7 ha of reclaimed upland (TMF and TMF pond), and 23.1 ha of naturally revegetated native upland (right of way [ROW] along the access road) which replaces a portion of the 504.4 ha of native upland vegetation cover classes

lost in the LAA. The Project will result in an increase in 75.8 ha of water as the open pit and satellite pit fills over the course of 40 years. As these pits fill, groundwater levels will slowly recover.

Comparison with the EIS

Project effects on vegetation and wetlands are the same as described in Section 11 of the EIS and no additional adverse effects on vegetation and wetlands are anticipated because of the footprint alteration.

3.3.6.4 Summary of Mitigation Measures

Proposed mitigation measures incorporated as part of this NOA/NOC include those standard practices and procedures identified in the EIS (Stantec 2020a) and associated technical review, as well as other general mitigation measures that are typically applied during construction and operation; all of which are discussed in the Vegetation and Wetlands Management and Monitoring Plan (Version 0, January 2025).

3.3.6.5 Residual Effects

During construction, alterations to the approved MacLellan site are positive for vegetation and wetlands as 23.1 fewer ha of land will be affected than predicted in the EIS. However, effects from groundwater drawdown near the open pit and satellite pit during construction and operation may alter the class, plant species composition and decomposition rates of 114.4 ha of fen and 138.9 ha of swamp wetland area in the LAA. These numbers are larger than what was presented in the EIS.

During decommissioning/closure, upland and wetland areas disturbed by the Project will be revegetated to establish reclaimed native upland. The open pit will be allowed to fill naturally over 50 years and is predicted to be reclaimed to water. The TMF at the MacLellan site will be partially capped with borrow material and seeded using a native reclamation mix (plants species of interest to Indigenous Nations are not likely to be used at the TMF) 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. The MRSA will also be capped and seeded with a native seed mix. Additional details on the plant selection for revegetation are included in the VWMP. Loss of entire plant communities from the LAA is not expected. With mitigation and reclamation, the Project will result in an increase in 553.5 ha of reclaimed native upland, 248.7 ha of reclaimed upland, and 23.1 ha of naturally revegetated native upland which replaces a portion of the 504.4 ha of lost native upland plant communities in the LAA. The Project will also result in the permanent loss of 338.4 ha of wetlands. Groundwater drawdown during construction and operation may alter the class, plant species composition and decomposition rates of 223.6 ha of fen and 382.3 ha of swamp wetland area.

The proposed alterations will not result in additional adverse effects on vegetation and wetlands at the MacLellan site and there is no change to the EIS conclusions.

3.3.7 Wildlife and Wildlife Habitat

Wildlife and wildlife habitat is a VC because it provides ecological, aesthetic, recreational, economic, and cultural value to stakeholders, the public, Indigenous Nations, local businesses, and government agencies (Stantec 2020a). The proposed alterations that may interact with the wildlife and wildlife habitat VC and were therefore assessed as part of this NOA/NOC, include but are not limited to the PDA layout and collection pond/TMF pond.

3.3.7.1 Regulatory and Guideline Setting

3.3.7.1.1 Guideline Criteria

The assessment of potential Project-related environmental effects on wildlife and wildlife habitat includes the consideration of the following federal legislation:

- The SARA provides protection for species at risk (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; and 2) the destruction of critical habitat of an endangered or threatened SAR.
- The *Migratory Birds Convention Act* provides protection for migratory birds, nests, and eggs. Protection is afforded to most native bird species with some exceptions, all of which are protected under provincial legislation. The updated Migratory Birds Regulations, 2022 (Government of Canada 2022) protect the nests of migratory birds only when they contain a live bird or viable eggs, with year-round protection for 18 species whose nests are commonly re-used by migratory birds.

The assessment of potential Project-related environmental effects on wildlife and wildlife habitat includes the 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 ESEA facilitates the management and development of recovery strategies for threatened, endangered, and extirpated or extinct species to prevent further declines and promote recovery.
- The *Wildlife Act* provides general provisions for regulating the activities relating to the take and trade of wild animals in Manitoba, which are 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.” Select amphibian, reptile, and mammal species and most bird species (including those not protected under the *Migratory Birds Convention Act*) known to exist in Manitoba are included.

3.3.7.1.2 IAAC Decision Statement

As per the Impact Assessment Agency of Canada (IAAC) Decision Statement, Alamos is required to adhere to the following conditions with respect to wildlife and wildlife habitat:

> *4.1 The Proponent shall carry out the Designated Project in a manner that protects migratory birds and avoids injuring, killing or harassing migratory birds or destroying, taking or disturbing their eggs, or damaging, destroying, removing or disturbing their nests, taking into account Environment and Climate Change Canada's Guidelines to avoid harm to migratory birds.*

3.3.7.2 Environmental Effects

As described in Section 12.4.2.4 of the EIS, the complete loss of wildlife habitat in the PDA during construction (937.9 ha) was assumed. Overall, the revised PDA (914.8 ha) is smaller than assessed in the EIS; however, several new Project components have been added to the MacLellan site or have changed in size (Table 2.1; Map 2, Appendix A). The alterations are not expected to affect sensitive wildlife habitat or features (e.g., raptor nests). While some of the Project components have increased in size, including the collection pond/TMF collection pond (from 1.8 ha to 9.0 ha), others like the TMF pond have decreased. The smaller TMF pond (26.9 ha reduced from 183.2 ha) will likely decrease mortality risk and adverse effects on health for migratory birds, which were already expected to be negligible or low (EIS Sections 12.4.3.4 and 12.4.4.4), by enhancing the effectiveness of the deterrents required by Section 4.4 of the IAAC Decision Statement. The increased collection pond/TMF collection pond could increase mortality risk and adverse effects on health for migratory birds, which will likely be mitigated by the required deterrents.

Project effects on SAR are the same as described in Section 12.0 of the EIS and no additional adverse effects on wildlife and wildlife habitat are anticipated as a result of the footprint alteration.

3.3.7.3 Summary of Mitigation Measures

Proposed mitigation measures incorporated as part of this NOA/NOC include those standard practices and procedures identified in the EIS (Stantec 2020a) as well as other general mitigation measures that are typically applied during construction and operation; all of which are also captured in the Wildlife Management and Monitoring Plan (Version 0, January 2025).

An additional mitigation measure required by the IAAC Decision Statement (and also captured in the Wildlife Management and Monitoring Plan, Version 0, January 2025) is:

- Installing and maintaining deterrents near Project infrastructure where contact water is stored or conveyed until such areas have been reclaimed (IAAC Decision Statement condition 4.4).

3.3.7.4 Residual Effects

Alterations to the approved MacLellan site are positive for wildlife and wildlife habitat as fewer hectares of land will be affected than predicted in the EIS. The effectiveness of bird deterrents on the TMF pond will be enhanced with the smaller pond size, and mitigation applied to the larger collection pond/TMF collection pond will reduce potential for areas to attract and support migratory birds including SAR. Project effects on wildlife and wildlife habitat at the MacLellan site during construction and operation were characterized in the EIS as adverse or positive, moderate to high or low, extending to the RAA, single event or continuous, short-term or medium-term, reversible, and disturbed ecological context. Project effects on mortality risk during construction and operation were characterized in the EIS as adverse, low, extending to the LAA, multiple irregular, short-term or medium term, reversible, and disturbed ecological context. Project effects on wildlife health during construction and operation were characterized in the EIS as adverse, negligible to low, extending to the LAA, continuous, long-term, reversible, and disturbed ecological context. Project effects on wildlife and wildlife habitat, mortality risk, and health during decommissioning were characterized in the EIS as adverse and/or positive, low or negligible to low, extending to the LAA, continuous or multiple irregular, long-term, reversible, and disturbed ecological context. The proposed alterations will not result in additional adverse effects on wildlife or wildlife habitat at the MacLellan site and there is no change to EIS conclusions.

3.3.8 Labour and Economy

Labour and economy is a VC because employment and business support the economic livelihoods of residents, and provide associated social benefits related to employment and income (Stantec 2020a). The proposed alterations that may interact with the labour and economy VC and were therefore assessed as part of this NOA/NOC, include but are not limited to the general infrastructure, major equipment list, and mine production capacity.

3.3.8.1 Regulatory and Guideline Setting

3.3.8.1.1 Guideline Criteria

The assessment of potential Project-related environmental effects on labour and economy includes the consideration of the following federal and provincial legislation:

- The Canadian Environmental Assessment Agency (CEA Agency, now IAAC) Final Guidelines for the Preparation of an EIS (CEA Agency 2017) 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).
- MECC Environment Act Proposal Report Guidelines, which require consideration of Project effects on humans and socio-economic implications resulting from environmental effects (MECC 2023).

3.3.8.1.2 IAAC Decision Statement

There are no conditions with respect to labour and economy as per the IAAC Decision Statement for Alamos to consider.

3.3.8.2 Environmental Effects

As described in Sections 13.4.2, 13.4.3, and 13.4.4, of the federal EIS and Section 6.8.2.1 of the provincial EAP Report, the assessment of potential environmental effects of the Project considered changes in the local and regional labour force, regional business, and regional economy. Demand for labour and regional expenditures are the primary pathways through which the Project may affect labour and economy. 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, through and after decommissioning/closure, resulting in loss of direct employment. Project spending has potential to both beneficially and adversely affect local and regional businesses. Beneficial effects include increases in business revenue, with the potential to support capital investment and hiring, resulting in increased capacity and capabilities for 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 and increased labour costs. Project spending will result in overall increased economic activity (i.e., gross domestic product [GDP]) in the LAA and RAA. The Project will also pay property taxes, or provide grants in lieu, to the Town of Lynn Lake and contribute to provincial and federal government revenues through taxation on labour, goods and services.

3.3.8.3 Summary of Mitigation Measures

Proposed mitigation and management measures incorporated as part of this NOA/NOC include those standard practices and procedures identified in the EIS (Stantec 2020a) as well as other general mitigation measures that are typically applied during construction and operation.

3.3.8.4 Residual Effects

Overall, the Project is expected to result in both positive and adverse effects. Positive residual effects on labour and economy were characterized in the EIS as low and moderate in magnitude. Low magnitude positive residual effects are associated with increased direct, indirect, and induced employment and contributions to municipal government revenues (through taxation). 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. Project expenditures on goods and services are likely to occur with a greater percentage in the RAA compared with LAA, due to the larger labour force of the RAA. Moderate magnitude positive residual effects are associated with anticipated Project contributions to GDP. Local and regional labour forces and businesses were characterized in the EIS as having positive residual effects, occurring within a non-resilient socio-economic context in the LAA and a resilient context in the RAA. Effects on the local and

regional economy were characterized in the EIS as occurring 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 on local and regional business (i.e., increased competition for labour and contributions to wage inflation) were characterized in the EIS as occurring continuously over the short-term during construction and medium-term during operation. Adverse effects associated with losses in employment and contributions to GDP were characterized in the EIS as occurring continuously over the short-term during decommissioning/closure. Adverse effects on local and regional labour forces and businesses were characterized in the EIS as occurring within a non-resilient socio-economic context in the LAA and a resilient context in the RAA. Effects on the local and regional economy were characterized in the EIS as occurring 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. The proposed alterations will not result in additional positive or adverse effects on labour and economy at the MacLellan site as noted in Section 13 and there is no change to EIS conclusions.

3.3.9 Community Services, Infrastructure, and Wellbeing

Community services, infrastructure, and wellbeing is a 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 (Stantec 2020a). The proposed alterations that may interact with the community services, infrastructure, and wellbeing VC and were therefore assessed as part of this NOA/NOC, include but are not limited to the PDA layout, general infrastructure, major equipment list, and mine production capacity.

3.3.9.1 Regulatory and Guideline Setting

3.3.9.1.1 Guideline Criteria

The assessment of potential Project-related environmental effects on community services, infrastructure, and wellbeing includes the consideration of the following federal and provincial legislation:

- The CEA Agency (now IAAC) Final Guidelines for the Preparation of an EIS (CEA Agency 2017) 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).

- MECC 2023 Environment Act Proposal Report Guidelines, which require consideration of Project effects on humans and socio-economic implications resulting from environmental effects (MECC 2023).
- Manitoba Health Seniors and Active Living's (MHSAL, formerly Manitoba Health and Healthy Living) 'Community Health Assessment Guidelines' (MHHL 2009a and 2009b), which provides a framework from which provincial health authorities develop region-specific Community Health Assessments.

3.3.9.1.2 IAAC Decision Statement

There are no conditions with respect to community services, infrastructure, and wellbeing as per the IAAC Decision Statement for Alamos to consider.

3.3.9.2 Environmental Effects

As described in Sections 14.4.2, 14.4.3, 14.4.4, and 14.4.5 of the federal EIS and Section 6.9.2 of the provincial EAP Report, the assessment of potential environmental effects of the Project considered changes in housing and temporary accommodations, local and community services, infrastructure, and wellbeing. Potential changes to community services and infrastructure will result from an in-migration of Project workers to the LAA because of the Project, thereby increasing demand on existing services and infrastructure, including but not limited to 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. Most facilities are at least 40 years old and in need of repair, upgrading, or replacement.

During construction and operation, a temporary increase in population in the LAA is expected because of the Project, which has potential to place additional demands on local availability of housing, accommodations, with workers primarily accommodated at a worker camp at the MacLellan site. Most of the physical Project activities will not affect community services and infrastructure, with the exception of wastes and emissions, movement of trucks, equipment, supplies, and personnel within the LAA. Demands on local policing and other social service providers may increase if Project-related income is spent on illicit activities. An increased demand is also expected for healthcare and emergency services by temporary Project workers, and/or related to accidents or malfunctions of the Project activities during these phases. The construction and operation activities will also affect transportation services and infrastructure through the creation of additional traffic in the LAA and RAA.

During decommissioning/closure, there will be a reduction in effects on community services and infrastructure as on-site workers move away due to diminishing employment. Traffic in the Town of Lynn Lake and along PR 391 between Thompson and the Town of Lynn Lake, utility use from on-site workers visiting the Town, and demand on local medical services and policing are expected to lessen. Potential changes in community wellbeing will result from a change in employment and income and change in population associated with each phase of the Project and its activities.

3.3.9.3 Summary of Mitigation Measures

Proposed mitigation measures incorporated as part of this NOA/NOC include those standard practices and procedures identified in the EIS (Stantec 2020a) as well as other general mitigation measures that are typically applied during construction and operation.

3.3.9.4 Residual Effects

With the implementation of Project mitigation and management measures, residual effects on community services and infrastructure were characterized in the EIS as being of negligible to low magnitude, occurring in the LAA, continuous for the medium-term, and reversible. They would generally occur in a socio-economic context that is characterized in the EIS as resilient, except for housing and temporary accommodations, which has a socio-economic context that is not resilient. Residual effects on local services and infrastructure were characterized in the EIS as low due to the independent nature of works related to power, camp water, and wastewater systems. The Project will not place additional demands on that local infrastructure within the Town of Lynn Lake.

With the implementation of Project mitigation and management measures, positive effects on community wellbeing were characterized in the EIS as being low in magnitude during construction and operation, occurring within the LAA on a continual basis over the medium-term, and reversible following the completion of decommissioning/closure. Positive residual effects of Project-related employment and income are likely to be inequitably distributed across the LAA population with vulnerable populations less likely to realize benefits. Positive residual effects were characterized in the EIS as occurring within a non-resilient socio-economic context. Adverse residual effects were characterized in the EIS as being moderate in magnitude during construction and operation, occurring within the LAA on a continual basis over the long-term, and reversible following the completion of decommissioning/closure. Residual effects were characterized in the EIS as occurring within a non-resilient socio-economic context. Residual effects on community wellbeing were characterized in the EIS as negligible in magnitude during decommissioning/closure. The proposed alterations will not result in additional positive or adverse effects on community services, infrastructure, and wellbeing at the Maclellan site as noted in Section 14 and there is no change to EIS conclusions.

3.3.10 Land and Resource Use

Land and resource use 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 PDA (Stantec 2020a). The proposed alterations that may interact with land and resource use and were therefore assessed as part of this NOA/NOC, include but are not limited to the PDA layout.

3.3.10.1 Regulatory and Guideline Setting

3.3.10.1.1 Guideline Criteria

The assessment of potential Project-related environmental effects on land and resource use includes the consideration of the following federal legislation:

- The *Explosives Act* requires that anyone working with explosives have a licence, certificate or permit issued by the federal Minister of Natural Resources.

The assessment of potential Project-related environmental effects on land and resource use includes the consideration of the following provincial legislation:

- The *Crown Lands Act* requires work permits for work conducted on provincial Crown lands. A lease or permit may also be required for the use or occupation of Crown lands. An easement or right-of-way would also be required for any work upon, over, under, or in respect of Crown lands.
- The *Forest Act* requires a permit for the cutting or removing of timber from Crown land in support of the Project.
- The *Water Rights Act* requires a licence for the use of surface water or groundwater for industrial or other purposes.
- The *Wildfires Act* requires a Burn Permit for open burning activities in a Burning Permit Area during the wildfire season (April 1 to November 15).

3.3.10.1.2 IAAC Decision Statement

There are no conditions with respect to land and resource use as per the IAAC Decision Statement for Alamos to consider.

3.3.10.2 Environmental Effects

As described in Sections 15.4.2.1, 15.4.3.1 and 15.4.4.1 of the federal EIS and Section 6.10.2.1 of the provincial EAP Report, clearing and construction activities within the PDA will result in the loss or alteration of area and the restriction of access to provincial Crown lands. As indicated in Table 2.2, the revised PDA (914.8 ha) will be smaller than anticipated in the EIS (937.9 ha). New Project components have either been added to the MacLellan site or have changed in size/location (Table 2.1 and Map 2, Appendix A).

Development of these areas is not expected to affect sensitive land use features (i.e., receptors). The operation of construction laydown areas/parking area will result in additional ground disturbance. The construction laydown/operational parking area is adjacent to the Keewatin River, a recreational canoe route. Sensory disturbance (e.g., noise, visual) from access to the area 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 construction laydown area at the MacLellan site could be visible to resource users operating in the area. No additional adverse effects are anticipated on land and resource use from Project alterations.

3.3.10.3 Summary of Mitigation Measures

Proposed mitigation measures incorporated as part of this NOA/NOC include those standard practices and procedures identified in the EIS (Stantec 2020a) as well as other general mitigation measures that are typically applied during construction and operation.

3.3.10.4 Residual Effects

A small area of provincial Crown land will be affected by the PDA alterations. There are no sensitive receptors (e.g., remote cabins, trapper's cabins) along the alignment and access road to the altered PDA or within the LAA.

The continued use of the Keewatin River as a recreational canoe route is not expected to be affected by the altered Project. The addition of the construction laydown areas/operational parking area presence may result in some visual disturbance to recreational users, although marginally so.

Project clearing and construction activities will lead to a loss of area for resource harvesting in the altered PDA. Project construction may also 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 for hunting and trapping. The revised Project footprint layout will contribute to a decline in net merchantable timber in the LAA, but only incrementally. Visual effects from the presence of the construction laydown areas/operational parking area could result in visual disturbance to resource users operating and travelling in the area (e.g., Keewatin River). The proposed alterations may be marginally visible from certain vantage points (e.g., 45 m from the Keewatin River [to laydown area/parking area]).

With the implementation of mitigation measures, residual effects on land and resource use for the approved MacLellan site were characterized in the EIS to be adverse, low in magnitude (low to moderate for noise), limited to the PDA/LAA, short- to long-term in duration, single, irregular to continuous in frequency, and reversible upon Project decommissioning/closure. Overall, the proposed alterations will not result in additional adverse effects on land and resource use at the MacLellan site as noted within Section 15 and there is no change to EIS conclusions.

3.3.11 Heritage Resources

Heritage resources is a 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 (Stantec 2020a). The proposed alterations that may interact with the heritage resources VC and were therefore assessed as part of this NOA/NOC, include but are not limited to the PDA layout.

3.3.11.1 Regulatory and Guideline Setting

3.3.11.1.1 Guideline Criteria

The assessment of potential Project-related environmental effects on land and resource use includes the consideration of the following provincial legislation:

- Under Section 12(2) of *The Heritage Resources Act*, if the Minister of Sport, Culture and Heritage has reason to believe that heritage resources or human remains are known, or thought likely to be present, on lands that are to be developed, then the owner/developer is required to conduct at his/her own expense, a heritage resource impact assessment (HRIA) and mitigation, if necessary, prior to the Project's start.

3.3.11.1.2 IAAC Decision Statement

As per the IAAC Decision Statement, Alamos is required to adhere to the following conditions with respect to heritage resources:

> *7.1 The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, and implement, during all phases of the Designated Project, an archaeological and heritage resource management plan for any structures, sites or things of historical, archaeological, paleontological or architectural significance discovered within the Project development areas. As part of the archaeological and heritage resource management plan, the Proponent shall:*
>
> > *7.1.1 immediately halt work at the location of the discovery, except for actions required to be undertaken to protect the integrity of the discovery;*
> >
> > *7.1.2 delineate an area of at least 50 metres around the discovery as a no-work zone;*
> >
> > *7.1.3 inform the Agency and Indigenous groups in writing within 24 hours of the discovery, and allow Indigenous groups to monitor and participate in archaeological works;*

7.1.4 have a qualified individual, whose expertise pertains to the requirements of Manitoba's Heritage Resources Act, conduct an assessment at the location of the discovery, including sampling and construction monitoring on landforms of similar historic potential to the discovery site(s) within the Project development areas that are planned for development, prior to development in these areas; and

7.1.5 consult with Indigenous groups and relevant authorities on the manner by which to comply with all applicable legislative or legal requirements and protocols respecting the discovery, recording, transferring and safekeeping of previously unidentified structures, sites or things of historical, archaeological, paleontological or architectural significance.

3.3.11.2 Environmental Effects

In 2015-2016, Stantec completed a HRIA of the MacLellan site on behalf of Alamos for the LLGP (formerly Lynn Lake Joint Venture [LLJV]) under Heritage Permit A37-15. The results of this HRIA were used to inform the assessment of effects on the heritage resources VC as described in Chapter 16.0 of the EIS (Stantec 2020a).

The HRIA included a review of previous archaeological studies, provincial and federal databases, satellite imagery, and peer-reviewed literature. Gaps and limitations with respect to general heritage resources and environmental assessment requirements were identified and recommendations were made to both satisfy these requirements and obtain a strong understanding of heritage resources in the project area. Stantec's 2015 field program focused on relocating previously recorded archaeological sites and completing survey transects within each of the project components and along the recently cleared access roads.

A permit report was submitted to the Historic Resources Branch, Manitoba Culture, Sport and Heritage (HRB) in May 2016 (Stantec Consulting Ltd., 2016). The 2015 field program surveyed all components of the Project that were determined to have a medium to high heritage resource potential. The HRB approved the permit report in 2017 and provided clearance for the Project to proceed as planned.

3.3.11.3 Summary of Mitigation Measures

No further assessment of the Project is recommended. No mitigation measures are required. A Heritage and Cultural Resource Protection Plan (HCRPP) has been developed according to condition 7.1 by Alamos and will be applied during construction, operation, and decommissioning. The revised PDA was communicated to the HRB with the sharing of the HCRPP (Version 0, January 2025). The HCRPP was approved by HRB.

3.3.11.4 Residual Effects

There are no residual effects on heritage resources. Review of the NOA/NOC plans indicate that no areas of heritage potential have been added to the Project footprint. The proposed alterations will not result in adverse effects on heritage resources at the MacLellan site and there is no change to EIS conclusions.

3.3.12 Current Use of Lands and Resources for Traditional Purposes by Indigenous Peoples

Current use of lands and resources for traditional purposes by Indigenous peoples (current use) is a VC because of the potential for the project to affect traditional activities, sites and resources identified by Indigenous Nations (Stantec 2020a). The proposed alterations that may interact with current use and were therefore assessed as part of this NOA/NOC, include but are not limited to the PDA layout.

3.3.12.1 Regulatory and Guideline Setting

3.3.12.1.1 Guideline Criteria

The assessment of potential Project-related environmental effects on current use includes the consideration of the following federal and provincial legislation:

Canadian Environmental Assessment Act (*CEAA 2012*). The EIS and EAP Report (Stantec 2020a and 2020b) were prepared under the CEAA 2012 which required 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 where the CEA Agency (now IAAC) is the responsible authority, was 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 of the EIS [Stantec 2020a]) also identified requirements for engagement with twelve Indigenous Nations (Chapter 17.0, 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 Nations for mitigating effects of changes to the environment. These are:

- IAAC 'Most Affected' Indigenous Nations:
  - 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 Métis Federation

- IAAC Indigenous Nations '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
    - Eastern Region 1
  - Chemawawin Cree Nation was added in May 2020

MSD (now MECC) provides guidance in Information Bulletin – Environment Act Proposal Guidelines (MSD 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 Nations, including, but not necessarily limited to:

- Direct effects on Indigenous Nations in the Project area.
- Resource use, such as hunting, fishing, trapping, and gathering.
- Cultural or traditional activities in the Project area.

3.3.12.1.2 IAAC Decision Statement

As per the IAAC Decision Statement, Alamos is required to adhere to the following conditions with respect to current use:

> *5.1 The Proponent shall develop, prior to construction and in consultation with Indigenous groups, measures to mitigate adverse impacts from the Designated Project on access to lands and resources used for traditional purposes, including the implementation of safe access point(s) and/or routes within the local assessment areas. The Proponent shall submit these measures to the Agency prior to construction.*
>
> *5.2 The Proponent shall avoid disturbing sites of traditional or cultural importance within or near the Project development areas, except for the construction of Designated Project components. In doing so, the Proponent shall:*
>
> > *5.2.1 identify, in consultation with Indigenous groups, the location of sites of traditional or cultural importance within or near the Project development areas.*
> >
> > *5.2.2 provide opportunities to Indigenous groups, prior to construction and at times determined in consultation with each Indigenous group, to:*

5.2.2.1 harvest and transplant, during seasons where plants can be identified and harvested, plant species used for traditional purposes from areas that will be cleared of vegetation; an

5.2.2.2 conduct ceremonies for any sites of traditional or cultural importance that will be disturbed by any Designated Project activities.

5.3 The Proponent shall prohibit, during all phases of the Designated Project, Designated Project employees and contractors from fishing and hunting within the Project development areas or using the Project development areas to access surrounding areas with the intent to fish or hunt, unless an employee or contractor is provided access by the Proponent for exercising Aboriginal rights.

5.4 The Proponent shall develop, prior to construction, and implement, during all phases of the Designated Project, a protocol for inspecting and cleaning vehicles, machinery and equipment associated with the Designated Project that have come from other worksites in order to limit the introduction and spread of weed species within the Project development areas.

5.5 The Proponent shall identify days of traditional or cultural importance in consultation with Indigenous groups and modify the blasting schedule for the Designated Project to minimize or avoid disturbance to current use of lands and resources by Indigenous groups, unless not technically or economically feasible.

5.6 The Proponent shall, when implementing measures to limit the introduction and spread of weed species within the Project development areas, use measures other than broadcast spraying when applying herbicides to mitigate effects to plant species used for traditional purposes by Indigenous groups, unless the Proponent determines that these measures are ineffective at controlling the introduction and spread of weed species.

5.7 The Proponent shall undertake, in consultation with Indigenous groups and relevant authorities, progressive reclamation of areas disturbed by the Designated Project. In doing so, the Proponent shall:

5.7.1 identify, in consultation with Indigenous groups, plant species native to the local assessment areas and plant species used for traditional purposes, to use for revegetation.

5.7.2 establish performance standards for reclaimed areas, including that the areas be self-sustaining, reduce establishment of weed species, restore native species assemblages, and reduce erosion of exposed soils; and

5.7.3 monitor reclaimed areas for a minimum of five years during post-closure or until performance standards established pursuant to condition 5.7.2 are met.

3.3.12.2 Environmental Effects

As described in Sections 15.4.2.1, 15.4.3.1 and 15.4.4.1 of the federal EIS and Section 6.10.2.1 of the provincial EAP Report, clearing and construction activities within the PDA will result in the loss or alteration of area and the restriction of access to provincial Crown lands. As indicated in Table 2.2, the proposed alterations to the PDA (914.8 ha) will result in a smaller PDA (23.1 ha) than anticipated in the EIS (937.9 ha). Chapter 17.0, Section 17.1.4 of the EIS identifies the potential environmental effects on current use measured by:

Change to availability of resources (physical presence, abundance, and distribution of lands and resources) through:

- 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

Change to ability to access lands and resources or alteration of lands and resources for current use activities through:

- Loss, alteration, or restriction of access (including trails and travelways) to current lands and resources

Change to the integrity of cultural and spiritual sites and areas that detract from use of the area or lead to avoidance of the area as a result of real and perceived disturbance of the environment through:

- 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

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).

Two elements of Section 6.3.4 of the Final EIS Guidelines required information about intangible values:

- Cultural value or importance associated with physical and cultural heritage.
- Cultural value or importance associated with traditional uses or areas.

Change to the environment that affects cultural value or importance associated with current use through:

- 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.

Intangible values relate to beliefs, perceptions, values, and qualitative experience. Given the subjective and conditional nature of intangible values, these potential effects were considered only when an Indigenous Nation 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 Therefore, potential effects on intangible values were not subject to a full effects assessment (e.g., that includes residual effects characterization). Rather, when an Indigenous Nation identified a related concern, the subjective and experiential components of current use that could not be measured were considered narratively. Both tangible and identified intangible values contributed to the conclusion for the current use assessment.

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 were 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.

3.3.12.3 Summary of Mitigation Measures

The mitigation measures that are relevant to availability of traditionally harvested resources are identical to the mitigation measures recommended in the EIS (Stantec 2020a) and described in the Country Foods Plan (Version 0, January 2025). No additional mitigation measures are required in relation to this NOA/NOC. Alamos is committed to the follow-up and monitoring, and adaptive management (if and as required) that is described in this plan.

3.3.12.4 Residual Effects

Project residual environmental effects on current use are assessed in Chapter 17.0 (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 former mine sites and the 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.

The IAAC's IR IAAC-R2-57 for the Lynn Lake Gold Project (the Project) directed Alamos to describe baseline conditions for each Indigenous Nation participating in the Project. Citing the *Guidelines for the Preparation of an Environmental Impact Statement Pursuant to the Canadian Environmental Assessment Act, 2012* (EIS Guidelines), IAAC required baseline information for each Indigenous Nation to inform the assessment of potential Project effects to Indigenous peoples. In response to IAAC-R2-57, Alamos provided a review and summary of the record of engagement with Indigenous Nations in one document. The intention of the review and summary was to report on engagement with each Indigenous Nation, describe baseline conditions, and demonstrate how Alamos has responded to the concerns and issues raised by each Indigenous Nation. Section 10 of the response presented Indigenous Nation-specific sections that consolidated available baseline information for each Indigenous Nation engaged on the Project with respect to the current use, Indigenous health and socioeconomic conditions, Indigenous rights, including intangible aspects of rights such as governance rights, and physical and cultural heritage. The intention for each Indigenous Nation-specific section was to provide a stand-alone summary of information obtained by Alamos for each Indigenous Nation and review of how it has been considered in the assessment of potential effects of the Project. The response to IAAC-R2-57 supported the original conclusions of the EIS.

The proposed alterations reducing the PDA by 23.1 ha as described in this document will not result in additional adverse effects on current use at the MacLellan site and there is no change to EIS conclusions.

3.3.13 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 worker camp within the PDA (Stantec 2020a). The proposed alterations that may interact with the human health VC and were therefore assessed as part of this NOA/NOC, include but are not limited to the PDA layout, major infrastructure, and mine production capacity.

3.3.13.1 Regulatory and Guideline Setting

3.3.13.1.1 Guideline Criteria

The assessment of potential Project-related environmental effects on human health includes the consideration of Health Canada guidance for evaluating human health effects in impact assessment, namely:

- Guidance for Evaluating Human Health Effects in Impact Assessment: Human Health Risk Assessment (Health Canada 2023a)
- Guidance for Evaluating Human Health Effects in Impact Assessment: Air Quality (Health Canada 2023b)
- Guidance for Evaluation Human Health Effects in Impact Assessment: Drinking and Recreational Water Quality (Health Canada 2023c)
- Guidance for Evaluating Human Health Effects in Impact Assessment: Country Foods (Health Canada 2023d)

3.3.13.1.2 IAAC Decision Statement

As per the IAAC Decision Statement, Alamos is required to adhere to the following conditions with respect to human health:

> *6.1 The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, measures to mitigate emissions of dust and fugitive particulates within the Project development areas, taking into account the standards and criteria set out in the Canadian Council of Ministers of the Environment's Canadian Ambient Air Quality Standards and Manitoba's Ambient Air Quality Criteria. The Proponent shall implement these measures from construction through decommissioning. In doing so, the Proponent shall:*
>
> > *6.1.1 apply dust suppressants, including water, that do not contain chemicals and have the least potential for adverse environmental effects, on haul and access roads during periods when dust generation is expected or occurring, including periods of drought and high winds;*

6.1.2 locate all stationary machinery and equipment used for processing ore indoors, where technically and economically feasible, including the crushing plant and conveyors feeding into the ore milling and processing plant;

6.1.3 ensure all equipment and vehicles used, including equipment and vehicles operated by third-party contractors, are serviced and maintained in accordance with the manufacturer's maintenance guidelines to meet or exceed applicable emission standards, including Tier 4 emission standards for off-road equipment with off-road diesel engines, pursuant to the Off-Road Compression-Ignition (Mobile and Stationary) and Large Spark-Ignition Engine Emission Regulations and Off-Road Compression-Ignition Engine Emission Regulations;

6.1.4 develop and implement policies to reduce the fuel consumption of equipment and vehicles operating in the Project development areas, including no idling and limited cold start policies; and

6.1.5 establish speed limits on the roads located in the Project development areas, taking into account the recommended speed limits in Environment and Climate Change Canada's Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities and by requiring and ensuring that speed limits are respected, including by installing signs indicating speed limits.

6.2 The Proponent shall implement measures, during all phases of the Designated Project, to avoid exceedances of the thresholds for noise and vibration, identified in Health Canada's Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise at sensitive receptors identified in the human health and ecological risk assessment in Volume 5 of the Environmental Impact Statement. In doing so, the Proponent shall:

6.2.1 develop, prior to construction, a protocol for receiving and addressing feedback related to the exposure to noise and vibration generated by the Designated Project. The Proponent shall provide the protocol to the Agency and Indigenous groups prior to construction and make the protocol publicly available online. As part of the protocol, the Proponent shall:

6.2.1.1 identify how a person may provide feedback, how the Proponent will handle the feedback received, including ranking and responding to feedback received according to the anticipated level of impacts, and how the Proponent may implement modified or additional mitigation measures(s) and/or follow-up requirement(s) in response to the feedback received;

6.2.1.2 record any feedback received as soon as feasible, no later than 48 hours after receiving the feedback; and

6.2.1.3 implement, as soon as technically feasible, any modified or additional mitigation measure and/or follow-up requirement that the Proponent deems necessary to respond to the feedback received.

6.3 The Proponent shall develop, prior to construction and in consultation with Indigenous groups, Health Canada, Environment and Climate Change Canada and any other relevant authorities, a follow-up program to verify the accuracy of the environmental assessment as it pertains to adverse environmental effects from the Designated Project on air quality and country foods as it relates to the health of Indigenous peoples, taking into account available Indigenous knowledge provided by Indigenous groups related to current use of lands and resources for traditional purposes. The Proponent shall implement the follow-up program during all phases of the Designated Project. As part of the implementation of the follow-up program, the Proponent shall:

6.3.1 identify, in consultation with Indigenous groups, the species of fish, vegetation and wildlife consumed as country foods that may be adversely affected by the Designated Project and the locations where these species shall be monitored;

6.3.2 monitor, beginning prior to construction and continuing through post-closure, contaminants of potential concern, including arsenic, copper, mercury, methylmercury and selenium, in the species and at the locations identified pursuant to condition 6.3.1;

6.3.3 monitor, throughout construction and operation, ambient air concentrations of total suspended particulates, PM_{10} and $PM_{2.5}$ at locations identified in consultation with Indigenous groups, and upwind and downwind from the Project development areas, taking into account 24-hour and 1-hour thresholds in the Canadian Council of Ministers of the Environment's Canadian Ambient Air Quality Standards;

6.3.4 monitor, during all phases of the Designated Project, dust fall at locations identified in consultation with Indigenous groups, and upwind and downwind from the Project development areas;

6.3.5 monitor ambient air concentrations of nitrogen dioxide (NO_2) at locations identified in consultation with Indigenous groups and relevant authorities, for at least two consecutive months during year 2 of operation, and continue to monitor during all phases of the Designated Project if the monitoring results exceed predicted levels in the atmospheric dispersion model in Volume 1 Chapter 6 of the Environmental Impact Statement;

6.3.6 monitor meteorological conditions (including wind speed, wind direction, temperature and relative humidity) upwind and downwind of the Project development areas, during construction and operation; and

6.3.7 if the monitoring results referred to in conditions 6.3.2 to 6.3.5 exceed predicted levels in the atmospheric dispersion model in Volume 1 Chapter 6 of the Environmental Impact Statement, taking into account the results of monitoring meteorological conditions pursuant to condition 6.3.6, the human health and ecological risk assessment in Volume 5 of the Environmental Impact Statement, or thresholds of the Canadian Council of Ministers of the Environment's Canadian Ambient Air Quality Standards, modify or implement additional mitigation measures pursuant to condition 2.8, and update the

human health and ecological risk assessment in Volume 5 of the Environmental Impact Statement. The Proponent shall submit any updates to the human health and ecological risk assessment to the Agency and relevant authorities.

6.5 The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and determine the effectiveness of mitigation measures as it pertains to noise and vibration from the Designated Project on the health of Indigenous peoples. The Proponent shall implement the follow-up program during all phases of the Designated Project. As part of the follow-up program, the Proponent shall:

6.5.1 monitor noise and vibration levels at receptors identified in Volume 1 Chapter 7 Tables 7-7 to 7-10 of the Environmental Impact Statement, and at any other human receptors identified in consultation with Indigenous groups.

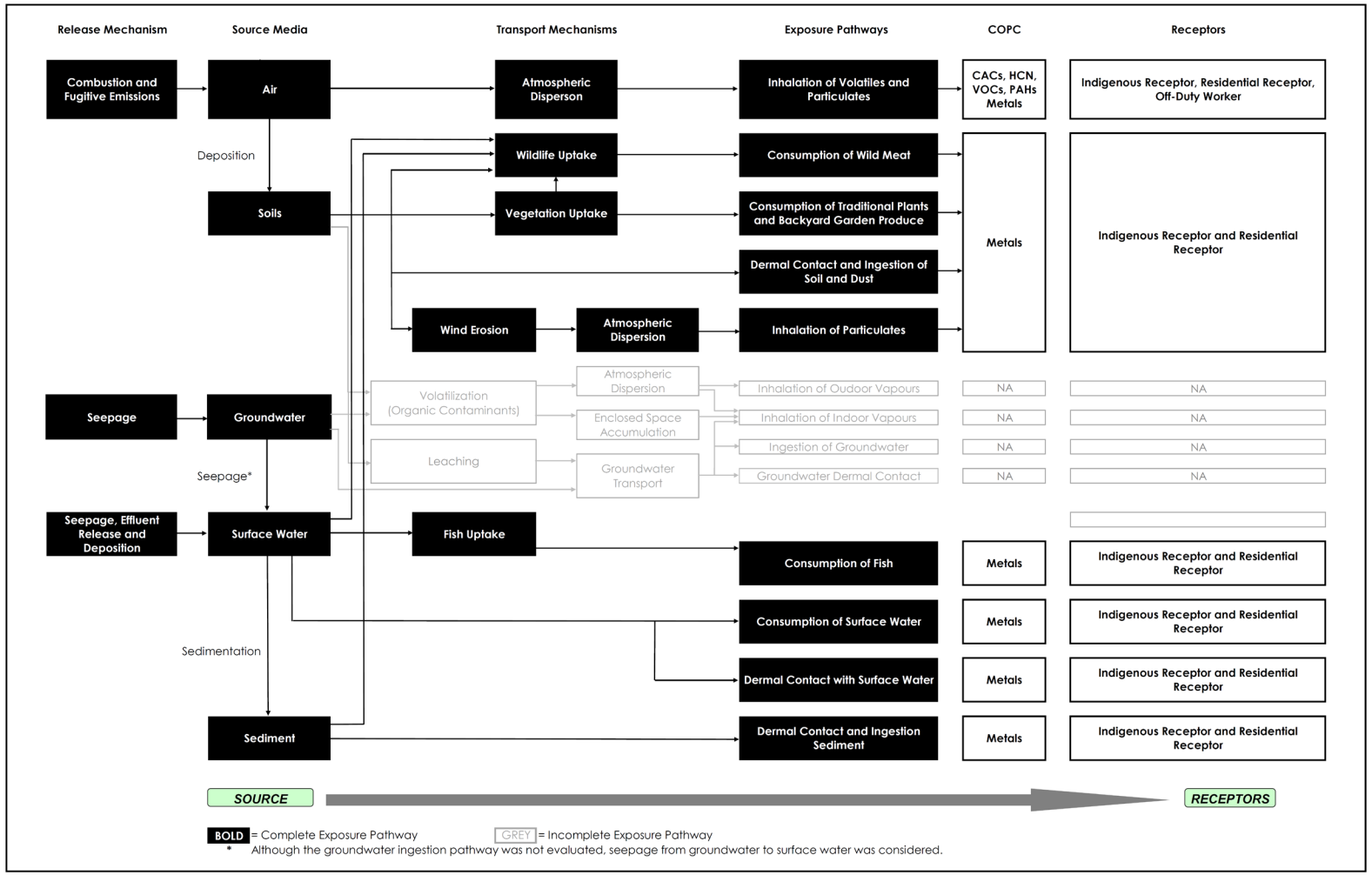
3.3.13.2 Environmental Effects

The construction, operation, and decommissioning/closure of the Project may affect the concentrations of chemicals in the air, soil, water, and biota near the Project. The EIS (Stantec 2020a) included a human health risk assessment (HHRA) to evaluate the potential effects to human health from modelled changes in environmental quality due to Project activities (EIS HHRA). The key components of the conceptual site model (CSM) for human health remain unchanged and are depicted in Figure 3.6.

Individuals most likely to be affected by changes in environmental quality include Indigenous people residing in or frequently visiting the area for food harvesting, non-Indigenous residents who may also engage in food harvesting, and off-duty workers located at the worker camp at the MacLellan site. Chemicals of potential concern (COPCs) related to Project activities include criteria air contaminants (NO_2, CO, SO_2, PM_{10}, $PM_{2.5}$), diesel particulate matter (DPM), HCN, volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and metals.

To assess the potential Project-related effects on human health due to the proposed alterations, the revised air and water model results were examined to understand how these new estimates of possible environmental quality changes might influence the original human health risk conclusions.

Figure 3.6 Conceptual Site Model for the Human Health Risk Assessment



3.3.13.2.1 Changes to Air Quality

The updated assessment of Project-related effects on air quality is presented in Section 3.3.1. The update focuses on potential changes in the Project's air quality effects resulting from the 2023 design updates during the operation phase. Changes in the Project design that might affect air quality include updates to the PDA, Project layouts, mining production quantities, major mine equipment, and operation blast parameters. The air quality model for the operation phase was revised using the same approach as the EIS (Stantec 2020a) and was used to estimate concentrations of key COPCs in air at 114 locations in the MacLellan region as well as the worker camp located within the PDA. These receptor locations were identified as part of the EIS HHRA, and represent places where receptors 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 air quality effects were assessed for key COPCs (NO_2, CO, SO_2, PM_{10}, $PM_{2.5}$, and HCN) and dustfall. The maximum modelled concentrations of these key COPCs and dustfall for the MacLellan site are detailed in the Summary of Air Dispersion Model Results for the Lynn Lake Gold Project Revised 2023 Mine Design memo (Appendix C) and summarized in Section 3.3.1. The other COPCs (VOCs, PAHs, metals) were not remodeled because the concentrations reported in the EIS HHRA were low (generally less than 1 µg/m³ for annual average concentrations) and were typically orders of magnitude less than the health-based exposure limits. Based on these findings, it is reasonable to conclude that these other COPCs represent a negligible risk to human health via inhalation.

The COPCs NO_2, CO, SO_2, PM_{10}, and $PM_{2.5}$ are non-threshold contaminants, for which it is acknowledged that any increase in exposure may result in adverse health effects. However, the severity of effects increases incrementally with exposure concentration and exposure duration. The absence of clearly defined toxicological reference values (TRVs) for these parameters presents a technical challenge for health regulatory agencies and health risk practitioners on how to assess the incremental increase in health risk resulting from modelled or measured exposure concentrations. The EIS HHRA used comparisons to CAAQS to assess potential human health risks. Following updated guidance from Health Canada (2023b), inhalation exposure limits have been established based on data reviews that examine health effects from different levels of these parameters in ambient air, as summarized by Health Canada (2023b) and WHO (2021).

Based on this updated guidance, WHO ambient air quality guidelines (WHO 2021) have been adopted for this assessment as exposure limits for most of these parameters (Table 3.31). According to WHO (2021), these guidelines represent the lowest level of exposure for which there is evidence of adverse health effects. The WHO air quality guideline is essentially “the lowest level of exposure for which there is evidence of adverse health effects”, and “it is assumed that adverse health effects do not occur or are minimal below this concentration level” (WHO 2021).

Table 3.31 Modelled Maximum Ground-level Concentrations from MacLellan Site Operation

COPC	Averaging Period	Maximum Concentration – Indigenous Receptor and Residential Receptor Locations (µg/m³)	Maximum Concentration – Off-Duty Worker at Worker Camp (µg/m³)	Exposure Limit or TRV (µg/m³)	Reference
NO_2	1-hour [a]	**241**	**538**	200	(WHO 2021)
NO_2	24-hour [b]	22	**45**	25	(WHO 2021)
NO_2	Annual [c]	3.6	9.0	10	(WHO 2021)
CO	1-hour [a]	7,284	19,179	35,000	(WHO 2021)
CO	8-hour [d]	1,686	4,592	10,000	(WHO 2021)
SO_2	24-hour [b]	11	11	40	(WHO 2021)
PM_{10}	24-hour [b]	**59**	**216**	45	(WHO 2021)
PM_{10}	Annual [c]	11	**48**	15	(WHO 2021)
$PM_{2.5}$	24-hour [b]	10	**36**	15	(WHO 2021)
$PM_{2.5}$	Annual [c]	3.8	**8.7**	5	(WHO 2021)
HCN	1-hour [a]	9.2	29	340	(OEHHA 2008)
HCN	Annual [c]	0.23	1.2	2.5	(US EPA 2010 as modified by OMECP 2015, 2022)
DPM	2-hour [e]	3.0	**14**	10	(Health Canada 2016a)
DPM	Annual [c]	0.021	0.15	5	(Health Canada 2016a)

Notes:

µg/m³: micrograms per cubic metre; NO_2: nitrogen dioxide; CO: carbon monoxide; SO_2: sulphur dioxide; PM_{10}: particulate matter <10 microns; $PM_{2.5}$: particulate matter <2.5 microns; HCN: hydrogen cyanide; DPM: diesel particulate matter; TRV: toxicological reference value

Values in **BOLD** are higher than the exposure limit or TRV

a. The maximum 1-hour concentration after eliminating 8 highest meteorological hours in each year
b. The 99th percentile (4th highest) of 24-hour concentrations
c. The maximum arithmetic average concentrations over a single calendar year of all 1-hour average concentrations
d. The maximum 8-hour average concentrations after eliminating the 1st highest meteorological hour in each year
e. The maximum 2-hour average concentrations after eliminating the 1st highest meteorological hour in each year

For SO_2, Health Canada (2016b) concluded that there is inadequate evidence to infer a causal relationship between long-term SO_2 exposure and cardiovascular effects, reproductive and development effects, total mortality, or cancer. As such, evaluation of the effects of chronic exposure to SO_2 was not conducted as part the EIS (Stantec 2020a) or this assessment.

The TRVs for HCN and DPM remain the same as the EIS HHRA (Table 3.31). The toxicologically relevant averaging periods for HCN are 1-hour (for short-term exposures) and average annual (for long-term exposures) while DPM are 2-hour (for short-term exposures) and average annual (for long-term exposures).

A summary of the maximum modelled concentrations for the human receptor locations (defined as the locations where Indigenous and non-Indigenous receptors most likely to be exposed) and the worker camp (where off-duty workers may be exposed) are provided in Table 3.31.

In the EIS HHRA, the assessment of human health risks from non-carcinogenic chemicals was conducted using concentration ratios (CRs) for the inhalation pathway. The CRs were calculated by dividing the appropriate statistical interpretation of the chemical concentrations in air by the exposure limit and comparing that result with a CR of 1.0. As noted in the EIS HHRA, if the CR is less than or equal to the target benchmark (CR ≤ 1.0), human health risks related to the Project are considered to be negligible. Concentration ratios greater than one do not necessarily indicate that adverse health effects are expected to occur, or that the health risks are considered unacceptable, but it does require further evaluation of the significance of the estimated risks, including assumptions built into the toxicity and exposure assessments.

The maximum human health risks associated with inhalation exposures to the key COPCs for Indigenous Receptor and the Residential Receptor (i.e., the maximum CR values of the 114 special human receptor locations in the MacLellan region) and the worker camp are provided in Table 3.32.

Table 3.32 Maximum Human Health Risks Associated with Inhalation Exposures from MacLellan Site Operation

	Maximum CR – Indigenous Receptor and Residential Receptor	Maximum CR – Off-Duty Worker Camp
NO_2		
1-hour	**1.2**	**2.7**
24-hour	0.9	**1.8**
Annual	0.4	0.9
CO		
1-hour	0.2	0.5
8-hour	0.2	0.5
SO_2		
24-hour	0.3	0.3
PM_{10}		
24-hour	**1.3**	**4.8**
Annual	0.7	**3.2**
$PM_{2.5}$		
24-hour	0.7	**2.4**
Annual	0.8	**1.7**
HCN		
1-hour	0.03	0.08
Annual	0.1	0.5
DPM		
2-hour	0.3	**1.4**
Annual	0.004	0.030

Notes:

NO_2: nitrogen dioxide; CO: carbon monoxide; SO_2: sulphur dioxide; PM_{10}: particulate matter <10 microns; $PM_{2.5}$: particulate matter <2.5 microns; HCN: hydrogen cyanide; DPM: diesel particulate matter; CR: Concentration Ratio

Values in **BOLD** are higher than the benchmark of 1.0

Nitrogen Dioxide (NO_2)

As shown in Table 3.32, the CRs associated with annual average concentrations of NO_2 meet the benchmark of 1.0; however, CRs associated with 1-hour and 24-hour concentrations are greater than the benchmark at one or more locations. These locations are limited to the worker camp and two human receptor locations, as shown in Table 3.33. At these locations, consideration is given to the magnitude, frequency and likelihood of exposure in the evaluation of potential human health risks.

Table 3.33 Receptor Locations where Concentration Ratios of NO_2 Are Greater than Benchmark (CR > 1.0)

	Concentration Ratio (CR)
NO_2 (1-hour)	
Worker Camp	2.7
Trapping Area 12	1.2
Waste Disposal Site	1.2
NO_2 (24-hour)	
Worker Camp	1.8

Of the two human receptor locations with elevated 1-hour concentrations, the Waste Disposal Site (located southeast of the PDA) is unlikely frequented by Indigenous Receptors and Residential Receptors. Trapping Area 12 represents a location that people could reasonably be expected to be present; however, the frequency of exceedances is expected to be low since the maximum 98th percentile of NO_2 daily maximum 1-hour average concentrations at a human health location of 96.9 µg/m^3 (see Table 9, Appendix C) is well below the exposure level of 200 µg/m³.

As reported by the WHO (2006), in experiments, researchers found that breathing in NO_2 at 560 µg/m³ can directly affect the lungs of people with asthma. Other studies show that people with asthma become more sensitive to NO_2 at levels starting from 200 µg/m³ (WHO 2006). Based on these studies, if people with asthma are present at these receptor locations when concentrations are greater than the exposure limit of 200 µg/m^3, they may experience respiratory effects. Although the maximum 1-hour concentrations at these receptor locations are greater than the exposure limit, maximum modelled concentrations for 24-hour and annual average exposures meet the exposure limits. The WHO (2021) notes that when the air quality meets the long-term exposure limits, the health burden related to a few incidents above the short-term exposure limit corresponds to a very small fraction of the total air pollution-related burden.

At the worker camp, CRs for both 1-hour and 24-hour NO_2 concentrations are greater than the benchmark of 1.0 (CR = 2.7 for 1-hour exposures and CR = 1.8 for 24-hour exposures). At the maximum 1-hour concentration of 538 µg/m³, workers with asthma may experience respiratory effects such as shortness of breath that would be expected to subside as NO_2 concentrations decline. Importantly, the annual average concentration of NO_2 at the worker camp meets the exposure limit. As noted earlier, when the air quality meets the long-term exposure limits, the health burden related to a few incidents above the short-term exposure limit corresponds to a very small fraction of the total air pollution-related burden (WHO 2021).

Based on the results, it is reasonable to conclude that occasional exceedances above the 1-hour and 24-hour NO_2 exposure limits do not represent an unacceptable human health risk for people who may be in the area. These findings are consistent with the EIS HHRA.

Isopleths of the 1-hour (98th percentile), frequency of exceedance of the 1-hour (98th percentile) concentrations relative to the CAAQS, 24-hour (98^{th} percentile) and annual concentrations of NO_2 are provided on Map 2, Map 3, Map 4 and Map 5, respectively, in Appendix C.

Carbon Monoxide (CO)

As shown in Table 3.32, the concentration ratios associated with 1-hour CO concentrations meet the benchmark of 1.0 at the human health receptor locations and the worker camp. Because adverse health effects are not expected to occur or are minimal below the exposure limit, there are no unacceptable risks to human receptors expected from inhalation of CO.

Isopleths of the 1-hour (9^{th} highest) concentrations of CO are provided on Map 6, Appendix C.

Sulphur Dioxide (SO_2)

As shown in Table 3.32, the concentration ratios associated with 24-hour SO_2 concentrations meet the benchmark of 1.0 at the human health receptor locations and the worker camp. Because adverse health effects are not expected to occur or are minimal below the exposure limit, there are no unacceptable risks to human receptors expected from inhalation of SO_2.

Isopleths of the 24-hour (98^{th} percentile) concentrations of SO_2 are provided on Map 11, Appendix C.

Particulate Matter (PM_{10}, $PM_{2.5}$)

As shown in Table 3.32, the CRs associated with 24-hour and annual average concentrations of particulate matter (PM_{10} and $PM_{2.5}$) are greater than the benchmark of 1.0 at one or more locations. These locations are limited to the worker camp and two human receptor locations, as shown in Table 3.34. At these locations, consideration is given to the magnitude, frequency and likelihood of exposure in the evaluation of potential human health risks.

Table 3.34 Receptor Locations where Concentration Ratios of PM Are Greater than Benchmark (CR > 1.0)

	Concentration Ratio (CR)
PM_{10} (24-hour)	
Worker Camp	4.8
Trapping Area 12	1.3
Waste Disposal Site	1.2
PM_{10} (Annual average)	
Worker Camp	3.2
$PM_{2.5}$ (24-hour)	
Worker Camp	2.4
$PM_{2.5}$ (Annual average)	
Worker Camp	1.7

Of the two human receptor locations with elevated 24-hour concentrations of PM_{10}, the Waste Disposal Site (located southeast of the PDA) is unlikely frequented by Indigenous Receptors and Residential Receptors. Trapping Area 12 represents a location where people could reasonably be expected to be present. The WHO (2006) suggests that when evaluating the WHO guidelines for particulate matter, the annual average takes precedence over the 24-hour average since, at low levels, there is less concern about remaining episodic excursions. As the annual average concentration of PM_{10} at Trapping Area 12 meets the exposure limit, and concentrations of both 24-hour and annual average $PM_{2.5}$ meet the exposure limit at the 114 human health receptor locations evaluated, there are no unacceptable risks to Indigenous Receptors or Residential Receptors from inhalation of particulate matter.

Both short-term (24-hour) and long-term (annual average) CRs of PM_{10} and $PM_{2.5}$ are greater than the benchmark of 1.0 at the worker camp. Off-duty workers are expected to be present at the worker camp on a two-week on/two-week off rotation schedule. As a result, off-duty workers would not be continuously exposed to the annual average concentrations and would have a reduced likelihood of exposure to the 24-hour concentrations of particulate matter. Both short-term and long-term exposures to particulate matter have been associated with a range of health effects, including premature mortality, increased hospitalizations, respiratory symptoms, and cardiovascular effects (Health Canada 2022). Although the CRs for PM_{10} and $PM_{2.5}$ at the worker camp are higher than the EIS HHRA, the modelled concentrations of particulate matter (PM_{10}, $PM_{2.5}$) are lower than the EIS (Stantec 2020a), as noted in Section 3.3.1. The higher CRs reflect the use of newer, more stringent health-based targets based on guidance from Health Canada (2023b). In other words, the 2023 Project design is expected to reduce inhalation exposure to particulate matter relative to the EIS design.

Isopleths of the 24-hour (98^{th} percentile) concentrations of PM_{10} are provided on Map 19, Appendix C while isopleths of the 24-hour (98^{th} percentile) and annual concentrations of $PM_{2.5}$ are provided on Map 21 and Map 22, respectively, in Appendix C.

Hydrogen Cyanide (HCN)

As shown in Table 3.32, the concentration ratios associated with both short-term and long-term HCN concentrations meet the benchmark of 1.0 at the worker camp and the human receptor locations. These results indicate a negligible risk to human health from inhalation of HCN.

Isopleths of the 1-hour and annual concentrations of HCN are provided on Map 13 and Map 15, respectively, in Appendix C.

Diesel Particulate Matter (DPM)

As shown in Table 3.32, the concentration ratios associated with both short-term and long-term DPM concentrations meet the benchmark at the human receptor locations. These results indicate a negligible risk to Indigenous Receptors and Residential Receptors from inhalation of DPM.

Although the CR associated with long-term DPM concentrations at the worker camp meets the benchmark, the CR associated with short-term DPM (CR = 1.4) is greater than the benchmark of 1.0. The DPM concentration associated with this CR (14 µg/m³) is slightly higher than the concentration from the EIS HHRA (11.5 µg/m³). The 2-hour DPM exposure limit of 10 µg/m³ was derived by Health Canada (2016a) from studies where increased respiratory resistance was reported in study groups that included subjects that were mildly asthmatic being exposed to diesel exhaust mixtures. Health Canada characterized the effects of short-term exposures to DPM as “mild and reversible” (Health Canada 2016a).

Considering that the health effects associated with the 2-hour limit are mild and reversible in sensitive individuals (such as people with asthma), and the maximum modelled annual average exposure for an off-duty worker is below the annual average exposure limit, it is reasonable to conclude that both short-term and long-term inhalation exposures to DPM for off-duty workers pose a negligible to low risk to human health.

Dustfall

Although dustfall itself is not considered a COPC, it serves as an indicator of possible deposition from air to soil. As depicted in Figure 3.6, this deposition can affect soil quality and result in human exposure through direct dermal contact and ingestion of soil and dust. Additionally, exposure can occur indirectly via wind erosion and subsequent inhalation of particulates from soil, and uptake by vegetation and wildlife, subsequently leading to the consumption of traditional plants, backyard garden produce, and wild meat.

The maximum predicted dustfall values are 1% to 3% higher than those reported in the EIS; however, the maximum predicted annual rates of dustfall at human health receptor locations are anticipated to decrease by 4% (refer to Table 9, Appendix C). Isopleths of maximum modelled annual average dustfall depositions are provided on Map 24, Appendix C.

The EIS HHRA concluded that Project-related changes to soil, terrestrial vegetation, and terrestrial wildlife posed a negligible risk to human health. Based on the updated 2023 Project design and modelled deposition rates, human receptor exposures to soil, terrestrial vegetation, and terrestrial wild meat are expected to be similar to or lower than those evaluated in the EIS HHRA. Therefore, Project-related changes to soil, terrestrial vegetation, and terrestrial wildlife are expected to continue to represent a negligible risk to human health.

3.3.13.2.2 Changes to Surface Water Quality

The updated assessment of Project-related effects to surface water quality are presented in Section 3.3.4. The updated NOA/NOC water quality model (the updated model) used the same assessment nodes and approach as the EIS surface water quality model (EIS model) with some slight modifications, as described in Section 3.3.4. Within the EIS HHRA, potential pathways related to surface water included direct pathways (consumption of surface water, direct contact with surface water) and indirect pathways (consumption of fish).

Although the CSM (Figure 3.6) identifies that humans could come in direct contact with sediment, the EIS HHRA concluded that risks related to sediment contact are considered minor. No public beaches or areas of shoreline where high intensity activities occur were identified in the MacLellan region. Locations where humans could be exposed to sediment are considered remote and exposure would be infrequent. Consistent with the EIS HHRA, exposures associated with direct contact with sediment are not assessed further.

The following provides an assessment of the human health risks associated with the surface water-related pathways based on the updated model results.

Ingestion and Dermal Contact with Surface Water

In certain instances, individuals might consume water directly from local lakes. However, information collected through various engagements suggest that such occurrences are rare, as people generally do not source their drinking water directly from these lakes. Consistent with the EIS HHRA, the updated modelled concentrations of metals in lakes in the MacLellan region were based on the maximum 12-month running average surface water concentrations for the Expected case for waterbodies in the LAA for the MacLellan site. These concentrations were compared with Canadian drinking water quality guidelines (Table 3.35). Preference was given to guidelines from Health Canada (2024); in the absence of Health Canada guidelines, guidelines from other jurisdictions (e.g., Ontario) were selected. Modelled concentrations of metals in the applicable lakes in the MacLellan region were less than the applicable guidelines, suggesting that even if the water were used for consumption, health risks related to metal exposures would be negligible. These findings are consistent with the EIS HHRA and the ingestion of and dermal contact with surface water pathways by humans was not assessed further.

Table 3.35 Comparison of Surface Water Concentration to Drinking Water Guidelines

COPC	Units	Updated Model Concentrations (Project Case) – MacLellan Region	Drinking Water Quality Guideline	Source
Antimony	mg/L	0.00042	0.006	Health Canada (2024)
Arsenic	mg/L	0.0012	0.01	Health Canada (2024)
Barium	mg/L	0.010	2	Health Canada (2024)
Beryllium	mg/L	0.000091	0.004	OMECP (2011)
Cadmium	mg/L	0.000012	0.007	Health Canada (2024)
Chromium	mg/L	0.00019	0.05	Health Canada (2024)
Cobalt	mg/L	0.00059	0.003	OMECP (2011)
Copper	mg/L	0.0012	2	Health Canada (2024)
Lead	mg/L	0.000077	0.005	Health Canada (2024)
Manganese	mg/L	0.055	0.12	Health Canada (2024)
Mercury	mg/L	0.0000016	0.001	Health Canada (2024)
Molybdenum	mg/L	0.00059	0.07	OMECP (2011)
Nickel	mg/L	0.0093	0.1	OMECP (2011)
Selenium	mg/L	0.000076	0.05	Health Canada (2024)
Silver	mg/L	0.0000054	0.01	OMECP (2011)
Strontium	mg/L	0.025	7	Health Canada (2024)
Thallium	mg/L	0.000037	0.002	OMECP (2011)
Uranium	mg/L	0.00011	0.02	Health Canada (2024)
Vanadium	mg/L	0.00021	0.0062	OMECP (2011)
Zinc	mg/L	0.0038	5	Health Canada (2024)

Consumption of Fish

The EIS HHRA assumed that people in the MacLellan region obtain a portion of their local fish from Cockeram Lake. Baseline metal concentrations in fish were based on 29 muscle tissue samples collected from Cockeram Lake in 2015 and 2016 and 95% UCLM concentrations were adopted as the Baseline concentration for each metal. Project-related changes in fish tissue concentrations were estimated using the predictive concentrations from surface water modelling, specifically, the maximum 12-month running average surface water concentrations in Cockeram Lake for the Expected case.

The EIS HHRA determined that the calculated non-cancer health risk for methyl mercury in fish for the Project Case (hazard quotient, HQ of 0.35) was greater than the target benchmark of 0.2 but was not substantially different than the Baseline Case (HQ of 0.34). The non-cancer health risks for all other COPCs via consumption of fish were less than the target benchmark of 0.2. Arsenic was the only COPC in fish that is considered a carcinogen. The EIS HHRA determined that the calculated carcinogenic risk associated with ingestion of fish was 7.6E-07 (or 0.076 in 100,000), which is well below the target threshold of 1E-05 (or 1 in 100,000). As a result, the EIS HHRA concluded that the modeled Project-related changes represent a negligible change in health risk.

Because uptake to fish tissues is modelled as being directly proportional to modelled changes in surface water concentrations, it is reasonable to assume that:

- If the updated model concentrations (for the maximum 12-month running average surface water concentrations in Cockeram Lake for the Expected case) are similar to or less than those in the EIS HHRA, there would be no changes to the HHRA conclusions.
- The percent difference between the modelled concentrations used in the EIS HHRA and the updated model concentrations are an indication of the potential increase in risk to human health via ingestion of fish.

As indicated in Table 3.36, the updated model concentration of chromium, copper, mercury, and vanadium in surface water are less than the concentrations assessed in the EIS HHRA, indicating that there would be no change to the EIS HHRA conclusions. The updated model concentrations for other COPCs ranged from a 1% increase (silver) to a 107% increase (cobalt). However, even if health risks for these other COPCs were to increase by 107%, the non-cancer health risks would remain less than the target of 0.2 and the cancer risk would remain less than the target of 1E-05. Because the updated model concentrations would result in health risks below the targets associated with negligible risk to human health, there would be no change to the EIS HHRA conclusions related to the consumption of fish.

Table 3.36 Changes in Model Concentrations at Cockeram Lake – Project Case

COPC	Units	EIS Model Concentrations	Updated Model Concentration	Increase in Concentration (%)
Antimony	mg/L	1.02E-04	1.45E-04	42%
Arsenic	mg/L	2.89E-04	4.53E-04	57%
Barium	mg/L	7.65E-03	8.53E-03	11%
Beryllium	mg/L	8.23E-05	8.92E-05	8%
Cadmium	mg/L	7.58E-06	1.40E-05	85%
Chromium	mg/L	1.78E-04	1.53E-04	-14%
Cobalt	mg/L	2.97E-04	6.16E-04	107%
Copper	mg/L	2.42E-03	2.38E-03	-2%
Lead	mg/L	4.92E-05	5.58E-05	13%
Manganese	mg/L	2.54E-02	3.39E-02	33%
Mercury	mg/L	1.15E-06	1.04E-06	-10%
Molybdenum	mg/L	1.31E-04	2.00E-04	53%
Nickel	mg/L	2.83E-02	2.92E-02	3%
Selenium	mg/L	4.96E-05	5.14E-05	4%
Silver	mg/L	5.10E-06	5.16E-06	1%
Strontium	mg/L	1.82E-02	1.92E-02	6%
Thallium	mg/L	2.96E-05	3.74E-05	26%
Uranium	mg/L	5.17E-05	6.51E-05	26%
Vanadium	mg/L	1.46E-04	1.28E-04	-12%
Zinc	mg/L	6.86E-03	7.67E-03	12%

3.3.13.3 Summary of Mitigation Measures

The mitigation measures to reduce environmental effects of the Project (e.g., as described in Sections 3.3.1 and 3.3.4) also serve to address potential human health effects through the potential exposure pathways previously described. Considering the current wind conditions and measured ambient concentration levels, suitable and effective mitigation options will be implemented to reduce Project emissions to air. This approach to managing emissions is referred to as “adaptive management”. Since emissions of NO_2, PM_{10}, $PM_{2.5}$, and DPM are dependent on the types of vehicles and equipment used, as well as how and when they are used, adaptive management is considered an effective means to mitigate exposures for off-duty workers at the worker camp as well as for people who may be present at Trapping Area 12. Additionally, monitoring of surface water quality and country foods will be conducted to provide an understanding of Project-related effects to environmental media of importance of human health and to identify if additional mitigation measured are needed.

3.3.13.4 Residual Effects

In comparison with the EIS results, the air quality effects from the Project activities slightly increased at some receptor locations as well as the worker camp. These changes were evaluated in the context of newer guidance and health-based targets (Health Canada 2023a and 2023b; WHO 2021). In instances where the updated modelled concentrations are above the current guidelines, the associated risks were generally limited to short-term exposures (1-hour, 24-hour), with a low frequency of exposures to concentrations above the guidelines. The exception is the worker camp, where both short-term and long-term exposures to particulate matter (i.e., PM_{10} and $PM_{2.5}$) are greater than health-based exposure limits.

Based on the 2023 design, dustfall levels at human receptor locations are expected to be lower than assessed in the EIS. Consequently, there would be no changes to human health due to dustfall and deposition. Similarly, the updated assessment of Project-related effects to surface water quality resulted in higher modelled concentrations of some metals with the MacLellan site; however, non-cancer and cancer health risks would remain with targets indicating negligible health risks.

After applying the mitigation measures, including adaptive management for air emissions, the residual human effects at the receptor locations during the construction, operation, and decommissioning phases are, as in the EIS, adverse, of negligible to low magnitude, confined to the LAA geographic area, long-term duration (metals in soil and water), and irreversible (metals in soil and water).

3.3.14 Indigenous Peoples

The section provides further consideration of effects to Indigenous or Treaty Rights (Stantec 2020a). The proposed alterations that may interact with the Indigenous peoples VC and were therefore assessed as part of this NOA/NOC, include but are not limited to the PDA layout.

3.3.14.1 Regulatory and Guideline Setting

3.3.14.1.1 Guideline Criteria

The assessment of potential Project-related environmental effects on Indigenous health conditions, Indigenous socio-economic conditions, and Indigenous physical and cultural heritage, current use and Indigenous or Treaty Rights includes the consideration of the following federal and provincial legislation:

Section 6.1.9 of the CEA Agency[3] EIS Final Guidelines for the Project (Final EIS Guidelines; Appendix 4A [Stantec 2020a]) required assessment of Project effects to health, social conditions, and physical and cultural heritage of Indigenous peoples as required by CEAA 2012 Paragraph 5(1)(c).

The Government of Manitoba *Northern Affairs Act* (1966 most recent revision in 2006) coordinates interprovincial and interjurisdictional initiatives, policies, and strategies affecting northern Manitoba.

[3] As of June 21, 2019, the CEA Agency became the IAAC. Documents or direction provided after this date are attributed to IAAC.

Manitoba's Department of Indigenous and Northern Relations (MINR) interim provincial policy for Crown consultation (MINR 2019) recognizes Manitoba's duty to consult with First Nations, Métis Nations, and other Indigenous Nations 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.

3.3.14.1.2 IAAC Decision Statement

As per the IAAC Decision Statement, Alamos is required to adhere to the following conditions with respect to health and socio-economic conditions of Indigenous peoples:

> *6.1 The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, measures to mitigate emissions of dust and fugitive particulates within the Project development areas, taking into account the standards and criteria set out in the Canadian Council of Ministers of the Environment's Canadian Ambient Air Quality Standards and Manitoba's Ambient Air Quality Criteria. The Proponent shall implement these measures from construction through decommissioning. In doing so, the Proponent shall:*
>
> > *6.1.1 apply dust suppressants, including water, that do not contain chemicals and have the least potential for adverse environmental effects, on haul and access roads during periods when dust generation is expected or occurring, including periods of drought and high winds;*
> >
> > *6.1.2 locate all stationary machinery and equipment used for processing ore indoors, where technically and economically feasible, including the crushing plant and conveyors feeding into the ore milling and processing plant;*
> >
> > *6.1.3 ensure all equipment and vehicles used, including equipment and vehicles operated by third-party contractors, are serviced and maintained in accordance with the manufacturer's maintenance guidelines to meet or exceed applicable emission standards, including Tier 4 emission standards for off-road equipment with off-road diesel engines, pursuant to the Off-Road Compression-Ignition (Mobile and Stationary) and Large Spark-Ignition Engine Emission Regulations and Off-Road Compression-Ignition Engine Emission Regulations;*
> >
> > *6.1.4 develop and implement policies to reduce the fuel consumption of equipment and vehicles operating in the Project development areas, including no idling and limited cold start policies; and*

6.1.5 establish speed limits on the roads located in the Project development areas, taking into account the recommended speed limits in Environment and Climate Change Canada's Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities and by requiring and ensuring that speed limits are respected, including by installing signs indicating speed limits.

6.2 The Proponent shall implement measures, during all phases of the Designated Project, to avoid exceedances of the thresholds for noise and vibration, identified in Health Canada's Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise at sensitive receptors identified in the human health and ecological risk assessment in Volume 5 of the Environmental Impact Statement. In doing so, the Proponent shall:

6.2.1 develop, prior to construction, a protocol for receiving and addressing feedback related to the exposure to noise and vibration generated by the Designated Project. The Proponent shall provide the protocol to the Agency and Indigenous groups prior to construction and make the protocol publicly available online. As part of the protocol, the Proponent shall:

6.2.1.1 identify how a person may provide feedback, how the Proponent will handle the feedback received, including ranking and responding to feedback received according to the anticipated level of impacts, and how the Proponent may implement modified or additional mitigation measures(s) and/or follow-up requirement(s) in response to the feedback received;

6.2.1.2 record any feedback received as soon as feasible, no later than 48 hours after receiving the feedback; and

6.2.1.3 implement, as soon as technically feasible, any modified or additional mitigation measure and/or follow-up requirement that the Proponent deems necessary to respond to the feedback received.

6.3 The Proponent shall develop, prior to construction and in consultation with Indigenous groups, Health Canada, Environment and Climate Change Canada and any other relevant authorities, a follow-up program to verify the accuracy of the environmental assessment as it pertains to adverse environmental effects from the Designated Project on air quality and country foods as it relates to the health of Indigenous peoples, taking into account available Indigenous knowledge provided by Indigenous groups related to current use of lands and resources for traditional purposes. The Proponent shall implement the follow-up program during all phases of the Designated Project. As part of the implementation of the follow-up program, the Proponent shall:

6.3.1 identify, in consultation with Indigenous groups, the species of fish, vegetation and wildlife consumed as country foods that may be adversely affected by the Designated Project and the locations where these species shall be monitored;

6.3.2 monitor, beginning prior to construction and continuing through post-closure, contaminants of potential concern, including arsenic, copper, mercury, methylmercury and selenium, in the species and at the locations identified pursuant to condition 6.3.1;

6.3.3 monitor, throughout construction and operation, ambient air concentrations of total suspended particulates, PM_{10} and $PM_{2.5}$ at locations identified in consultation with Indigenous groups, and upwind and downwind from the Project development areas, taking into account 24-hour and 1-hour thresholds in the Canadian Council of Ministers of the Environment's Canadian Ambient Air Quality Standards;

6.3.4 monitor, during all phases of the Designated Project, dust fall at locations identified in consultation with Indigenous groups, and upwind and downwind from the Project development areas;

6.3.5 monitor ambient air concentrations of nitrogen dioxide (NO_2) at locations identified in consultation with Indigenous groups and relevant authorities, for at least two consecutive months during year 2 of operation, and continue to monitor during all phases of the Designated Project if the monitoring results exceed predicted levels in the atmospheric dispersion model in Volume 1 Chapter 6 of the Environmental Impact Statement;

6.3.6 monitor meteorological conditions (including wind speed, wind direction, temperature and relative humidity) upwind and downwind of the Project development areas, during construction and operation; and

6.3.7 if the monitoring results referred to in conditions 6.3.2 to 6.3.5 exceed predicted levels in the atmospheric dispersion model in Volume 1 Chapter 6 of the Environmental Impact Statement, taking into account the results of monitoring meteorological conditions pursuant to condition 6.3.6, the human health and ecological risk assessment in Volume 5 of the Environmental Impact Statement, or thresholds of the Canadian Council of Ministers of the Environment's Canadian Ambient Air Quality Standards, modify or implement additional mitigation measures pursuant to condition 2.8, and update the human health and ecological risk assessment in Volume 5 of the Environmental Impact Statement. The Proponent shall submit any updates to the human health and ecological risk assessment to the Agency and relevant authorities.

6.4 The Proponent shall develop, in consultation with Indigenous groups, and implement a follow-up program to verify the accuracy of the environmental assessment and determine the effectiveness of the mitigation measures as it pertains to adverse effects on the socio-economic conditions of Indigenous peoples from changes to the environment caused by the Designated Project. The Proponent shall solicit and incorporate additional information provided by Indigenous groups when monitoring these effects. The Proponent shall implement the follow-up program during all phases of the Designated Project. As part of the follow-up program, the Proponent shall:

6.4.1 monitor, based on the information provided by Indigenous groups that are trapping, harvesting, fishing or hunting within the local assessment areas, including Marcel Colomb First Nation and holders of registered trap lines:

6.4.1.1 the ability of trappers, harvesters, fishers and hunters to relocate, if required to do so, to new trapping, harvesting, fishing and hunting sites used for traditional purposes, including registered trap lines;

6.4.1.2 the quantity and quality of resources obtained through trapping, harvesting, fishing and hunting activities; and

6.4.1.3 the changes in socio-economic conditions of Indigenous groups, including any additional financial costs incurred by Marcel Colomb First Nation and holders of registered trap lines, as they relate to the relocation of trapping, harvesting, fishing and hunting activities.

6.5 The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and determine the effectiveness of mitigation measures as it pertains to noise and vibration from the Designated Project on the health of Indigenous peoples. The Proponent shall implement the follow-up program during all phases of the Designated Project. As part of the follow-up program, the Proponent shall:

6.5.1 monitor noise and vibration levels at receptors identified in Volume 1 Chapter 7 Tables 7-7 to 7-10 of the Environmental Impact Statement, and at any other human receptors identified in consultation with Indigenous groups.

Condition 7.2 regarding Physical and Cultural Heritage is described above in Section 3.3.11 heritage resources.

7.2 The Proponent shall develop, prior to construction and in consultation with Indigenous groups, nation-specific measures to address the effects described in the Environmental Assessment Report caused by the Designated Project on cultural heritage, including tangible and intangible losses to culture. The Proponent shall implement the measures during all phases of the Designated Project and submit these measures to the Agency prior to implementing them, while ensuring that confidential information is protected. The Proponent shall report its discussions with Indigenous groups as part of the annual report referred to in condition 2.10, including the level of satisfaction of Indigenous groups with the implementation of the measures. As part of the measures, the Proponent shall:

7.2.1 develop and/or contribute to Indigenous-led program(s) and/or initiative(s) to preserve and enhance cultural heritage, including the transfer of intergenerational knowledge; and

7.2.2 develop, in collaboration with Indigenous groups, cultural awareness training for all employees associated with the Designated Project, including the cultural setting and providing an understanding of cultural practices, protocols and considerations.

Condition 5, current use is described in Section 3.3.12 above.

3.3.14.2 Environmental Effects

3.3.14.2.1 Change to Indigenous Health Conditions

The effect pathways carried forward for Indigenous health conditions were addressed in the current use (Chapter 17.0) and human health (Chapter 18.0) assessments of the EIS. These are tabulated below with reference to the relevant section of the EIS, the potential effect, and the effect pathways.

Table 3.37 Indigenous Health Conditions Effects Pathways

Valued Component	Potential effect assessed in related VC	Effect pathways carried forward for Indigenous health conditions
Current Use (Chapter 17.0, 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 18.0, 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.

3.3.14.2.2 Change to Indigenous Socio-Economic Conditions

The effect pathways carried forward for Indigenous socio-economic conditions were addressed in the assessments of labour and economy (Chapter 13.0), community services, infrastructure, and wellbeing (Chapter 14.0), and land and resource use (Chapter 15.0) section of the EIS. These are tabulated below with reference to the relevant section of the EIS, the potential effect, and the effect pathways.

Table 3.38 Indigenous Socio-Economic Conditions Effects Pathways

Valued Component	Potential effect assessed in Related VC	Effect pathways carried forward for Indigenous Socio-Economic conditions
Land and Resource Use (Chapter 15.0, 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 14.0, 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 Nations.
	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 Nations.
	Change in community wellbeing	Project-related employment may increase disposable income, reduce financial barriers to beneficial health practices, change the demographics of nearby Nations and result in changes of sense of place, alter participation in recreational, subsistence, and family-related activities.
Labour and Economy (Chapter 13.0, 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 Nations.

3.3.14.2.3 Change in Current Use

Please refer to Section 3.3.12 for a description of the potential effects of the Project on current use.

3.3.14.2.4 Change to Indigenous Physical and Cultural Heritage

The effect pathways carried forward for Indigenous physical and cultural heritage were addressed in the heritage resources (Chapter 16.0) and current use (Chapter 17.0) 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.

These are tabulated below with reference to the relevant section of the EIS, the potential effect, and the effect pathways.

Table 3.39 Indigenous Physical and Cultural Heritage Effects Pathways

Valued Component	Potential Effect assessed in Related VC	Effect pathways carried forward for Indigenous Physical and Cultural Heritage
Heritage Resources (Chapter 16.0, 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 Nations.
Current Use (Chapter 17.0, 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 Nations, 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.

3.3.14.3 Summary of Mitigation Measures

Mitigation measures proposed to avoid or reduce potential adverse effects on Indigenous health conditions include those identified in the current use (Chapter 17.0) and human health (Chapter 18.0) of the EIS and discussed in the Management and Monitoring Plans (Version 0, January 2025).

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 15.0), community services, infrastructure, and wellbeing (Chapter 14.0), and labour and economy (Chapter 13.0) of the EIS.

Mitigation measures proposed to avoid or reduce potential adverse effects on Indigenous physical and cultural heritage include those identified in the current use (Chapter 17.0, Sections 17.4.2.2, 17.4.3.2, and 17.4.4.2) and heritage resources chapters (Chapter 16.0, Section 16.4.2.2) of the EIS.

3.3.14.4 Residual Effects

Residual effects will act upon Indigenous peoples harvesting and consuming country foods within the LAA and RAA by changes in the availability of country foods and value or perceived quality of country foods, as assessed in current use (Chapter 17.0). The availability of country foods within the PDA is currently limited by the former mine sites. The Project is anticipated to increase wildlife mortality and habitat loss for wildlife, fish, and plants within the PDA during construction and operation (Chapters 9.0, 10.0, and 12.0), but the residual effects are not anticipated to cause population-level effects to plant, animal, or fish species, including those harvested as country foods within the RAA. It is anticipated that residual effects will primarily be experienced by Marcel Colomb First Nation, whose reserve is within the LAA and RAA. Nevertheless, other Indigenous Nations may also experience residual effects of the Project, through members traveling to the Lynn Lake area to harvest and consume country foods.

Residual effects to Indigenous socio-economic conditions are anticipated to Indigenous peoples living and working within the 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 anticipated to be positive and adverse, and to primarily affect Marcel Colomb First Nation with its reserve within the LAA. Effects may extend to other Indigenous Nations 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.

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 LAA. Effects are anticipated to primarily affect Indigenous Nations within the LAA (i.e., Marcel Colomb First Nation), but other Indigenous Nations engaged on the Project may also experience residual effects to cultural and spiritual sites.

Project residual environmental effects on current use are assessed in Chapter 17.0 (Section 17.4). 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 an existing mine 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. 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 seasonal. Effects on current use will be reversible with decommissioning/closure, except for the open pits and mine rock, which will be permanent features.

The IAAC's IR IAAC-R2-57 for the Project directed Alamos to describe baseline conditions for each Indigenous Nation participating in the Project. Citing the *Guidelines for the Preparation of an Environmental Impact Statement Pursuant to the Canadian Environmental Assessment Act, 2012* (EIS Guidelines), IAAC required baseline information for each Indigenous Nation to inform the assessment of potential Project effects to Indigenous peoples. In response to IAAC-R2-57, Alamos provided a review and summary of the record of engagement with Indigenous Nations in one document. The intention of the review and summary was to report on engagement with each Indigenous Nation, describe baseline conditions, and demonstrate how Alamos has responded to the concerns and issues raised by each Indigenous Nation. Section 10 of the response presented Indigenous Nation-specific sections that consolidated available baseline information for each Indigenous Nation engaged on the Project with respect to current use, Indigenous health and socioeconomic conditions, Indigenous rights, including intangible aspects of rights such as governance rights, and physical and cultural heritage. The intention for each Indigenous Nation-specific section was to provide a stand-alone summary of information obtained by Alamos for each Indigenous Nation and review of how it has been considered in the assessment of potential effects of the Project. The response to IAAC-R2-57 supported the original conclusions of the EIS.

The proposed alterations totaling a 23.1 ha reduction of the PDA described in this document will not result in additional adverse effects within the LAA as addressed above at the MacLellan site and there is no change to EIS conclusions.

4 Conclusions

Stantec has prepared this report on behalf of Alamos in support of the NOA/NOC application for modification to the approved MacLellan site (Licence No. 3391) and the federal Decision Statement for the Lynn Lake Gold Project. The NOA/NOC application is filed in accordance with Section 14(1) of *The Environment Act* (which requires a proponent to notify the Director [for Class 1 and 2 developments] if the proponent intends to alter a licensed development [MECP 2022]) and filed in accordance with conditions 2.16 and 2.17 of the federal Decision Statement (which require notification of IAAC if the proponent is proposing to carry out the Designated Project in a manner other than described in the Decision Statement).

The proposed alteration encompasses an increase to the mine tonnage, an extended mine life (specifically extended production period), and modifications to the approved MacLellan site, inclusive of the adjustment of footprints of several of the Project components and the addition of a couple new Project components. Those components that have been modified through engineering detailed design include the MRSA, TMF, TMF pond, overburden stockpile, topsoil stockpile, worker camp, OEM platform, temporary crushing area, OSA, explosives mixing plant, process plant, open pit, access road, and water management infrastructure (sumps, collection pond, the siting of the sewage treatment plant). The new Project components include the addition of a satellite pit and additional construction laydown areas.

Potential interactions of the proposed alteration and the environment were evaluated with likely interactions examined to assess residual effects on the assumption of typical mitigation measures representative of best practices and previous construction methods employed at the MacLellan site. Based on information available to date and as presented in this NOA/NOC, residual effects of the proposed alterations are characterized in the same way as presented in the EIS (Stantec 2020a) and the EAP Report (Stantec 2020b) for the following VCs:

- Atmospheric Environment
- Noise and Vibration
- Vegetation and Wetlands*
- Wildlife and Wildlife Habitat
- Labour and Economy
- Community Services, Infrastructure, and Wellbeing
- Land and Resource Use
- Heritage Resources
- Current Use of Lands and Resources for Traditional Purposes by Indigenous Peoples
- Indigenous Peoples

**The proposed alterations will not result in additional adverse effects on vegetation and wetlands at the MacLellan site and there is no change to the EIS (Stantec 2020a) and the EAP Report (Stantec 2020b) conclusions for vegetation and wetlands, however, the LAA has changed from what was presented in the EIS and EAP Report because of groundwater drawdown and changes in the PDA. The LAA is based on a 100 m buffer around the furthest expected groundwater drawdown contour, a 1 km buffer around the revised PDA extent, and also a 1 km buffer around the PR 391 highway. The changes increase the LAA by 43.5 ha from that presented in the EIS and EAP Report.*

Based on information available to date and as presented in this NOA/NOC, residual effects characterizations in this NOA/NOC differed from the residual effects characterizations in the EIS (Stantec 2020a) and the EAP Report (Stantec 2020b) for the following VCs:

- Groundwater
- Surface Water
- Fish and Fish Habitat
- Human Health

Results of the updated groundwater model do not change the characterization of residual effects to groundwater quality, but do change the magnitude of residual effect to groundwater quantity, which is now high in the PDA and low within the LAA/RAA. However, results of the updated groundwater assessment do not change the significance rating for groundwater from those presented in the EIS, which was not significant.

Results of the updated surface water balance model do not change the characterization of residual effects to surface water quantity (i.e., stream flows and lake levels) from those presented in the EIS. However, the results of the updated surface water quality model do change the characterization of residual effects to surface water quality from those presented in the EIS. This is because of differences in the magnitude, timing, duration, and location of predicted water quality concentrations that exceed water quality guidelines for the protection of freshwater aquatic life and because of the use of more stringent Federal Environmental Quality Guidelines (FEQGs) for screening model results in this NOA/NOC. Whereas water quality guideline exceedances were predicted to occur primarily in the Keewatin River tributary KEE3-B1 during post-closure in the EIS, water quality guideline exceedances were predicted to occur in Minton Lake, tributary KEE3-PAY1 (the Payne Lake outlet), and tributary KEE3-B1 during operation, closure, and post-closure phases in the NOA/NOC.

Results of the updated surface water quality model have increased the magnitude of residual effects to surface water quality from moderate (EIS; Stantec 2020a) to high (this NOA/NOC). This is due to predicted increases in total arsenic, total cobalt, and dissolved copper concentrations in tributary KEE3-B1, tributary KEE3-PAY1, and Minton Lake that extend into post-closure. However, Alamos will reduce the risk to fish and other aquatic resources in these waterbodies during all phases by implementing the SWMMP (Version 0, January 2025), including its adaptive management framework, if necessary. This adaptive management framework includes trigger response thresholds and a list of additional mitigation measures that could be implemented to reduce contaminant loadings from the Project (e.g., passive or active treatment). Therefore, with implementation of the SWMMP (monitoring and

adaptive management as required), the residual effects to surface water quality are expected to be similar to the assessment in the EIS and not significant.

Changes to the approved MacLellan site and changes in stream flows and lake levels predicted by the updated surface water balance model water do not change the significance of residual effects to fish habitat at the MacLellan site, which was rated as low in magnitude, local in geographic extent, short-term in duration and reversible in the EIS. This is because alterations to the approved MacLellan site will not result in any additional HADD of fish habitat and none of the predicted changes in stream flow or lake levels are large enough to reduce the quantity or quality of fish habitat used by any fish species or life stage more than predicted in the EIS. However, predicted changes in the extent of groundwater table drawdown may affect additional fish-bearing swamps at the MacLellan site. The fish-bearing status of these swamps will be continued to be investigated, and additional offsets or monitoring may be adapted in the Management and Monitoring Plans as required. A change in the fish-bearing status will not result in a negative impact that cannot be managed through the Fisheries Act Authorization and/or Management and Monitoring Plans, as appropriate.

Results of the updated surface water quality model have increased the magnitude of residual effects to fish health, growth, or survival from negligible (EIS; Stantec 2020a) to high (this NOA/NOC). This is due to predicted increases in total cobalt in tributary KEE3-B1 and dissolved copper concentrations in tributary KEE3-PAY1 and Minton Lake that extend into post-closure. However, residual effects to fish health, growth, or survive are expected to remain not significant because Alamos will reduce the risk to fish and other aquatic resources in these waterbodies during all phases by implementing the SWMMP (Version 0, January 2025) and the adaptive management framework therein, if and as necessary.

The residual effects of the proposed alterations to the human health VC are expected to be characterized in the same way as presented in the EIS (Stantec 2020a) and the EAP Report (Stantec 2020b), with the exception of the magnitude and the geographic extent of the residual effects, which are now of negligible to low magnitude and confined to the LAA geographic area. Overall, the effects are not significant.

Overall, the proposed alterations described in this NOA/NOC are not significant and do not appear to warrant any adjustment to either the federal Decision Statement or the provincial Environment Act Licence No 3391. Alamos remains committed to developing and operating the Project inclusive of the proposed alterations in a manner that provides environmental protection for VCs and long-term benefits for the region. The additional mitigation measures identified in Section 3.3, which are beyond those identified in the EIS (Stantec 2020a) and the EAP Report (Stantec 2020b) will be incorporated (change from Version 0 to Version 1) into the applicable Management and Monitoring Plans, which are living documents following approval of this NOA/NOC.

A draft of this NOA/NOC was shared with all Indigenous Nations involved in the Project. No feedback has been received to date. If any feedback is received, Alamos will address it with the respective Indigenous Nation(s) and share this information with the Province and IAAC.

5 References

BC MOE (British Columbia Ministry of Environment). 1990. Ambient Water Quality Criteria for Fluoride – Technical Appendix. BC MOE Water Sustainability Branch, Victoria, BC. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/fluoride-tech.pdf.

BC MOE. 2019b. Copper Water Quality Guideline for the Protection of Aquatic Life – Technical Report. BC Ministry of Environment and Climate Change Strategy, Victoria, BC. WQG-03-1. 76pp.

Camargo, J.A. 2003. Fluoride Toxicity to Aquatic Organisms: a review. Chemosphere. 50:251-264.

CCME (Canadian Council of Ministers of the Environment). 2001. Canadian Water Quality Guidelines for the Protection of Aquatic Life – Arsenic. CCME, Hull, QC.

CCME. 2002. Canadian Water Quality Guidelines for the Protection of Aquatic Life – Inorganic Fluorides. CCME, Hull, QC.

CCME. 2004. Canadian Guidance Framework for the Management of Freshwater Systems - Phosphorus. CCME, Hull QC.

CCME. 2012a. The Air Quality Management System. Federal, Provincial and Territorial Roles and Responsibilities. Canadian Council of Ministers of the Environment (CCME). October 11, 2012.

CCME. 2012b. Guidance Document on Achievement Determination Canadian Ambient Air Quality Standards for Fine Particulate Matter and Ozone. PN 1483. Canadian Council of Ministers of the Environment.

CCME. 2017. Canada's Air: CAAQS. Canadian Council of Minister of the Environment (CCME). 2017.

CCME. 2019. Guidance Document on Air Zone Management. PN 1593, 978-1-77202-050-2 PDF. Canadian Council of Ministers of the Environment. Available at https://ccme.ca/en/res/guidancedocumentonairzonemanagement_secured.pdf. Last accessed on July 10, 2024.

CCREM (Canadian Council of Resource and Environment Ministers). 1987. Canadian Water Quality Guidelines. CCREM, Ottawa, ON. 1484pp.

CEA Agency (Canadian Environmental Assessment Agency). 2015. Technical Guidance for Assessing the Current Use of Lands and Resources for Traditional Purposes under *CEAA 2012.* Canadian Environmental Assessment Agency, Ottawa, Ontario.

CEA Agency. 2017. Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act, 2012*. Lynn Lake Gold Project. Alamos Gold Inc. Version 2: November 2017.

CEMI (Centre for Excellence in Mining Innovation). 2010. Literature Review of Current Fugitive Dust Control Practices within the Mining Industry. August 11, 2010. Submitted to: The Centre for Excellence in Mining Innovation (CEMI). Submitted by: Golder Associates Ltd.

Cott, P.A., and B. Hanna. 2005. Monitoring explosive-based winter seismic exploration in waterbodies, NWT 2000-2002. In: Offshore Oil and Gas Environmental Effects Monitoring: Approaches and Technologies (S.L. Armstrong, P.J. Cranford, and K. Lee eds.). Battelle Press, Columbus, OH.

De Schamphelaere, K.A.C. and C.R. Janssen. 2004. Effects of dissolved organic carbon concentration and source, pH, and water hardness on chronic toxicity of copper to *Daphnia magna*. Environmental Toxicology and Chemistry. 23(5): 1115-1122.

ECCC (Environment and Climate Change Canada). 2002. Sulphur in Diesel Fuel Regulations. SOR/2002-254. Available at https://laws-lois.justice.gc.ca/PDF/SOR-2002-254.pdf. Last accessed on November 12, 2019.

ECCC. 2005. Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities. March 2005. Prepared by: Cheminfo Services Inc. Prepared for: Environment and Climate Change Canada. Available at http://www.bv.transports.gouv.qc.ca/mono/1173259.pdf. Last accessed on November 12, 2019.

ECCC. 2017. Federal Environmental Quality Guidelines: Cobalt. May 2017. Ottawa, ON.

ECCC. 2021. Federal Environmental Quality Guidelines: Copper. April 2021. Ottawa, ON.

DFO (Fisheries and Oceans Canada and Manitoba Natural Resources. 1996. Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat. May 1996. 48 p.+ appendices

DFO. 2013. Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada. Can. Sci. Adv. Secr. Sci. Adv. Rep. 2013/017.

DFO. 2025. Manitoba Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat. Web site at https://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/mb-eng.html

Government of Canada. 2022. Migratory Bird Regulations, 2022. Last amended 2024. Available at https://laws-lois.justice.gc.ca/PDF/SOR-2022-105.pdf.

Government of Canada. 2025. Species at Risk Public Registry, A to Z species index. Accessed on February 24, 2025, at https://species-registry.az.ec.gc.ca/index-en.html#/species/958-677.

Health Canada. 2016a. Human Health Risk Assessment for Diesel Exhaust. Fuel Assessment Section, Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada. March 2016.

Health Canada. 2016b. Human Health Risk Assessment for Sulphur Dioxide (CAS RN:7446-09-5), Analysis of Ambient Exposure to and Health Effects of Sulphur Dioxide in the Canadian Population. Water and Air Quality Bureau, Safe Environments and Consumer Safety Branch, Health Canada. January 2016.

Health Canada. 2022. Canadian Health Science Assessment for Fine Particulate Matter (PM2.5). March, 2022. Ottawa, Ontario. ISBN. 978-0-660-41742-4.

Health Canada. 2023a. Guidance for Evaluating Human Health Effects in Impact Assessment: Human Health Risk Assessment.

Health Canada. 2023b. Guidance for Evaluating Human Health Effects in Impact Assessment: Air Quality.

Health Canada. 2023c. Guidance for Evaluation Human Health Effects in Impact Assessment: Drinking and Recreational Water Quality.

Health Canada. 2023d Guidance for Evaluating Human Health Effects in Impact Assessment: Country Foods.

Health Canada. 2023e. Guidance for Evaluating Human Health Effects in Impact Assessment: Noise.

Health Canada. 2024. Guidelines for Canadian Drinking Water Quality – Summary Tables. Available at: Guidelines for Canadian Drinking Water Quality - Summary Tables - Canada.ca.

Kramer, K.J.M., R.G. Jak, B. van Hattum, R.N. Hooftman, J.J.G. Zwolsman. 2004. Copper toxicity in relation to surface water-dissolved organic matter: Biological effects to *Daphnia magna*. Environmental Toxicology and Chemistry. 23(12):2971-2980.

MB CDC (Manitoba Conservation Data Centre). 2015. Accessed at: https://gov.mb.ca/nrnd/fish-wildlife/cdc/index.html .

MECC (Manitoba Environment and Climate Change). 2023. Information Bulletin – Environment Act Proposal Report Guidelines. Available at https://www.manitoba.ca/sd/pubs/environmental-approvals/eap_report_guidelines.pdf.

MECP (Manitoba Environment, Climate and Parks). 2022. Information Bulletin – Alterations to Developments with Environment Act Licences. Available at http://www.gov.mb.ca/sd/eal/publs/alteration_guidelines2016.pdf. Accessed September 18, 2023.

MHHL (Manitoba Health and Healthy Living). 2009a. Community health Assessment Guidelines 2009. Available online at: https://www.gov.mb.ca/health/rha/docs/chag.pdf. Last accessed in October 2019.

MHHL 2009b. Community health Assessment Guidelines 2009. Appendices. Available online at: https://www.gov.mb.ca/health/rha/docs/chag_app.pdf. Last accessed in October 2019.

MINR (Manitoba Indigenous and Northern Relations). 2019. Crown Aboriginal Consultations. Available at https://www.gov.mb.ca/inr/reconciliation strategy/index.html. Accessed on November 5, 2019.

MSD (Manitoba Sustainable Development). 2005. Manitoba Ambient Air Quality Criteria. July 2005. Available at https://www.gov.mb.ca/sd/envprograms/airquality/pdf/2005_air_quality.pdf. Last accessed on November 12, 2019.

MSD. 2017. Information Bulletin - Environment Act Proposal Report Guidelines. Winnipeg: Government of Manitoba.

OEHHA (Office of Environmental Health Hazard Assessment). 2008. Acute Exposure Reference Levels, Hydrogen Cyanide. Available at https://oehha.ca.gov/chemicals/hydrogen-cyanide.

OMECP (Ontario Ministry of the Environment, Conservation and Parks). 1985. Guidelines on Information Required for the Assessment of Blasting Noise and Vibration.

OMECP. 2011. Rationale for the Development of Soil and Groundwater Standard for Use at Contaminated Sites in Ontario. April, 2011. Standards Development Branch, Ontario Ministry of the Environment.

OMECP. 2012. Ontario's Ambient Air Quality Criteria. Ontario Ministry of the Environment and Climate Change (MOECC), formerly Ontario Ministry of the Environment. April 2012. Available at http://www.airqualityontario.com/downloads/AmbientAirQualityCriteria.pdf. Last accessed on September 9, 2024.

OMECP. 2015. Toxicity Reference Value (TRV) Selections for Cyanide. Human Toxicology and Air Standards Section, Standards Development Branch, Ontario Ministry of the Environment and Climate Change. November 2015.

OMECP. 2022. Human Health Toxicity Reference Values (TRVs). Human Toxicology and Air Standards Section, Technical Assessment and Standards Development Branch, Ontario Ministry of the Environment, Conservation and Parks. December 2022.

Reuther, R. 1992. Arsenic introduced into a littoral freshwater model ecosystem. Sci. Tot. Environ. 115: 219-237.

Stantec (Stantec Consulting Ltd). 2016. HRIA of the Lynn Lake Joint Venture MacLellan and Farley Lake Mines. Permit A37-15. Manuscript on file with Manitoba Sport, Culture and Heritage, Historic Resources Branch.

Stantec. 2017a. Lynn Lake Gold Project (LLGP): Water Quality Baseline Technical Data Report. 2015-2017 Aquatic Environment Baseline Program. A report prepared for Alamos Gold Inc., Toronto, ON by Stantec Consulting Ltd., Winnipeg, MB

Stantec. 2017b. Lynn Lake Gold Project (LLGP): Fish, Fish Habitat, and Fish Tissue Baseline Technical Data Report. 2015/2016 Baseline Program. A report prepared for Alamos Gold Inc., Toronto, ON by Stantec Consulting Ltd., Winnipeg, MB.

Stantec. 2020a. Environmental Impact Statement for the Lynn Lake Gold Project. Prepared for Alamos Gold Inc. Winnipeg, MB.

Stantec. 2020b. Lynn Lake Gold Project Environment Act Proposal – MacLellan Site. Prepared for Alamos Gold Inc. Winnipeg, MB.

Stantec. 2025. Lynn Lake Gold Project: MacLellan Gold Mine Closure Plan. Closure Plan Pursuant to Manitoba Mine Closure Regulation 67/99 and Environment Act Licence No 3391 (MacLellan Gold Mine). Approved by Manitoba Mining, Oil and Gas. Winnipeg, MB.

Stubblefield, W.A., E.V. Genderen, A.S. Cardwell, D.G. Heijerick, C. R. Janssen, K.A.C. De Schamphelaere. 2020. Acute and Chronic Toxicity of Cobalt to Freshwater Organisms: Using a Species Sensitivity Distribution Approach to Establish Internation Water Quality Standards. Environmental Toxicology and Chemistry. 39 (4): 799-811.

US EPA (United States Environmental Protection Agency). 2007. Aquatic Life Ambient Freshwater Quality Criteria – Copper. 2007 Revision. Washington, DC.

US EPA. 2010. Toxicological Review of Hydrogen Cyanide and Cyanide Salts, in support of Summary Information on the Integrated Risk Information System (IRIS). September 2010.

US FTA (United States Federal Transit Administration). 2018. Transit Noise and Vibration Impact Assessment Manual. FTA Report No. 0123. Prepared by John A. Volpe National Transportation Systems Center.

WHO (World Health Organization). 2006. Air Quality Guidelines, Global Update 2005, Particulate matter, ozone, nitrogen dioxide and sulfur dioxide.

WHO. 2009. Night noise guidelines for Europe. World Health Organization. Regional Office for Europe. Available at https://www.who.int/europe/publications/i/item/9789289041737.

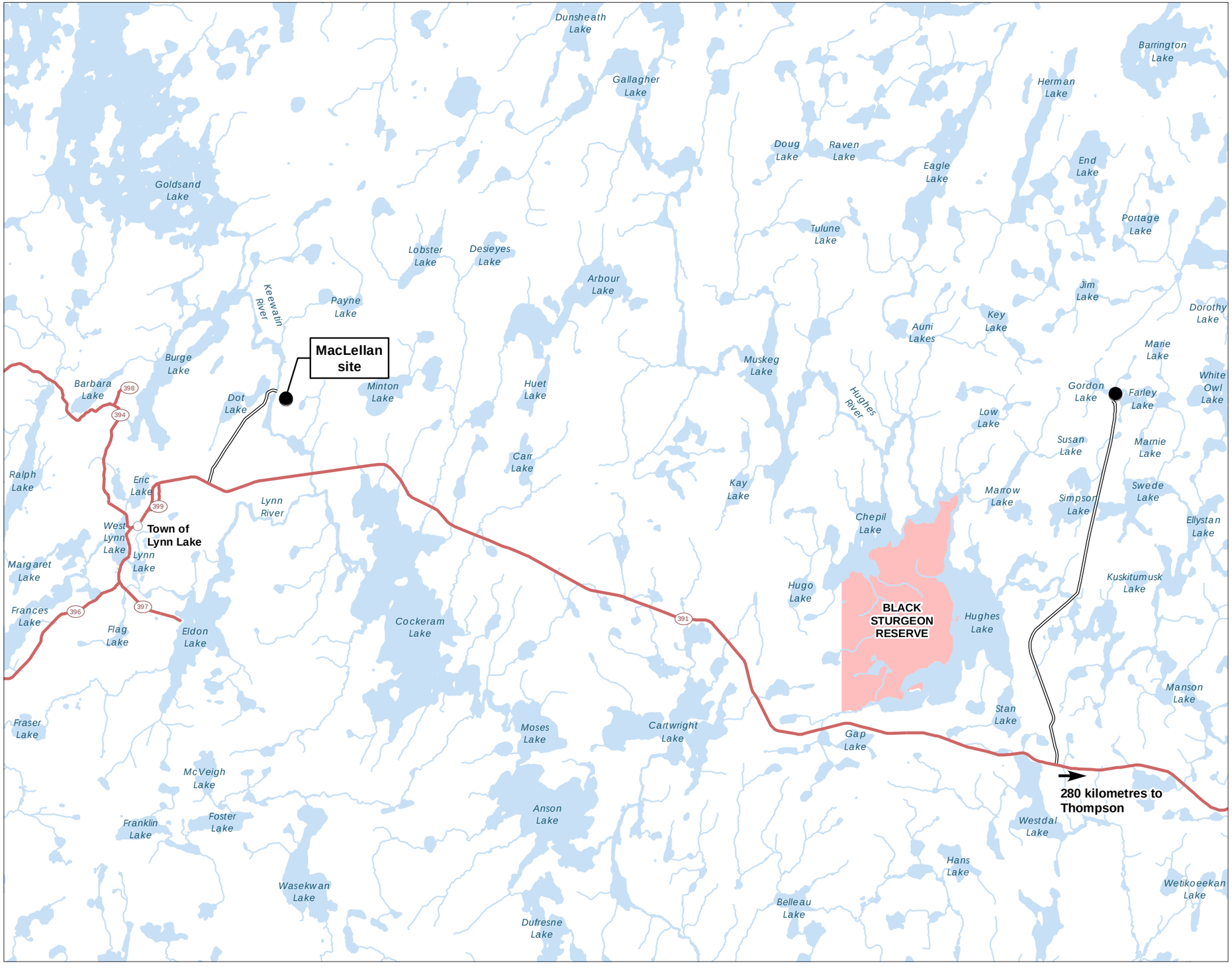
WHO. 2021. WHO global air quality guidelines - Particulate matter ($PM_{2.5}$ and PM_{10}), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. Geneva. Licence: CC BY-NC-SA 3.0 IGO.

WRAP (Western Regional Air Partnership). 2006. Western Regional Air Partnership Fugitive Dust Handbook. Western Regional Air Partnership. September 7, 2006. Available at https://www.env.nm.gov/wp-content/uploads/sites/2/2017/02/WRAP_FDHandbook_Rev_06.pdf. Last accessed on November 12, 2019.

Wright, D.G., and G.E. Hopky. 1998. Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters. Can. Tech. Rep. Fish. Aquat. Sci. 2107: ii+ 34 p.

Appendices

Appendix A Maps



Stantec

Alamos Gold Inc.

Landbase

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

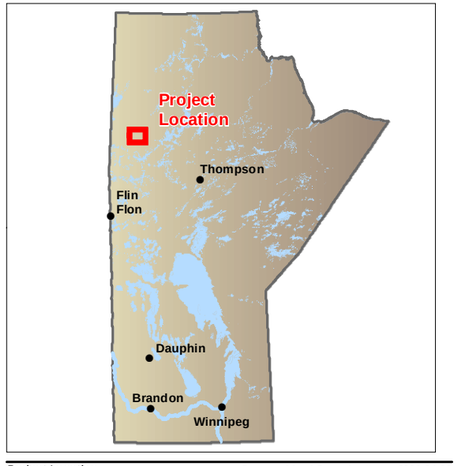
N

0 2.5 5 Kilometres

(At original document size of 11x17)
1:150,000

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 2020-04-02
Technical Review by ASomers on 2020-04-02
Senior GIS Review by GKroupa on 2020-04-02

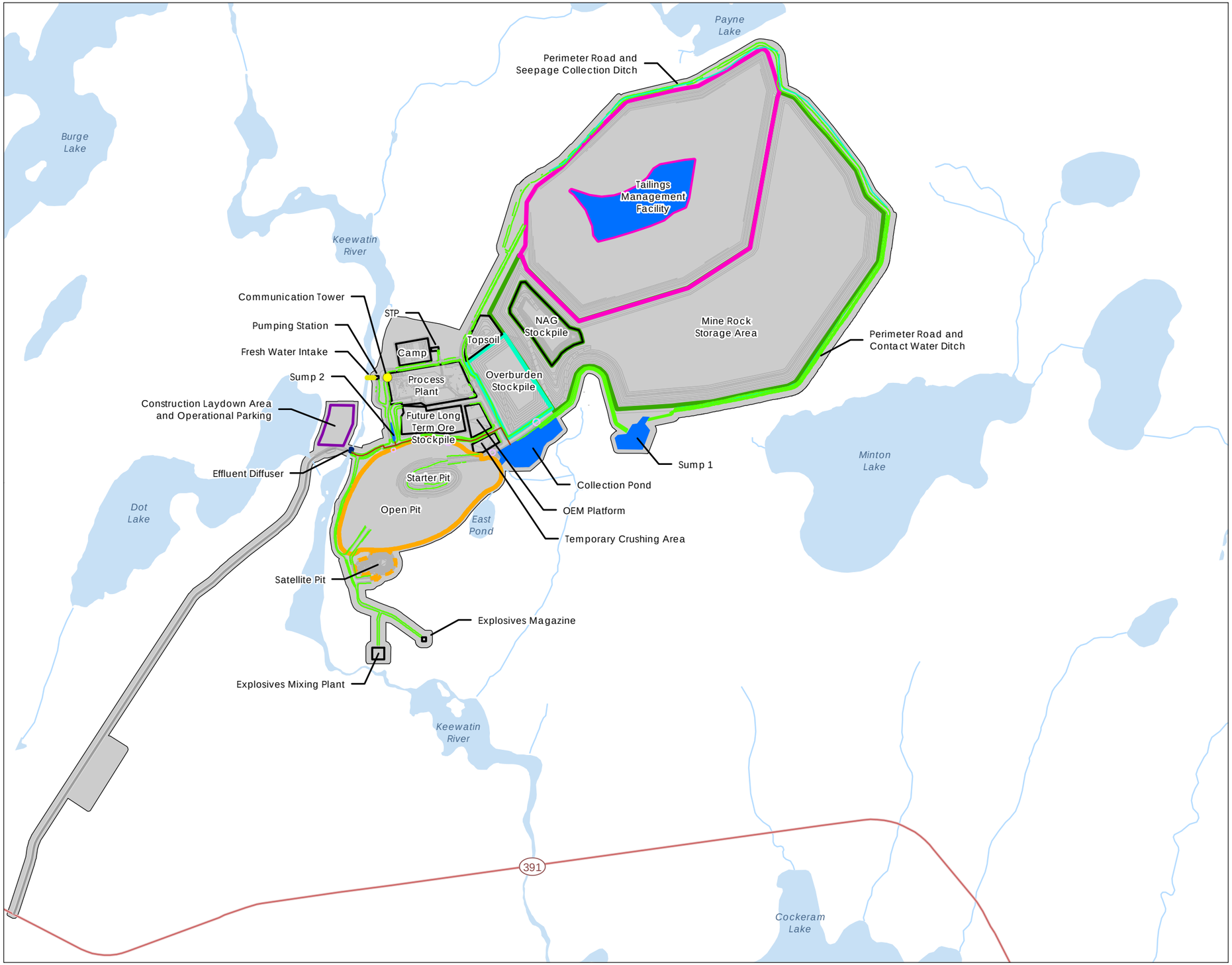
Client/Project 111473008

ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
1

Title
General Project Area

G:_GIS Project Folder\111473008_LGP_EA\figures\Ch1_Intro\For Review\Map1-1 GeneralProjectArea_20200402.mxd Revised: 2020-04-02 By: ACampigotto



Stantec

Project Infrastructure (NOA)

- Communication Tower
- Culvert
- Ditching
- Corridor / Access Road
- Collection Pond Discharge
- Fresh Water Intake
- Effluent Diffuser
- Mine Rock Storage Area
- Overburden Stockpile
- Tailings Management Facility
- Open Pit
- Satellite Pit
- Collection Pond/Sumps
- Other Infrastructure
- Construction Laydown Area
- NOA Project Development Area (PDA)

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 2025-01-31
Technical Review by KMathers on 2025-01-31

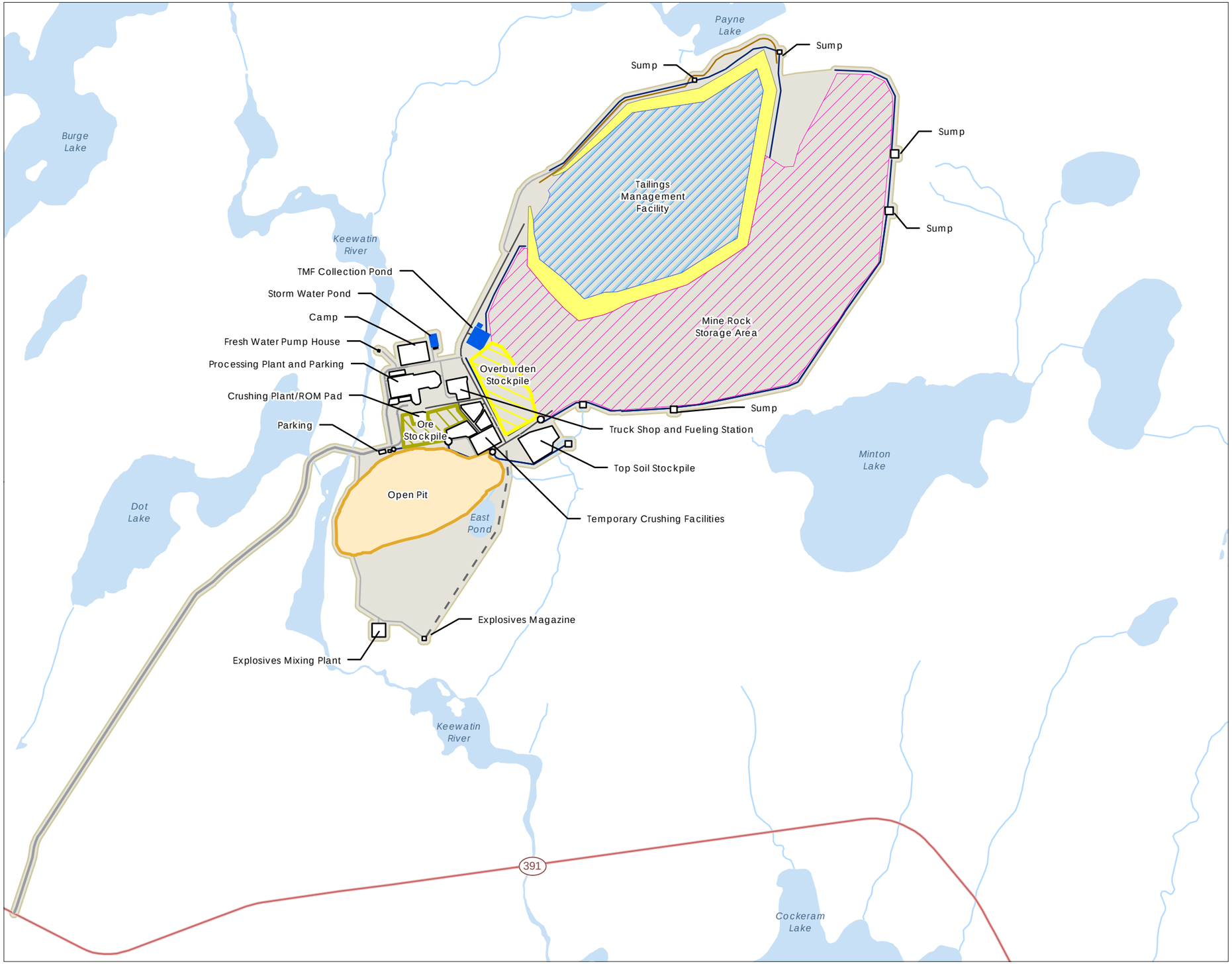
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473084

Map No.
2

Title
NOA/NOC Footprint (PDA) - MacLellan site

G:\ GIS Project Folder\111473008 LLGP EA\admin\data out\STANTEC\ 20250131_ Mac_ PDA_ adjustments\ 111473084 LLGP MacLellan Possible Updated PDA NOA 20250131.mxd Revised: 2025-01-31 By: ACampigotto



Stantec

Alamos Gold Inc.

Project Infrastructure

- Project Development Area
- Proposed Open Pit
- Proposed Mine Rock Stockpile
- Proposed Overburden Stockpile
- Proposed Ore 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

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 2020-05-08
Technical Review by ASomers on 2020-05-08
Senior GIS Review by GKroupa on 2020-05-08

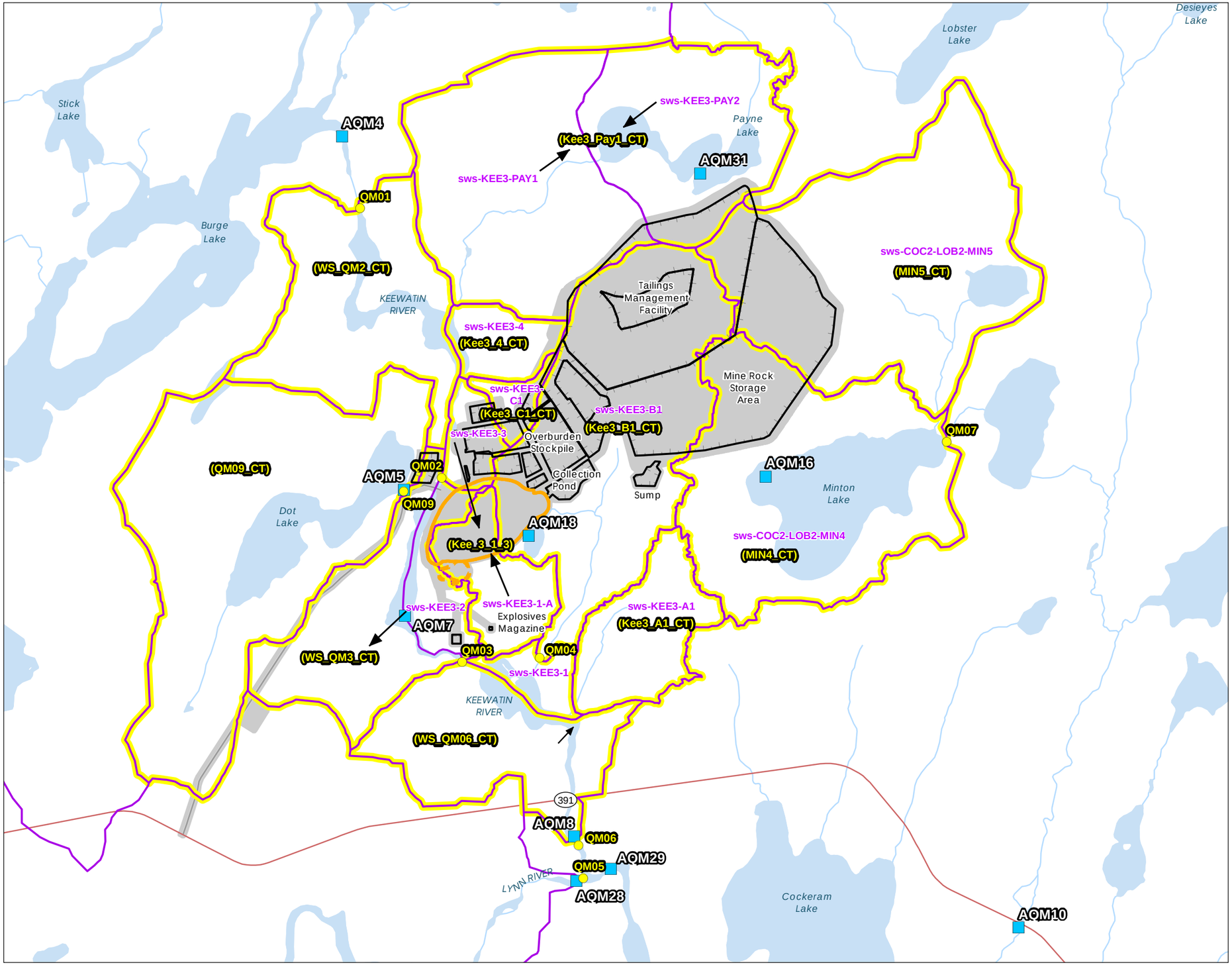
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473008

Map No.
3

Title
EIS Footprint (PDA)
- MacLellan site

G:_GIS Project Folder\111473008_LGP_EA\Figures\Ch2_Project Description\For Review\Map#2_PD_MacLellanDevelopment_20200508.mxd Revised: 2020-05-11 By: ACampigotto



Stantec

Project Infrastructure
- Proposed Open Pit
- Proposed Satellite Pit
- Proposed Infrastructure
- Project Development Area (PDA)

Project Data
- Hydrology Model Subwatersheds (sws-FAR5)
- Water Quality Model Subcatchments (QF04_CT)
- Combined Subwatersheds
- Hydrology Monitoring Station
- Water Quality Station

Landbase
- Access Road
- Highway
- Watercourse
- Waterbody

N

0 0.45 0.9 Kilometres

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

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 2025-02-03
Technical Review by KMathers on 2025-02-03

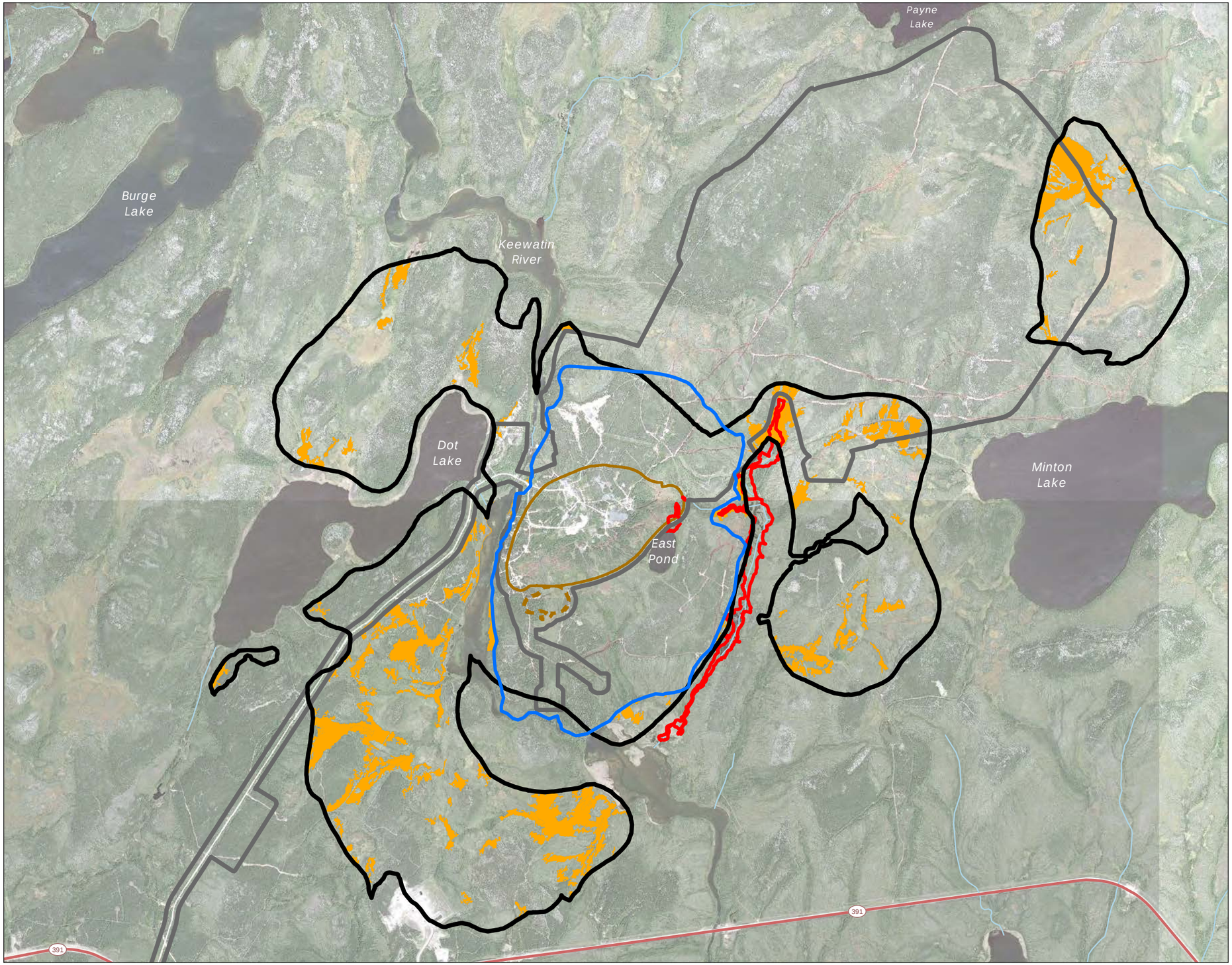
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473084

Map No.
4

Title
Project Components and Catchment Areas at MacLellan Site

G:\GIS Project Folder\111473008-LGP-EA\IRs\3\WQ_2024_Program\111473084 ProjectComponents and Catchments MacLellan 20250203.mxd Revised: 2025-02-03 By: ACampigotto



Stantec

Project Infrastructure

- Open Pit
- Satellite Pit
- Project Development Area

Study Area

- Extent of Groundwater Table Draw-down Greater than 1 m (NOA)
- Extent of Groundwater Table Draw-down Greater than 1 m (EIS)

Ground-truthed Landuse/Landcover

- Fish-bearing swamp

Remotely Sensed Landuse/Landcover

- Swamp

Landbase

- Highway

N

0 500 1,000 Metres

(At original document size of 11x17)
1:27,500

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 2025-02-28
Technical Review by BHorne on 2025-02-28

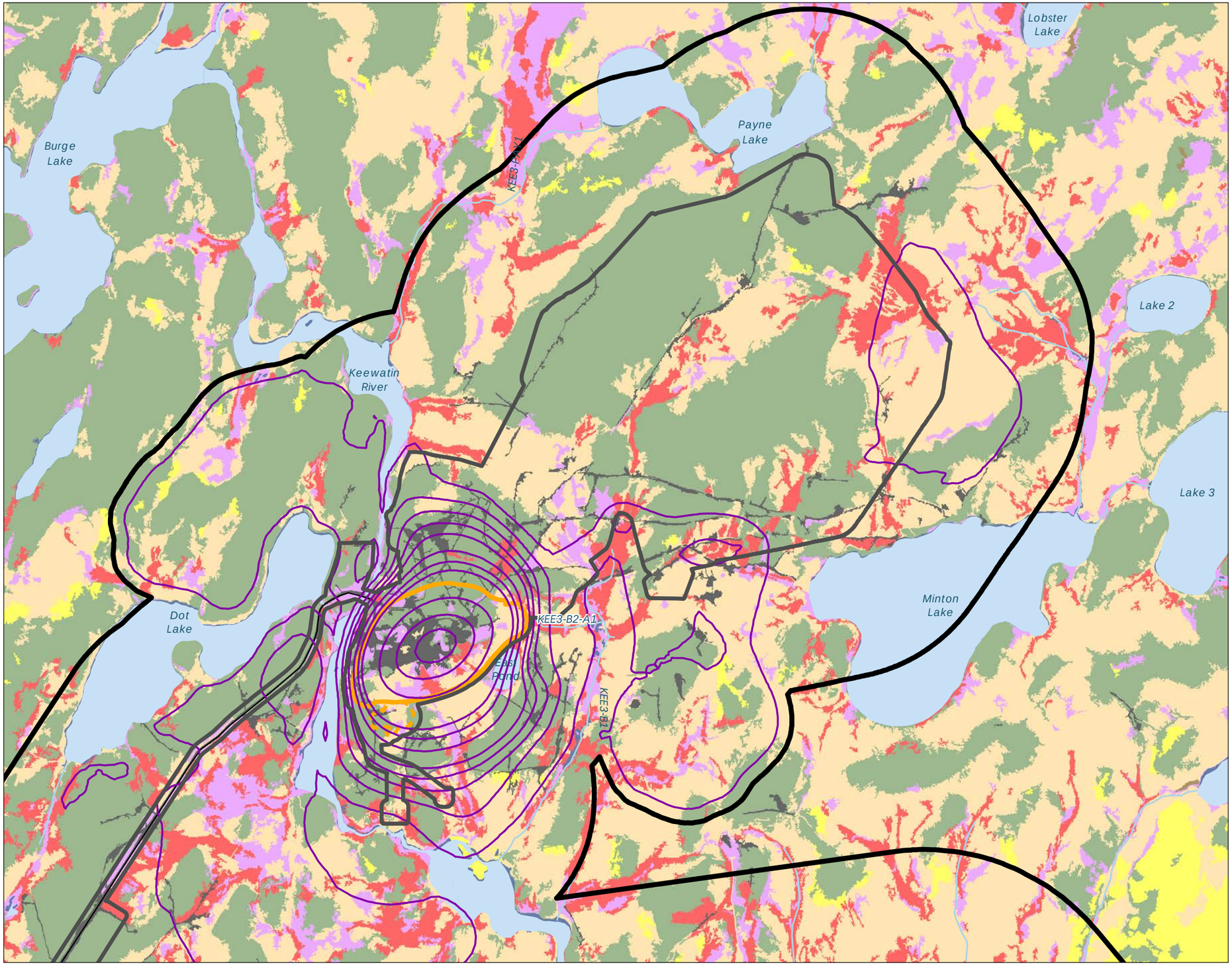
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473084

Map No.
5

Title
Location of Ground-truthed Fish-bearing Swamps and Remotely Sensed, Potential Fish-bearing Swamps within the Zones of Groundwater Table Draw-down Predicted for the EIS and the NOA/NOC

G:\ GIS Project Folder\111473008 LGP EA\Mxd\AAC #2 80 wetlands surveys\NOA\Comparison of RemotelySensed and GroundTruthed Swamps MacLellan NOA 20250228.mxd Revised: 2025-02-28 By: ACampigotto



Stantec

Project Infrastructure
- Open Pit
- Satellite Pit
- Project Development Area

Study Area
- Vegetation and Wetlands Local Assessment Area (LAA)

Survey Locations
- Predicted Water Table Drawdown Contours

Land Use/Land Cover
- Barren
- Coniferous
- Deciduous
- Mixedwood
- Shrubland
- Water
- Bog
- Fen
- Marsh
- Swamp
- Development

Landbase
- Existing Access Road
- Watercourse
- Waterbody

N

0 250 500 Metres
(At original document size of 11x17)
1:28,000

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 2025-02-24
Technical Review by NKearns on 2025-02-24

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473084

Map No.
6

Title
Area of Potential Indirect Wetland Affects from Groundwater Drawdown - MacLellan site

G:\GIS Project Folder\111473008-LGP-EA\Rev\R2_109-ULC_GW drawdown\NOA Update\ULC Vegetation LAA with updated Max GW drawdown MacLellan_20250224.mxd Revised: 2025-02-24 By: ACampigotto

Appendix B Summary of Light Modelling Results for the Lynn Lake Gold Project Revised 2023 Mine Design

Stantec

Memo

To:	Alamos Gold Inc.	From:	Stantec Consulting Ltd.
Project/File:	111473076.301.104	Date:	June 19, 2025

Reference: Summary of Light Modelling Results for the Lynn Lake Gold Project Revised 2023 Mine Design

The Lynn Lake Gold Project (LLGP; the Project) consists of two primary deposit sites, the MacLellan site and Gordon site, which are both located near the Town of Lynn Lake, Manitoba. Alamos Gold Inc. (Alamos) will construct (redevelop), operate and eventually close/reclaim open-pit gold mines at both historical mine sites. The Project will be built as two open pit mines with a centralized processing plant facility and a tailings management facility (TMF). The processing plant, located at the MacLellan site has an expected nominal processing throughput of 8,000 tonnes/day with an estimated 17-year production life.

Stantec Consulting Ltd. (Stantec) completed an Environmental Impact Statement (EIS) for the Project that included Light as a Valued Component (Stantec 2020). The EIS was completed to fulfill a requirement of the "Guidelines for the Preparation of an Environmental Impact Statement" (2017) pursuant to the *Canada Environmental Assessment Act* (2012) for the Project. The assessment provides an overview of the existing conditions in the Project area and identifies the changes in ambient light at key receptor locations for the Project to determine potential residual and cumulative changes to lighting in support of the EIS.

The Project was approved under the *Canadian Environmental Assessment Act* (2012) with a federal Decision Statement issued March 5, 2023 (subsequently revised July 28, 2024). It was approved under *The Environment Act* of Manitoba with two provincial licences issued March 6, 2023 (Licence No. 3390 relating to the Gordon site and Licence No. 3391 relating to the MacLellan site).

Since Project approval, Alamos has completed a 2023 Feasibility Study Update (FSU) NI 43-101 Technical Report (Alamos 2023) that includes design updates. The design updates include, but are not necessarily limited to the following:

- The processing plant and TMF at the MacLellan site
- General infrastructure at both sites; and
- Major development area layouts.

Stantec has been engaged by Alamos to prepare an update of the light assessment for the Project based on the 2023 Feasibility Study Update or FSU. This update includes a review of the changes to the Project design, and changes/updates to the light model to assess how these Project design changes may affect the conclusions of the light assessment completed back in 2020. This memo summarizes the findings and results of the light assessment updates for the Project.

1 Summary of Major Changes to Project Design

Stantec reviewed and compared the Project design parameters for 2019, and the update published in 2023. Mine design changes, relevant to lighting, are based on the following design information provided by Alamos for the Project:

- Feasibility Study Update, NI 43-101 Technical Report for the Lynn Lake Project. Issue date: August 22, 2023 (Alamos 2023).
- Updated lighting plan design documents (Worley 2024; pers comm 2024).

The lighting design at the Gordon site has not been updated. Since the lighting design used for the original assessment for Gordon was based on conservative assumptions that are likely to overestimate the lighting required for mining, the initial lighting assessment at Gordon is still considered representative of the final design.

The lighting design at the MacLellan site includes refined designs for the parking area, process area, and primary crushing area. Marked up drawings of the luminaires for these areas as provided by Worley are provided in Appendix A. The exterior lighting design is still being finalized at the MacLellan site, and therefore lighting designs have not been updated for the administrative building, warehouse, assay lab, truck shop, and truck wash area. In these cases, the previous lighting design was also based on conservative assumptions for the anticipated lighting requirements for the activities occurring in those areas, and so the previous lighting design for those areas was still considered representative of the final design (pers comm 2024).

A summary of the relevant changes to the lighting design at MacLellan is listed as follows:

- The parking lot to the north of the process area required a re-alignment of the parking spaces and resulted in a relocation of the luminaires.
- The updated design of the process area shifted a conveyor system and refined the lighting plan for the Fine Ore Bin, Leach Tanks, Oxygen Plant, Thickener, and Primary Crushing. The updated lighting plan resulted in changes in the location and type of some luminaires in those areas.

2 Lighting Modelling Update Results

The light modelling methodology used to assess the potential effects of the 2023 design changes on lighting noted above is identical to the methodology used in the EIS (Stantec 2020). Light modelling focused on changes in illuminance and glare for nearby receptors. The changes in illuminance and glare were assessed using criteria established by the Commission Internationale de l'Éclairage (CIE 2017). A summary of the guideline levels for light trespass and glare are provided in Table 1. The threshold for glare is based on distance between the source and receptor and so the glare threshold in Table 1 is related to the nearest receptor location (Receptor 87).

Table 1 Guideline Threshold Criteria for Lighting Assessment (Based on CIE 2017)

Threshold	Value
Light Trespass	1 lux
Glare *	754 cd

Note:

* The threshold for glare is related to the distance between the source and receptor and so the value shown is based on the distance between the nearest luminaire and Receptor 87

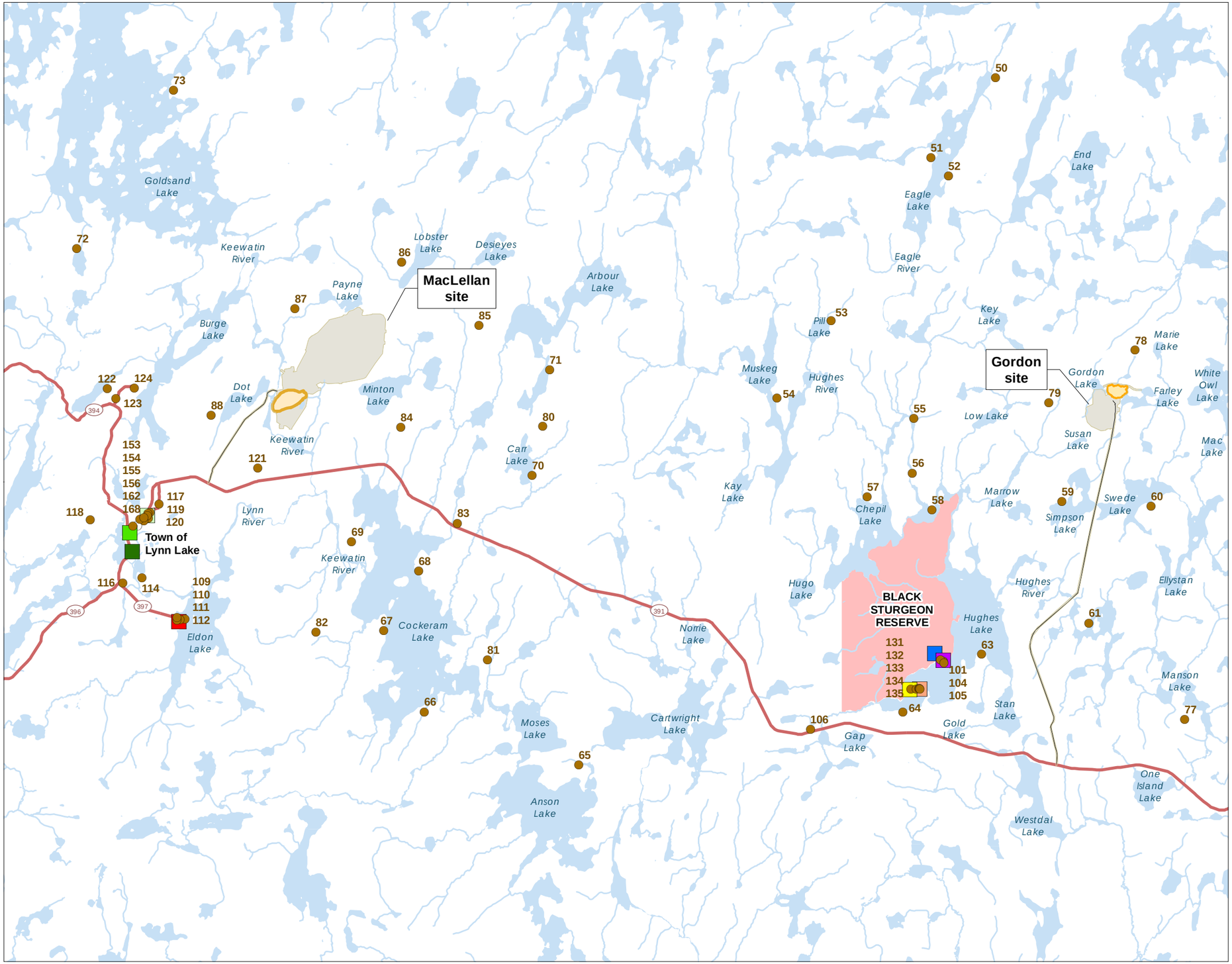
Nearby receptors are shown in Figure 1 and are the same as those considered in the EIS (Stantec 2020). Figure 1 includes receptors that are nearby but that do not have a direct line of sight to project components. Only receptors with a direct line of sight to project components were included in the light modelling update.

A summary of the modelling results for light trespass and glare is provided in Table 2. Light levels were still predicted to be low at nearby receptors. Receptor 87 was predicted to have some glare; however the glare value was still well below the CIE threshold.

The updated lighting design is therefore predicted to comply with the guideline levels for trespass and glare established by the CIE.

Table 2 Predicted Levels of Light Trespass and Glare at nearby Receptors

Receptor ID	Light Trespass (lux)	Glare (cd)
84	<0.0001	<0.001
85	<0.0001	<0.001
86	<0.0001	<0.001
87	0.0002	12
88	0.0001	<0.001
121	0.0005	<0.001
Cluster 1	<0.0001	<0.001
Cluster 2	0.0002	<0.001
Cluster 3	<0.0001	<0.001
Cluster 4	0.0001	<0.001
Cluster 5	0.0001	<0.001
Lynn Lake Cluster North	<0.0001	<0.001
Lynn Lake Cluster Central	<0.0001	<0.001
Lynn Lake Cluster South	<0.0001	<0.001



Stantec

Alamos Gold Inc.

Project Infrastructure
- Proposed Open Pit
- Project Development Area

Receptors
- Individual Receptor

Receptor Groups
- Cluster 1
- Cluster 2
- Cluster 3
- Cluster 4
- Cluster 5
- Lynn Lake Cluster North
- Lynn Lake Cluster Central
- Lynn Lake Cluster South

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

N

0 2.5 5 Kilometres

(At original document size of 11x17)
1:150,000

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 2019-11-27
Technical Review by GHatcher on 2019-11-27
Senior GIS Review by XXxxxxxx on XXXX-xx-xx

Client/Project 111473073
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
1

Title
Receptor Locations Considered for Predictive Modelling

G:_GIS_Project Folder\111473908 - LGP EA\Figures\Chp_4\Atmospheric_Environment\TDR Report\ch1MAP2-3 LGP Rec appr locations_20191127.mxd Revised: 2019-12-04 By: ACampigotto

3 Conclusion

This update of the lighting assessment focused on the potential changes of the Project lighting effects due to the updated Project 2023 design during the operation phase. Changes to the Project design include updates to the parking and road access, along with the location and size of the main process area, the truck wash and truck shop, and the administration building. The lighting model for the operation phase of the Project was updated using the same approach and receptor locations as the previous Stantec 2020 assessment.

The predicted lighting levels from the updated project activities are not expected to change significantly from the previous assessment completed in 2020. Further, the estimated illuminance and glare are not predicted to exceed the guideline levels recommended by the Commission International de l'Éclairage. **In conclusion, the results of the updated lighting assessment do not change the characterization of residual effects, or the significance ratings summarized as presented in the EIS (Stantec 2020).**

4 Limitations and Sign-off

This document entitled was prepared by *Stantec Consulting Ltd.* ("Stantec") for the account of *Alamos Gold Inc.* (the "Client") to support the permitting process for its Lynn Lake Gold Project (the "Project"). In connection therewith, this document may be reviewed and used by the *Impact Assessment Agency of Canada* and *Manitoba Conservation and Climate* participating in the review process in the normal course of its duties. Except as set forth in the previous sentence, any reliance on this document by any other party or use of it for any other purpose is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The information and conclusions in the document are based on the conditions existing at the time the document was published and does not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by the Client or others, unless expressly stated otherwise in the document. Any use which another party makes of this document is the responsibility and risk of such party. Such party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other party as a result of decisions made or actions taken based on this document.

Reference: **Summary of Light Modelling Results for the Lynn Lake Gold Project Revised 2023 Mine Design**

If you have any questions or require additional information, please do not hesitate to contact us

Regards,

Stantec Consulting Ltd.

Prepared by: Digitally signed by Bylhouwer, Brian Date: 2025.06.20 08:55:12 -03'00'

Signature

Brian Bylhouwer

Printed Name

Reviewed by: Digitally signed by Murphy, Mike (Charlottetown) Date: 2025.06.20 09:13:28 -03'00'

Signature

Michael Murphy, Ph.D., P.Eng.

Printed Name

Approved to transmit by: Digitally signed by Mathers, Karen Date: 2025.06.20 09:24:53 -05'00'

Signature

Karen Mathers

Printed Name

5 References

Alamos. 2023. Feasibility Study Update (FSU). NI 43-101 Technical Report for the Lynn Lake Project, Lynn Lake, Manitoba, Canada. August 22, 2023.

Pers comm. 2024. November 1 and November 11, 2024 email correspondence from Robert Halas, (Alamos Gold Inc. Sr. Project Engineer, Lynn Lake, Projects) to Karen Mathers (Stantec Senior Principal - Environmental Services).

Stantec (Stantec Consulting Inc.). 2020. Lynn Lake Gold Project Environmental Impact Statement, May 2020.

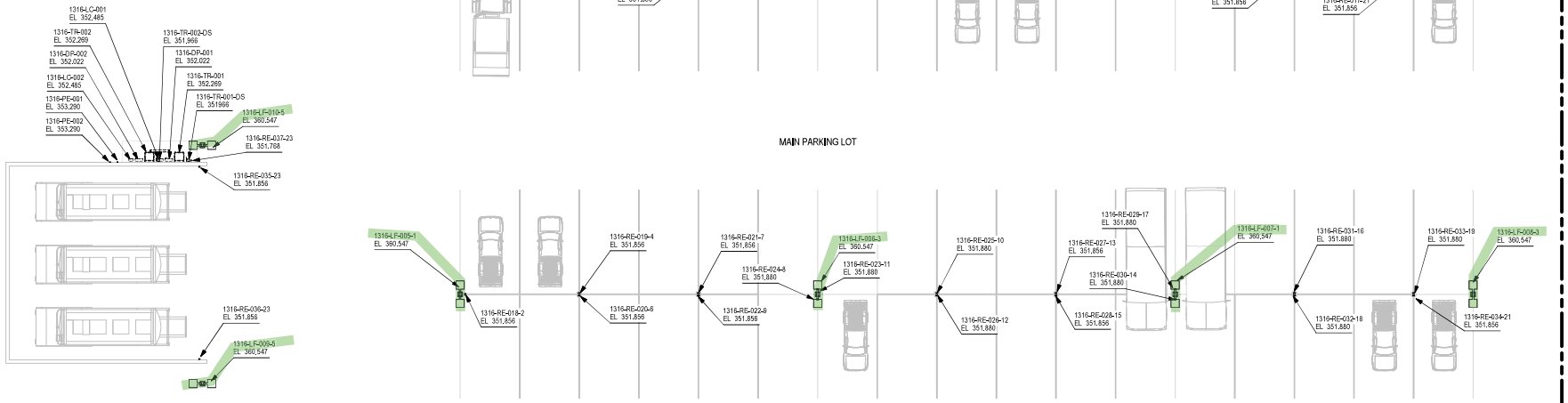
Worley 2024. AGL Design Review Navisworks Drawing.

Reference: Summary of Light Modelling Results for the Lynn Lake Gold Project Revised 2023 Mine Design

Appendix A Updated Light Plans from Worley

NOTES:

1. FOR STANDARD NOTES SEE DRAWING LLGP-0000-EL-DID-0010 THRU 0013.
2. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SPECIFIED OTHERWISE.
3. ALL INSTALLATION SHALL BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC), PART 1, 2024 EDITION.
4. CONTRACTOR MAY USE MANUFACTURER PART NUMBERS SPECIFIED ON DRAWING OR APPROVED EQUAL.
5. ALL THE MATERIALS FOR OUTDOOR INSTALLATIONS SHALL BE GALVANIZED STEEL FOR NON AGGRESSIVE ENVIRONMENT, 316L STAINLESS STEEL AND FIBER REINFORCED POLYESTER FOR CORROSIVE AREAS.
6. ALL LIGHTING ELEVATIONS ARE REFERENCED FROM THE BOTTOM OF THE FIXTURE UNLESS NOTED OTHERWISE.



EQUIPMENT BILL OF MATERIALS

ITEM	DESCRIPTION	QTY.
1	LIGHTING CONTROL PANEL, 30A, 120V, 60Hz, GE #CR463L60AJA20A0	2
	1316-LC-001	1
	1316-LC-002	1
2	LIGHTING PANEL, 30CCTs, 208Y/120V, 60Hz	2
	1316-DP-001	1
	1316-DP-002	1
3	LIGHTING TRANSFORMER, 45kVA, 600/208Y-120V, DRY TYPE, 3Ph, 6-Hz	2
	1316-TR-001	1
	1316-TR-002	1
4	SAFETY SWITCH, 60A, 600V, 3Ph, EATON #DH362UWKW	2
	1316-TR-001-DS	1
	1316-TR-002-DS	1

LIGHTING AND RECEPTACLE BILL OF MATERIALS

Item	TAG NUMBER	QTY.	UNIT	Tag Number
1	1316-RE-001-2, 1316-RE-002-4, 1316-RE-003-6, 1316-RE-004-7, 1316-RE-005-9, 1316-RE-006-11, 1316-RE-007-8, 1316-RE-008-10, 1316-RE-009-12, 1316-RE-010-13, 1316-RE-011-15, 1316-RE-012-17, 1316-RE-013-14, 1316-RE-014-16, 1316-RE-015-18, 1316-RE-016-19, 1316-RE-017-21, 1316-RE-018-2, 1316-RE-019-4, 1316-RE-020-6, 1316-RE-21-07, 1316-RE-022-9, 1316-RE-023-11, 1316-RE-024-8, 1316-RE-025-10, 1316-RE-026-12, 1316-RE-027-13, 1316-RE-028-15, 1316-RE-029-17, 1316-RE-030-14, 1316-RE-031-16, 1316-RE-032-18, 1316-RE-033-19, 1316-RE-034-21, 1316-RE-035-23, 1316-RE-036-23, 1316-RE-037-23	37	ea.	2-GANG WATERPROOF GFCI RECEPTACLE, 120V, 20A, HEAVY DUTY DIE-CAST AL BOX & COVER, HUBBELL TAYMAC MX6200
2	1316-LF-001-1, 1316-LF-002-3, 1316-LF-003-1, 1316-LF-004-3, 1316-LF-005-1, 1316-LF-006-3, 1316-LF-007-1, 1316-LF-008-3, 1316-LF-009-5, 1316-LF-010-5	10	ea.	LED STREET LIGHT, 2x(58W, 120V, 400K, 3967lLUM). COOPER #GLEON-SA6C-740-U-T-QM-ISK, w/ POLE #R556M30SY22X
3	1316-PE-001, 1316-PE-002	2	ea.	PHOTOCELL, 3.3A, 120V, 60Hz, CROUSE-HINDS #D2520

DRAFT

REV	DATE (DD/MM/YY)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
A	07.07.24	ISSUED FOR IFR/CR	AW	FO	SH	ES				

A1 SHEET SCALE 1:150

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
MAIN PARKING LOT
LIGHTING, RECEPTACLE AND EQUIPMENT PLAN

DRG No LLGP-1316-EL-DAL-0031

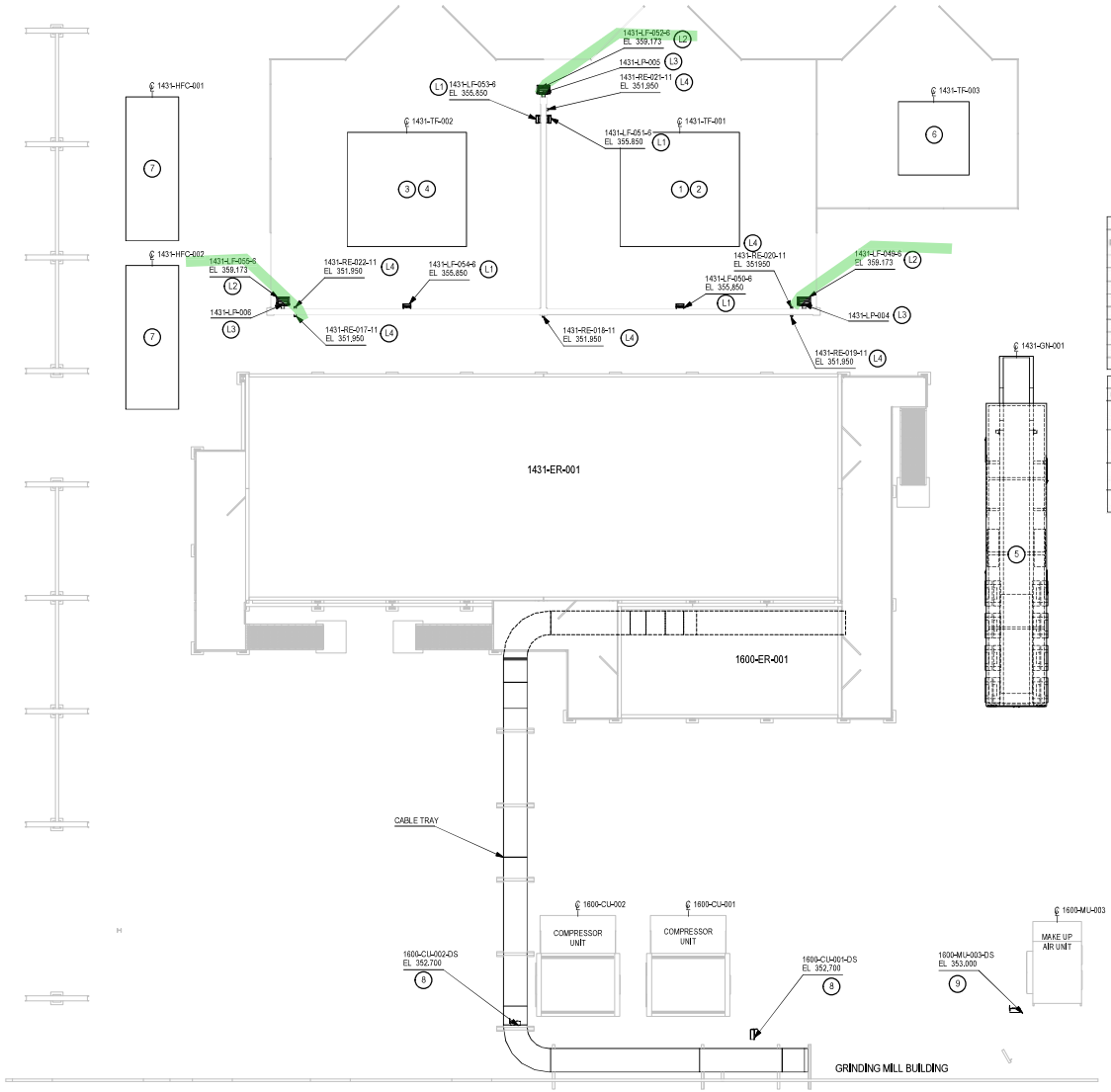
REV A

USER NAME: nicwilliamsmac

PLOT DATE & TIME: 9 Jul 2024 08:31:34

SAVE DATE & TIME: 9 Jul 2024 08:31:34

Worley_A1



NOTES:

1. FOR STANDARD ELECTRICAL NOTES SEE DRAWING LLGP-0000-EL-DID-0010 THRU 0013.
2. FOR STANDARD EQUIPMENT NOTES SEE DRAWING LLGP-0000-EL-DAL-0001 THRU 0006
3. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SPECIFIED OTHERWISE.
4. ALL INSTALLATIONS SHALL BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC), PART 1, 2024 EDITION.
5. CONTRACTOR MAY USE MANUFACTURER PART NUMBERS SPECIFIED ON THE DRAWING OR APPROVED EQUAL.
6. ALL MATERIALS FOR OUTDOOR INSTALLATIONS SHALL BE GALVINIZED STEEL FOR NON AGGRESSIVE ENVIRONMENTS AND 316L STAINLESS STEEL OR FIBER REINFORCED POLYESTER FOR CORROSIVE AREAS.
8. ALL LIGHTING ELEVATIONS ARE REFERENCED FROM THE BOTTOM OF THE FIXTURE UNLESS NOTED OTHERWISE.

EQUIPMENT LIST

ITEM	TAG NUMBER	QTY	DESCRIPTION	WEIGHT (kg)	HEAT DISSIPATION (kw)	DIMENSIONS (mm, WxDxH)
1	1431-TF-001	1	LIQUID IMMERSED POWER TRANSFORMER, 25/33MVA, ONAN/ONAF, 34.5/13.8kV, 3Ph, 60Hz	2600	4.25	2400x1400x2350
2	1431-NGR-001	1	NEUTRAL GROUNDING RESISTOR, 25A FOR 10 SECONDS, 15kV, BIL 95kV	44950	TBD	4800x4000x4500
3	1431-TF-002	1	LIQUID IMMERSED POWER TRANSFORMER, 25/33MVA, ONAN/ONAF, 34.5/13.8kV, 3Ph, 60Hz	TBD	TBD	TBD
4	1431-NGR-002	1	NEUTRAL GROUNDING RESISTOR, 25A FOR 10 SECONDS, 15kV, BIL 95kV	44950	TBD	4800x4000x4500
5	1431-GN-001	1	STANDBY DIESEL GENERATOR SET, 2MW, 600Vac GENERATOR, c/w 1200A CIRCUIT BREAKER.	TBD	TBD	TBD
6	1431-TF-003	1	DRY TYPE STEP-UP TRANSFORMER, 2.5MVA, 600V/13.8kV, 3Ph, 60Hz, OUTDOOR TYPE	7264	TBD	TBD
7	1431-HFC-001, 143-HFC-002	2	13.8kV HARMONIC FILTER & POWER FACTOR CORRECTION SET, 4.5MVA	TBD	TBD	TBD
8	1600-CU-001-DS, 1600-CU-002-DS	2	SAFETY SWITCH, 200A, 600V, 3Ph, EATON #DH364UWKW	TBD	TBD	TBD
9	1600-MU-003-DS	1	SAFETY SWITCH, 200A, 600V, 3Ph, EATON #DH364UWKW	TBD	TBD	TBD

LIGHTING BILL OF MATERIAL

ITEM	[illegible]	QTY	UNIT	DESCRIPTION
L1	1431-LF-053-6, 1431-LF-052-6, 1431-LF-051-6, 1431-LF-054-6	4		WP WALL PACK LED, 6200 LUMEN, 50W, 120V, 60Hz, 5000K COOL, NEMA 4X, COOPER WPMLED13
L2	1431-LF-049-6, 1431-LF-052-6, 1431-LF-055-6	3		FLOODLIGHT, 25500 lm LED, 239W, 120V, 60Hz, 5000K COOL, YOKE MOUNTING, NEMA 4X, CRUISE HINES #FMM2SLC1-UNV176
L3	1431-LF-004, 1431-LF-005, 1431-LF-006	3		9' SPRING LIGHT POLE, C-R #WSH-6, #WHK-WG, & #LMB-FL-40
L4	1431-RE-017-11, 1431-RE-018-11, 1431-19-11, 1431-RE-020-11, 1431-RE-022-11	5		2-GANG WATERPROOF GFCI RECEPTACLE, 120V, 20A, HEAVY DUTY DIE-CAST AL BOX & COVER, HUBBELL TAYMAC MX3200

DRAFT

0 750 1500 3000 4500 6000 7500mm
1:75

REV	DATE (DD/MM/YY)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
									LLGP-1431-EL-DAL-0051	MAIN PLANT SUBSTATION & MAU ELECTICAL RM. GROUNCING LAYOUT
A	23/04/24	ISSUED FOR IFR/CR	AW	FO	SH	ES	YM		LLGP-1431-EL-DAL-0011	MAIN PLANT SUBSTATION & MAU ELECTICAL RM. CABLE TRAY LAYOUT

A1 SHEET SCALE 1:75

Worley

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

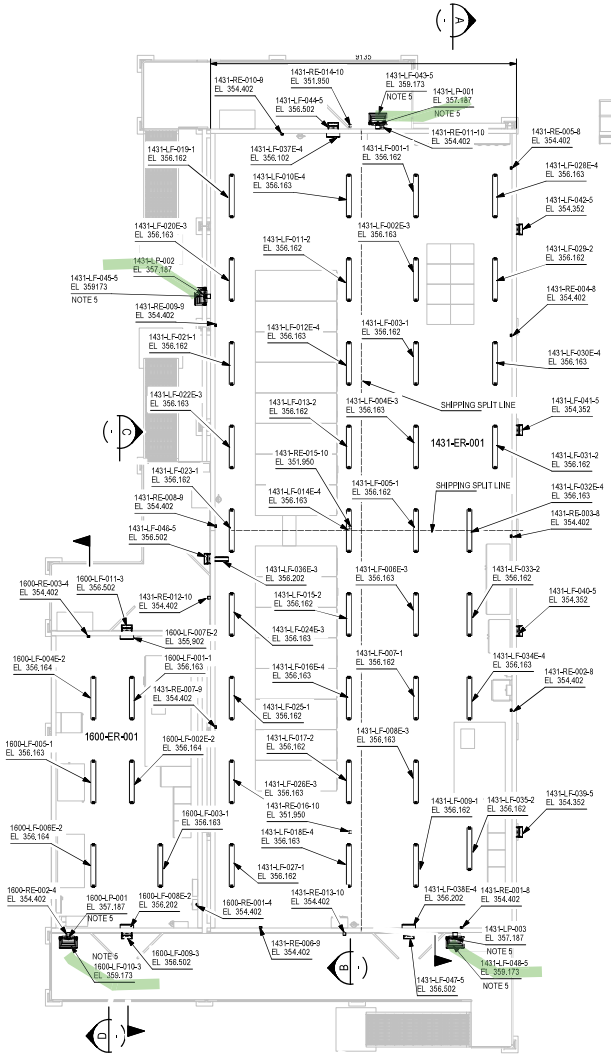
"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
MAIN PLANT SUBSTATION (1431-ER-001)
& MAU ELECTICAL ROOM (1600-ER-001)
YARD EQUIPMENT & LIGHTING LAYOUTS

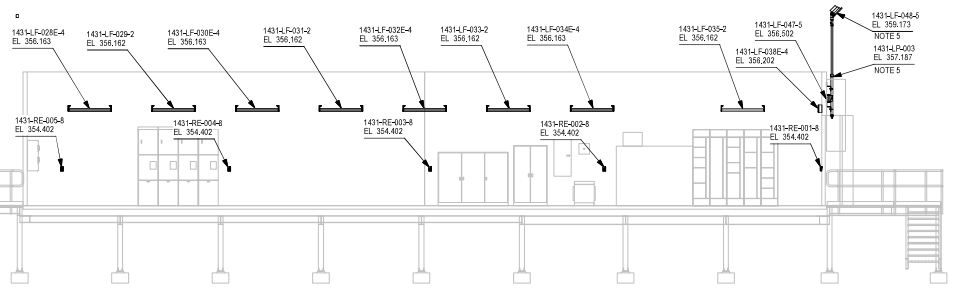
DRG No LLGP-1431-EL-DAL-0001 REV A

USER NAME: alexanderson
PLOT DATE & TIME: 17 Apr 2024 15:18:38
SAVE DATE & TIME: 17 Apr 2024 15:18:38

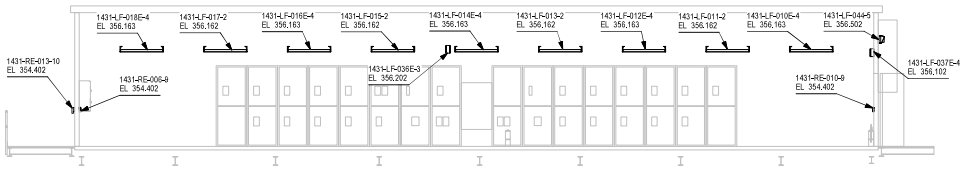


1431-ER-001 & 1600-ER-001 PLAN - LAYOUT

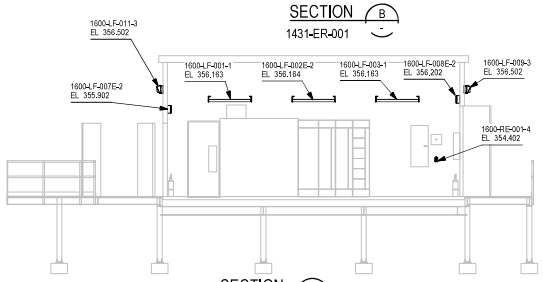
1:75



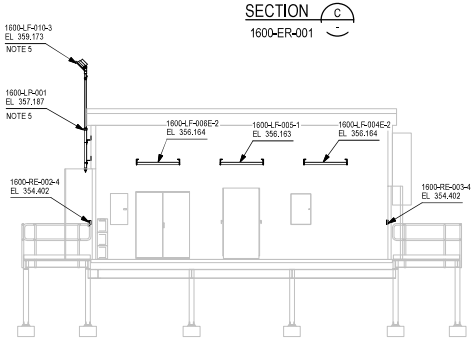
SECTION A
1431-ER-001



SECTION B
1431-ER-001



SECTION C
1600-ER-001



SECTION D
1600-ER-001

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SHOWN OTHERWISE.
2. THE LOCATION OF LIGHT FIXTURES AND RECEPTACLES IN THIS DRAWING ARE PRILIMINARY ONLY. THE ACTUAL LOCATION DEPENDS ON THE E-ROOM VENDOR AND SHALL BE DETERMINED AT THE TIME OF INSTALLATION.
3. THE LIGHTING FIXTURE & RECEPTACLE TAG NUMBER: AAAA-BB-CCCX-Y
   AAAA: AREA NUMBER
   BB: LF - LIGHTING FIXTURE
   LP - LIGHTING POLE
   RE - RECEPTACLE
   PE - PHOTOCELL
   CCCX: CCC - SEQUENCE NUMBER (001-999)
   X - BLANK: STANDARD LIGHTING FIXTURE
   E: INTEGRATED EMERGENCY BATTERY BACK-UP
   Y: CIRCUIT NUMBER OF LIGHTING PANEL
4. ALL MATERIAL PART NUMBERS CAN BE SUBSTITUTED WITH APPROVED EQUIVANENT.
5. LIGHT FIXTURES ARE NOT PART OF E-ROOM VENDOR PACKAGE AND WILL BE SUPPLIED AND INSTALLED AT SITE BY ELECTRICAL CONTRACTOR.

LIGHTING BILL OF MATERIAL

ITE	1600-ER-001 TAG NUMBERS	QT	UN	DESCRIPTION
1	1600-LF-001-1, 1600-LF-003-1, 1600-LF-005-1	3	ea.	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W,120V, 60Hz, c/w DP1053MTK & 90 MIN BATTERY MODULE, C-H #PLL4-UNV1-5903-TF-EM1
2	1600-LF-002E-2, 1600-LF-004E-2, 1600LF-006E-2	3	ea.	7900 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 62W,120V, 60Hz, c/w DP1053MTK KIT, CROUSE-HINDS #PLL4-UNV1-5903-TF
3	1600-LF-009-3, 1600-LF-011-3	2	ea.	WP WALL PACK LED, 6200 lm, 50W, 120V, 60Hz, 5000K COOL, NEMA 4X, COOPER WPMLED11
4	1600-RE-002-4	1	ea.	1-GANG WATERPROOF GFCI RECEPTACLE, 120V, 20A, HEAVY DUTY DIE-CAST AL BOX & COVER, HUBBELL TAYMAC MX3200
5	16000-RE-001-4, 1600-RE-003-4,	2	ea.	1-GANG RECEPTACLE, 20A, 120V, 60HZ
6	1600-LF-007E-2, 1600-LF-008E-2	2	ea.	LED EXIT SIGNS, 1.4W, 120V, 60Hz, SELF-POWED, SIGNAL FACE, c/w NICKEL CADMIUM BATTERY, CROUSE-HINDS #LUX715D
7	1600-LF-010-3	1	ea.	FLOODLIGHT, 25500 lm LED, 216W, 120V, 60Hz, 5000K COOL, YOKE MOUNTING, NEMA 4X, CROUSE-HINDS #PFMA25LCY-UNV176
8	1600-LP-001	1	ea.	V-SPRING LIGHT POLE, C-H #V65H-G, #MHK-WG, & #LMB-FL-40

1	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]

DRAFT

1:75 0 750 1500 3000 4500 6000 7500mm

REV	DATE (D/M/Y)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
									LLGP-1431-EL-DAL-0250	MAIN PLANT SUBSTATION & MAU ELECTICAL ROOM GROUNDING LAYOUT
B	10/04/24	REISSUED FOR IFR/CR	AW	FO	SH	ES	YM		LLGP-1431-EL-DAL-0200	MAIN PLANT SUBSTATION & MAU ELECTICAL ROOM EQUIPMENT LAYOUTS
A	23/02/24	ISSUED FOR IFR/CR	AW	FO	SH	ES	YM		LLGP-1431-EL-DAL-0210	MAIN PLANT SUBSTATION & ELETRICAL ROOM CABLE TRAY LAYOUTS

A1 SHEET SCALE 1:75

Worley

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

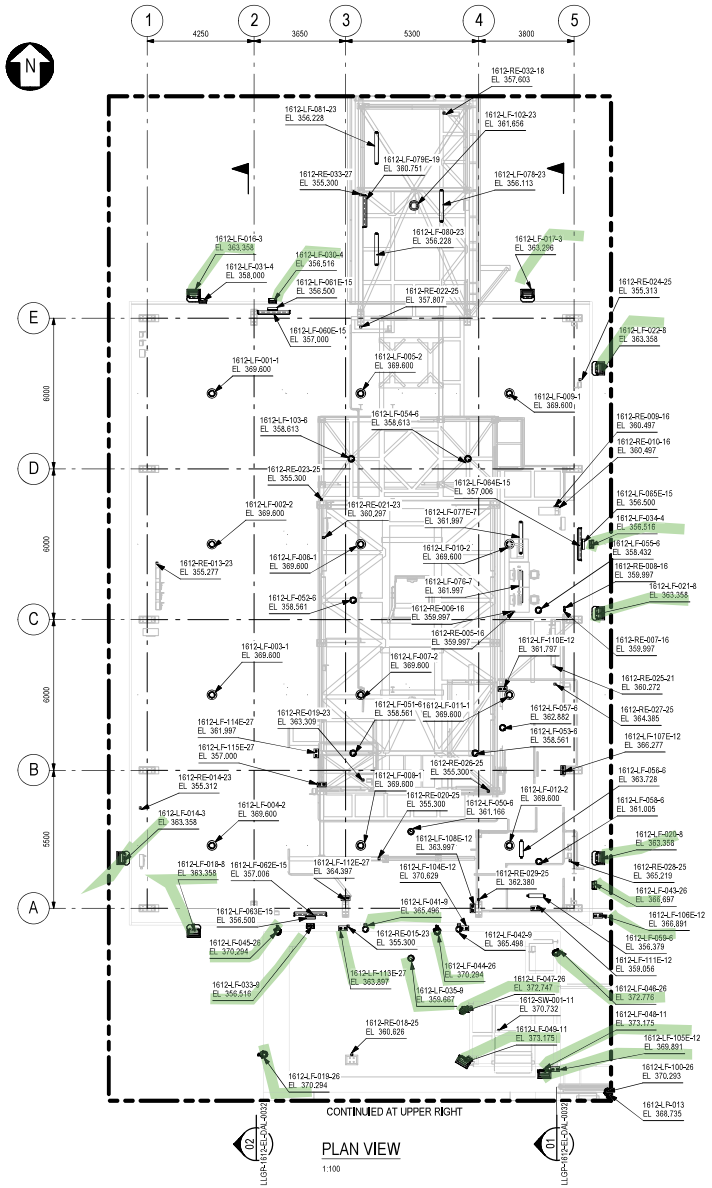
DRG TITLE

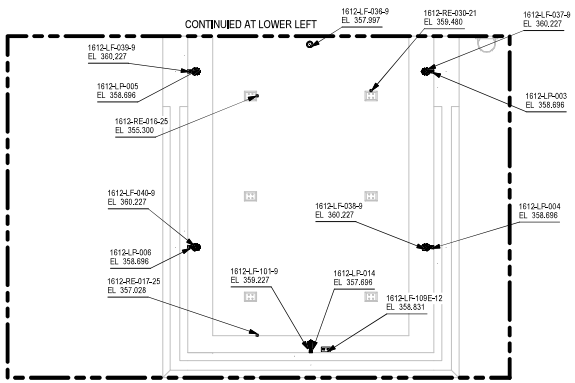
LYNN LAKE GOLD PROJECT
MACLELLAN SITE
MAIN PLANT SUBSTATION (1431-ER-001)
& MAU ELECTICAL ROOM (1600-ER-001)
LIGHTING LAYOUT & ELEVATIONS

DRG No LLGP-1431-EL-DAL-0220 REV B

Worley_A1

USER NAME: alexanderson
PLOT DATE & TIME: 29 Apr 2024 10:30:00
SAVE DATE & TIME: 19 Apr 2024 10:28:09





DRAFT

0 1000 2000 4000 6000 8000 10000mm
1:100

NOTES:

1. FOR STANDARD NOTES SEE DRAWING LLGP-0000-EL-DID-0010 THRU 0013.
2. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SPECIFIED OTHERWISE.
3. ALL INSTALLATION SHALL BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC), PART 1, 2024 EDITION.
4. CONTRACTOR MAY USE MANUFACTURER AND PART NUMBER SPECIFIED ON DRAWING OR APPROVED EQUAL.
5. ALL THE MATERIALS FOR THE OUTDOOR INSTALLATIONS SHALL BE GALVINIZED STEEL FOR NON AGGRESSIVE ENVIRONMENT, 316L STAINLESS STEEL AND FIBER REINFORCED POLYESTER FOR CORROSIVE AREAS.
6. ALL LIGHTING ELEVATIONS ARE REFERENCED FROM THE BOTTOM OF THE FIXTURE UNLESS NOTED OTHERWISE.

ITEM	TAG NUMBER	QTY.	UNIT	DESCRIPTION
1	1612-LF-001-1, 1612-LF-002-1, 1612-LF-003-1, 1612-LF-004-1, 1612-LF-005-1, 1612-LF-006-1, 1612-LF-007-1, 1612-LF-008-1, 1612-LF-009-1, 1612-LF-010-1, 1612-LF-011-1, 1612-LF-012-1, 1612-LF-013-1, 1612-LF-014-1	120	ea.	25000 lm LED, 208W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, PENDANT MOUNTING, NEMA 4X, CROUSE-HINDS #PVML-25-2A-UNV1
2	1612-LF-060E-15, 1612-LF-061E-15, 1612-LF-062E-15, 1612-LF-063E-15, 1612-LF-064E-15, 1612-LF-065E-15, 1612-LF-066E-15, 1612-LF-067E-15, 1612-LF-068E-15, 1612-LF-069E-15, 1612-LF-070E-15, 1612-LF-071E-15, 1612-LF-072E-15, 1612-LF-073E-15, 1612-LF-074E-15, 1612-LF-075E-15, 1612-LF-076E-15, 1612-LF-077E-15, 1612-LF-078E-15, 1612-LF-079E-15, 1612-LF-080E-15, 1612-LF-081E-15, 1612-LF-082E-15, 1612-LF-083E-15, 1612-LF-084E-15, 1612-LF-085E-15, 1612-LF-086E-15, 1612-LF-087E-15, 1612-LF-088E-15, 1612-LF-089E-15, 1612-LF-090E-15, 1612-LF-091E-15, 1612-LF-092E-15, 1612-LF-093E-15, 1612-LF-094E-15, 1612-LF-095E-15, 1612-LF-096E-15, 1612-LF-097E-15, 1612-LF-098E-15, 1612-LF-099E-15, 1612-LF-100E-15, 1612-LF-101E-15, 1612-LF-102E-15, 1612-LF-103E-15, 1612-LF-104E-15, 1612-LF-105E-15, 1612-LF-106E-15, 1612-LF-107E-15, 1612-LF-108E-15, 1612-LF-109E-15, 1612-LF-110E-15, 1612-LF-111E-15, 1612-LF-112E-15, 1612-LF-113E-15, 1612-LF-114E-15, 1612-LF-115E-15	71	ea.	1-GANG GFCI RECEPTACLE, 20A, 120V, 60HZ
3	1612-RE-013-23, 1612-RE-014-23, 1612-RE-015-23, 1612-RE-016-25, 1612-RE-017-25, 1612-RE-018-25, 1612-RE-019-23, 1612-RE-020-25, 1612-RE-021-23, 1612-RE-022-25, 1612-RE-023-25, 1612-RE-024-25, 1612-RE-025-21, 1612-RE-026-25, 1612-RE-027-25, 1612-RE-028-25, 1612-RE-029-25, 1612-RE-030-21, 1612-RE-031-27, 1612-RE-032-18, 1612-RE-033-27	20	ea.	1-GANG WATERPROOF GFCI RECEPTACLE, 120V, 20A, HEAVY DUTY DIE-CAST AL BOX & COVER, HUBBELL TAYMAC MK3200
4	1612-LF-045-26, 1612-LF-046-26, 1612-LF-047-26, 1612-LF-048-26, 1612-LF-049-26, 1612-LF-050-26, 1612-LF-051-26, 1612-LF-052-26, 1612-LF-053-26, 1612-LF-054-26, 1612-LF-055-26, 1612-LF-056-26	5	ea.	5250 lm LED, 28W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, NEMA 4X, CROUSE-HINDS #PVML-3-UNV1
5	1612-LF-056-6, 1612-LF-059-6	2	ea.	3958 lm LINEAR LED, 2 ft LENGTH, OPTICS 120° 33W, 120V, 60Hz, c/w DP1053MTK KIT, CROUSE-HINDS #PLL2-UNV1-5903-TF
6	1612-LP-001, 1612-LP-002, 1612-LP-003, 1612-LP-004, 1612-LP-005, 1612-LP-006, 1612-LP-008, 1612-LP-009, 1612-LP-010, 1612-LP-011, 1612-LP-012, 1612-LP-013, 1612-LP-014	13	ea.	V-SPRING LIGHT POLE, C-H #V65H-G, #MHK-RTG & JM5
7	1612-LF-103-6,1612-LF-051-6, 1612-LF-052-6, 1612-LF-053-6, 1612-LF-054-6, 1612-LF-055-6, 1612-LF-057-6, 1612-LF-058-6	7	ea.	5537 lm LED, 45W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, CEILING MOUNTING, NEMA 4X, CROUSE-HINDS #PVML-5-2C-UNV1
8	1612-LF-041-9, 1612-LF-042-9	2	ea.	5537 lm LED, 45W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, WALL MOUNTING, NEMA 4X, CROUSE-HINDS #PVML-5-2STW-UNV1
9	1612-LF-060E-15, 1612-LF-062E-15, 1612-LF-064E-15	3	ea.	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W, 120V, 60Hz, c/w DP1052MTK & 90 MIN BATTERY MODULE, C-H #PLL4-UNV1-5903-TF-EM1
10	1612-LF-077E-7, 1612-LF-079E-19	2	ea.	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W, 120V, 60Hz, c/w DP1053MTK & 90 MIN BATTERY MODULE, C-H #PLL4-UNV1-5903-TF-EM1
11	1612-LF-076-7, 1612-LF-078-23, 1612-LF-080-23, 1612-LF-081-23,	4	ea.	7900 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 84W, 120V, 60Hz, c/w DP1053MTK KIT, CROUSE-HINDS #PLL4-UNV1-5903-TF
12	1612-LF-085-9, 1612-LF-056-9, 1612-LF-050-6, 1612-LF-037-9, 1612-LF-038-9, 1612-LF-039-9, 1612-LF-040-9, 1612-LF-047-26, 1612-LF-101-9,	9	ea.	9254 lm LED, 76W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, CEILING MOUNTING, NEMA 4X, CROUSE-HINDS #PVML-9-2C-UNV1
13	1612-LF-014-3, 1612-LF-016-3, 1612-LF-017-3, 1612-LF-018-8, 1612-LF-020-8, 1612-LF-021-8, 1612-LF-022-8, 1612-LF-048-11, 1612-LF-049-11,	9	ea.	FLOODLIGHT, 25500 lm LED, 216W, 120V, 60Hz, 5000K COOL, PURE MOUNTING, NEMA 4X, CROUSE-HINDS #PFM216LCV-UNV178
14	1612-LF-061E-15, 1612-LF-063E-15, 1612-LF-065E-15,	3	ea.	LED EXIT SIGNS, 1.4W, 120V, 60Hz, SELF-POWED, SIGNAL FACE, c/w NICKEL CADMIUM BATTERY, CROUSE-HINDS #UX7150
15	1612-LF-104E-12, 1612-LF-105E-12, 1612-LF-106E, 1612-LF-107E-12, 1612-LF-108E-12,1612-LF-109E-12,1612-LF-110E-12,1612-LF-111E-12, 1612-LF-112E-27, 1612-LF-113E-27, 1612-LF-114E-27, 612-LF-115E-27	12	ea.	EMERGENCY LIGHT LED, 28W, 120V, 60Hz, 2x8W LED LAMP, 90 MINUTES BATTERY, CROUSE-HINDS #N2LPS12222 SS
16	1612-LF-102-23	1	ea.	13100 lm LED, 95W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, CEILING MOUNTING, NEMA 4X, CROUSEHINDS #PVML-13-2C-UNV1
17	1612-LF-030-4, 1612-LF-031-4, 1612-LF-033-9,1612-LF-034-4, 1612-LF-043-26	5	ea.	WP WALL PACK LED, 6200 lm, 50W, 120V, 60Hz, 5000K COOL, NEMA 4X, COOPER WPMLED15
18	1612-SW-001-11	1	ea.	LIGHT SWITCH, 1 POLES, 15A

REV	DATE (D.MMM.Y)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
C	29 Apr 24	REISSUED FOR IIR/ICR	AW	FO	SH	ES	YM		LLGP-1612-EL-LST-0001	LIGHTING PANEL SCHEDULE AND WIRING DIA
B	3 Nov 2023	ISSUED FOR IIR AND ICR	AW	FO	SH	ES	YM		LLGP-1612-EL-DAL-0051	PRIMARY CRUSHER GROUNDING LAYOUT
A	26 Jul 2023	ISSUED FOR INTERNAL REVIEW	AW	FO	SH	ES	YM		LLGP-1612-EL-DAL-0032	PRIMARY CRUSHER LIGHTING SECTIONS

A1 SHEET SCALE 1:100

Worley

WORLEY PROJECT No.
317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
PRIMARY CRUSHER
LIGHTING
LAYOUT

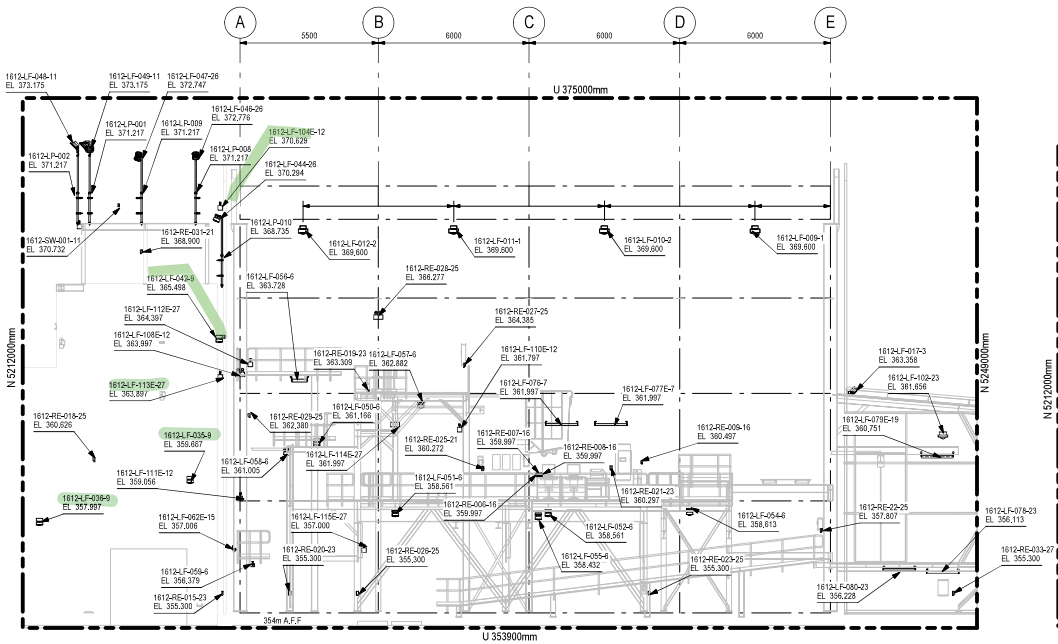
DRG No LLGP-1612-EL-DAL-0031

REV C

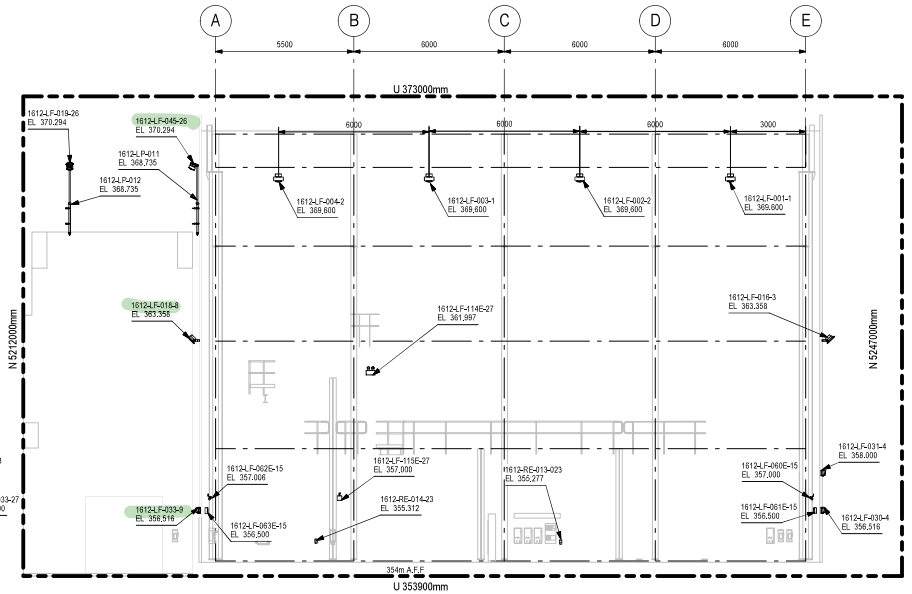
USER NAME: allevanson
PLOT DATE & TIME: 3 May 2024 10:42:35
SAVE DATE & TIME: 3 May 2024 10:43:31

NOTES:

1. FOR STANDARD NOTES SEE DRAWING LLGP-0000-EL-DID-0010 THRU 0013.
2. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SPECIFIED OTHERWISE.
3. ALL INSTALLATION SHALL BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC), PART 1, 2024 EDITION.
4. CONTRACTOR MAY USE MANUFACTURER AND PART NUMBER SPECIFIED ON DRAWING OR APPROVED EQUAL.
5. ALL THE MATERIALS FOR THE OUTDOOR INSTALLATIONS SHALL BE GALVINIZED STEEL FOR NON AGGRESSIVE ENVIRONMENT, 316L STAINLESS STEEL AND FIBER REINFORCED POLYESTER FOR CORROSIVE AREAS.
6. ALL LIGHTING ELEVATIONS ARE REFERENCED FROM THE BOTTOM OF THE FIXTURE UNLESS NOTED OTHERWISE.



SECTION 01
LLGP-1612-EL-DAL-0031



SECTION 02
LLGP-1612-EL-DAL-0031

DRAFT

0 1000 2000 4000 6000 8000 10000mm
1:100

REV	DATE (D/M/Y)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
C	29 Apr 24	REISSUED FOR IIR/ICR	AW	FO	SH	ES	YM		LLGP-1612-EL-LST-0001	LIGHTING PANEL SCHEDUKE AND WIRING DIA.
B	6 Nov 2023	ISSUED FOR IIR AND ICR	AW	FO	SH	ES	YM		LLGP-1612-EL-DAL-0051	PRIMARY CHRUSHER GROUNDING LAYOUT
A	26 Jul 2023	ISSUED FOR INTERNAL REVIEW	AW	FO	SH	ES	YM		LLGP-1612-EL-DAL-0031	PRIMARY CRUSHER LIGHTING LAYOUT

A1 SHEET SCALE 1:100

Worley

WORLEY PROJECT No.
317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

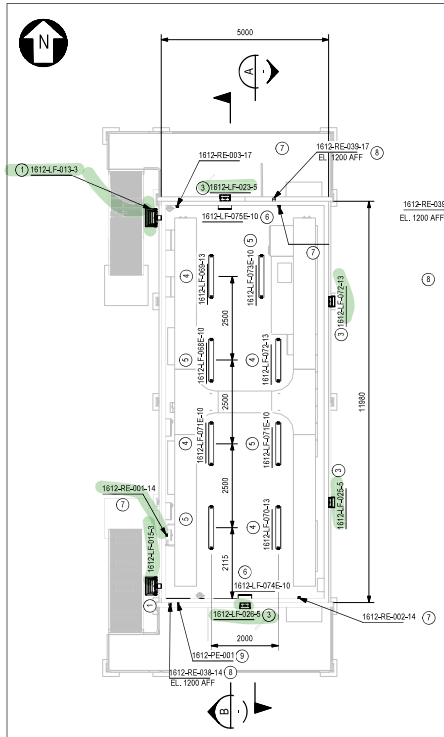
DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
PRIMARY CRUSHER
LIGHTING
SECTIONS

DRG No LLGP-1612-EL-DAL-0032

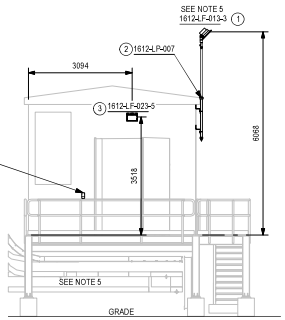
REV C

USER NAME: alexwatson
PLOT DATE & TIME: 3 May 2024 10:31:09
SAVE DATE & TIME: 3 May 2024 10:31:09



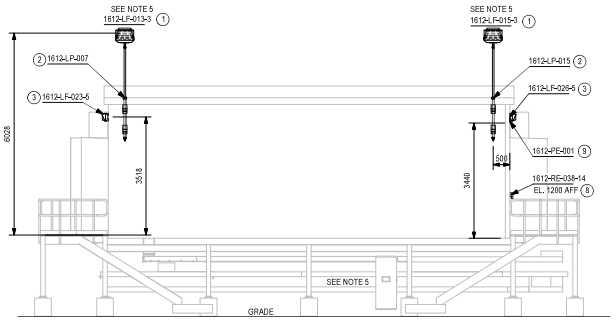
LIGHTING LAYOUT INSIDE E-ROOM - PLAN

1:75



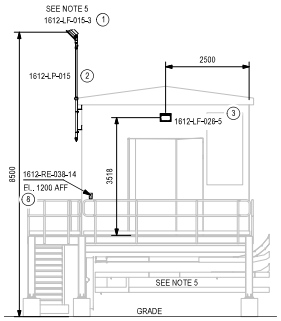
ELEVATION - NORTH VIEW

1:75



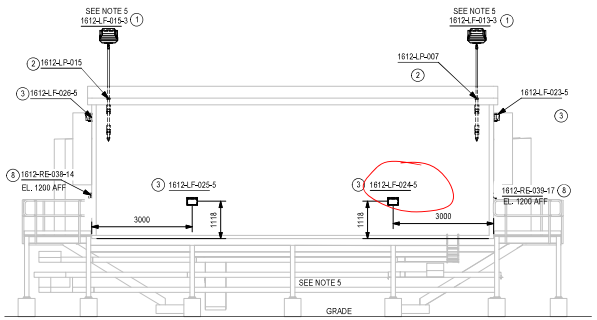
ELEVATION - WEST VIEW

1:75



ELEVATION - SOUTH VIEW

1:75



ELEVATION - EAST VIEW

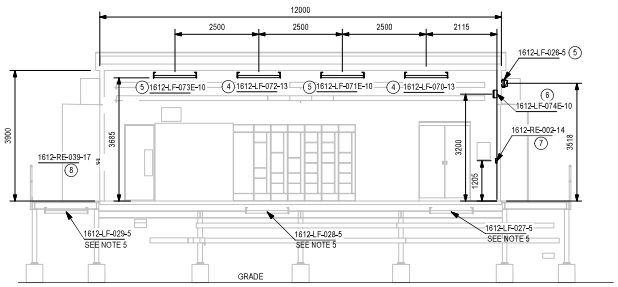
1:75

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SHOWN OTHERWISE.
2. THE LOCATION OF LIGHT FIXTURES AND RECEPTACLES IN THIS DRAWING IS INDICATIVE ONLY. THE ACTUAL LOCATION DEPENDS ON THE E-ROOM VENDOR AND SHALL BE DETERMINED AT THE TIME OF INSTALLATION.
3. THE LIGHTING FIXTURE & RECEPTACLE TAG NUMBER: AAAA-BB-CCCX-Y
   AAAA: AREA NUMBER
   BB: LF - LIGHTING FIXTURE
   LP - LIGHTING POLE
   RE - RECEPTACLE
   PE - PHOTOCELL
   CCCX: CCC - SEQUENCE NUMBER (001-999)
   X - BLANK: STANDARD LIGHTING FIXTURE
   E: INTEGRATED EMERGENCY BATTERY BACK-UP
   Y: CIRCUIT NUMBER OF LIGHTING PANEL
4. ALL MATERIAL PART NUMBERS CAN BE SUBSTITUTED WITH APPROVED EQUIVALENT.
5. LIGHT FIXTURES AND RECEPTACLE ARE NOT PART OF E-ROOM VENDOR PACAKAGE AND WILL BE SHIPPED LOOSE TO BE INSTALLED ON SITE BY ELECTRICAL CONTRACTOR.

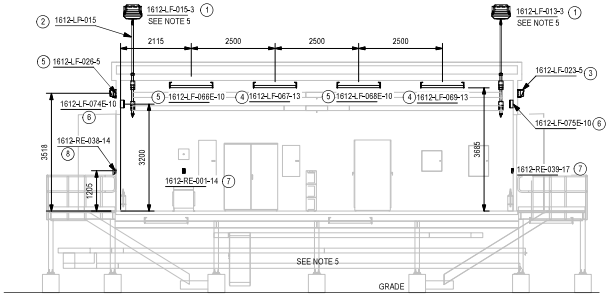
LIGHTING BILL OF MATERIAL

ITEM	TAG NUMBER	QTY	DESCRIPTION
1	1612-LF-013, 1612-LF-015	2	FLOODLIGHT, 36600 lm LED, 318W, 120V, 60Hz, 6000K COOL, YOKE MOUNTING, NEMA 4X, CROUSE-HINDS #PFMA25LCY-UNV1T5
2	1612-LP-007, 1612-LP-015	2	V-SPRING LIGHT POLE, C.H #WSH-G, #MHK-INT, & (6) MH-FT-40
3	1612-LF-023, 1612-LF-023, 1612-LF-024, 1612-LF-025, 1612-LF-026	4	IMP WALL PACK LED, 5280 LUMEN, 50W, 120V, 60Hz, 5000K COOL, NEMA 4X, COOPER #IPMLED15
4	1612-LF-027, 1612-LF-028, 1612-LF-029, 1612-LF-067, 1612-LF-068, 1612-LF-070, 1612-LF-072,	4	7900 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 60V, 120V, 60Hz, UW DP1/52MTK KIT, CROUSE-HINDS #PLL4-UNV1-5963 TF
5	1612-LF-068E, 1612-LF-069E, 1612-LF-071E, 1612-LF-073E	4	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W, 120V, 60Hz, UW DP1/90MTK & 90 MINUTE BATTERY MODULE, CROUSE-HINDS #PLL4 UNV1 5603 TF EM1
6	1612-LF-074E, 1612-LF-075E	2	LED EXIT SIGNS, 1.4W, 120V, 60Hz, SELF-POWED, SIGNAL FACE, UW NICKEL CADMIUM BATTERY, CROUSE-HINDS #LEX7TSD
7	1612-RE-001, 1612-RE-002, 1612-RE-003, 1612-RE-004	4	1-GANG RECEPTACLE, 20A, 120V, 60Hz
8	1612-RE-038, 1612-RE-039	2	1-GANG WATERPROOF GFCI RECEPTACLE, 125V, 20A, HEAVY DUTY DIE-CAST AL IRON & COVER, HUBBELL TAYMAC MX2200
9	1612-PE-001	1	PHOTOCELL, 3.3A, 120V, 60Hz, CROUSE-HINDS #DSU



SECTION A

1:75



SECTION A

1:75

DRAFT

0 750 1500 3000 4500 6000 7500mm

1:75

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
B	7/04/23	RE-ISSUED FOR IFR/CR	AW	FO	SH	ES	YM		LLGP-1612-EL-DAL-0210	PRIMARY CRUSHER AREA ELEC, RM, 16120ER-001 CABLE TRAY LAYOUT
A	20/12/23	ISSUED FOR IFR AND ICR	AW	FO	SH	ES	YM	GD	LLGP-1612-EL-DAL-0200	PRIMARY CRUSHER AREA ELEC, RM, 16120ER-001 EQUIPMENT LAYOUT

A1 SHEET SCALE 1:75

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
PRIMARY CRUSHER AREA
ELECTRICAL ROOM 1612-ER-001
LIGHTING LAYOUT

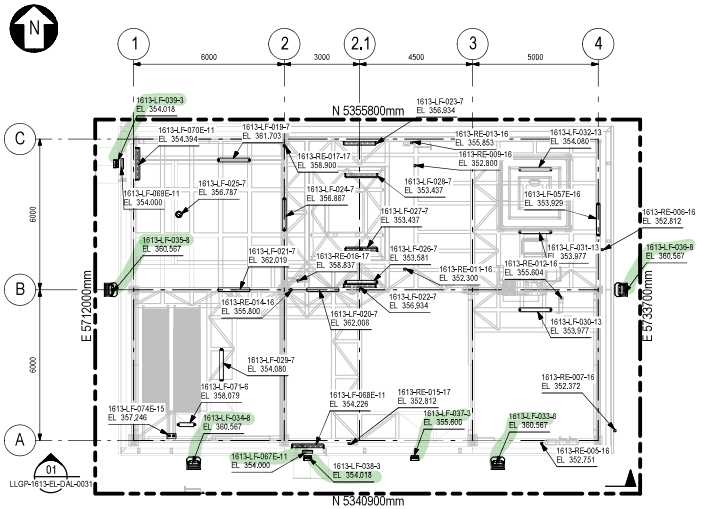
DRG No LLGP-1612-EL-DAL-0220

REV B

USER NAME: sharnesh.ra
PLOT DATE & TIME: 29 Apr 2024 09:37:11
SAVE DATE & TIME: 11 Apr 2024 09:27:11

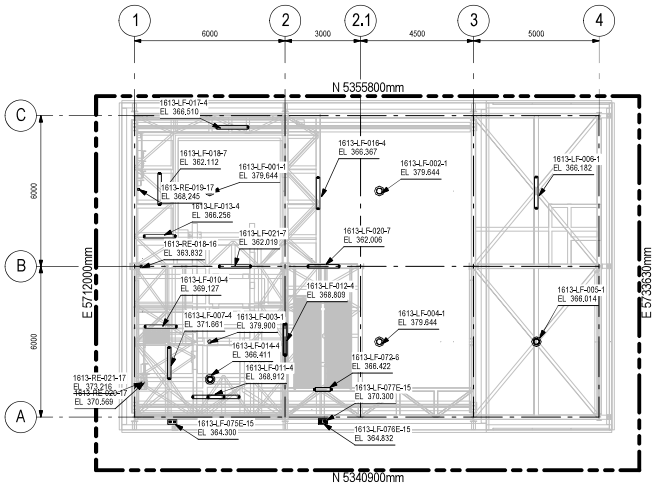
NOTES:

1. FOR STANDARD NOTES SEE DRAWING LLGP-0000-EL-DID-0010 THRU 0013.
2. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SPECIFIED OTHERWISE.
3. ALL INSTALLATION SHALL BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC), PART 1, 2024 EDITION.
4. CONTRACTOR MAY USE MANUFACTURER AND PART NUMBER SPECIFIED ON DRAWING OR APPROVED EQUAL.
5. ALL THE MATERIALS FOR THE OUTDOOR INSTALLATIONS SHALL BE GALVINIZED STEEL FOR NON AGGRESSIVE ENVIRONMENT, 316L STAINLESS STEEL AND FIBER REINFORCED POLYESTER FOR CORROSIVE AREAS.
6. ALL LIGHTING ELEVATIONS ARE REFERENCED FROM THE BOTTOM OF THE FIXTURE UNLESS NOTED OTHERWISE.



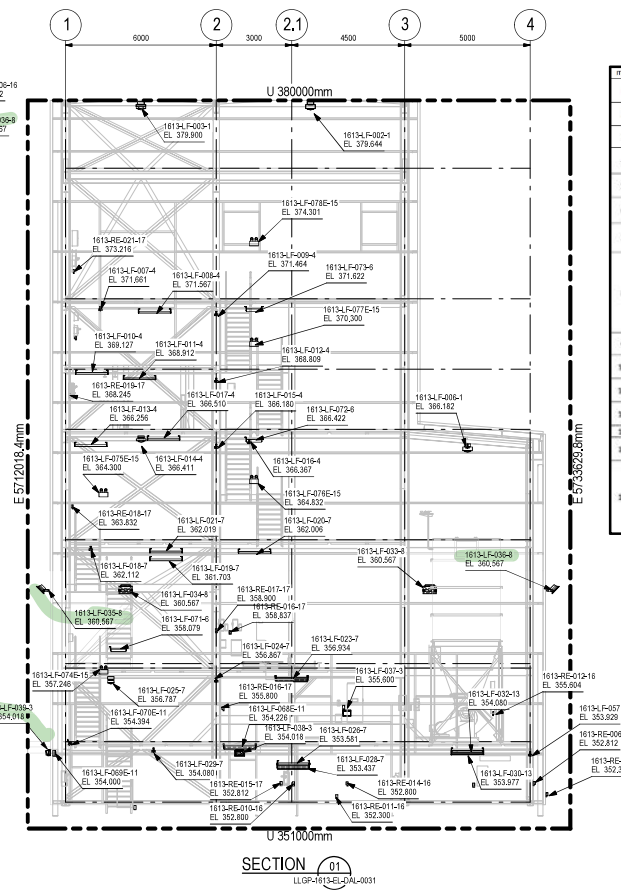
PLAN VIEW LOWER LEVEL

1:100



PLAN VIEW UPPER LEVEL

1:100



SECTION 01 LLGP-1613-EL-DAL-0031

ITEM	TAG NUMBER	QTY.	UNIT	DESCRIPTION
1	1613-LF-003-1	1	ea.	13100 lm LED, 95W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, CEILING MOUNTING, NEMA 4X, CROUSE-HINDS #PMLED2-25-2C-UNV1/2
2	1613-LF-014-2	1	ea.	17800 lm LED, 147W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, CEILING MOUNTING, NEMA 4X, CROUSE-HINDS #PMLED2-27-2C-UNV1/2
3	1613-LF-001-1, 1613-LF-002-1, 1613-LF-004-1, 1613-LF-005-1	4	ea.	25000 lm LED, 206W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, CEILING MOUNTING, NEMA 4X, CROUSE-HINDS #PMLED2-25-2C-UNV1/2
4	1613-LF-071-14, 1613-LF-072-14, 1613-LF-073-14	3	ea.	3958 lm LINEAR LED, 2 ft LENGTH, OPTICS 120° 52W,120V, 60Hz, c/w DP1053MTK KIT, CROUSE-HINDS #PLL2-UNV1-5903-TF
5	1613-LF-068E-13, 1613-LF-070E-13	2	ea.	6730 lm LINEAR LED, 4 ft, OPTICS 120°, 58W,120V, 60Hz, c/w DP1052MTK & 90 MIN BATTERY MODULE, C-H #PLL4-UNV1-5903-TF-EM1
6	1613-LF-057E-12	1	ea.	6730 lm LINEAR LED, 4 ft, OPTICS 120°, 58W,120V, 60Hz, c/w DP1053MTK & 90 MIN BATTERY MODULE, C-H #PLL4-UNV1-5903-TF-EM1
7	1613-LF-022-3, 1613-LF-023-3, 1613-LF-027-3, 1613-LF-028-3	4	ea.	7900 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 62W,120V, 60Hz, c/w DP1052MTK KIT, CROUSE-HINDS #PLL4-UNV1-5903-TF
8	1613-LF-006-1, 1613-LF-007-2, 1613-LF-008-2, 1613-LF-009-2, 1613-LF-010-2, 1613-LF-011-2, 1613-LF-012-2, 1613-LF-013-2, 1613-LF-015-2, 1613-LF-016-2, 1613-LF-017-2, 1613-LF-018-3, 1613-LF-019-3, 1613-LF-020-3, 1613-LF-021-3, 1613-LF-024-3, 1613-LF-026-3, 1613-LF-029-3, 1613-LF-030-11, 1613-LF-031-11, 1613-LF-032-11	21	ea.	7900 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 62W,120V, 60Hz, c/w DP1053MTK KIT, CROUSE-HINDS #PLL4-UNV1-5903-TF
9	1613-LF-075-3	1	ea.	9234 lm LED, 76W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, CEILING MOUNTING, NEMA 4X, CROUSE-HINDS #PMLED2-25-2C-UNV1
10	1613-LF-074E-15, 1613-LF-075E-15, 1613-LF-076E-15, 1613-LF-077E-15, 1613-LF-078E-15	5	ea.	EMERGENCY LIGHT LED, 28W, 120V, 60Hz, 2x3W LED LAMP, 90 MIN BATTERY MODULE, CROUSE-HINDS #NZLPS12222 S5
11	1613-LF-033-4, 1613-LF-034-4, 1613-LF-035-4, 1613-LF-036-4	4	ea.	FLOODLIGHT,25500 lm LED, 210W, 120V, 60Hz, 5000K COOL, YOKE MOUNTING, NEMA 4X, CROUSE-HINDS #PFMA25LCY-UNV176
12	1613-LF-067L-13, 1613-LF-069L-13	2	ea.	LED EXIT SIGNS, 1.4W, 120V, 60Hz, SELF-POWED, SIGNAL FACE, c/w NICKEL CADMIUM BATTERY, CROUSE-HINDS #UX71SD
13	1613-LP-001, 1613-LP-002	2	ea.	V-SPRING LIGHT POLE, C-H #V6SH-G, #BMHK-WG, & #LMB-FL-40
14	1613-LF-037-5, 1613-LF-038-5, 1613-LF-039-5	3	ea.	WP WALL PACK LED, 6200 lm, 50W, 120V, 60Hz, 5000K COOL, NEMA 4X, COOPER WPMLED15
15	1613-RE-005-16, 1613-RE-006-16, 1613-RE-007-16, 1613-RE-009-16, 1613-RE-010-16, 1613-RE-011-16, 1613-RE-012-16, 1613-RE-013-16, 1613-RE-014-16, 1613-RE-015-17, 1613-RE-016-17, 1613-RE-017-17, 1613-RE-018-17, 1613-RE-019-17, 1613-RE-020-17, 1613-RE-021-17	16	ea.	1-GANG GFCI RECEPTACLE, 20A, 120V, HEAVY DUTY DIE-CAST AL BOX & COVER, HUBBELL TAYMAC MK8200

DRAFT

1:100 0 1000 2000 4000 6000 8000 10000mm

REV	DATE (DD/MM/YY)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
C	20 May 24	REISSUED FOR IIR/ICR	AW	FO	SH	ES	YM		LLGP-1613-EL-LST-0001	SECONDARY CRUSHER LIGHTING PANEL SCHEDULE & WIRING DIAGRAM
B	6 Nov 2023	ISSUED FOR IIR AND ICR	AW	FO	SH	ES	YM		LLGP-1613-EL-DAL-0051	SECONDARY CRUSHER GROUNDING LAYOUT
A	26 Jul 2023	ISSUED FOR INTERNAL REVIW	AW	FO	SH	ES	YM		LLGP-1613-EL-DAL-0011	SECONDARY CRUSHER CABLE TRAY LAYOUT

A1 SHEET SCALE 1:100

Worley

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

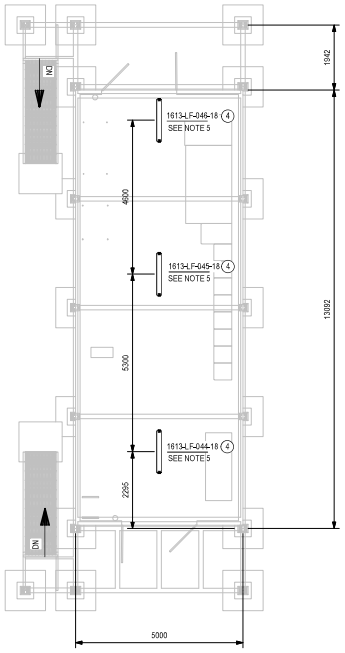
"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
SECONDARY CRUSHER & ELECTRICAL RM
LIGHTING
LAYOUTS AND SECTION

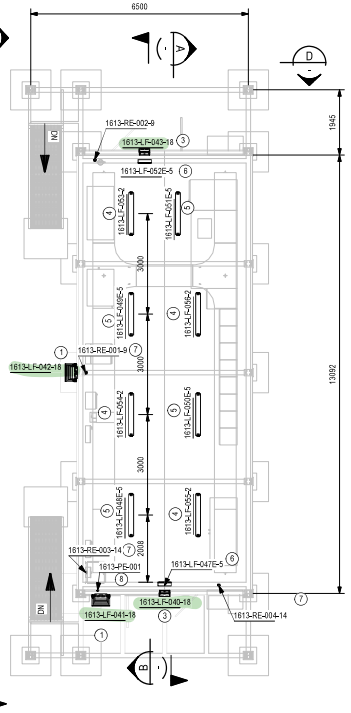
DRG No LLGP-1613-EL-DAL-0031 REV C

USER NAME: allevadson
PLOT DATE & TIME: 16 May 2024 08:18:13
SAVE DATE & TIME: 16 May 2024 08:18:13



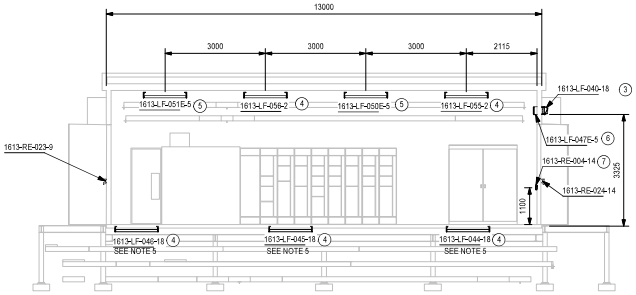
PLAN VIEW UNDER E-ROOM

1:75



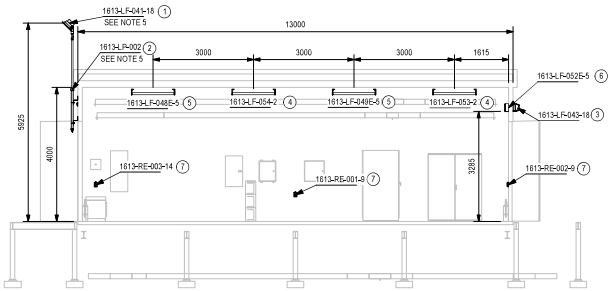
PLAN VIEW E-ROOM

1:75



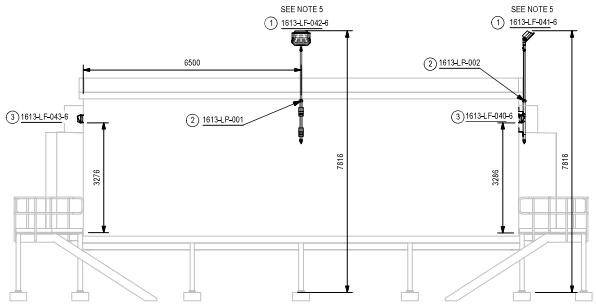
SECTION A

1:75



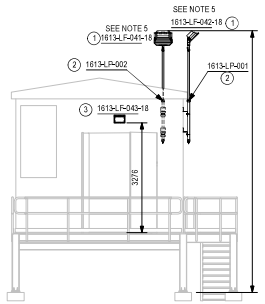
SECTION B

1:75



SECTION C

1:75



SECTION D

1:75

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SHOWN OTHERWISE.
2. THE LOCATION OF LIGHT FIXTURES AND RECEPTACLES IN THIS DRAWING ARE PRELIMINARY ONLY. THE ACTUAL LOCATION DEPENDS ON THE E-ROOM VENDOR AND SHALL BE DETERMINED AT THE TIME OF INSTALLATION.
3. THE LIGHTING FIXTURE & RECEPTACLE TAG NUMBER: AAAA-BB-CCCX-Y
   AAAA: AREA NUMBER
   BB: LF - LIGHTING FIXTURE
   LP - LIGHTING POLE
   RE - RECEPTACLE
   PE - PHOTOCELL
   CCCX: CCC - SEQUENCE NUMBER (001-999)
   X - BLANK: STANDARD LIGHTING FIXTURE
   E: INTEGRATED EMERGENCY BATTERY BACK-UP
   Y: CIRCUIT NUMBER OF LIGHTING PANEL
4. ALL MATERIAL PART NUMBERS CAN BE SUBSTITUTED WITH APPROVED EQUIVALENT.
5. LIGHT FIXTURES ARE PART OF E-ROOM VENDOR PACKAGE AND WILL BE SHIPPED LOOSE TO BE INSTALEED ON SITE BY ELECTRICAL AT SITE BY ELECTRICAL CONTRACTOR.

LIGHTING BILL OF MATERIAL

ITEM	TAG NUMBER	QTY.	DESCRIPTION
1	1613-LF-041,1613-LF-042	2	FLOODLIGHT, 25500 LUMEN LED, 216W, 120Vac, 60Hz, [illegible] White LIGHT, YOKE MOUNTING, NEMA 4X, CROUSE-HINDS CHAMP FRO #PFMA25LCY-UNV1-76
2	1613-LP-001,1613-LP-002	2	V-SPRING LIGHT POLE, C-H #V65H-G, #M-K-WG, 6-ft, MH FI, 40
3	1613-LF-040-6,1613-LF-043-6	2	WP WALL PACK LED, 5250 LUMENS, 50W, 120V, 60Hz, [illegible] COOL, NEMA 4X COOPER XPWLED15
4	1613-LF-053,1613-LF-054,1613-LF-055,1613-LF-056	4	7500 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 62W, [illegible] 60Hz, UW OP7553MTK KIT, CROUSE-HINDS #PLL4-UNV1-5965
5	1613-LF-044-6,1613-LF-045-6,1613-LF-046-6,1613-LF-053-6, 1613-LF-054-6,1613-LF-055-6,1613-LF-056-6	4	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W, 120V, 60Hz, [illegible] UW OP7553MTK & 90 MIN BATTERY MODULE, CROUSE-HINDS #PLL4-UNV1-5965 IF EM
6	1613-LF-049E,1613-LF-052E	2	LED EXIT SIGNS, 1.4W, 120V, 60HZ, SELF-POWED, SIGNAL PANEL, [illegible] NICKEL CADMIUM BATTERY, CROUSE HINDS #UX71SD
7	1613-RE-001,1613-RE-002, 1613-RE-003, 1613-RE-004	4	2-GANG GFCI RECEPTACLE, 20A, 120V, 60Hz
8	1613-PE-001	1	PHOTOCELL, 3.3A, 120V 60Hz, CROUSE-HINDS #CDS9

DRAFT

REV	DATE (DD-MMM-YY)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
									LLGP-1613-EL-LST-0001	SECONDARY CRUSHER LIGHTING PANEL SCHEDULE & WIRING DIAGRAM
									LLGP-1613-EL-DAL-0051	SECONDARY CRUSHER E-ROOM 1613-ER-001 GROUNDING LAYOUT
B	09.04.24	RE-ISSUED FOR IFR/CR	AW	FO	SH	ES	YM		LLGP-1613-EL-DAL-0210	SECONDARY CRUSHER E-ROOM 1613-ER-001 TRAY LAYOUT
A	10.11.2023	ISSUED FOR IR AND ICR	AW	FO	SH	ES	YM		LLGP-1613-EL-DAL-0200	SECONDARY CRUSHER E-ROOM 1613-ER-001 EQUIPMENT LAYOUT

A1 SHEET SCALE 1:75

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
SECONDARY CRUSHER AREA
ELECTRICAL ROOM 1613-ER-001
LIGHTING LAYOUT AND SECTIONS

DRG No LLGP-1613-EL-DAL-0220

REV B

0 750 1500 3000 4500 6000 7500mm

1:75

USER NAME: [illegible]

PLOT DATE & TIME: 29 Apr 2024 09:53:12

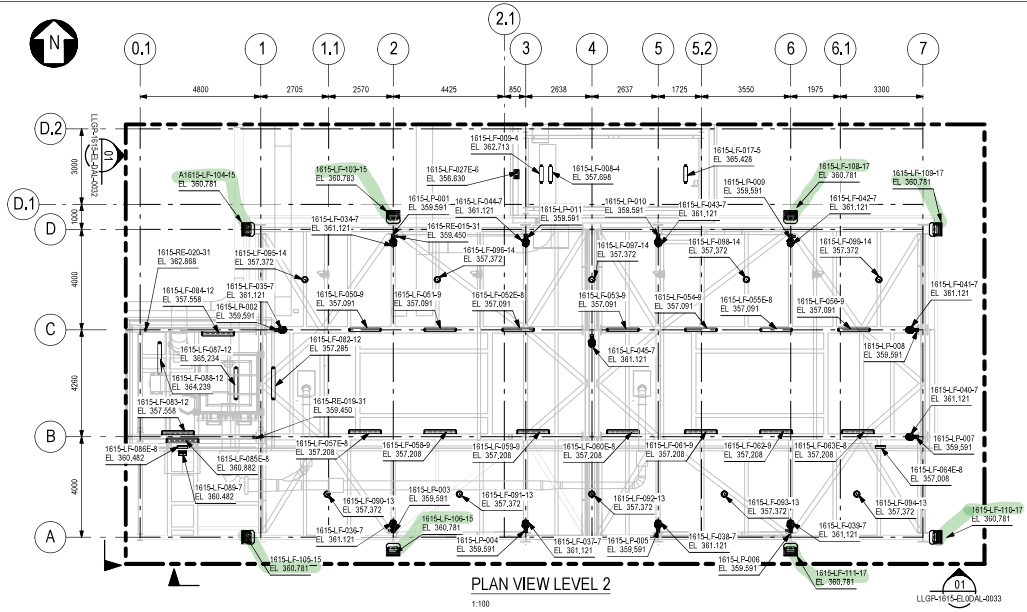
SAVE DATE & TIME: 11 Apr 2024 09:53:12

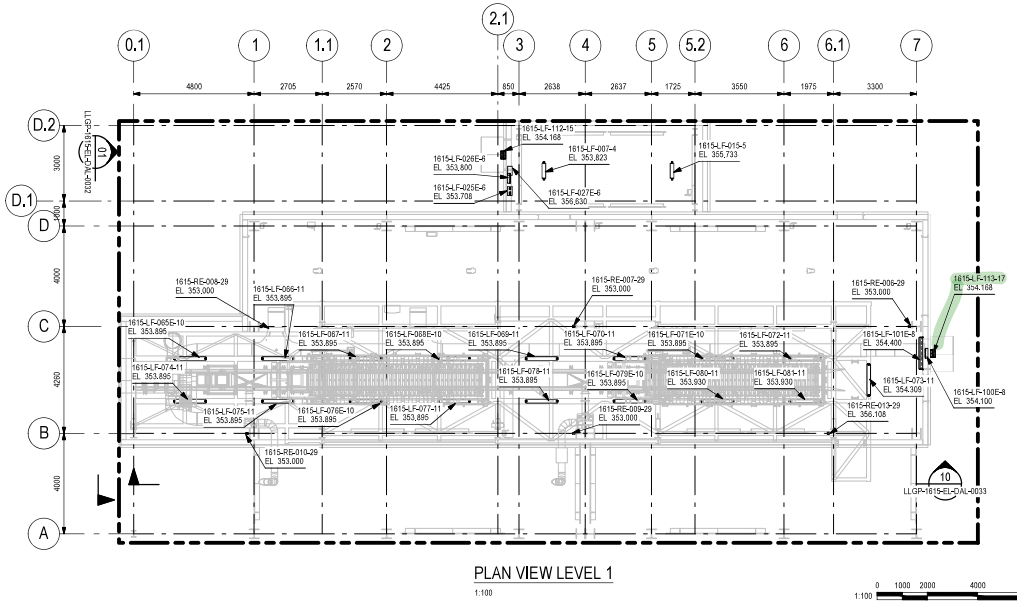
NOTE:
THIS TABLE ONLY REFLECTS LIGHT FIXTURES AND RECEPTICLES SHOWN ON THIS DRAWINGS
FOR FULL FINE ORE BIN AREA BILL OF MATERIALS REFER TO DRAWING LLGP-1615-EL-DAL-0034.
DUPLICATION OF FIXTURE TAGS MAY BE REFERED TO ON MULTIPULE DRAWINGS

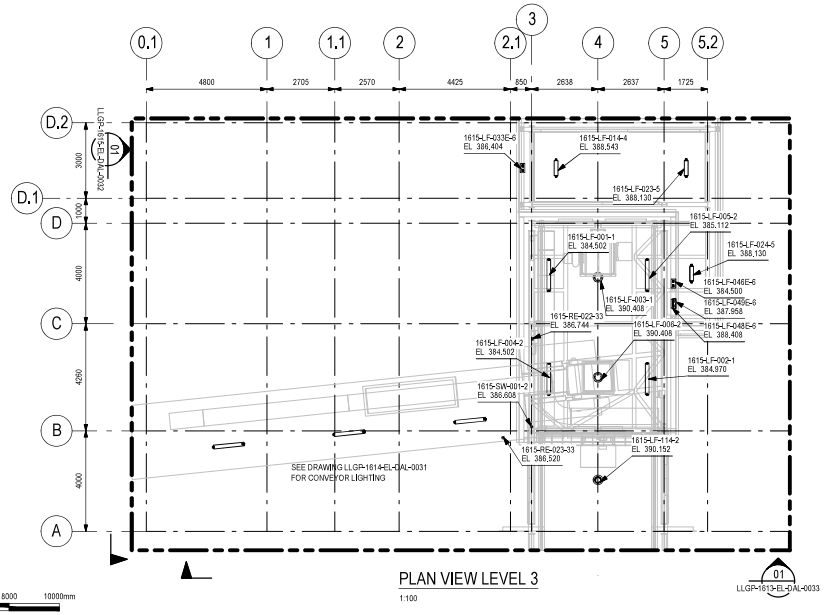
NOTES:

1. FOR STANDARD NOTES SEE DRAWING LLGP-0000-EL-DID-0001 THRU 0006.
2. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SHOWN OTHEWRWISE.

1	1615-LF-058-1, 1615-LF-059-2	2	ea.
2	1615-LF-061-1	1	ea.
3	1615-LF-062-1, 1615-LF-063-1, 1615-LF-063-2, 1615-LF-063-3, 1615-LF-063-4, 1615-LF-063-5, 1615-LF-063-6, 1615-LF-063-7, 1615-LF-063-8, 1615-LF-063-9, 1615-LF-063-10, 1615-LF-063-11, 1615-LF-063-12	12	ea.
4	1615-LF-065-1, 1615-LF-065-2, 1615-LF-065-3, 1615-LF-065-4, 1615-LF-065-5, 1615-LF-065-6, 1615-LF-065-7, 1615-LF-065-8, 1615-LF-065-9, 1615-LF-065-10, 1615-LF-065-11, 1615-LF-065-12, 1615-LF-065-13, 1615-LF-065-14, 1615-LF-065-15, 1615-LF-065-16, 1615-LF-065-17, 1615-LF-065-18, 1615-LF-065-19, 1615-LF-065-20, 1615-LF-065-21, 1615-LF-065-22, 1615-LF-065-23, 1615-LF-065-24, 1615-LF-065-25, 1615-LF-065-26, 1615-LF-065-27, 1615-LF-065-28, 1615-LF-065-29, 1615-LF-065-30, 1615-LF-065-31, 1615-LF-065-32, 1615-LF-065-33, 1615-LF-065-34, 1615-LF-065-35, 1615-LF-065-36, 1615-LF-065-37, 1615-LF-065-38, 1615-LF-065-39, 1615-LF-065-40, 1615-LF-065-41, 1615-LF-065-42, 1615-LF-065-43, 1615-LF-065-44, 1615-LF-065-45, 1615-LF-065-46, 1615-LF-065-47, 1615-LF-065-48, 1615-LF-065-49, 1615-LF-065-50, 1615-LF-065-51, 1615-LF-065-52, 1615-LF-065-53, 1615-LF-065-54, 1615-LF-065-55, 1615-LF-065-56, 1615-LF-065-57, 1615-LF-065-58, 1615-LF-065-59, 1615-LF-065-60, 1615-LF-065-61, 1615-LF-065-62, 1615-LF-065-63, 1615-LF-065-64, 1615-LF-065-65, 1615-LF-065-66, 1615-LF-065-67, 1615-LF-065-68, 1615-LF-065-69, 1615-LF-065-70, 1615-LF-065-71, 1615-LF-065-72, 1615-LF-065-73, 1615-LF-065-74, 1615-LF-065-75, 1615-LF-065-76, 1615-LF-065-77, 1615-LF-065-78, 1615-LF-065-79, 1615-LF-065-80, 1615-LF-065-81, 1615-LF-065-82, 1615-LF-065-83, 1615-LF-065-84, 1615-LF-065-85, 1615-LF-065-86, 1615-LF-065-87, 1615-LF-065-88	91	ea.
5	1615-LF-065E-1, 1615-LF-065E-2, 1615-LF-065E-3, 1615-LF-065E-4, 1615-LF-065E-5, 1615-LF-065E-6, 1615-LF-065E-7, 1615-LF-065E-8, 1615-LF-065E-9, 1615-LF-065E-10, 1615-LF-065E-11, 1615-LF-065E-12, 1615-LF-065E-13, 1615-LF-065E-14, 1615-LF-065E-15, 1615-LF-065E-16, 1615-LF-065E-17, 1615-LF-065E-18, 1615-LF-065E-19, 1615-LF-065E-20	20	ea.
6	1615-LF-058-9, 1615-LF-059-9, 1615-LF-061-9, 1615-LF-062-9, 1615-LF-063-12, 1615-LF-084-12	7	ea.
7	1615-LF-001-1, 1615-LF-002-1, 1615-LF-004-2, 1615-LF-005-2, 1615-LF-050-9, 1615-LF-051-9, 1615-LF-053-9, 1615-LF-054-9, 1615-LF-056-9, 1615-LF-066-11, 1615-LF-067-11, 1615-LF-069-11, 1615-LF-070-11, 1615-LF-072-11, 1615-LF-073-11, 1615-LF-074-11, 1615-LF-075-11, 1615-LF-077-11, 1615-LF-078-11, 1615-LF-080-11, 1615-LF-082-12, 1615-LF-087-12, 1615-LF-088-12	24	ea.
8	1615-LF-090-13, 1615-LF-091-13, 1615-LF-092-13, 1615-LF-093-13, 1615-LF-094-13, 1615-LF-095-14, 1615-LF-096-14, 1615-LF-097-14, 1615-LF-098-14, 1615-LF-099-14	10	ea.
9	1615-LF-034-7, 1615-LF-035-7, 1615-LF-036-7, 1615-LF-037-7, 1615-LF-038-7, 1615-LF-039-7, 1615-LF-040-7, 1615-LF-041-7, 1615-LF-042-7, 1615-LF-043-7, 1615-LF-044-7, 1615-LF-045-7	12	ea.
10	1615-LF-025E-6, 1615-LF-027E-6, 1615-LF-033E-6, 1615-LF-046E-6, 1615-LF-048E-6	5	ea.
11	1615-LF-103-15, 1615-LF-104-15, 1615-LF-105-15, 1615-LF-106-15, 1615-LF-108-17, 1615-LF-109-17, 1615-LF-110-17, 1615-LF-111-17	8	ea.
12	1615-LF-026E-6,1615-LF-049E-6, 1615-LF-064E-8, 1615-LF-086E-8, 1615-LF-100E-8	6	ea.
13	1615-SW-001-2	1	ea.
14	1615-PL-001, 1615-PL-002, 1615-PL-003 1615-PL-004, 1615-PL-005, 1615-PL-006, 1615-PL-007, 1615-PL-008, 1615-PL-009	11	ea.
15	1615-LF-089-7, 1615-LF-112-15, 1615-LF-113-17,	3	ea.
16	1615-RE-006-29, 1615-RE-007-29, 1615-RE-008-29, 1615-RE-009-29, 1615-RE-010-29, 1615-RE-013-29, 1615-RE-015-31, 1615-RE-019-31, 1615-RE-020-31, 1615-RE-022-33, 1615-RE-023-33	11	ea.







REV	DATE (DD/MMM/YY)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER
C	20.05.2024	REISSUED FOR IIR/ICR	AW	FO	SH	ES	YM	
B	8 Nov 2023	ISSUED FOR IIR AND ICR	AW	FO	SH	ES	YM	
A	16.10.2023	ISSUED FOR INTERNAL REVIEW	AW	FO	SH	ES	YM	

REF DRAWING No	REFERENCE DRAWING TITLE
LLGP-1615-EL-DAL-0220	ELECTRICAL ROOM 1615-ER-001 LIGHTING LAYOUT & SECTIONS
LLGP-1615-EL-LST-0002	FINE ORE BIN LIGHTING WIRING DIAGRAM
LLGP-1615-EL-LST-0001	FINE ORE BIN LIGHTING PANEL SCHEDULE & SCHMATIC DIAGRAM
LLGP-1615-EL-DAL-0034	FINE ORE BIN COMPLETE BILL OF MATERILS
LLGP-1615-EL-DAL-0033	FINE ORE BIN LIGHTING SECTION AND BILL OF MATERIAL
LLGP-1615-EL-DAL-0032	FINE ORE BIN LIGHTING SECTION AND BILL OF MATERIAL
LLGP-1615-EL-DAL-0051	FINE ORE BIN GROUNDING LAYOUT
LLGP-1615-EL-DAL-0011	FINE ORE BIN CABLE TRAY LAYOUTS

A1 SHEET SCALE 1:100

WORLEY PROJECT No.
317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

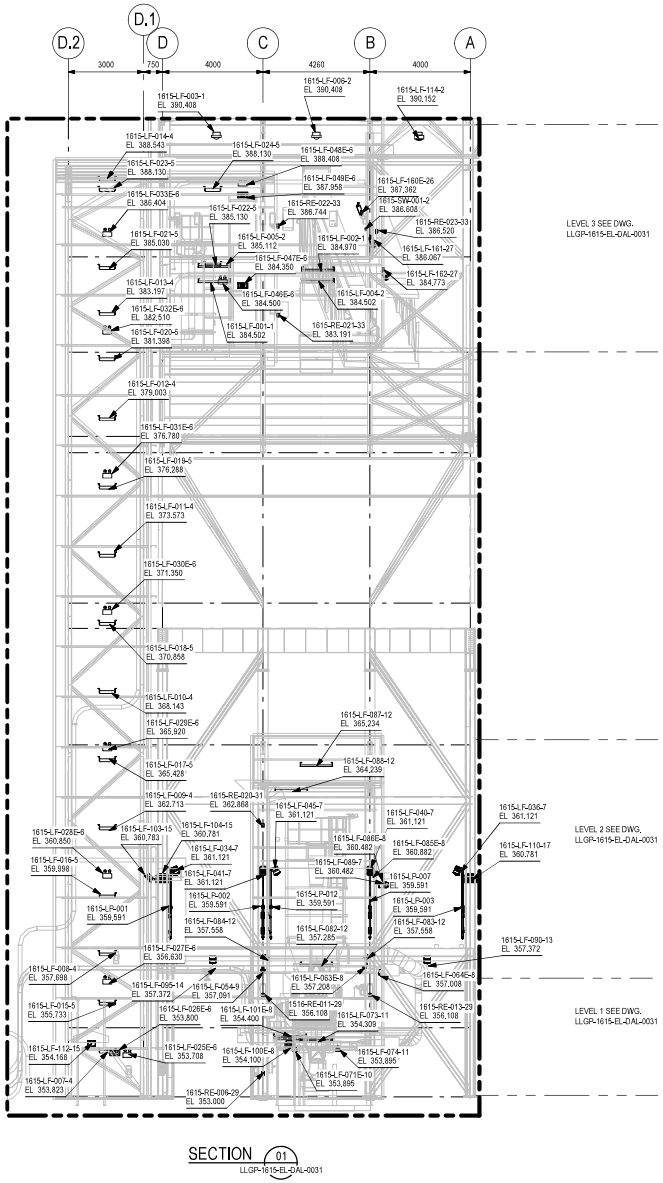
CUSTOMER
ALAMOS GOLD INC.

"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE
LYNN LAKE GOLD PROJECT
MACLELLAN SITE
FINE ORE BIN
LIGHTING
LAYOUTS AND BILL OF MATERIL

DRG No LLGP-1615-EL-DAL-0031 REV C

USER NAME: allexanderson
PLOT DATE & TIME: 16 May 2024 13:40:18
SAVE DATE & TIME: 15 May 2024 13:40:20



SECTION 01
LLGP-1615-EL-DAL-0031

NOTES:

1. FOR STANDARD NOTES SEE DRAWING LLGP-0000-EL-DID-0001 THRU 0008.
2. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SHOWN OTHERWISE.

NOTE:
THIS TABLE ONLY REFLECTS LIGHT FIXTURES SHOWN ON DRAWINGS LLGP-1615-EL-DAL-0031, 32 AND 33.
FOR FULL FINE ORE BIN AREA BILL OF MATERIALS REFER TO DRAWING LLGP-1615-EL-DAL-0034.
DUPLICATION OF FIXTURE TAGS MAY BE REFERED TO ON MULTIPULE DRAWINGS

ITE	TAG NUMBER	CTY	UNI	DESCRIPTION
1	1615-LF-003-1, 1615-LF-006-2	2	ea.	13100 m LED, 95W, 120V, 60Hz 5000K COOL, TYPE V OPTICAL, CEILING MOUNTING, NEMA 4X, CROUSE-HINDS #PVML-13-2C-UNV1
2	1615-LF-114-2	1	ea.	25900 m LED, 206W, 120V, 60Hz, 5000K COOL, TYPEV OPTICAL, CEILING MOUNTING, NEMA IX, CROUSE-HINDS #PVML-25-2C-UNV1
3	1615-LF-007-4, 1615-LF-008-4,1615-LF-009-4, 1615-LF-010-4, 1615-LF-011-4, 1615-LF-012-4, 1615 LF-#13-4, 1615-LF-014-4, 1615-LF-0:5-5 1615-LF-015-5,1615-LF 017-5, 1615-LF-018-5, 1615-LF-019-5,1615-LF-020-5, 1615-LF-021-5, 1615 LF-022-5, 1615-LF-023-5, 1615-LF-024-5	18	ea.	3958 lm LINEAR LED, 2 ft LENGTH, OPTICS 120° 32W.120V, 60Hz,c/w DP1053MTP KIT. CROUSE-HINDS #PLL2-UNVI-S903-TF
4	1615-LF-033E-8, 1315-LF-301E-8	2	ea.	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 38W.120V, 60Hz,c/w DP1052MTP & 90 MIN BATTERY MODULE, C-H #PLL4-UNV1-S903-TF-EM1
5	1615-LF-071E-10, 1615-LF-160E-26, 1615-LF-161E-27, 1615 LF-162-2,	4	ea.	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 38W.120V, 60Hz,c/w DP1053MTP & 90 MIN BATTERY MODULE, C-H #PLL4-UNV1-S903-TF-EM1
6	1615-LF-083-12, 1315-LF-084-12, 1615 LF-085E-8	3	ea.	7900 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 62W.120V, 60Hz,c/w DP1053MTP KIT. CROUSE-HINDS #PLL4-UNVI-S903-TF
7	1615-LF-001-1, 1615-LF-002-1,1615-LF-004-2, 1615-LF-005-2, 1615-LF-054-9, 1615-LF-073-11,1615-LF-074-11,1615-LF-082-12 1615-LF-087-12 1615-LF-088-12	10	ea.	7900 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 62W.120V, 60Hz,c/w DP1053MTP KIT. CROUSE-HINDS #PLL4-UNVI-S903-TF
8	1615-LF-030-13, 1315-LF-095-14	2	ea.	9234 lm LED, 76W, 120V, 60Hz, 5000K COOL TYPE V OPTICAL, CEILING MOUNTING, NEMA 4X CROUSE-HINDS#PVML-9-2C-UNV1
9	1615-LF-034-7, 1615-LF-036-7,1615-LF-040-7, 1615-LF-041-7, 1615-LF-045-7	5	ea.	9234 lm LED, 76W, 120V, 60Hz, 5000K COOL TYPE V OPTICAL, NEMA4X, CROUSE-HINDS #PVML-9-UNV1
10	1615-LF-025E-6, 1315-LF-027E-6, 1615-LF-028E-6, 1615-LF-329E-6, 1615-LF-030C-6, 1315-LF-031E-6, 1615-LF-032E-6, 1615-LF-333(-6, 1615-LF-046E-6, 1315-LF-048E-6	10	ea.	EMERGENCY LIGHT LED, 28W, 120V, 60Hz, 2x3W LED LAMP, 90 MIN BATTERY MODULE, CROUSE-HINDS #N2LPS12222SS
11	1615-LF-133-15, 1315-LF-304-15, 1615-LF-310-17	3	ea.	FLOODLIGHT, 2550 lm LED, 216W,120V, 60Hz, 5000K COOL YOKE MOUNTING, NEMA 4X, CROUSE-HINDS #PSMA25LCY-UNV176
12	1615-LF-026E-6, 1315-LF-047E-6, 1615 LF-049E-6, 1615-LF-364E-8, 1615-LF-086E-8, 1315-LF-300E-8	6	ea.	LED EXT SIGNS, 1.4W, 120V, 60Hz, SELF-POWED, SIGNAL FACE, c/w NICKEL CADNIUM BATTERY, CROUSE-HINDS #UX/15D
13	1615-SW-301-2	1	ea.	unset
16	1615-PL-001, 1615-PL-002 1615-PL-003, 1615-PL-007, 1615-PL-012	5	ea.	V-SPRING LIGHT POLE, 5-H #V65H-GC, #MHE-W5, &#IN5
17	1615-LF-089-7, 1615-LF-112-15	2	ea.	WP WALL FACH LED, 6200 lm, 50W, 120V, 60Hz, 5000K COOL NEMA 4X, COOPER WPMLED15
18	1615-RE-006-29, 1615-RE-011-29, 1615-RE-013-29, 1615-RE-023-3', 1615-RE-031-33, 1615-RE-022-33, 1615-RE-023-33	7	ea.	1-GANG GFCI RECEPTACLE,20A120V, HEAVY DUTY DIE CAST ALBOX & COVER, HUBBELL TAYMAC MX320

DRAFT

1:100 0 1000 2000 4000 6000 8000 10000mm

REV	DATE (D.M.M.A.Y)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
									LLGP-1615-EL-DAL-0034	FINE ORE BIN COMPLETE BILL OF MATERILS
									LLGP-1615-EL-DAL-0033	FINE ORE BIN SECTION AND BILL OF MATERILS
C	20.05.2024	REISSUED FOR IIR/ICR	AW	FO	SH	ES	YM		LLGP-1615-EL-DAL-0031	FINE ORE BIN LIGHTING LAYOUTS
B	8 Nov 2023	ISSUED FOR IIR AND ICR	AW	FO	SH	ES	YM		LLGP-1615-EL-DAL-0051	FINE ORE BIN GROUNDING LAYOUT
A	16.10.2023	ISSUED FOR INTERNAL REVIEW	AW	FO	SH	ES	YM		LLGP-1615-EL-DAL-0011	FINE ORE BIN CABLE TRAY LAYOUTS

A1 SHEET SCALE 1:100

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

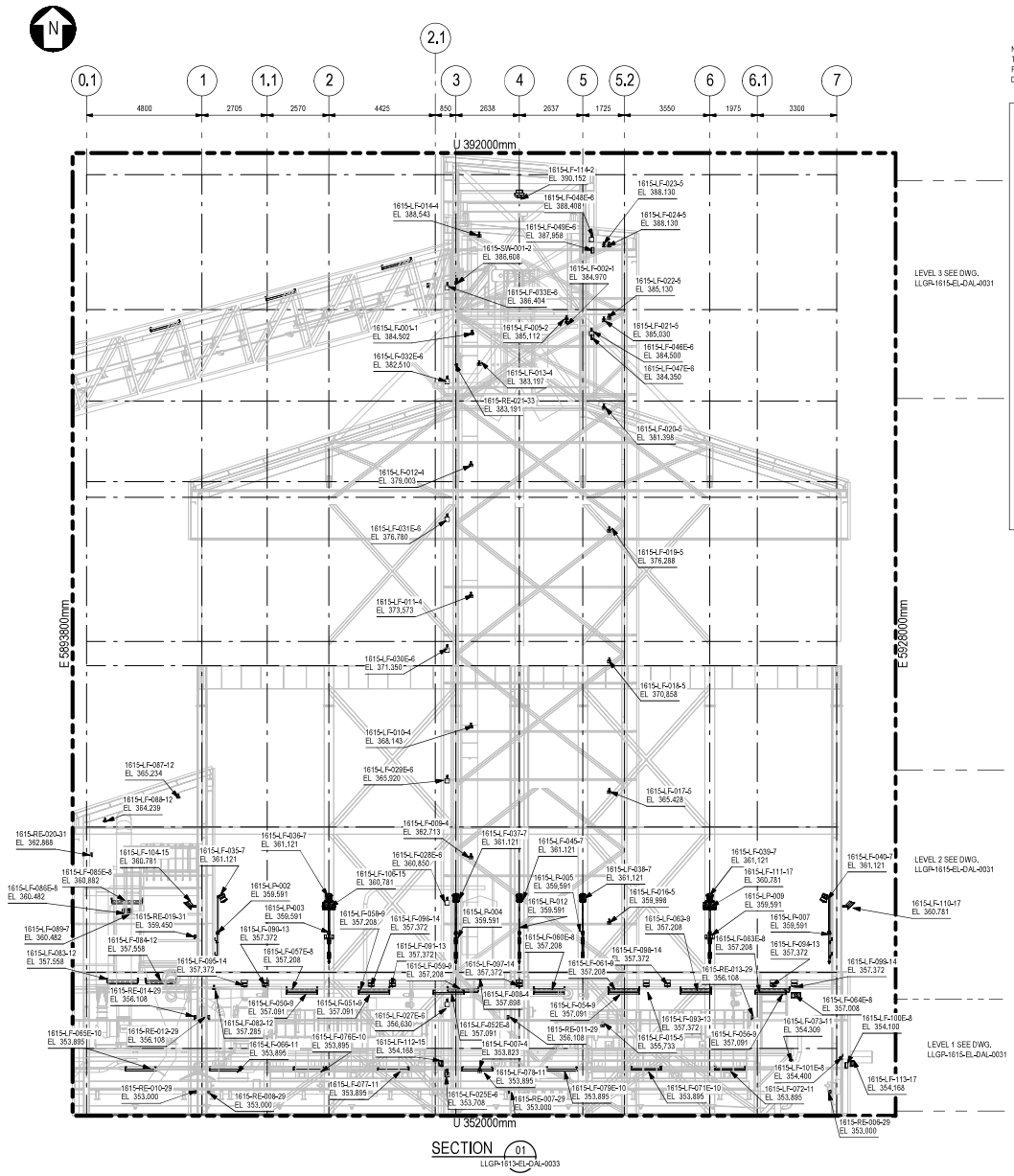
"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in the drawing."

DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
FINE ORE BIN
LIGHTING
SECTION AND BILL OF MATERIAL

DRG No LLGP-1615-EL-DAL-0032 REV C

USER NAME: alexanderson
PLOT DATE & TIME: 15 May 2024 16:23:19
SAVE DATE & TIME: 15 May 2024 16:23:19



SECTION 01
LLGP-1615-EL-DAL-0033

NOTE:
THIS TABLE ONLY REFLECTS LIGHT FIXTURES AS RECEPTICLES SHOWN ON THIS DRAWINGS.
FOR FULL FINE ORE BIN AREA BILL OF MATERIALS REFER TO DRAWING LLGP-1615-EL-DAL-0034.
DUPLICATION OF FIXTURE TAGS MAY BE REFERED TO ON MULTIPULE DRAWINGS

NOTES:

1. FOR STANDARD NOTES SEE DRAWING LLGP-0000-EL-DID-0001 THRU 0006.
2. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SHOWN OTHEWRWISE.

DRAFT

1:100 0 1000 2000 4000 6000 8000 10000mm

REV	DATE (DD/MM/YY)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
									LLGP-1615-EL-LST-0002	FINE ORE BIN LIGHTING WIRING DIAGRAM
									LLGP-1615-EL-LST-0001	FINE ORE BIN LIGHTING PANEL SCHEDULE & SCHEMATIC DIAGRAM
									LLGP-1615-EL-DAL-0034	FINE ORE BIN LIGHTING COMPLETE BILL OF MATERILS
									LLGP-1615-EL-DAL-0032	FINE ORE BIN LIGHTING SECTION AND BILL OF MATERIAL
C	20.05.2024	REISSUED FOR IIR/ICR	AW	FO	SH	ES	YM		LLGP-1615-EL-DAL-0031	FINE ORE BIN LIGHTING LAYOUTS AND BILL OF MATERIAL
B	8 Nov 2023	ISSUED FOR IIR AND ICR	AW	FO	SH	ES	YM		LLGP-1615-EL-DAL-0051	FINE ORE BIN GROUNDING LAYOUT
A	10.16.2023	ISSUED FOR INTERNAL REVIEW	AW	FO	SH	ES	YM		LLGP-1615-EL-DAL-0011	FINE ORE BIN CABLE TRAY LAYOUTS

A1 SHEET SCALE 1:100

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
FINE ORE BIN
LIGHTING
SECTION AND BILL OF MATERIAL

DRG No LLGP-1615-EL-DAL-0033 REV C

USER NAME: allexanderm
PLOT DATE & TIME: 15 May 2024 15:07:59
SAVE DATE & TIME: 15 May 2024 13:07:09

NOTES:
1. FOR STANDARD NOTES SEE DRAWING LLGP-0000-EL-DID-0001 THRU 0006.

ITE	TAG NUMBER	QT	UN	DESCRIPTION
1	1615-LF-003-1, 1615-LF-006-2	2	ea.	13100 lm LED, 95W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, CEILING MOUNTING, NEMA 4X, CROUSE-HINDS #PVML-13-2C-UNV1
2	1615-LF-124-2	1	ea.	25300 lm LED, 206W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, CEILING MOUNTING, NEMA 4X, CROUSE-HINDS #PVML-25-2C-UNV1
3	1615-LF-007-4, 1615-LF-008-4, 1615-LF-009-4, 1615-LF-010-4, 1615-LF-011-4, 1615-LF-012-4, 1615-LF-013-4, 1615-LF-014-4, 1615-LF-015-5, 1615-LF-016-5, 1615-LF-017-5, 1615-LF-018-5, 1615-LF-019-5, 1615-LF-020-5, 1615-LF-021-5, 1615-LF-022-5, 1615-LF-023-5, 1615-LF-024-5	18	ea.	3958 lm LINEAR LED, 2 ft LENGTH, OPTICS 120° 32W,120V, 60Hz, c/w DP1053MTK KIT, CROUSE-HINDS #PLL2-UNV1-S903-TF
4	1615-LF-057E-8, 1615-LF-060E-8, 1615-LF-063E-8, 1615-LF-101E-8	4	ea.	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W,120V, 60Hz, c/w DP1052MTK & 90 MIN BATTERY MODULE, C-H #PLL4-UNV1-S903-TF-EM1
5	1615-LF-052E-8, 1615-LF-055E-8, 1615-LF-065E-10, 1615-LF-068E-10, 1615-LF-071E-10, 1615-LF-076E-10, 1615-LF-079E-10	7	ea.	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W,120V, 60Hz, c/w DP1053MTK & 90 MIN BATTERY MODULE, C-H #PLL4-UNV1-S903-TF-EM1
6	1615-LF-058-9, 1615-LF-059-9, 1615-LF-061-9, 1615-LF-062-9, 1615-LF-083-12, 1615-LF-084-12, 1615-LF-085E-8	7	ea.	7900 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 62W,120V, 60Hz, c/w DP1052MTK KIT, CROUSE-HINDS #PLL4-UNV1-S903-TF
7	1615-LF-001-1, 1615-LF-002-1, 1615-LF-004-2, 1615-LF-005-2, 1615-LF-050-9, 1615-LF-051-9, 1615-LF-053-9, 1615-LF-054-9, 1615-LF-056-9, 1615-LF-066-11, 1615-LF-067-11, 1615-LF-069-11, 1615-LF-070-11, 1615-LF-072-11, 1615-LF-073-11, 1615-LF-074-11, 1615-LF-075-11, 1615-LF-077-11, 1615-LF-078-11, 1615-LF-080-11, 1615-LF-081-11, 1615-LF-082-12, 1615-LF-087-12, 1615-LF-088-12	24	ea.	7900 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 62W,120V, 60Hz, c/w DP1053MTK KIT, CROUSE-HINDS #PLL4-UNV1-S903-TF
8	1615-LF-090-13, 1615-LF-091-13, 1615-LF-092-13, 1615-LF-093-13, 1615-LF-094-13, 1615-LF-095-14, 1615-LF-096-14, 1615-LF-097-14, 1615-LF-098-14, 1615-LF-099-14	10	ea.	9234 lm LED, 76W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, CEILING MOUNTING, NEMA 4X, CROUSE-HINDS #PVML-9-2C-UNV1
9	1615-LF-034-7, 1615-LF-035-7, 1615-LF-036-7, 1615-LF-037-7, 1615-LF-038-7, 1615-LF-039-7, 1615-LF-040-7, 1615-LF-041-7, 1615-LF-042-7, 1615-LF-043-7, 1615-LF-044-7, 1615-LF-045-7	12	ea.	9234 lm LED, 76W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, NEMA 4X, CROUSE-HINDS #PVML-9-UNV1
10	1615-LF-025E-6, 1615-LF-027E-6, 1615-LF-028E-6, 1615-LF-029E-6, 1615-LF-030E-6, 1615-LF-031E-6, 1615-LF-032E-6, 1615-LF-033E-5, 1615-LF-046E-6, 1615-LF-048E-6	10	ea.	EMERGENCY LIGHT LED, 28W, 120V, 60Hz, 2x3W LED LAMP, 90 MIN BATTERY MODULE, CROUSE-HINDS #N2LPS12222 SS
11	1615-LF-102-15, 1615-LF-103-15, 1615-LF-104-15, 1615-LF-105-15, 1615-LF-106-15, 1615-LF-107-17, 1615-LF-108-17, 1615-LF-109-17, 1615-LF-110-17, 1615-LF-111-17, 1615-LF-187-28	11	ea.	FLOOD LIGHT, 25500 lm LED, 216W, 120V, 60Hz, 5000K COOL, YOKE MOUNTING, NEMA 4X, CROUSE-HINDS #PFMA25LCY-UNV176
12	1615-LF-026E-6, 1615-LF-047E-6, 1615-LF-049E-6, 1615-LF-054E-8, 1615-LF-085E-8, 1615-LF-100E-8	6	ea.	LED EXIT SIGNS, 1.4W, 120V, 60Hz, SELF-POWED, SIGNAL FACE, c/w NICKEL CADMIUM BATTERY, CROUSE-HINDS #UX71SD
13	1615-SW-001-2	1	ea.	unset
16	1615-PL-001, 1615-PL-002, 1615-PL-003, 1615-PL-004, 1615-PL-005, 1615-PL-006, 1615-PL-007, 1615-PL-008, 1615-PL-009, 1615-PL-010, 1615-PL-011, 1615-PL-012, 1615-FL-015	13	ea.	V-SPRING LIGHT POLE, C-H #V65H-GC, #MHK-WG, & #JM5
17	1615-LF-089-7, 1615-LF-112-15, 1615-LF-113-17,	3	ea.	WP WALL PACK LED, 6200 lm, 50W, 120V, 60Hz, 5000K COOL, NEMA 4X, COOPER WPMLED15
18	1615-RE-006-29, 1615-RE-007-29, 1615-RE-008-29, 1615-RE-009-29, 1615-RE-010-29, 1615-RE-011-29, 1615-RE-012-29, 1615-RE-013-29, 1615-RE-014-29, 1615-RE-015-31, 1615-RE-019-31, 1615-RE-020-31, 1615-RE-021-33, 1615-RE-022-33, 1615-RE-023-33	15	ea.	1-GANG GFCI RECEPTACLE, 20A, 120V, HEAVEY DUTY DIE-CAST AL BOX & COVER, HUBBELL TAYMAC MX3200

DRAFT

REV	DATE (DD/MM/YY)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
									LLGP-1615-EL-DAL-0031	FINE ORE BIN LIGHTING LAYOUTS AND BILL OF MATERILS
									LLGP-1615-EL-DAL-0033	FINE ORE BIN LIGHTING SECTION AND BILL OF MATERIAL
C	16 May 24	REISSUED FOR IIR/ICR	AW	FO	SH	ES	YM		LLGP-1615-EL-DAL-0032	FINE ORE BIN LIGHTING SECTION AND BILL OF MATERIAL
B	8 Nov 2023	ISSUED FOR IIR AND ICR	AW	FO	SH	ES	YM		LLGP-1615-EL-DAL-0051	FINE ORE BIN GROUNDING LAYOUT
A	16.10.2023	ISSUED FOR INTERNAL REVIEW	AW	FO	SH	ES	YM		LLGP-1615-EL-DAL-0011	FINE ORE BIN CABLE TRAY LAYOUTS

A1 SHEET SCALE 1:100

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

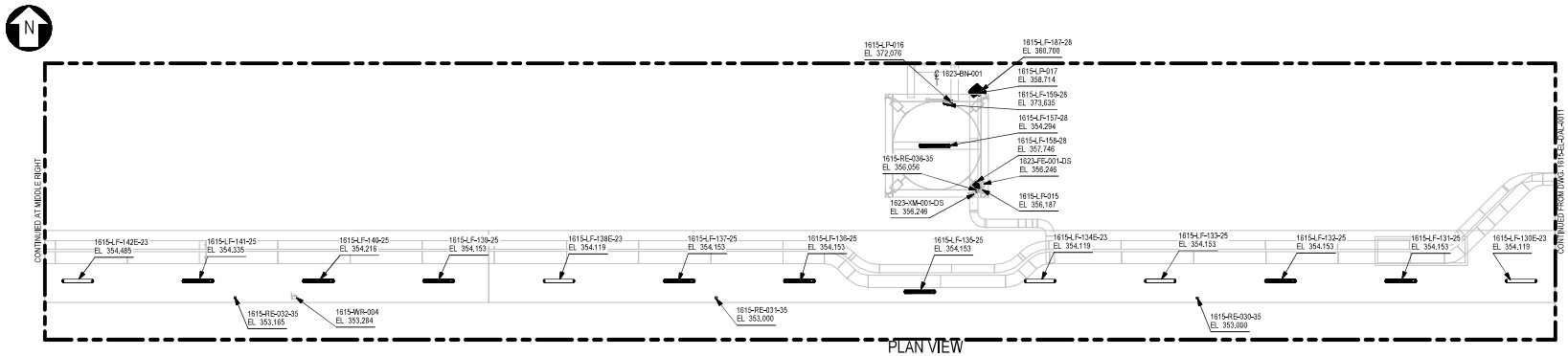
DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
FINE ORE BIN
LIGHTING
COMPLETE BILL OF MATERILS

DRG No LLGP-1615-EL-DAL-0034

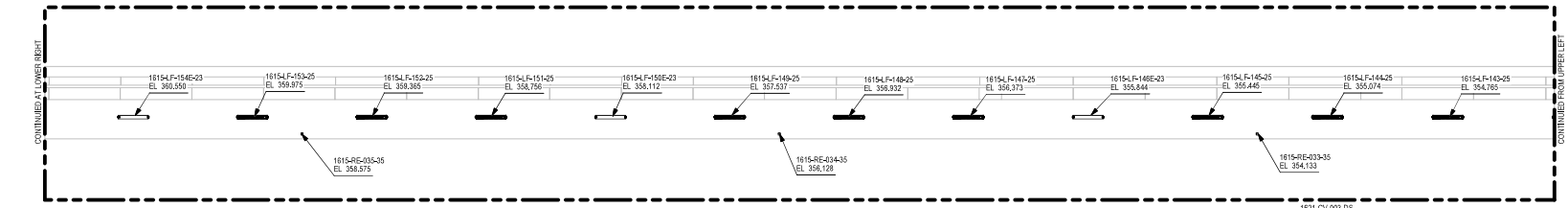
REV C

USER NAME: allexanderson
PLOT DATE & TIME: 16 May 2024 16:07:40
SAVE DATE & TIME: 16 May 2024 16:07:40



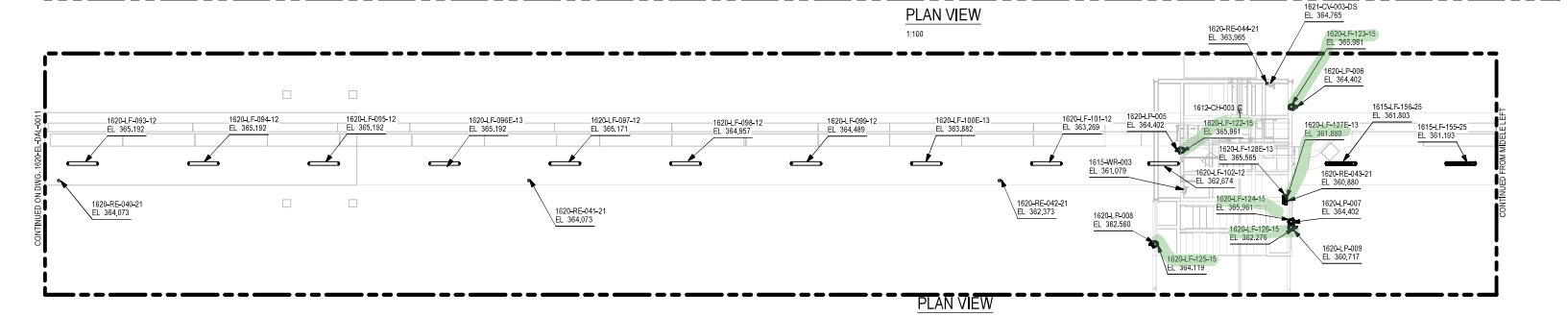
PLAN VIEW

1:100



PLAN VIEW

1:100



PLAN VIEW

1:100

NOTES:

1. FOR STANDARD NOTES SEE DRAWING LLGP-0000-EL-DID-0010 THRU 0013.
2. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SPECIFIED OTHERWISE.
3. ALL INSTALLATIONS SHALL BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC), PART 1, 2024 EDITION.
4. CONTRACTOR MAY USE MANUFACTURER PART NUMBERS SPECIFIED ON THE DRAWING OR APPROVED EQUAL.
5. ALL MATERIALS FOR OUTDOOR INSTALLATIONS SHALL BE GALVANIZED STEEL FOR NON AGGRESSIVE ENVIRONMENTS AND 316L STAINLESS STEEL OR FIBER REINFORCED POLYESTER FOR CORROSIVE AREAS.
6. ALL LIGHTING ELEVATIONS ARE REFERENCED FROM THE BOTTOM OF THE FIXTURE UNLESS NOTED OTHERWISE.

ITE	TAG NUMBER	QT	UN	DESCRIPTION
1	1615-LF-130E-23, 1615-LF-134E-23, 1615-LF-138E-23, 1615-LF-142E-23, 1615-LF-146E-23, 1615-LF-150E-23, 1615-LF-154E-23, 1620-100E-13, 1620-LF-096E-13,	9	ea.	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W,120V, 60Hz, c/w DP1053MTK & 90 MIN BATTERY MODULE, C-H #PLL4-UNV1-S903-TF-EM1
2	1615-LF-131-25, 1615-LF-132-25, 1615-133-25, 1615-LF-135-25, 1615-LF-136-25, 1615-137-25, 1615-LF-139-2, 1615-LF-140-25, 1615-LF-141-25, 1615-LF-143-25, 1615-LF-144-25, 1615-LF-145-25, 1615-LF-147-25, 1615-LF-148-25, 1615-LF-149-25, 1615-LF-151-25, 1615-LF-152-25, 1615-LF-153-25, 1615-LF-155-25, 1615-LF-156-25, 1615-LF-157-28, 1620-LF-102-12, 1620-LF-101-12, 1620-LF-099-12, 1620-LF-098-12, 1620-LF-097-12, 1620-LF-095-12, 1620-094-12, 1620-LF-093-12	29	ea.	7900 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 62W,120V, 60Hz, c/w DP1053MTK KIT, CROUSE-HINDS #PLL4-UNV1-S903-TF
3	1615-LF-158-28, 1615-LF-159-28	2	ea.	9234 lm LED, 76W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, NEMA 4X, CROUSE-HINDS #PVML-9-UNV1
4	1620-LF-122-15, 1620-LF-123-15, 1620-LF124-15, 1620-LF-125-15, 1620-LF-126-15	5	ea.	3250 lm LED, 28W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, NEMA 4X, CROUSE-HINDS #PVML-3-UNV1
5	1615-LP-017	1		V-SPRING LIGHT POLE, C-H #V65H-GC, #MHK-WG, & #LMB-FL-40
6	1615-LP-015, 1615-LP-016, 1620-LP-005,1620-LP-006, 1620-LP-007, 1620-LP-008, 1620-LP-009	7	ea.	V-SPRING LIGHT POLE, C-H #V65H-GC, #MHK-WG, & #LM5
7	1615-LF-187-28	1		FLOODLIGHT, 25500 lm LED, 216W, 120V, 60Hz, 5000K COOL, YOKE MOUNTING, NEMA 4X, GROUSE-HINDS #PFMA25LCY-UNV176
8	1615-RE-030-35, 1615-RE-031-35, 1615-RE-032-35, 1615-RE-033-35, 1615-RE-034-35, 1615-RE-035-35, 1620-RE-040-21, 1620-RE-041-21, 1620-RE-042-21, 1620-043-21, 1620-RE-044-21,	11	ea.	1-GANG WATERPROOF GFCI RECEPTACLE, 120V, 20A, HEAVY DUTY DIE-CAST AL BOX & COVER, HUBBELL TAYMAC MX3200
9	1620-LF-127E-13, 1620-LF-128E-13	2	ea.	EMERGENCY LIGHT LED, 28W, 12V, 60Hz, 2x3W LED LAMP, 90 MIN. BATTERY MODULE, CROUSE-HINDS #IN2LPS122225S

ITEM	DESCRIPTION	QTY.
1	[illegible] #WSRDW6351CH-S901	
	[illegible]	1
	[illegible]	1
2	[illegible]	
	[illegible]	1
	[illegible]	1
	[illegible]	1

0 1000 2000 4000 6000 8000 10000mm

1:100

REV	DATE (DD/MM/YY)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
A	09.01.24	ISSUED FOR IRIACR	AW	FO	SH	ES	YM		LLGP-1613-EL-DAL-0012	FINE ORE BIN & 1615 ELECTRICAL RM CABLE TRAY SECTIONS

A1 SHEET SCALE 1:100

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
FINE ORE BIN 1615 CONVEYOR
LIGHTING AND EQUIPMENT
LAYOUTS

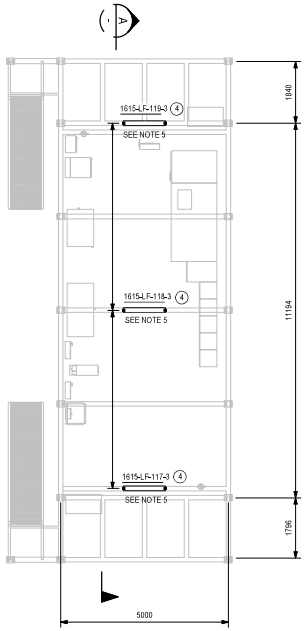
DRG No LLGP-1615-EL-DAL-0035

REV A

USER NAME: [illegible]

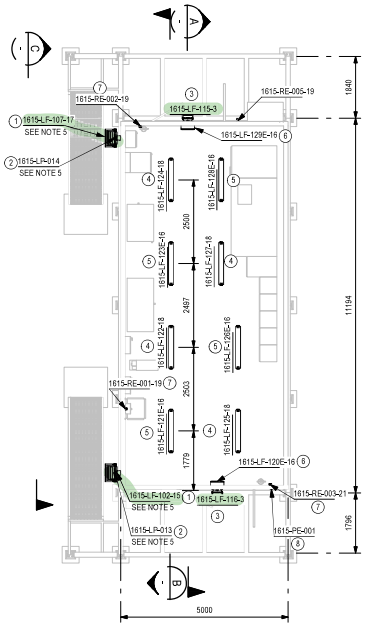
PLOT DATE & TIME: 26 Jan 2024 10:24:48

SAVE DATE & TIME: 18 Jan 2024 10:24:48



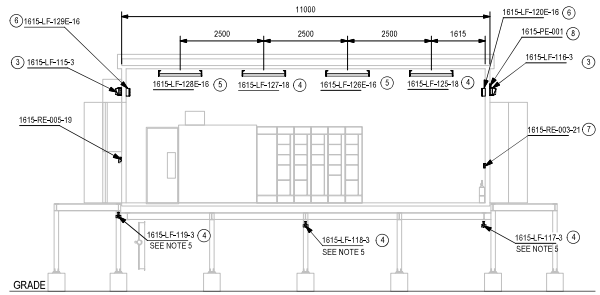
PLAN VIEW UNDER E-ROOM

1:75



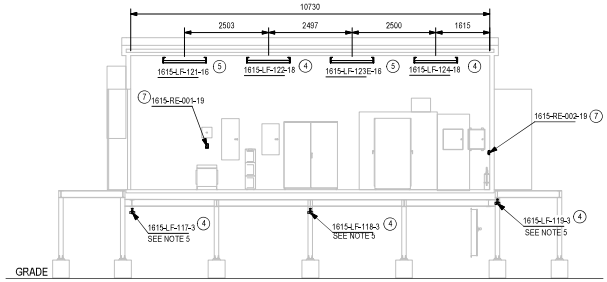
PLAN VIEW E-ROOM

1:75



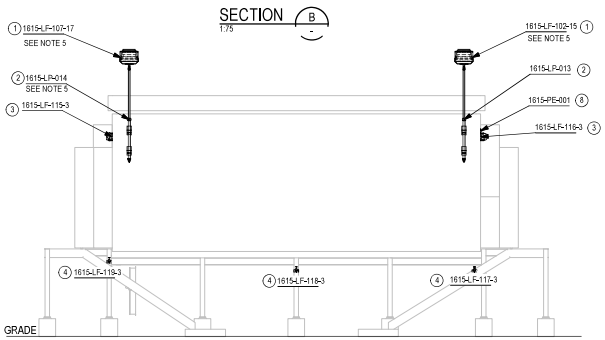
SECTION A

1:75



SECTION B

1:75



SECTION C

1:75

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SHOWN OTHERWISE.
2. THE LOCATION OF LIGHT FIXTURES AND RECEPTACLES IN THIS DRAWING ARE PRILIMINARY ONLY. THE ACTUAL LOCATION DEPENDS ON THE E-ROOM VENDOR AND SHALL BE DETERMINED AT THE TIME OF INSTALLATION.
3. THE LIGHTING FIXTURE & RECEPTACLE TAG NUMBER: AAAA-BB-CCCX-Y
   AAAA: AREA NUMBER
   BB: LF - LIGHTING FIXTURE
   LP - LIGHTING POLE
   RE - RECEPTACLE
   PE - PHOTOCELL
   CCCX: CCC - SEQUENCE NUMBER (001-999)
   X - BLANK: STANDARD LIGHTING FIXTURE
   E: INTEGRATED EMERGENCY BATTERY BACK-UP
   Y: CIRCUIT NUMBER OF LIGHTING PANEL
4. ALL MATERIAL PART NUMBERS CAN BE SUBSTITUTED WITH APPROVED EQUIVANENT.
5. LIGHT FIXTURES ARE NOT PART OF E-ROOM VENDOR PACKAGE AND WILL BE SUPPLIED AND INSTALLED AT SITE BY ELECTRICAL CONTRACTOR.

LIGHTING BILL OF MATERIAL

ITEM	TAG NUMBER	QTY.	DESCRIPTION
1	1615-LF-102-15, 1615-LF-107-17	2	FLOODLIGHT, 26500 LUMEN LED, 216W, 120Vac, 60Hz, 5000K CCOL WHITE LIGHT, YOKE MOUNTING, NEMA 4X, CROUSE-HINDS CHAMP PRO #PFMA25LCY-UNV1-76
2	1615-LF-013, 1615-LF-014	2	Y-SPRING LIGHT POLE, C-H #V66H-G, #MHK-6KG, & #LMB-FL-40
3	1615-LF-115-3, 1615-LF-116-3	2	WF WALL PACK LED, 6200 LUMEN, 50W, 120V, 60Hz, 5000K COOL, NEMA 4X, COOPER WPMLED15
4	1615-LF-117-3, 1615-LF-118-3, 1615-LF-119-3, 1615-LF-122-18, 1615-LF-124-18, 1615-LF-125-18, 1615-LF-127-18	7	794 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 62W, 120V, 60Hz, c/w DP1053MTK KIT, CROUSE HINDS #PLL4-UNV1-5903-TF
5	1615-LF-121-16, 1615-LF-123-16, 1615-LF-125-16, 1615-LF-126-16	4	6730 lm LINEAR LED, 4 ft, OPTICS 120°, 58W, 120V, 60Hz, c/w DP1053MTK & 90 MIN BATTERY MODULE, CROUSE-HINDS #PLL4-UNV1-5903-TF-EM1
6	1615-LF-120E-16, 1615-129E-16	2	LED EXIT SIGNS, 1.4W, 120V, 60Hz, SELF POWED, SIGNAL FACE, c/w NICKEL CADMIUM BATTERY, CROUSE-HINDS #UX71SD
7	1615-RE-001-19, 1615-RE-002-19, 1615-RE-003-21	4	3-GANG RECEPTACLE, 20A, 120V, 60Hz
8	1615-PE-001	1	PHOTOCELL, 3.3A,120V,60Hz, CROUSE-HINDS #D2S20

DRAFT

REV	DATE (DD/MM/YY)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
									LLGP-1615-EL-DAL-0210	FINE ORE BIN AREA E-ROOM 1615-ER-001 CABLE TRAY LAYOUT
									LLGP-1615-EL-DAL-0200	FINE ORE BIN AREA E-ROOM 1615-ER-001 EQUIPMENT LAYOUT
									LLGP-1615-EL-LST-0001	FINE ORE BIN PANEL SCHEDULE & WIRING DIAGARM
									LLGP-1615-EL-DAL-0051	FINE ORE BIN GROUNDING LAYOUT
B	14.3.24	RE-ISSUED FOR IFR/CR	AW	FO	SH	ES	YM		LLGP-1615-EL-DAL-0012	FINE ORE BIN CABLE TRAY SECTIONS
A	16.11.23	ISSUED FOR IR AND ICR	AW	FO	SH	ES	YM		LLGP-1615-EL-DAL-0011	FINE ORE BIN CABLE TRAY LAYOUT

A1 SHEET SCALE 1:75

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER: ALAMOS GOLD INC.

"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

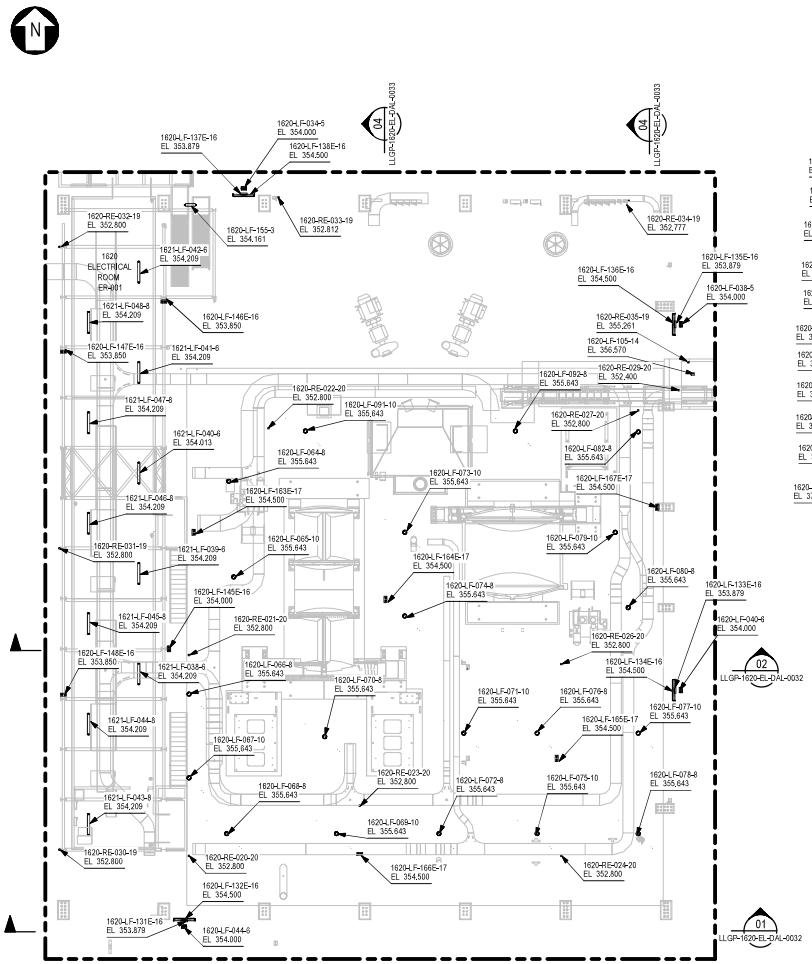
LYNN LAKE GOLD PROJECT
MACLELLAN SITE
FINE ORE BIN AREA
ELECTRICAL ROOM 1615-ER-001
LIGHTING LAYOUT

DRG No LLGP-1615-EL-DAL-0220 REV B

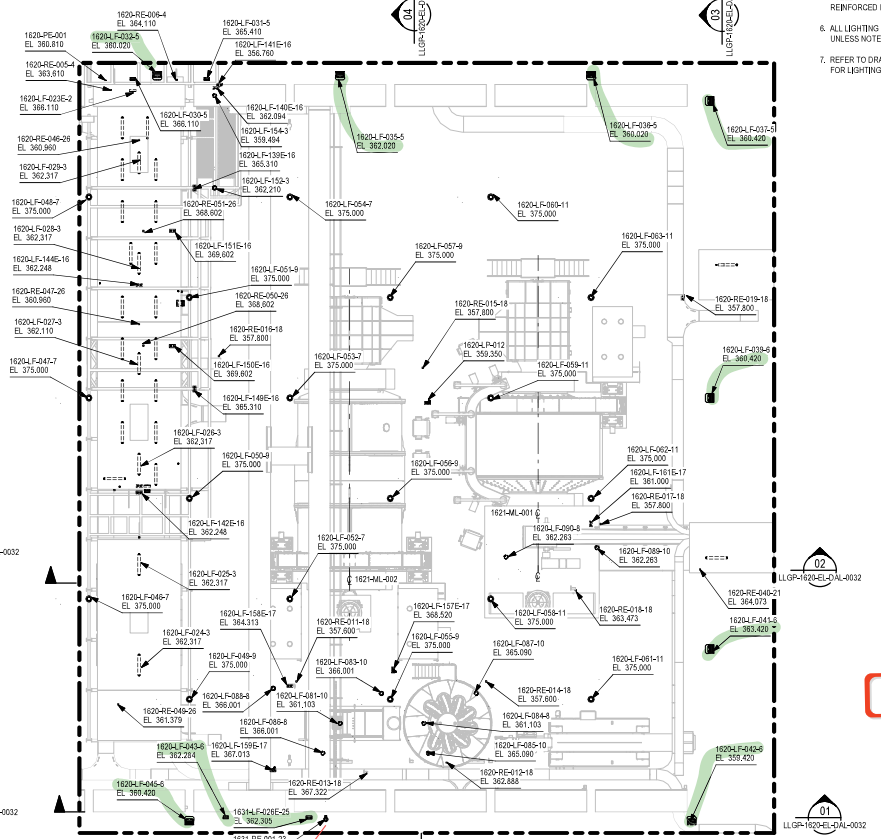
USER NAME: alexanderson
PLOT DATE & TIME: 29 Apr 2024 09:59:24
SAVE DATE & TIME: 19 Apr 2024 09:09:34

NOTES:

1. FOR STANDARD NOTES SEE DRAWING LLGP-0000-EL-DID-0010 THRU 0013.
2. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SPECIFIED OTHERWISE.
3. ALL INSTALLATIONS SHALL BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC), PART 1, 2024 EDITION.
4. CONTRACTOR MAY USE MANUFACTURER PART NUMBERS SPECIFIED ON THE DRAWING OR APPROVED EQUAL.
5. ALL THE MATERIALS FOR THE OUTDOOR INSTALLATIONS SHALL BE GALVINIZED STEEL FOR NON AGGRESSIVE ENVIRONMENTS AND 316L STAINLESS STEEL OR FIBER REINFORCED POLYESTER FOR CORROSIVE AREAS.
6. ALL LIGHTING ELEVATIONS ARE REFERENCED FROM THE BOTTOM OF THE FIXTURE UNLESS NOTED OTHERWISE.
7. REFER TO DRAWING LLGP-EL-DAL-0032, GRINDING MILL AREA LIGHTING SECTIONS FOR LIGHTING BILL OF MATERIAL.



PLAN VIEW LOWER LEVEL
1:150



1631-LF-001-22 IS MISSING

PLAN VIEW UPPER LEVEL
1:150

DRAFT

1:150 0 1500 3000 6000 9000 12000 15000mm

REV	DATE (DD-MMM-YY)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
									LLGP-1620-EL-DAL-0033	GRINDING MILL LIGHTING SECTIONS
B	23 May 24	REISSUED FOR IIR/ICR	AW	FO	SH	ES	YM		LLGP-1620-EL-DAL-0032	GRINDING MILL LIGHTING SECTIONS
A	20.11.2023	ISSUED FOR IIR AND ICR	AW	FO	SH	ES	YM		LLGP-1600-ME-DKP-0001	PROCESS PLANT & SERVICES - KEY PLAN & DRAWING INDEX

A1 SHEET SCALE 1:150

Worley

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

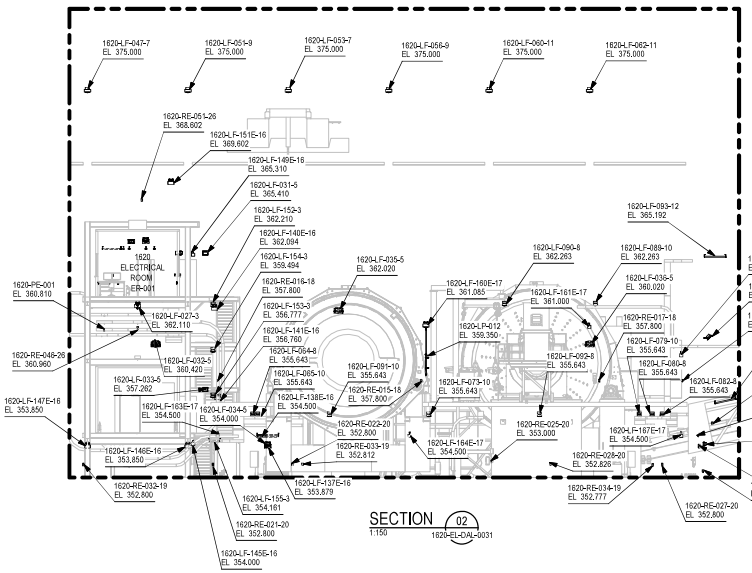
"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

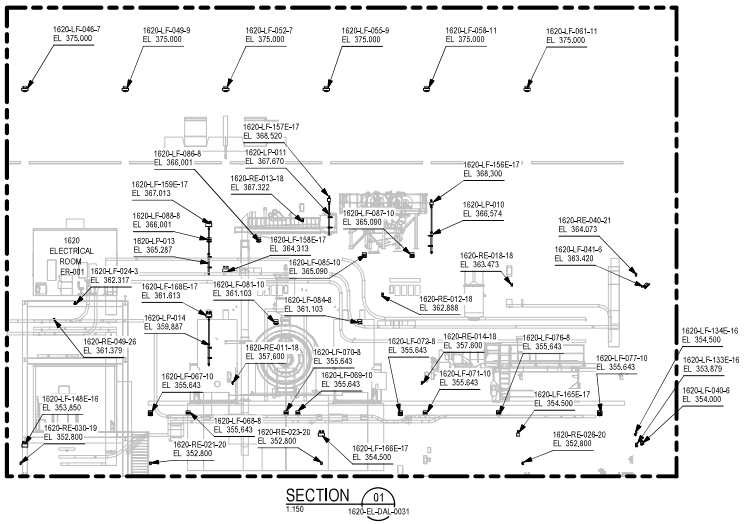
DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
GRINDING MILL AREA
LIGHTING
LAYOUT

DRG No LLGP-1620-EL-DAL-0031 REV B

USER NAME: alexanderson
PLOT DATE & TIME: 29 May 2024 11:44:22
SAVE DATE & TIME: 27 May 2024 11:44:22





NOTES:

1. FOR STANDARD NOTES SEE DRAWING LLGP-0000-EL-DID-0010 THRU 0013.
2. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SPECIFIED OTHERWISE.
3. ALL INSTALLATION SHALL BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC), PART 1, 2024 EDITION.
4. CONTRACTOR MAY USE MANUFACTURER AND PART NUMBER SPECIFIED ON DRAWING OR APPROVED EQUAL.
5. ALL THE MATERIALS FOR THE OUTDOOR INSTALLATIONS SHALL BE GALVINIZED STEEL FOR NON AGGRESSIVE ENVIRONMENT, 316L STAINLESS STEEL AND FIBER REINFORCED POLYESTER FOR CORROSIVE AREAS.
6. ALL LIGHTING ELEVATIONS ARE REFERENCED FROM THE BOTTOM OF THE FIXTURE UNLESS NOTED OTHERWISE.

Item	TAG NUMBER	QTY.	UNIT	Tag Number
1	1620-RE-005-4, 1620-RE-006-4,1620-RE-011-18, 1620-RE-012-18,1620-RE-013-18, 1620-RE-014-18, 1620-RE-015-18, 1620-RE-016-18, 1620-RE-017-18, 1620-RE-018-18, 1620-RE-019-18, 1620-RE-020-20, 1620-RE-021-20, 1620-RE-022-20, 1620-RE-023-20, 1620-RE-024-20, 1620-RE-025-20, 1620-RE-026-20, 1620-RE-027-20, 1620-RE-028-20, 1620-RE-029-20, 1620-RE-030-19, 1620-RE-031-19, 1620-RE-032-19, 1620-RE-033-19, 1620-RE-034-19, 1620-RE-035-19, 1620-RE-040-21, 1620-RE-046-26, 1620-RE-047-26, 1620-RE-048-26, 1620-RE-049-26, 1620-RE-050-26, 1620-RE-051-26, 1631-RE-001-23	35	ea.	1-GANG WATERPROOF GFCI RECEPTACLE, 120V, 20A, HEAVY DUTY DIE-CAST AL BOX & COVER, HUBBELL TAYMAC MX3200
2	1620-LF-046-7, 1520-LF-047-7, 1620-LF-048-7, 1620-LF-049-9, 1620-LF-050-9, 1620-LF-051-9, 1520-LF-052-7, 1620-LF-053-7, 1620-LF-054-7, 1620-LF-055-9, 1620-LF-056-9 1620-LF-057-9, 1620-LF-058-11, 1620-LF-059-11, 1620-LF-060-11,1620-LF-061-11, 1620-LF-062-11, 1620-LF-063-11	18	ea.	25000 lm LED, 206W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, PENDANT MOUNTING, NEMA 4X, CROUSE-HINDS #PVML-25-2A-UNV1
3	1620-LF-155-3	1	ea.	3958 lm LINEAR LED, 2 ft LENGTH, OPTICS 120° 32W,120V, 60Hz, c/w DP1053MTK KIT, CROUSE-HINDS #PLL2-UNV1-5903-TF
4	1631-LF-001-22	1	ea.	5537 lm LED, 45W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, WALL MOUNTING, NEMA 4X, CROUSE-HINDS #PVML-5-25TW-UNV1
5	1620-LF-132E-16, 1620-LF-134E-16, 1620-LF-136E-16, 1620-LF-131E-16	4	ea.	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W,120V 60Hz, c/w DP1053MTK & 90 MIN BATTERY MODULE, C-H #PLL4-UNV1-5903-TF-EM1
6	1620-LF-064-8, 1520-LF-065-10, 1620-LF-066-8, 1620-LF-067-10, 1620-LF-068-8, 1620-LF-069-10, 1620-LF-070-8,1620-LF-071-10, 1620-LF-072-8, 1620-LF-073-10, 1620-LF-074-8, 1520-LF-075-10,1620-LF-076-8, 1620 LF-077-10, 1620-LF-078-8, 1620-LF-079-10, 152C-LF-080-8, 1620-LF-081-10, 1620-LF-082-8, 1620-LF-083-10, 1620-LF-084-8, 1620-LF-085-10, 1620-LF-086-8, 1620-LF-088-8,1620-LF-089-10, 1520-LF-090-8, 1620-LF-091-10, 1620-LF-092-8,1620-LF-152-3 1620-LF-153-3, 1620-LF-154-3	31	ea.	7442 lm LED, 61W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, CEILING MOUNTING, NEMA 4X, CROUSE-HINDS #PVML-7-2C-UNV1
7	1620-LF-024-3, 1520-LF-025-3, 1620-LF-026-3, 1620-LF-027-3, 1620-LF-028-3, 1620-LF-029-3, 1520-LF-087-10,1620 LF-088-8, 1620 LF-089-10, 1620-LF-305-14, 1621-LF-027-6, 1620-LF-038-6, 1621-LF-039-6, 1623-LF-040-6, 1521-LF-041-5, 3621-LF-042-6, 1621-LF-043-8, 1621-LF-044-8, 1621-LF-045-8, 1621-LF-046-8, 1621-LF-347-8, 1621-LF-048-8	22	ea.	7900 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 62W,120V, 60Hz, c/w DP1053MTK KIT, CROUSE-HINDS #PLL4-UNV1-5903-TF
8	1620-LF-139E-16, 1620-LF-140E-16, 1620-LF-141E-16, 1620-LF-142E-16, 1620-LF-141E-16, 152C-LF-144E-16, 1626-LF-145E-16, 1620-LF-146E-16, 1620-LF-147E-16, 1620-LF-148E 16, 1620-LF-149E-16, 1620-LF-150E 16 1620-LF-151E-16 1620-LF-156E-17, 1620-LF-157E 17, 1620-LF-158E 17, 1620-LF-159E 17, 1620-LF-160E-17 1620-LF-161E-17, 1620-LF-162E-17, 1620-LF-163E-17, 1620-LF-164E-17, 1620-LF-165E-17, 1620-LF-166E-17, 152C-LF-167E-17, 1633-LF-026E-25, 1620-LF-168E-17	27	ea.	EMERGENCY LIGHT LED, 28W, 120V, 60Hz, 2x3W LED LAMP, 90 MIN BATTERY MODULE, CROUSE-HINDS #N2LPS12222 SS
9	1620-LF-032-5, 1520-LF-035-5, 1620-LF-036-5, 1620-LF-037-5, 1620-LF-039-6, 1620-LF-041-6, 1520-LF-042-6, 1623-LF-045-6	8	ea.	FLOOD LIGHT, 25500 lm LED, 216W, 120V, 60Hz, 5000K COOL, YOKE MOUNTING, NEMA 4X, CROUSE-HINDS #FFMA25LCY-UNV176
10	1620-LF-023E-2, 1620-LF-131E-16, 1620-LF-133E-16, 1620-LF-135E-16, 1620-LF-137E-16	5	ea.	LED EXIT SIGNS, 1.4W, 120V, 60Hz, SELF-POWED, SIGNAL FACE, c/w NICKEL CADMIUM BATTERY, CROUSE-HINDS #UX71SD
11	1620-PE-001	1	ea.	PHOTOCELL, 3.3A, 120V, 60Hz, CROUSE-HINDS #D2520
12	1620-LP-010, 1620-LP-011, 1620-LP-012,1620-LP-013, 1620-LF-014	5	ea.	V-SPRING LIGHT POLE, C-H #V65H-G, #MHK-RTG, & #LMB-FL40
13	1620-LF-030-5, 1620-LF-031-5, 1620-LF-033-5, 1620-LF-034-5, 1620-LF-038-5, 1620-LF-040-6, 1520-LF-043-6, 1623-LF-044-6	8	ea.	WP WALL PACK LED, 6200 lm, 59W, 120V, 60Hz, 5000K COOL, NEMA4X, COOPER WPMLED15

DRAFT

1:150 0 1500 3000 6000 9000 12000 15000mm

REV	DATE (D/M/Y)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
									LLGP-1620-EL-DAL-0033	GRINDING MILL AREA LIGHTING SECTIONS
B	24 May 24	REISSUED FOR IIR/CIR	AW	FO	SH	ES	YM		LLGP-1620-EL-DAL-0031	GRINDING MILL AREA LIGHTING LAYOUTS
A	20.11.2023	ISSUED FOR IIR AND ICR	AW	FO	SH	ES	YM		LLGP-1600-ME-DKP-0001	PROCESS PLANT & SERVICES - KEY PLAN & DRAWING INDEX

A1 SHEET SCALE 1:100

Worley energy | chemicals | resources

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

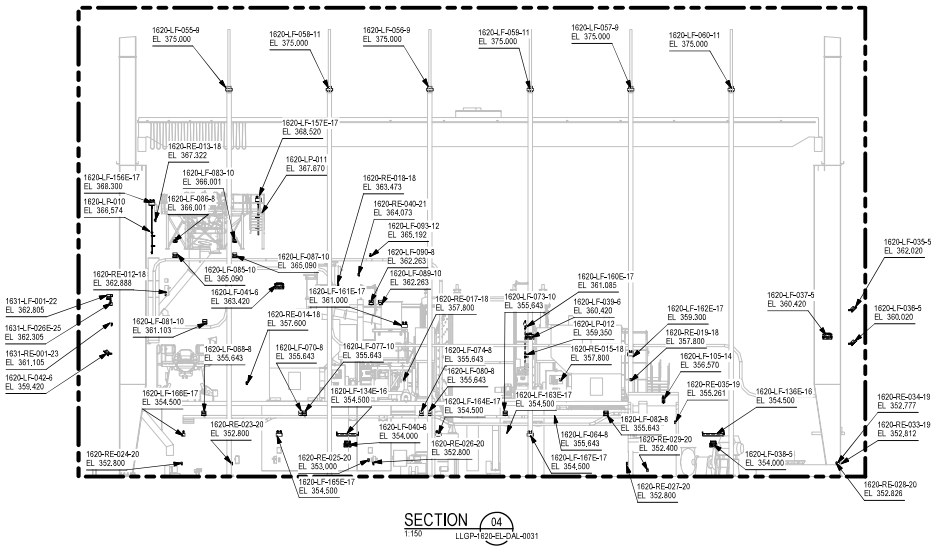
"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

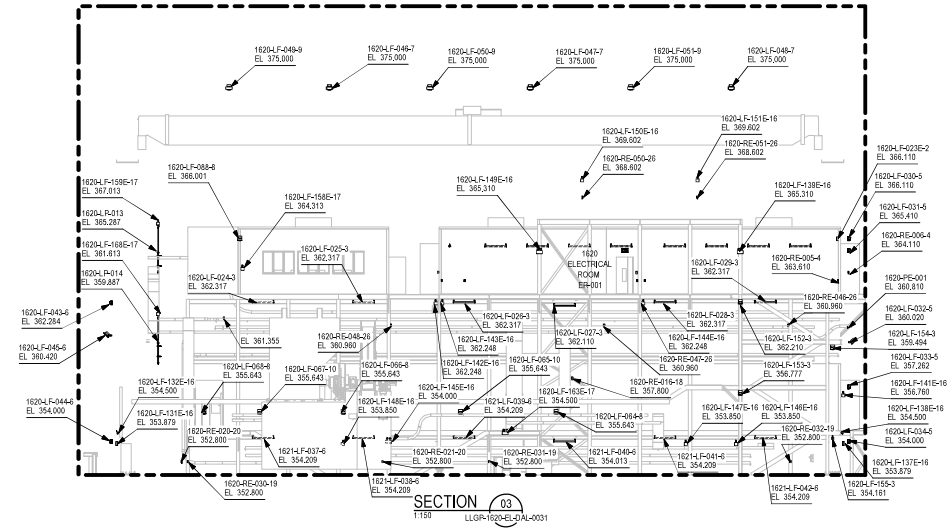
LYNN LAKE GOLD PROJECT
MACLELLAN SITE
GRINDING MILL AREA
LIGHTING
SECTIONS

DRG No LLGP-1620-EL-DAL-0032 REV B

USER NAME: alexanderson
PLOT DATE & TIME: 29 May 2024 11:48:53
SAVE DATE & TIME: 27 May 2024 11:48:53



SECTION 04
1:150
LLGP-1620-EL-DAL-0031



SECTION 03
1:150
LLGP-1620-EL-DAL-0031

NOTES:

1. FOR STANDARD NOTES SEE DRAWING LLGP-0000-EL-DID-0010 THRU 0013.
2. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SPECIFIED OTHERWISE.
3. ALL INSTALLATION SHALL BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC), PART 1, 2024 EDITION.
4. CONTRACTOR MAY USE MANUFACTURER AND PART NUMBER SPECIFIED ON DRAWING OR APPROVED EQUAL.
5. ALL THE MATERIALS FOR THE OUTDOOR INSTALLATIONS SHALL BE GALVINIZED STEEL FOR NON AGGRESSIVE ENVIRONMENT, 316L STAINLESS STEEL AND FIBER REINFORCED POLYESTER FOR CORROSIVE AREAS.
6. ALL LIGHTING ELEVATIONS ARE REFERENCED FROM THE BOTTOM OF THE FIXTURE UNLESS NOTED OTHERWISE.
7. REFER TO DRAWING LLGP-EL-DAL-0032, GRINDING MILL AREA LIGHTING SECTIONS FOR LIGHTING BILL OF MATERIAL.

DRAFT

0 1500 3000 6000 9000 12000 15000mm
1:150

REV	DATE (D.MMM.Y)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
									LLGP-1620-EL-DAL-0031	GRINDING MILL LIGHTING LAYOUTS
B	24.05.2024	REISSUED FOR IIR/ICR	AW	FO	SH	ES	YM		LLGP-1620-EL-DAL-0032	GRINDING MILL LIGHTING SECTIONS
A	20.11.2023	ISSUED FOR IIR AND ICR	AW	FO	SH	ES	YM		LLGP-1600-ME-DKP-0001	PROCESS PLANT & SERVICES - KEY PLAN & DRAWING INDEX

A1 SHEET SCALE 1:150

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

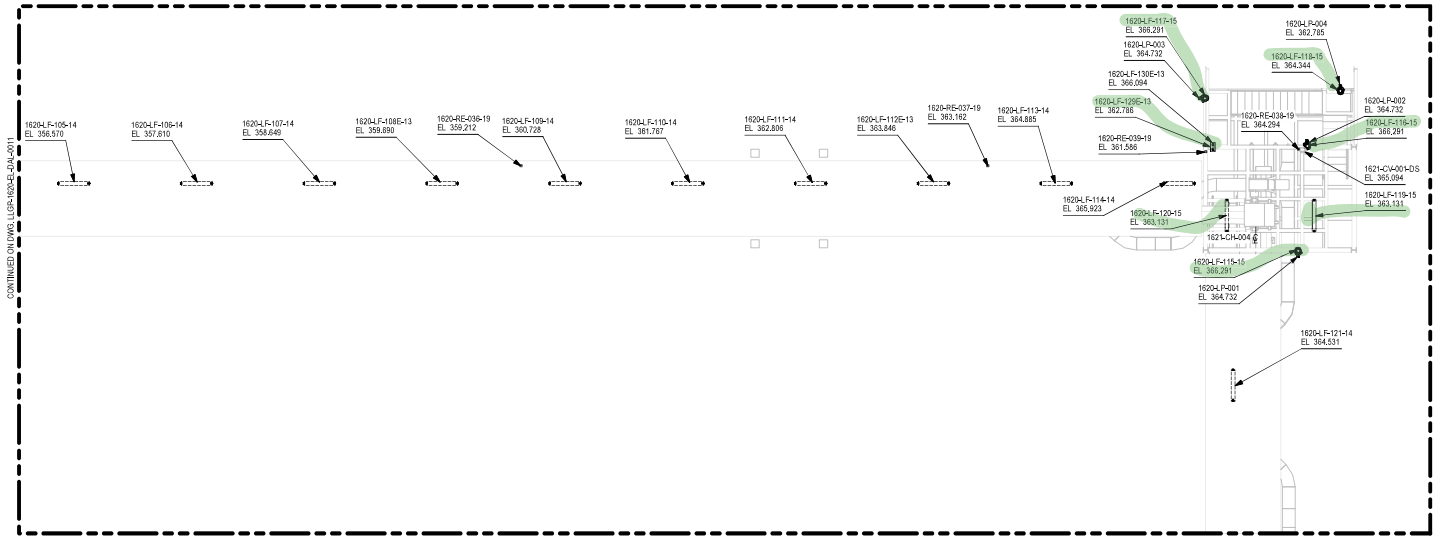
"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
GRINDING MILL AREA
LIGHTING
SECTIONS

DRG No LLGP-1620-EL-DAL-0033 REV B

USER NAME: alexandrem
PLOT DATE & TIME: 27 May 2024 11:39:44
SAVE DATE & TIME: 24 May 2024 11:39:48



NOTES:

1. FOR STANDARD NOTES SEE DRAWING LLGP-0000-EL-DID-0010 THRU 0013.
2. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SPECIFIED OTHERWISE.
3. ALL INSTALLATIONS SHALL BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC), PART 1, 2024 EDITION.
4. CONTRACTOR MAY USE MANUFACTURER PART NUMBERS SPECIFIED ON THE DRAWING OR APPROVED EQUAL.
5. ALL MATERIALS FOR OUTDOOR INSTALLATIONS SHALL BE GALVANIZED STEEL FOR NON AGGRESSIVE ENVIRONMENTS AND 316L STAINLESS STEEL OR FIBER REINFORCED POLYESTER FOR CORROSIVE AREAS.
6. ALL LIGHTING ELEVATIONS ARE REFERENCED FROM THE BOTTOM OF THE FIXTURE UNLESS NOTED OTHERWISE.

DRAFT

EQUIPMENT LIST		
ITEM	DESCRIPTION	QTY.
1	SAFETY SWITCH, 30A, 600V, 3Ph, EATON #DH361UWKW	
	1621-CV-001-DS	1

ITEM	TAG NUMBER	QTY	UN	DESCRIPTION
1	1620-LF-108E-13, 1620-LF-112E-13	2	ea.	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W,120V, 60Hz, c/w DP1053MTK & 90 MIN BATTERY MODULE, C-H #P114-UNVS-9903-TF-EM1
2	1620-LF-105-14, 1620-LF-106-14, 1620-LF-107-14, 1620-LF-109-14, 1620-110-14, 1620-111-14, 1620-LF-113-14, 1620-LF-114-14, 1620-LF-119-15, 1620-LF-120-15, 1620-LF-121-14	15	ea.	7900 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 67W,120V, 60Hz, c/w DP1053VTK KIT, CROUSE-HINDS #P114-UNVT-9909-TF
3	1620-RE-036-19, 1620-RE-037-19, 1620-RE-38-19, 1620-RE-039-19,	4	ea.	1-GANG WATERPROOF GFCI RECEPTACLE, 120V, 20A, HEAVY DUTY DIE-CAST AL BOX & COVER, HUBBELL TAYMAC MK3200
4	1620-LF-125-15, 1620-LF-116-15, 1620-LF-117-15, 1620-LF-118-15,	4	ea.	3250 lm LED, 28W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, NEMA 4X, CROUSE-HINDS #PVML-3-UNV1
5	1620-LF-129E-13, 1620-LF-130E-13	2	ea.	EMERGENCY LIGHT LED, 28W, 120V, 60Hz, 2x28W LED LAMP, 90 MINUTES BATTERY, CROUSE-HINDS #NZLPS12222 SS
6	1620-LF-001, 1620-LF-002, 1620-LF-003, 1620-LF-004	4	ea.	V-SPRING LIGHT POLE, C-H #V45H-G, #MHK-RTG, & JM5

0 1000 2000 4000 6000 8000 10000mm
1:100

REV	DATE (DD-MMM-YY)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
									LLGP-1620-EL-DAL-0031	GRINDING MILL LIGHTING LAYOUT
A	09.01.24	ISSUED FOR IFR/CR	AW	FO	SH	ES	YM		LLGP-1615-EL-DAL-0035	FINE ORE BIN 1615/1620 CONVEYOR LIGHTING AND EQUIPMENT LAYOUT

A1 SHEET SCALE 1:100
WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

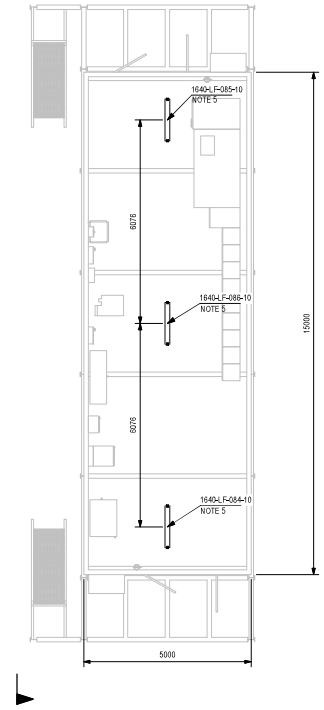
CUSTOMER
ALAMOS GOLD INC.

"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE
LYNN LAKE GOLD PROJECT
MACLELLAN SITE
FINE ORE BIN 1615/1620 CONVEYOR
LIGHTING AND EQUIPMENT
LAYOUTS

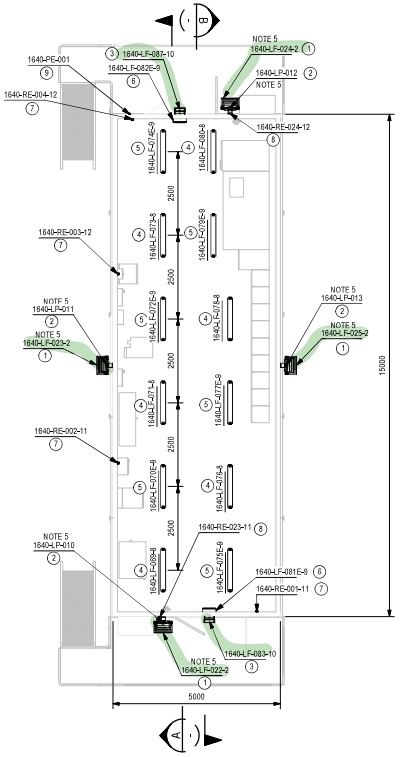
DRG No LLGP-1621-EL-DAL-0031 REV A

USER NAME: allevadson
PLOT DATE & TIME: 17-Jun-2024 10:10:42
SAVE DATE & TIME: 17-Jun-2024 10:10:42



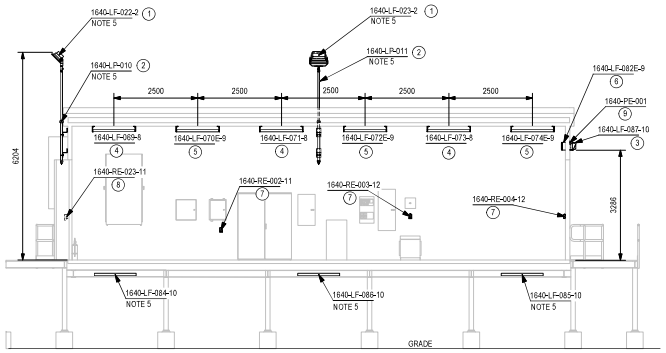
PLAN VIEW UNDER E-ROOM

1:75

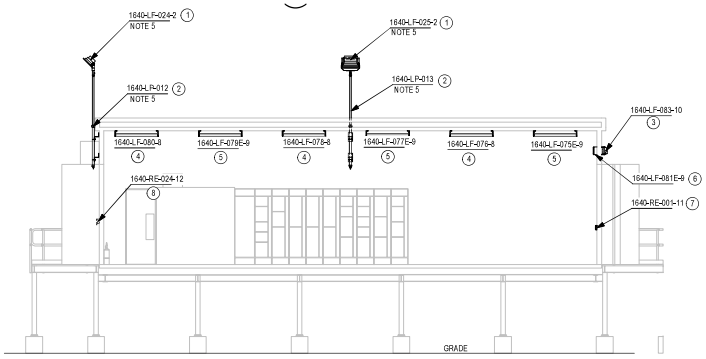


1640-ER-001 LAYOUT - PLAN

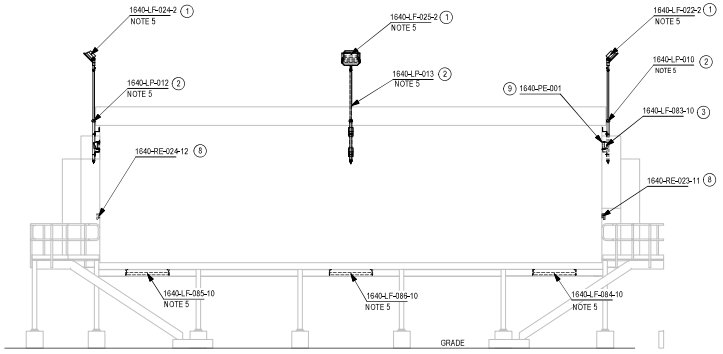
1:75



SECTION A



SECTION B



SECTION C

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SHOWN OTHERWISE.

2. THE LOCATION OF LIGHT FIXTURES AND RECEPTACLES IN THIS DRAWING ARE PRELIMINARY ONLY. THE ACTUAL LOCATION DEPENDS ON THE E-ROOM VENDOR AND SHALL BE DETERMINED AT THE TIME OF INSTALLATION.

3. THE LIGHTING FIXTURE & RECEPTACLE TAG NUMBER: AAAA-BB-CCCX-Y
   AAAA: AREA NUMBER
   BB: LF - LIGHTING FIXTURE
   LP - LIGHTING POLE
   RE - RECEPTACLE
   PE - PHOTOCELL
   CCCX: CCC - SEQUENCE NUMBER (001-999)
   X - BLANK: STANDARD LIGHTING FIXTURE
   E: INTEGRATED EMERGENCY BATTERY BACK-UP
   Y: CIRCUIT NUMBER OF LIGHTING PANEL

4. ALL MATERIAL PART NUMBERS CAN BE SUBSTITUTED WITH APPROVED EQUIVANENT.

5. LIGHT FIXTURES ARE PART OF E-ROOM VENDOR PACKAGE AND WILL BE SUPPLIED AND INSTALLED ON SITE BY ELECTICAL CONTRACTOR.

LIGHTING BILL OF MATERIAL

ITEM	TAG NUMBER	QTY	DESCRIPTION
1	1640-LF-022-2, 1640-LF-025-2, 1640-LF-024-2, 1640-LF-025-2	4	FLOODLIGHT, 25500 LUMEN LED, 216W, 120Vac, 60Hz, 5000K COOL WHITE LIGHT, YOKE MOUNTING, NEMA 4X, CROUSE-HINDS CHAMP PRO XPMA25 (OR EQUIV ONLY)
2	1640-LF-010, 1640-LF-011, 1640-LF-012, 1640-LF-013	4	X-SPONG LIGHT POLE, CHEVRON D, BARK WG & BLND FL 40
3	1640-LF-083-10, 1640-LF-087-10	2	WP WALL PACK LED 6200 LUMEN, 50W, 120V, 60Hz, 5000K COOL NEMA 4X, COOPER WPMLED (OR EQUIV ONLY)
4	1640-LF-069-8, 1640-LF-071-8, 1640-LF-073-8, 1640-076-8, 1640-078-8, 1640-LF-080-8, 1640-LF-064-10, 1640-LF-085-10, 1640-LF-086-10	9	7500 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 60W 120V 60Hz c/w DP1053MTK KIT, CROUSE-HINDS (OR EQUIV ONLY)
5	1640-LF-070E-9, 1640-LF-072E-9, 1640-LF-074E-9, 1640-LF-075E-9, 1640-LF-077E-9, 1640-LF-079E-9	6	5720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W 120V 60Hz, c/w DP1053MTK & 90 MIN BATTERY MODULE, CROUSE-HINDS (OR EQUIV ONLY) 5903-TF-EM1
6	1640-LF-081E-9, 1640-LF-082E-9,	2	LED EXIT SIGNS, 1.4W, 120V, 60Hz, SELF-POWERED, SIGNAL FACE, c/w NICKEL CADMIUM BATTERY, CROUSE-HINDS (OR EQUIV ONLY)
7	1640-RE-001-11, 1640-RE-002-11, 1640-RE-003-12, 1640-RE-004-12	4	2-GANG RECEPTACLE, 20A, 125V, 60Hz
8	1640-RE-023-11, 1640-RE-024-11	2	1-GANG WATERPROOF GFCI RECEPTACLE, 120V, 20A, HEAVY DUTY DIE-CAST AL BOX & COVER, HUBBELL TAYMAC MX3200
9	1640-PE-001	1	PHOTOCELL, 3.3A, 120V, 60Hz, CROUSE-HINDS (EQUIV ONLY)

DRAFT

1:75 0 750 1500 3000 4500 6000 7500mm

REV	DATE (DD/MM/YY)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
B	10/04/24	RE-ISSUED FOR IIR_ICR	AW	FO	SH	ES	YM		LLGP-1640-EL-DAL-200	LEACH AREA ELECTRICAL ROOM 1640-ER-001 EQUIPMENT LAYOUT
A	01/03/24	ISSUED FOR IIR/ICR	AW	FO	SH	ES	YM		LLGP-1640-EL-DAL-210	LEACH AREA ELECTRICAL ROOM 1640-ER-001 CABLE TRAY LAYOUT

A1 SHEET SCALE 1:75

Worley

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

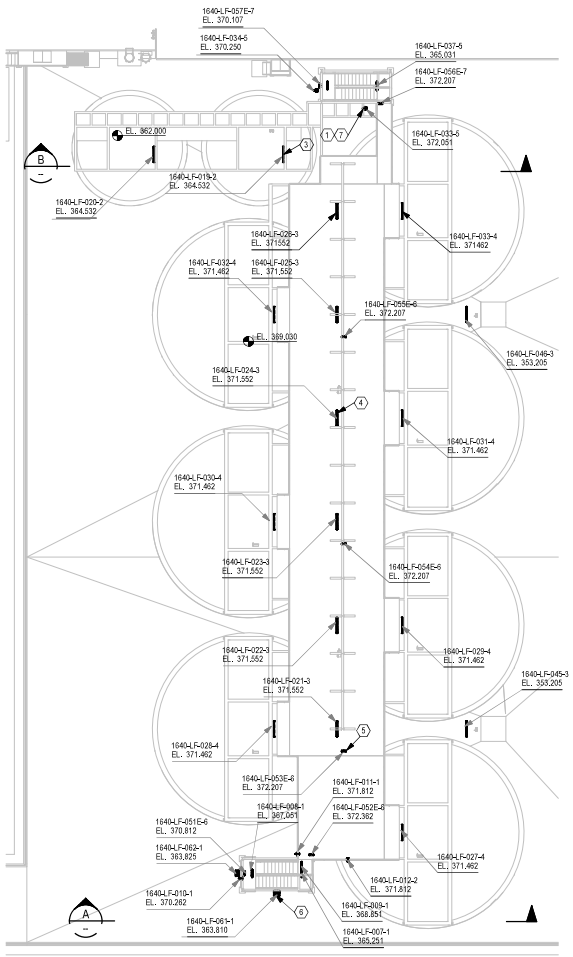
"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
LEACH AREA
ELECTRICAL ROOM 1640-ER-001
LIGHTING LAYOUT

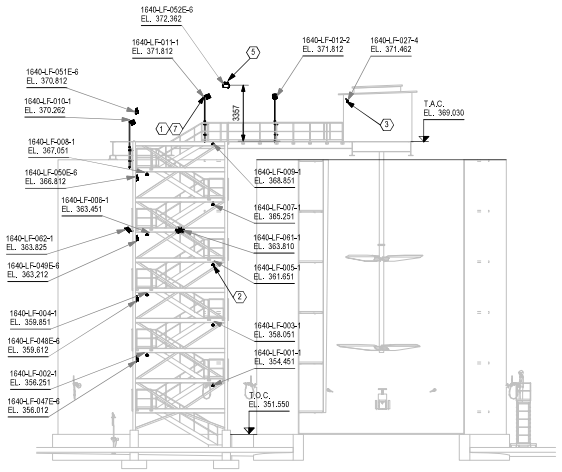
DRG No LLGP-1640-EL-DAL-0220 REV B

USER NAME: shawn.ha
PLOT DATE & TIME: 29 Apr 2024 10:22:22
SAVE DATE & TIME: 19 Apr 2024 10:22:22

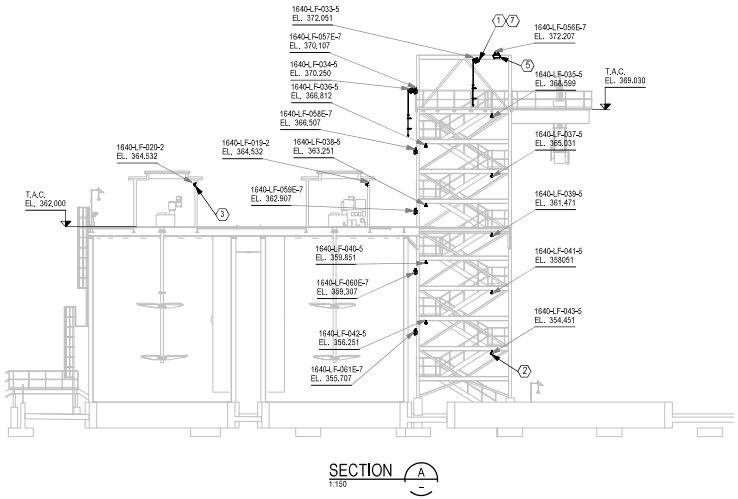


LIGHTING LAYOUT PLAN VIEW

SCALE 1:200



SECTION A
1:150



SECTION A
1:150

NOTES:

1. FOR STANDARD NOTES SEE DRAWING LLGP-1600-EL-DID-0001 & 0002.
2. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNO.
3. ALL INSTALLATION SHALL BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC), PART 1, 2021 EDITION.
4. CONTRACTOR MAY USE MANUFACTURER AND PART NUMBER SPECIFIED ON DRAWINGS OR AN APPROVED EQUAL.
5. ALL THE MATERIALS FOR THE OUTDOOR INSTALLATIONS SHALL BE GALVANIZED STEEL FOR NON AGGRESSIVE ENVIRONMENT, 316L STAINLESS STEEL AND FIBER-REINFORCED POLYESTER FOR CORROSIVE AREAS.
6. ALL LIGHTING ELEVATIONS ARE REFERENCE, REFERENCED FROM THE BOTTOM OF THE FIXTURE UNLESS NOTED OTHERWISE.
7. FOR LIGHTING CONTROL PANEL SEE DRAWING LLGP-1641-EL-LST-0001.

LIGHTING BILL OF MATERIAL

ITEM	TAG NUMBER	QTY.	DESCRIPTION	NOTES
1	1640-LF-010-1; 1640-JF-011-1 1640-LF-012-2; 1640-JF-033-5 1640-LF-034-5	5	3250 lm LED, 28W, 120V, 60Hz, 5000K COOL, TYPE 'V' OPTICAL, NEMA 4X, CROUSE-HINDS #PVML-3-UNV1	
2	1640-LF-001-1; 1640-JF-002-1 1640-LF-003-1; 1640-JF-004-1 1640-LF-005-1; 1640-JF-006-1 1640-LF-007-1; 1640-JF-008-1 1640-LF-009-1; 1640-JF-035-5 1640-LF-036-5; 1640-JF-037-5 1640-LF-038-5; 1640-JF-039-5 1640-LF-040-5; 1640-JF-041-5 1640-LF-042-5;	18	3958 lm LINEAR LED, 2 ft LENGTH, OPTICS 110° 32W,120V, 60Hz, c/w DP1033MTK KIT, CROUSE-HINDS #"PLL2-UNV1-S9G3-TF	
3	1640-LF-019-2; 1640-JF-020-2 1640-LF-027-4; 1640-JF-028-4 1640-LF-029-4; 1640-JF-030-4 1640-LF-031-4; 1640-JF-032-4 1640-LF-033-4	9	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W,120V, 60Hz, c/w DF1052MTK & 90 MIN BATTERY MODULE, CH #PLL4-UNV1-S903-TF-EM1	
4	1640-LF-021-3; 1640-JF-022-3 1640-LF-023-3; 1640-JF-024-3 1640-LF-025-3; 1640-JF-026-3 1640-LF-045-3; 1640-JF-046-3	8	7900 lm LINEAR LED, 4 ft LENGTH, OPTICS 110° 52W,120V, 60Hz, c/w DP1053MTK KIT, CROUSE-HINDS #"PLL4-UNV1-S9G3-TF	
5	1640-LF-047E-6; 1640-LF-048E-6; 1640-LF-049E-6; 1640-LF-050E-6; 1640-LF-051E-6; 1640-LF-052E-6; 1640-LF-053E-6; 1640-LF-054E-6; 1640-LF-055E-6; 1640-LF-056E-7; 1640-LF-057E-7; 1640-LF-058E-7; 1640-LF-059E-7; 1640-LF-060E-7; 1640-LF-061E-7	15	EMERGENCY LIGHT LED, 28W, 120V, 60Hz, 1x3W LED LAMP, 9) MIN BATTERY MODULE, CROUSE-HINDS #N2LFS12222 SS	
6	1640-LF-061-1; 1640-JF-062-1	2	FLOODLIGHT, 25500 lm LED, 216W, 120V, 60Hz, 5000K COOL, YOKE MOUNTING, NEMA 4X, CROUSE-HINDS #PFMA25LCY-UNV176	
7	1640-LF-001; 1640-LF-002; 1640-LP-003; 1640-LP-010; 1640-LP-011;	5	V-SPRING LIGHT POLE, C-H #V65H-G, #MHK-RTG, 8 #JM5	

DRAFT

1:100 0 1000 2000 4000 6000 8000 10000mm

REV	DATE (DD-MMM-YY)	REVISION DESCRIPTION	DRAWN	CHECK	DESIGN	ENG CHK	APPROVE	CUSTMR	REF DRAWING No	REFERENCE DRAWING TITLE
A	26-Sep-2023	ISSUED FOR INTERNAL REVIEW	RM	FO	SH	ES				

A1 SHT SCALE INDICATED

Worley

WORLEY PROJECT No.
317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

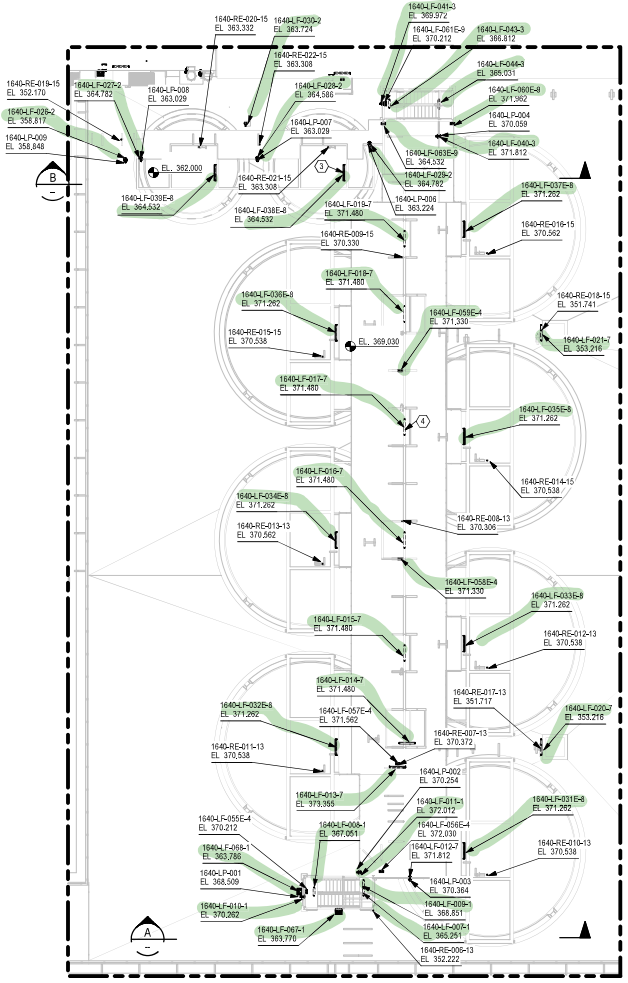
"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE
LYNN LAKE GOLD PROJECT
MACLELLAN SITE
LEACHING
LEACHING TANKS
LIGHTING LAYOUT

DRG No LLGP-1642-EL-DAL-0031

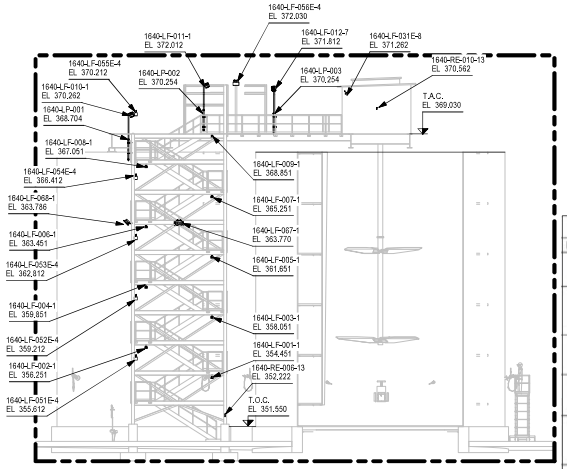
REV A

USER NAME: rclarke.j.mc/mac
PLOT DATE & TIME: 28 Sep 2023 11:07:54
SAVE DATE & TIME: 27 Sep 2023 11:07:54



LIGHTING LAYOUT PLAN VIEW

1:200



SECTION A

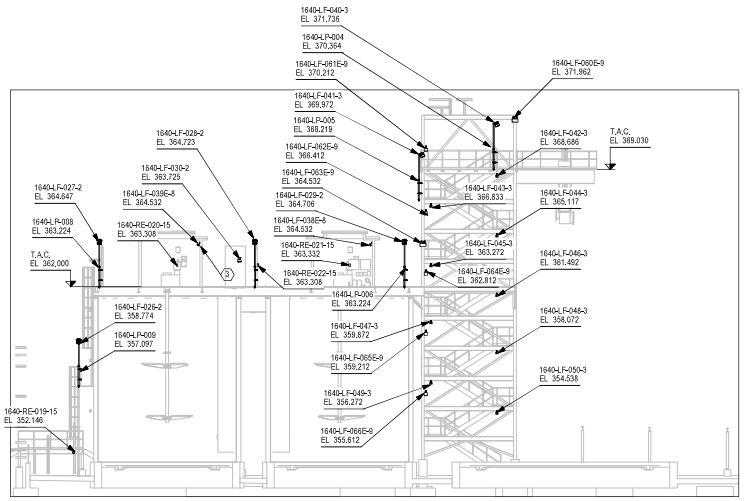
1:150

NOTES:

1. FOR STANDARD NOTES SEE DRAWING LLGP-1600-EL-DID-0001 & 0002.
2. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS NOTED OTHERWISE.
3. ALL INSTALLATION SHALL BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC), PART 1, 2024 EDITION.
4. CONTRACTOR MAY USE MANUFACTURER AND PART NUMBERS SPECIFIED ON DRAWINGS OR AN APPROVED EQUAL.
5. ALL MATERIALS FOR THE OUTDOOR INSTALLATIONS SHALL BE GALVANIZED STEEL FOR NON AGGRESSIVE ENVIRONMENT, 316L STAINLESS STEEL AND FIBER-REINFORCED POLYESTER FOR CORROSIVE AREAS.
6. ALL LIGHTING ELEVATIONS ARE REFERENCE, REFERENCED FROM THE BOTTOM OF THE FIXTURE UNLESS NOTED OTHERWISE.
7. FOR LIGHTING CONTROL PANEL SEE DRAWING LLGP-1641-EL-LST-0001.

LIGHTING BILL OF MATERIAL

ITEM	TAG NUMBER	QTY	DESCRIPTION
1	1640-LF-010-1, 1640-LF-011-1, 1640-LF-015-7, 1640-LF-028-2, 1640-LF-029-2, 1640-LF-040-3, 1640-LF-041-3, 1640-LF-042-3, 1640-LF-043-3, 1640-LF-044-3	10	3250 lm LED, 28W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, NEMA 4X, CROUSE-HINDS #PVMI-3-UNV1
2	1640-LF-001-1, 1640-LF-002-1, 1640-LF-003-1, 1640-LF-004-1, 1640-LF-005-1, 1640-LF-006-1, 1640-LF-007-1, 1640-LF-008-1, 1640-LF-009-1, 1640-LF-340-3, 1640-LF-041-3, 1640-LF-042-3, 1640-LF-043-3, 1640-LF-048-3, 1640-LF-045-3, 1640-LF-046-3, 1640-LF-047-3, 1640-LF-048-3, 1640-LF-049-3, 1640-LF-050-3	20	3958 lm LINEAR LED, 2 ft LENGTH, OPTICS 120° 32W,120V, 60Hz, c/w DP1053MTK KIT, CROUSE-HINDS #PLL2-UNV1-S903-TF
3	1640-LF-019-2, 1640-LF-020-2, 1640-LF-027-2, 1640-LF-028-4, 1640-LF-029-4, 1640-LF-030-2, 1640-LF-031E-8, 1640-LF-032E-8, 1640-LF-033E-8, 1640-LF-034E-8, 1640-LF-035E-8, 1640-LF-036E-8, 1640-LF-037E-8, 1640-LF-038E-8, 1640-LF-039E-8,	15	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W,120V, 60Hz, c/w DP1052MTK & 90 MIN BATTERY MODULE, C-H #PLL4-UNV1-S903-TF-EM1
4	1640-LF-013, 1640-LF-014-7, 1640-LF-015-7, 1640-LF-016-7, 1640-LF-017-7, 1640-LF-018-7, 1640-LF-019-7, 1640-LF-020-7, 1640-LF-021-7, 1640-LF-022-1, 1640-LF-023-1, 1640-LF-024-3, 1640-LF-025-3, 1640-LF-026-3, 1640-LF-045-3, 1640-LF-046-3	16	7900 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 62W,120V, 60Hz, c/w DP1053MTK KIT, CROUSE-HINDS #PLL4-UNV1-S903-TF
5	1640-LF-051E-4, 1640-LF-052E-4, 1640-LF-053E-4, 1640-LF-054E-4, 1640-LF-055E-4, 1640-LF-056E-4, 1640-LF-057E-4, 1640-LF-058E-4, 1640-LF-059E-4, 1640-LF-060E-9, 1640-LF-061E-9, 1640-LF-062E-9 ; 1640-LF-062E-9 ; 1640-LF-063E-9 ; 1640-LF-064E-9, 1640-LF-065E-9 ; 1640-LF-066E-9	17	EMERGENCY LIGHT LED, 28W, 120V, 60Hz, 2x3W LED LAMP, 90 MIN BATTERY MODULE, CROUSE-HINDS #N2LPS122222 SS
6	1640-LF-067-1, 1640-LF-068-1	2	FLOODLIGHT, 26500 lm LED, 216W, 120V, 60Hz, 5000K COOL, YOKE MOUNTING, NEMA 4X, CROUSE-HINDS #FFMA25LCY-UNV176
7	1640-LP-001, 1640-LP-002, 1640-LP-003, 1640-LP-005, 1640-LP-006, 1640-LP-007, 1640-LP-008, 1640-LP-009	8	V-SPRING LIGHT POLE, C-H #V65H-G, #M6K-RTG, & #JM5
8	1640-RE-006-13, 1640-RE-007-13, 1640-RE-008-13, 1640-RE-009-15, 1640-RE-010-13, 1640-RE-011-13, 1640-RE-012-13, 1640-RE-013-13, 1640-RE-014-15, 1640-RE-015-15, 1640-RE-016-15, 1640-RE-017-13, 1640-RE-018-15, 1640-RE-019-15, 1640-RE-020-15, 1640-RE-021-15, 1640-RE-022-15	17	1-GANG WATERPROOF GFCI RECEPTACLE 120V, 20A, HEAVY DUTY DIE-CAST AL BOX & COVER, HUBBELL TAYMAC MX3200



SECTION B

1:150

DRAFT

REV	DATE (D-MMM-Y)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
									LLGP-1642-EL-DAL-0051	LEACHING TANKS GROUNDING LAYOUT
B	27 Jun 24	REISSUED FOR IIR/CR	AW	FO	SH	ES	YM		LLGP-1642-EL-DAL-0011	LEACHING TANK CABLE TRAY PLAN & SECTION
A	26,Sep,2023	ISSUED FOR INTERNAL REVIEW	RM	FO	SH	ES			LLGP-1642-EL-DAL-0001	LEACHING TANK EQUIPMENT LAYOUT

A1 SHEET | SCALE AS SHOWN

Worley

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

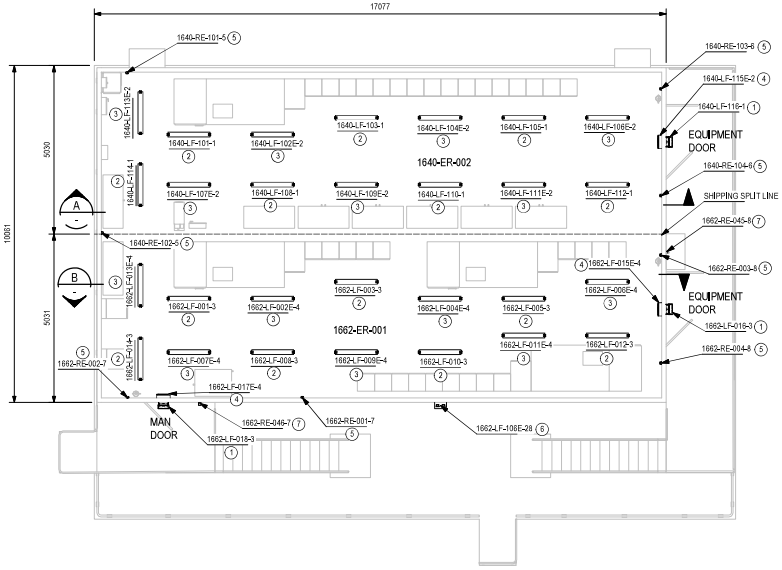
"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
LEACHING
LEACHING TANKS
LIGHTING LAYOUT

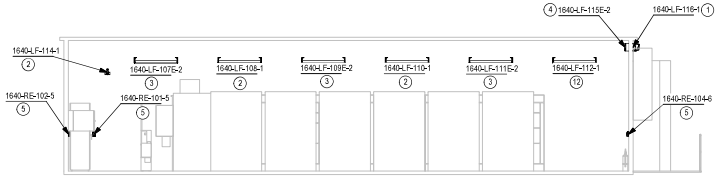
DRG No LLGP-1642-EL-DAL-0031 REV B

USER NAME: rsevilla.martinez
PLOT DATE & TIME: 27 Jun 2024 14:19:05
SAVE DATE & TIME: 27 Jun 2024 14:19:05

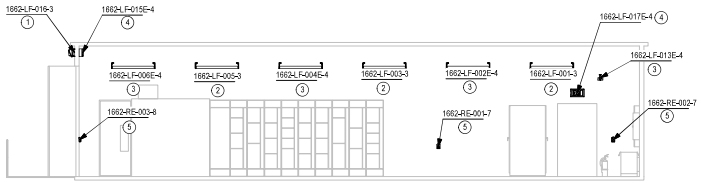


ELECTRICAL ROOM 1640-ER-002 & 1662-ER-001 LAYOUT - PLAN

1:75



SECTION A
1640-ER-002



SECTION B
1662-ER-001

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SHOWN OTHERWISE.
2. THE LOCATION OF LIGHT FIXTURES AND RECEPTACLES IN THIS DRAWING ARE PRELIMINARY ONLY, THE ACTUAL LOCATION DEPENDS ON THE E-ROOM VENDOR AND SHALL BE DETERMINED AT THE TIME OF INSTALLATION.
3. THE LIGHTING FIXTURE & RECEPTACLE TAG NUMBER: AAAA-BB-CCCX-Y
   AAAA: AREA NUMBER
   BB: LF - LIGHTING FIXTURE
   LP - LIGHTING POLE
   RE - RECEPTACLE
   PE - PHOTOCELL
   CCCX: CCC - SEQUENCE NUMBER (001-999)
   X - BLANK: STANDARD LIGHTING FIXTURE
   E: INTEGRATED EMERGENCY BATTERY BACK-UP
   Y: CIRCUIT NUMBER OF LIGHTING PANEL
4. ALL MATERIAL PART NUMBERS CAN BE SUBSTITUTED WITH APPROVED EQUIVANENT.
5. LIGHT FIXTURES ARE NOT PART OF E-ROOM VENDOR PACKAGE AND WILL BE INSTALLED AT THE E-ROOM FABRICATION SHOP.

E-ROOM 1640-ER-002 LIGHTING BILL OF MATERIAL

ITEM	TAG NUMBER	QTY.	DESCRIPTION
1	1640-LF-116-1	1	WP WALL PACK LED, 6200 LUMEN, 50W, 120V, 60Hz,5000K CCOL, NEMA 4X, COOPER WFMLED15
2	1640-LF-101-1, 1640-LF-103-1, 1640-LF-105-1, 1640-LF-108-1, 1640-LF-110-1, 1640-112-1, 1640-LF-114-1	7	7990 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 62W/120V, 60Hz, c/w DP1063MTK KIT, CROUSE-HINDS #FLL4-UNV1-5903-TF
3	1640-102E-2, 1640-104E-2, 1640-109E-2, 1640-LF-107E-2, 1640-LF-109E-2, 1640-LF-111E-2, 1640-LF-113-2	7	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W,120V, 60Hz, c/w DP1053MTK & 90 MIN BATTERY MODULE, CROUSE-HINDS #FLL4-UNV1-5903-TF-EM1
4	1640-LF-115E-2	1	LED EXIT SIGNS, 1.4W, 120V, 60Hz, SELF-POWED, SIGNAL FACE, c/w NICKEL CADMIUM BATTERY, CROUSE-HINDS #LX71SD
5	1640-RE-101-5, 1640-RE-102-5, 1640-RE-103-6, 1640-RE-104-6	4	2-GANG RECEPTACLE, 20A, 120V, 60Hz

E-ROOM 1662-ER-001 LIGHTING BILL OF MATERIAL

ITEM		QTY.	DESCRIPTION
1	1662-LF-016-3, 1662-LF-018-3	2	WP WALL PACK LED, 6200 LUMEN, 50W, 120V, 60Hz, 5000K CCOL, NEMA 4X, COOPER WFMLED15
2	1662-LF-001-3, 1662-LF-003-3, 1662-LF-005-3, 1662-LF-0008-3, 1662-LF-010-3, 1662-LF-012-3, 1662-LF-014-3	7	7990 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 62W,120V, 60Hz, c/w DP1063MTK KIT, CROUSE-HINDS #FLL4-UNV1-5903-TF
3	1662-LF-002E-4, 1662-LF-004E-4, 1662-LF-006E-4, 1662-LF-007E-4, 1662-LF-009E-4,1662-LF-011E-4, 1662-LF-013-3	7	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W,120V, 60Hz, c/w DP1053MTK & 90 MIN BATTERY MODULE, CROUSE-HINDS #FLL4-UNV1-5903-TF-EM1
4	1662-LF-015E-4, 1662-LF-017E-4	2	LED EXIT SIGNS, 1.4W, 120V, 60Hz, SELF-POWED, SIGNAL FACE, c/w NICKEL CADMIUM BATTERY, CROUSE-HINDS #LX71SD
5	1662-RE-001-7, 1662-RE-002-7, 1662-RE-003-8, 1662-RE-004-8	4	2-GANG RECEPTACLE, 20A, 120V, 60Hz
6	1662-LF-108E-28	1	EMERGENCY LIGHT LED, 28A, 120V, 60Hz 2x3W LED LAMP, 90 MINUTES BATTERY, CROUSE-HINDS #NZLPS12222 SS
7	1662-RE-045-8, 1662-RE-046-7	2	1-GANG WATERPROOF GFCI RECEPTACLE, 120V, 20A, HEAVY DUTY DIE-CAST AL BOX & COVER, HUBBELL TAYMAC vSX200

DRAFT

1:75 0 750 1500 3000 4500 6000 7500mm

REV	DATE (D/M/M/A)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
									LLGP-1662-EL-DAL-0230	ELECTRWINNING AREA 1640-ER-002 & 1662-ER-001 GROUNDING LAYOUT
B	16/04/24	REISSUED FOR IFR/CR	AW	FO	SH	ES	YM		LLGP-1662-EL-DAL-0200	ELECTRWINNING AREA 1640-ER-002 & 1662-ER-001 EQUIPMENT LAYOUT
A	11/03/24	ISSUED FOR IFR/CR	AW	FO	SH	ES	YM		LLGP-1662-EL-DAL-0210	ELECTROWINNING AREA 1640-ER-002 & 1662-ER-001 CABLE TRAY LAYOUT

A1 SHEET SCALE 1:75

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

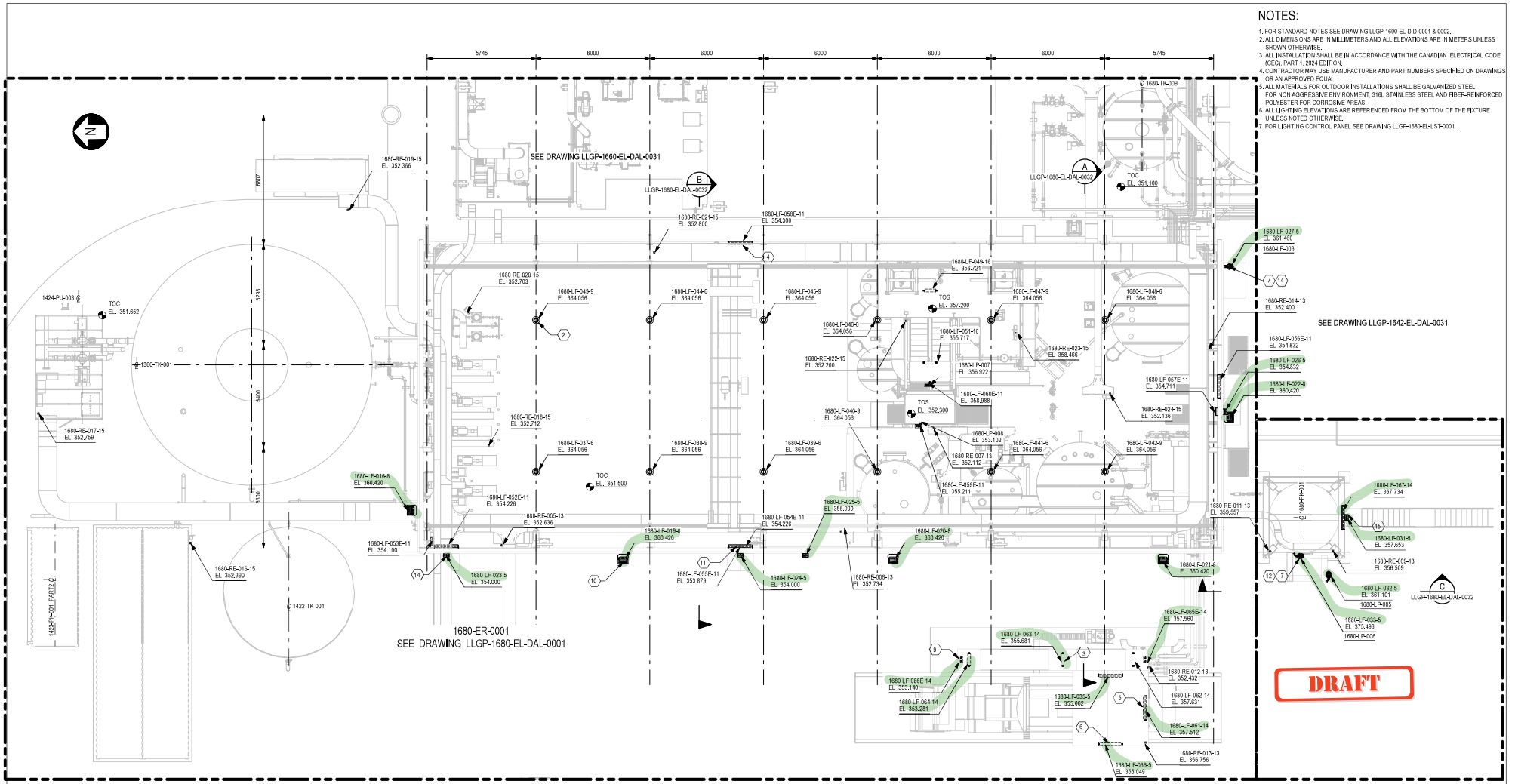
"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in the drawing."

DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
CIP / ADSORPTION / ELECTROWINDING AREA
ELEC. ROOM 1640-ER-002 & 1662-ER-001
LIGHTING LAYOUT

DRG No LLGP-1662-EL-DAL-0220 REV B

USER NAME: alexanderson
PLOT DATE & TIME: 29 Apr 2024 10:25:51
SAVE DATE & TIME: 19 Apr 2024 10:25:51



LIGHTING LAYOUT REAGENTS & SERVICES PLAN

1:100

REV	DATE (DD/MMM/YY)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
B	24 Jun 24	REISSUED FOR IIR/CR	AW	FO	SH	ES	YM		LLGP-1680-EL-DAL-0032	REAGENTS & SERVICES PLAN-LIGHTING
A	23 Nov 2023	ISSUED FOR IIR/CR	RM	FO	SH	ES	YM		LLGP-1600-ME-DKP-0001	PROCESS PLANT & SERVICES-KEY PLAN & DRAWING INDEX

A1 SHEET SCALE 1:100

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
REAGENTS & SERVICES PLANT
LIGHTING LAYOUT

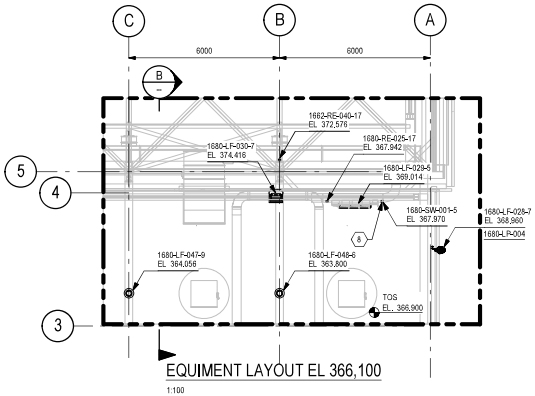
DRG No LLGP-1680-EL-DAL-0031

REV B

USER NAME: rsevilu.sumfreec

PLOT DATE & TIME: 27 Jun 2024 15:08:18

SAVE DATE & TIME: 27 Jun 2024 15:08:18



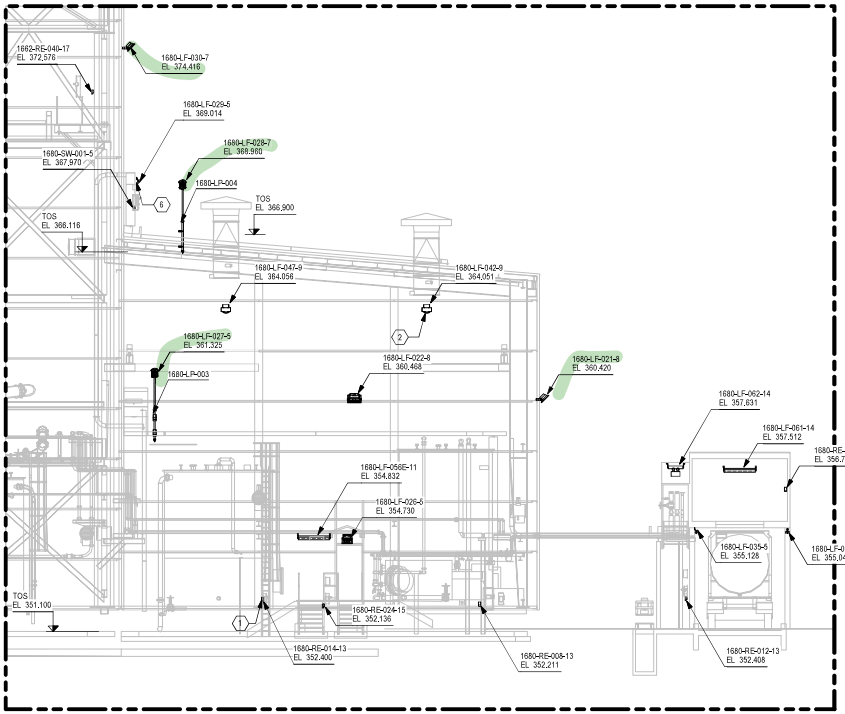
EQUIMENT LAYOUT EL 366,100

1:100

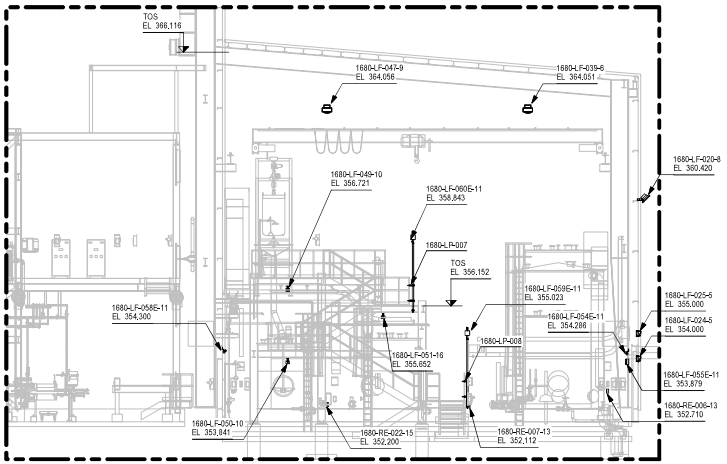
Item	TAG NUMBER	QTY.	UNIT	Tag Number
1	1680-RE-005-13, 1680-RE-006-13,1680-RE-007-13, 1680-RE-008-13, 1680-RE-009-13, 1680-RE-010-13, 1680-RE-011-13, 1680-RE-013-13, 1 1680-RE-014-13, 1680-RE-016-15, 1680-RE-017-15, 1680-RE-018-15, 1680-RE-019-15, 1680-RE-020-15. 1680-RE-021-15, 1680-RE-022-15, 1680-RE-023-15, 1680-RE-024-15, 1680-RE-025-17, 1680-RE-040-17	20	ea.	1-GANG WATERPROOF GFCI RECEPTACLE, 120V, 20A, HEAVY DUTY DIE-CAST AL BOX & COVER, HUBBELL TAYMAC MX3200
2	1680-LF-037-6, 1680-LF-038-9, 1680-LF-039-6, 1680-LF-040-9, 1680-LF-041-6, 1680-LF-042-9, 1680-LF-043-9, 1680-LF-044-6, 1680-LF-045-9, 1680-LF-046-6, 1680-LF-047-9, 1680-LF-048-14	12	ea.	25000 lm LED, 206W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, PENDANT MOUNTING, NEMA 4X, CROUSE-HINDS #PVML-25-2A-UNV1
3	1680-LF-049-10, 1680-LF-050-10, 1680-LF-051-16, 1680-LF-062-14, 1680-LF-063-14, 1680-LF-064-14	6	ea.	3958 lm LINEAR LED, 2 ft LENGTH, OPTICS 120° 32W,120V, 60Hz, c/w DP1053MTK KIT, CROUSE-HINDS #PLL2-UNV1-5903-TF
4	1680-LF-052E-11, 1680-LF-054E-11, 1680-LF-056E-11, 1680-LF-058E-11	4	ea.	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W,120V, 60Hz, c/w DP1052MTK & 90 MIN BATTERY MODULE, C-H #PLL4-UNV1-5903-TF-EM1
5	1680-LF-027-5, 1680-LF-028-7, 1680-032-5, 1680-LF-033-5	4	ea.	9234 lm LINEAR LED, 76W, 120V, 60Hz, 5000K COOL, TYPE V OPTICAL, NEMA 4X, CROUSE-HINDS #PVML-7-2C-UNV1
6	1680-LF-029-5, 1680-LF-035-5, 1680-LF-036-5, 1680-LF-061-14, 1680-LF-067-14, 1680-LF-068-12	6	ea.	7900 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 62W,120V, 60Hz, c/w DP1053MTK KIT, CROUSE-HINDS #PLL4-UNV1-5903-TF
7	1680-LF-059E-11, 1680-LF-060E-11,	2	ea.	EMERGENCY LIGHT LED, 28W, 120V, 60Hz, 2x3W LED LAMP, 90 MIN BATTERY MODULE, CROUSE-HINDS #NZLPS12222 SS
8	1680-LF-016-8, 1680-LF-019-8, 1680-LF-020-8, 1680-LF-021-8, 1680-LF-022-8, 1680-LF-030-7	6	ea.	FLOODLIGHT, 25500 lm LED, 216W, 120V, 60Hz, 5000K COOL, YOKE MOUNTING, NEMA 4X, CROUSE-HINDS #PFMA25LCY-UNV176
9	1680-LF-053E-11, 1680-LF-055E-11, 1680-LF-057E-11, 1680-LF-065E-14, 1680-LF-066E-14	5	ea.	LED EXIT SIGNS, 1.4W, 120V, 60Hz, SELF-POWED, SIGNAL FACE, c/w NICKEL CADMIUM BATTERY, CROUSE-HINDS #UX715D
10	1680-SW-001-5	1	ea.	DOUBLE TOGGLE SWITCH FLUSH MOUNTED
11	1680-LP-003	1	ea.	V-SPRING LIGHT POLE, C-H #V65H-G, #MHK-WG, & #IM5
12	1680-LP-004, 1680-LP-005, 1680-LP-006	3	ea.	V-SPRING LIGHT POLE, C-H #V65H-G, #MHK-RTG, & #IM5
13	1680-LP-007, 1680-LP-008	2	ea.	V-SPRING LIGHT POLE, C-H #V65H-G, #MHK-RTG, & #LMB-FL40
14	1680-LF-023-5, 1680-LF-024-5, 1680-LF-025, 1680-LF-026-5, 1680-LF-031-5, 1680-LF-034-7	6	ea.	WP WALL PACK LED, 6200 lm, 50W, 120V, 60Hz, 5000K COOL, NEMA 4X, COOPER WPMLED15

NOTES:

1. FOR STANDARD NOTES SEE DRAWING LLGP-1680-EL-DID-0001 & 0002.
2. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNO.
3. UNLESS INSTALLATION SHALL BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC), PART 1, 2021 EDITION.
4. CONTRACTOR MAY USE MANUFACTURER AND PART NUMBER SPECIFIED ON DRAWINGS OR AN APPROVED EQUAL.
5. ALL THE MATERIALS FOR THE OUTDOOR INSTALLATIONS SHALL BE GALVANIZED STEEL FOR NON AGGRESSIVE ENVIRONMENT, 316L STAINLESS STEEL AND FIBER-REINFORCED POLYESTER FOR CORROSIVE AREAS.
6. ALL LIGHTING ELEVATIONS ARE REFERENCED FROM THE BOTTOM OF THE FIXTURE UNLESS NOTED OTHERWISE.
7. FOR LIGHTING CONTROL PANEL SEE DRAWING LLGP-1680-EL-LST-0001.

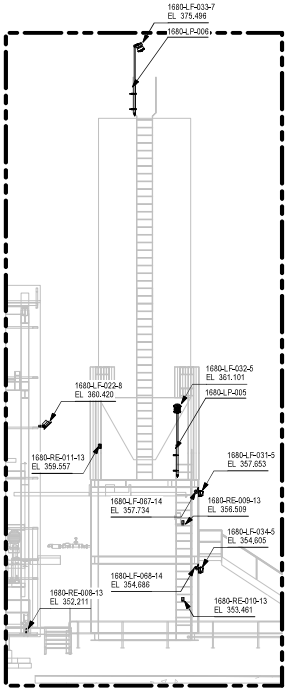


SECTION A 1:100



SECTION B 1:100

DRAFT



SECTION C 1:100

1:100 0 1000 2000 4000 6000 8000 10000mm

REV	DATE (D/M/Y)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
B	25 Jun 24	REISSUED FOR IIR/CR	AW	FO	SH	ES	YM			
A	23 Nov 2023	ISSUED FOR IIR/CR	RM	FO	SH	ES	YM		LLGP-1680-EL-DAL-0031	REAGENTS & SERVICES PLAN LIGHTING LAYOUT

A1 SHEET SCALE 1:100

Worley

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

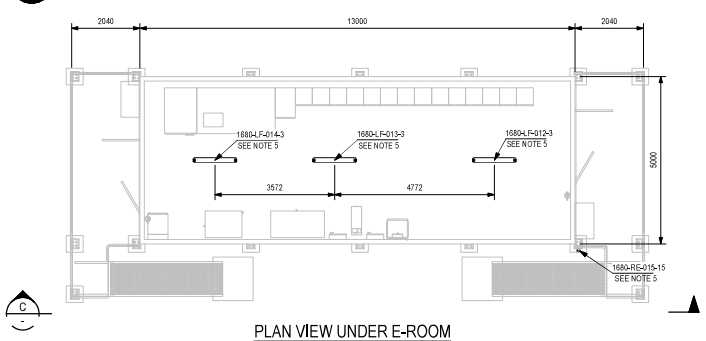
LYNN LAKE GOLD PROJECT
MACLELLAN SITE
REAGENTS & SERVICES PLAN
LIGHTING LAYOUT
PLAN AND SECTIONS

DRG No LLGP-1680-EL-DAL-0032 REV B

USER NAME: rsevilla.martinez

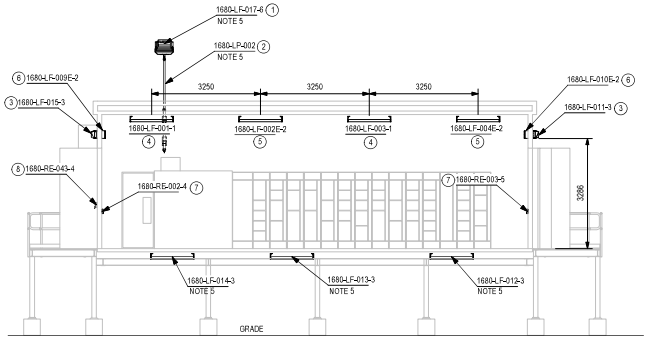
PLOT DATE & TIME: 27 Jun 2024 15:13:47

SAVE DATE & TIME: 27 Jun 2024 15:13:47



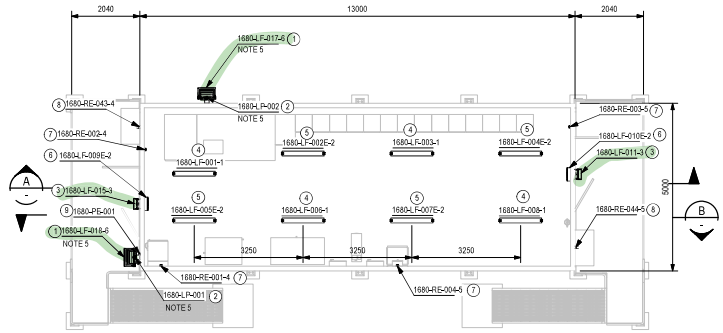
PLAN VIEW UNDER E-ROOM

1:75



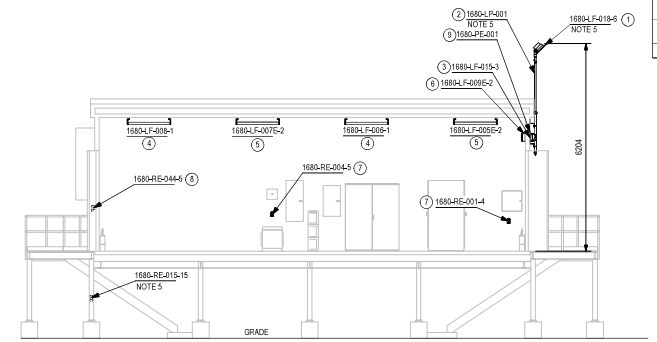
SECTION A

1:75



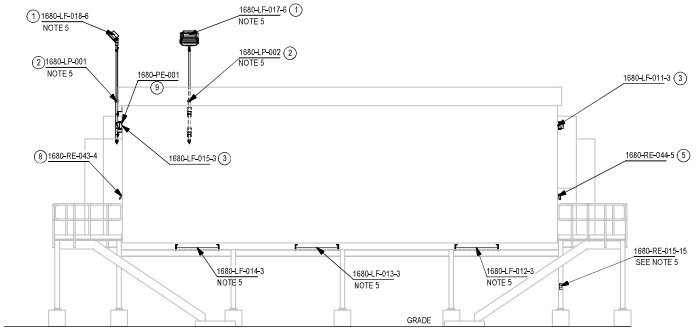
1680-ER-001 LAYOUT - PLAN

1:75



SECTION B

1:75



SECTION C

1:75

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ALL ELEVATIONS ARE IN METERS UNLESS SHOWN OTHERWISE.
2. THE LOCATION OF LIGHT FIXTURES AND RECEPTACLES IN THIS DRAWING ARE PRILIMINARY ONLY. THE ACTUAL LOCATION DEPENDS ON THE E-ROOM VENDOR AND SHALL BE DETERMINED AT THE TIME OF INSTALLATION.
3. THE LIGHTING FIXTURE & RECEPTACLE TAG NUMBER: AAAA-BB-CCCX-Y
   AAAA: AREA NUMBER
   BB: LF - LIGHTING FIXTURE
   LP - LIGHTING POLE
   RE - RECEPTACLE
   PE - PHOTOCELL
   CCCX: CCC - SEQUENCE NUMBER (001-999)
   X - BLANK: STANDARD LIGHTING FIXTURE
   E: INTEGRATED EMERGENCY BATTERY BACK-UP
   Y: CIRCUIT NUMBER OF LIGHTING PANEL.
4. ALL MATERIAL PART NUMBERS CAN BE SUBSTITUTED WITH APPROVED EQUIVANENT.
5. LIGHT FIXTURES AND RECEPTACLE ARE NOT PART OF E-ROOM VENDOR PACKAGE AND WILL BE SUPPLIED AND INSTALLED INSTALLED ON SITE BY ELECTRICAL CONTRACTOR.

LIGHTING BILL OF MATERIAL

ITEM	TAG NUMBER	QTY.	DESCRIPTION
1	1680-LF-017-6, 1680-LF-018-6	2	FLOODLIGHT, 25500 LUMEN LED, 216W, 120Vac, 60Hz, 5000K COOL WHITE LIGHT, YOKE MOUNTING, NEMA 4X, CROUSE-HINDS CHAMP PRO #PFMA25LCY-UNV1-76
2	1680-LP-001, 1680-LP-002	2	9' SPIGOT LIGHT POLE, C-H #V9S9-0, #MBK WH, & #LMB-FL-40
3	1680-LF-011-3, 1680-LF-015-3	2	WP WALL PACK LED, 6260 LUMEN, 53W, 120V, 60Hz, 5000K COOL, NEMA 4X, COOPER #FMLED15
4	1680-LF-001-1, 1680-LF-003-1, 1680-LF-006-1, 1680-LF-008-1, 1680-LF-012-3, 1680-LF-013-3, 1680-LF-014-3	7	7900 lm LINEAR LED, 4 ft LENGTH, OPTICS 120° 62W,120V, 60Hz, c/w DP1863MTK KIT, CROUSE-HINDS #PLL4-UNV1-5983-TF
5	1680-LF-002E-2, 1680-LF-004E-2, 1680-LF-005E-2, 1680-LF-007E-2	4	6720 lm LINEAR LED, 4 ft, OPTICS 120°, 58W,120V, 60Hz, c/w DP1863MTK & 90 MIN BATTERY MODULE, CROUSE-HINDS #PLL4-UNV1-5983-TF-EM1
6	1680-LF-009E-2, 1680-LF-010E-2	2	LED EXIT SIGNS, 1.4W, 120V, 60Hz, SELF-POWER, SIGNAL FACE, c/w NICKEL CADMIUM BATTERY, CROUSE-HINDS #UX71SD
7	1680-RE-001-4, 1680-RE-002-4, 1680-RE-003-5, 1680-RE-004-5	4	2-GANG RECEPTACLE, 20A, 120V, 60Hz
8	1680-RE-015-15, 1680-RE-043-4, 1680-RE-044-5	3	1-GANG WATERPROOF GFCI RECEPTACLE, 120V, 20A, HEAVY DUTY DIE-CAST AL BOX & COVER, HUBBELL TAYMAC MX3200
9	1680-PE-001	1	PHOTOCELL, 3.3A,120V,60 Hz, CROUSE-HINDS #02520

DRAFT

REV	DATE (DD/MM/YY)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
									LLGP-1680-EL-DAL-251	REAGENTS & WATER SYS. AREA ELEC. RM. 1680-ER-001 GROUND'G LAYOUT
B	10/04/24	REISSUED FOR IIR/CR	AW	FO	SH	ES	YM		LLGP-1680-EL-DAL-200	REAGENTS & WATER SYS. AREA ELEC. RM 1680-ER-001 EQUIPMENT LAYOUT
A	7/03/24	ISSUED FOR IIR/CR	AW	FO	SH	ES	YM		LLGP-1680-EL-DAL-210	REAGENTS & WATER SYS. AREA ELEC. RM 1680-ER-001 TRAY LAYOUT

A1 SHEET SCALE 1:75

Worley

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

ALAMOS GOLD INC.

"This drawing is prepared solely for the use of the contracted customer of Worley Canada Services Ltd. (Worley) and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

LYNN LAKE GOLD PROJECT
MACLELLAN SITE
REAGENTS & WATER MANAGEMENT SYS. AREA
ELECTRICAL ROOM 1680-ER-001
LIGHTING LAYOUT

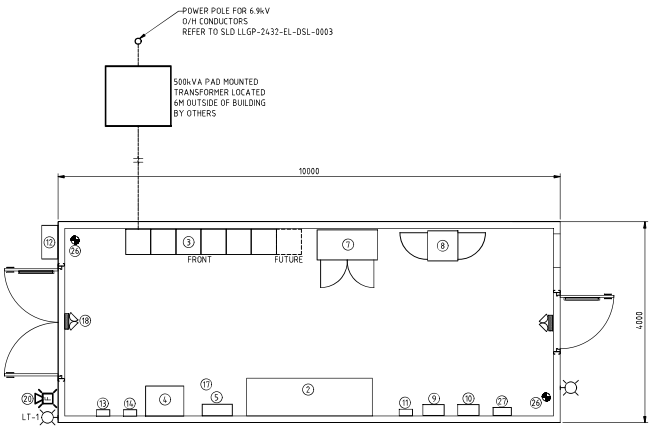
DRG No LLGP-1680-EL-DAL-0220 REV B

USER NAME: rclarck.j.mc/mac

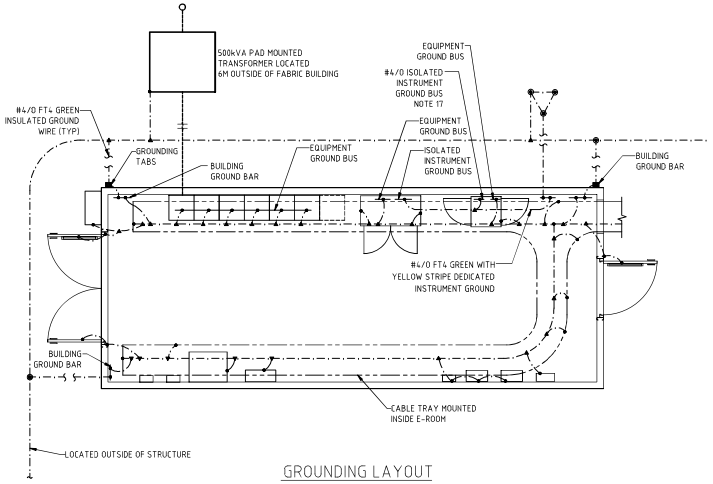
PLOT DATE & TIME: 24 Apr 2024 11:19:48

SAVE DATE & TIME: 19 Apr 2024 11:19:48

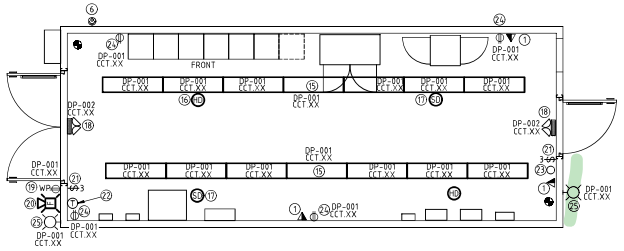
Worley_A1



TRUCK MAINTENANCE SHOP ELECTRICAL ROOM 2322-ER-001 - PLAN



GROUNDING LAYOUT



POWER AND LIGHTING LAYOUT

DRAFT

EQUIPMENT LIST

ITEM	QTY.		DESCRIPTION
1	3	2322-TDO-001	COMBINATION TELEPHONE/DATA OUTLET
2	1	2322-LT-001	LAYOUT TABLE
3	1	2322-MCC-001	MOTOR CONTROL CENTER, 600V, 1600A BUS, 3PHASE, 5 SECTIONS, SIZE 42kAIC, NEMA 1 ENCLOSURE (TBD)
4	1	2322-TR-001	30kVA 600/120-280V TRANSFORMER
5	1	2322-DP-001	208-120V, 60Hz, DISTRIBUTION PANEL (42 CCT.)
6	1	2322-PC-001	PHOTOCELL LOCATION (TBD)
7	1	2322-PLC-001	PLC CABINET, 1600mm (W) x 800mm (D) 2100 (H), FRONT ACCESS (TBD).
8	1	2322-CC-001	COMMUNICATIONS CABINET, 800mm (W) x 1100mm (D) x 2100 (H). FRONT AND BACK ACCESS (TBD)
9	1	2322-UPS-001	UPS SYSTEM
10	1	2322-BR-001	BATTERY RACK
11	1	2322-UPS-002	UPS PANEL (30CCT.)
12	1	2322-HVAC-001	HVAC UNIT (HVAC UNIT MAY NOT BE REQUIRED IF BUILDING A/C SUPPLIES THE THE ELECTRICAL ROOM)
13	1	2322-EWS-001	EYE WASH STATION
14	1	2322-FAS-001	FIRST AID STATION
15	14	2322-LL-001	LED LIGHTS
16	2	2322-HD-001	HEAT DETECTOR
17	2	2322-SD-001	SMOKE DETECTOR
18	2	2322-EEL-001	EMERGENCY EXIT LIGHT
19	1	2322-WP-001	WEATHERPROOF RECEPTACLE
20	1	2322-FAS-001	FIRE ALARM SYSTEM HORN AND STROBE
21	2	2322-LS-001	LIGHT SWITCH 3 WAY
22	1	2322-CP-001	THERMOSTAT CONTROL PANEL FOR HVAC UNIT
23	1	2322-TEL-001	TELEPHONE
24	4	2322-IDR-001	INTERIOR DUPLEX RECEPTACLE
25	2	2322-ELF-001	EXTERIOR LIGHT FIXTURE
26	2	2322-FE-001	FIRE EXTINGUISHER
27	1	2322-FAP-001	FIRE ALARM PANEL

CONSTRUCTION NOTES:

1. THE E-ROOM SUPPLIER SHALL DESIGN & SUPPLY A COMPLETE BUILDING WITH INTERNAL EQUIPMENT AS SHOWN IN THE BILL OF MATERIALS. THE E-ROOM WILL BE LOCATED WITHIN THE MAINTENANCE SHOP FABRIC STRUCTURE PREFERABLY IN THE SOUTH WEST AREA OF THE BUILDING TO FACILITATE INCOMING POWER. VENDOR TO VERIFY. THE E-ROOM IS TO BE PLACED ON PILES AT AN ELEVATION OF 2M OR 6 FEET ABOVE GRADE. OUTGOING CABLES TO ALL POWER LOADS INTERNAL AND EXTERNAL OF THE MAINTENANCE SHOP WILL BE RUN IN TRAYS UNDER THE BUILDING. THIS BUILDING IS TO SUPPLY POWER FOR THE MAINTENANCE SHOP, TRUCK WASH, FUEL BAY FIELD LIGHTING AND OTHER ASSOCIATED LOADS (TBD)
2. THE E-ROOM SHALL BE COMPLETED TESTED & ONLY REQUIRE THE CONNECTION OF EXTERNAL CABLES TO MAKE IT OPERABLE.
3. EQUIPMENT SHOWN IN THE BILL OF MATERIALS WILL BE ISSUED TO THE E-ROOM SUPPLIER FOR INSTALLATION & WIRING.
4. THE E-ROOM VENDOR SHALL SUPPLY ALL NECESSARY HVAC EQUIPMENT. LOCATION OF HVAC EQUIPMENT SHOWN FOR REFERENCE ONLY.
5. THE ELECTRICAL EQUIPMENT SHALL BE BONDED WITH #4/0 AWG INSULATED CU. GROUND WIRE TO THE OUTDOOR BARE CU. PERIMETER GROUND GRID.
6. THE E-ROOM ILLUMINATION LEVEL SHALL BE 500 LUX MINIMUM. INTERNAL LIGHTS SHALL ALWAYS BE ON.
7. THE E-ROOM SUPPLIER SHALL VERIFY THE DIMENSIONS FOR ALL OWNER SUPPLIED EQUIPMENT WITH VENDOR DRAWINGS NOT YET RECEIVED.
8. FIRE PANEL AND FIRE DEVICES TO BE DESIGNED, SUPPLIED AND INSTALLED AT SITE BY OTHERS.
9. ALL DOORS SHALL BE BONDED TO THE ROOM PERIMETER GROUND BUS.
10. CONTRACTOR SHALL SUPPLY AND INSTALL #4/0 FT4 RATED INSULATED GROUNDING CABLE IN THE FULL LENGTH OF THE CABLE TRAY. BOND EVERY SECTION AND FITTING OF THE CABLE TRAY.
11. THE MAIN BUILDING GROUND GRID SHALL BE #4/0 BARE STRANDED COPPER BUILDING GROUND BURIED TO A DEPTH OF NOT LESS THAN 460mm BELOW LEVEL GRADE. THIS DOES NOT INCLUDE THE SURFACE LEVEL OF GRAVEL OR CRUSHED ROCK,.
12. USE #2/0 FT-4 GREEN INSULATED CONDUCTOR FOR TAPS TO 600V EQUIPMENT AND STRUCTURAL STEEL INCLUDING ALL JUNCTION BOXES, TERMINAL BOXES, DISCONNECT SWITCHES, ETC. RELIANCE ON THE TECK CABLE GROUND CORE ALONE SHALL NOT BE ACCEPTABLE.
13. USE #4 FT-4 GREEN INSULATED CONDUCTOR FOR BONDING TO ELECTRICAL EQUIPMENT LESS THAN 600V INCLUDING ALL P.B. STATION, LIGHTING EQUIPMENT, INSTRUMENT STANDS AND ASSOCIATED EQUIPMENT. RELIANCE ON THE TECK CABLE GROUND CORE ALONE SHALL NOT BE ACCEPTABLE.
14. EXPOSED COPPER PORTION ON ALL BURIED CONNECTIONS OF JACKETED CONDUCTORS SHALL BE COATED WITH GLYTAL AND TAPED WITH A 25mm LAP OF ELECTRICAL TAPE. APPLY GLYTAL TO ALL ABOVE GROUND CONNECTIONS.
15. ALL INSTALLATION SHALL BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC) PART 1, 2024 EDITION.
16. ISOLATED INSTRUMENT GROUND CONDUCTOR SHALL BE GREEN INSULATED CABLE WITH YELLOW STRIPE TO DIFFERENTIATE IT FROM COMMON GROUND.

LEGEND:

- CABLE TRAY MOUNTED INSIDE E-ROOM
- GROUND CONDUCTOR COPPER CU.
- BOLTED CONNECTION
- BRANCH COMPRESSION CONNECTION BURNDY 'YG' SERIES
- GROUNDING WELL
- GROUNDING ROD

HOLD NOTES:

1. HOLD FOR TRUCK SHOP AND WAREHOUSE BUILDING INFORMATION FROM STRUCTURAL AND MECHANICAL.

PRELIMINARY
NOT FOR CONSTRUCTION

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
B	08.04.24	RE-ISSUED FOR CLIENT REVIEW	AW	EY	FO	ES	YM		LLGP-2432-EL-DSL-0003	GORDON SITE 6.9kV O/H DISTRIBUTION & 600V FACILITIES POWER SUPPLY SINGLE LINE DIA.
A	23.05.23	ISSUED FOR CLIENT IIR AND ICR	AW	FO	FO	JD	YM	DG	LLGP-2000-CI-DWG-1001	GORDON SITE OVERALL SITE PLAN

A1 SHEET SCALE 1:50

WORLEY PROJECT No. 317045-00108

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER: ALAMOS GOLD INC.

"This drawing is prepared solely for the use of the contractual customer of Worley and Worley assumes no liability to any other party for any representations contained in this drawing."

DRG TITLE

LYNN LAKE GOLD PROJECT
GORDON SITE
TRUCK SHOP AND WAREHOUSE
ELECTRICAL ROOM 2322-ER-001
POWER, LIGHTING AND GROUNDING LAYOUT

DRG No: LLGP-2322-EL-DAL-0001 REV: B

Worley_A1

LOCATION: C:\USERS\ALLAN.WATSON\WORLEY\LYNN LAKE GOLD PROJECT - DOCUMENTS\10_ENG\05_ELEC - DETAIL DESIGN\04_LAYOUTS\01 - E-ROOM & CONTROL ROOM LAYOUTS\01_WORKING FILES\LLGP-2322-EL-DAL-0001.DWG
USER NAME: allan.watson
PLOT DATE & TIME: 16/4/2024, 12:12:31 PM
SAVE DATE & TIME: 16/4/2024, 12:10:17 PM

Appendix C Summary of Air Dispersion Model Results for the Lynn Lake Gold Project Revised 2023 Mine Design

Stantec

Memo

To:	Alamos Gold Inc.	From:	Stantec Consulting Ltd.
Project/File:	Lynn Lake Gold Project 111473076 task 301.104a	Date:	November 18, 2024

Reference: Summary of Air Dispersion Model Results for the Lynn Lake Gold Project Revised 2023 Mine Design

The Lynn Lake Gold Project (LLGP; the Project) consists of two primary deposit sites, the MacLellan site and Gordon site, which are both located near the Town of Lynn Lake, Manitoba. Alamos Gold Inc. (Alamos) will construct (redevelop), operate and eventually close/reclaim open-pit gold mines at both historical mine sites. The Project will be built as two open pit mines with a centralized processing plant facility and a tailings management facility (TMF). The processing plant, located at the MacLellan site has an expected nominal processing throughput of 8,000 tonnes/day with an estimated 17-year production life.

Stantec Consulting Ltd. (Stantec) completed an Environmental Impact Statement (EIS) for the Project (Stantec 2020). The corresponding Air Quality Valued Component section included Chapter 6, Volume 1 of the EIS and a Technical Modelling Report (TMR) in Appendix A, Volume 5 of the EIS. Stantec 2020 was completed to fulfill a requirement of the "Guidelines for the Preparation of an Environmental Impact Statement" (2017) pursuant to the *Canada Environmental Assessment Act* (2012) for the Project. The assessment provides an overview of the existing conditions in the Project area and identifies the changes in ambient air quality at key receptor locations for the Project to determine potential residual and cumulative changes to air quality in support of the EIS.

The Project was approved under the *Canadian Environmental Assessment Act* (2012) with a federal Decision Statement issued March 5, 2023 (subsequently revised July 28, 2024). It was approved under *The Environment Act* of Manitoba with two provincial licences issued March 6, 2023 (Licence No. 3390 relating to the Gordon site and Licence No. 3391 relating to the MacLellan site).

Since Project approval, Alamos has completed a 2023 Feasibility Study Update (FSU) NI 43-101 Technical Report (Alamos 2023) that includes design updates. The design updates include, but are not necessarily limited to the following:

- The processing plant and TMF at the MacLellan site
- General infrastructure at both sites;
- Major development area layouts;
- Major equipment lists
- Mine production capacities.

Reference: Summary of Air Dispersion Model Results for the Lynn Lake Gold Project Revised 2023 Mine Design

Stantec has been engaged by Alamos to conduct an update of the air quality assessment for the Project based on the 2023 FSU. The assessment update focused on the Project design changes, updating the air quality model for the operation phase of the Project, and predicting the potential air quality effects on the receptors. As an amendment to Stantec 2020, this memo summarizes the findings and results of the air quality assessment updates for the Project.

1 Summary of Major Changes to Project Design

The air quality modelling updates focused on the Project operation phase and considered air emissions from the mobile and stationary equipment during operation activities at the MacLellan site and Gordon site. The mobile equipment included the trucks and equipment moving around the Project area (e.g., haul trucks, loaders, excavators). The stationary equipment included the processing equipment (e.g.., crushers, mills, pumps, compressors). The air dispersion model update also considered air emissions from the open pit production blast.

Stantec reviewed and compared the Project design parameters for 2019 and 2023. The design changes that may affect the air quality assessment are summarized in the subsections below.

Mine design changes, relevant to air emissions, are based on the following design information provided by Alamos for the Project:

- Feasibility Study Update, NI 43-101 Technical Report for the Lynn Lake Project. Issue date: August 22, 2023 (Alamos 2023).
- Capital and Operating Cost Estimate – MacLellan 13Apr2023 V1.9 update 13Aug2023 (Excel Spreadsheet, pers comm 2024).
- Capital and Operating Cost Estimate – Gordon 13Apr2023 V1.9 update 13Aug2023 (Excel Spreadsheet, pers comm 2024).
- Gordon Highway Haul Calculator 26Apr2023 Plan V1.9 (Excel Spreadsheet, pers comm 2024).
- Schedule MacLellan 13Apr2023 V1.9 (Excel Spreadsheet, pers comm 2024).
- Schedule Gordon 13Apr2023 V1.9 (Excel Spreadsheet, pers comm 2024).
- Process Design Criteria – Process Plant (Worley document issued 12-April-2023), Process Plant Plot Plan and Elevation Drawings showing the building heights (pers comm 2024).

Table 1 summarizes the changes in total years of mine operations between the 2019 and 2023 designs. These changes were determined to possibly alter the air quality effects at the receptors, necessitating the re-assessment.

Table 1 Comparison of Years of Mine Operations between 2019 Design and 2023 Design

Parameter	Unit	AQ Model 2019	Feasibility Study 2023
Gordon Operation	year	5 (mining)	5 (mining) + 2 (stockpile reclaim)
MacLellan Operation	year	13 (mining)	11 (mining) + 6 (stockpile reclaim)

1.1 Project Development Area and Project Layouts

Comparison of the updated drawings of the Project Development Area (PDA) at the MacLellan site and the Gordon site for the 2019 and 2023 designs shows that there are some changes to the Project footprint and the detailed layouts of the Project components, including access road and haul road, the open pit, mine rock storage areas (MRSA), overburden stockpiles, and ore stockpiles at both sites. Additionally, there are changes to the TMF and ore milling and processing plant at the MacLellan site. Although there are changes to the Project components within the PDA, the air quality local assessment area (LAA) does not change from what was included for the 2020 Air Quality Valued Component section and TMR (Stantec 2020).

Table 2 summarizes the major changes to the Project layouts between the 2019 and 2023 designs. These changes will alter the Project equipment layouts and the spatial distribution of the air emission sources and will therefore have potential effects on the maximum model predicted air quality concentrations.

Table 2 Comparison of Project Layouts between the 2019 Design and 2023 Design

Mine Site	Project Major Components	2019 Design	2023 Design
MacLellan	PDA	-[1]	Changes
	LAA	-	No Changes
	Open Pit	-	Changes
	Satellite Pit	N/A[2]	Located at south of Open Pit, new component
	TMF and MRSA	-	Changes – changes to the extents of the MRSA, TMF pond, and TMF bank area
	Overburden Stockpile	-	Changes – the new area is larger
	Topsoil Storage Area	-	Changes – the location is moved from south to north of the Overburden Stockpile

Reference: Summary of Air Dispersion Model Results for the Lynn Lake Gold Project Revised 2023 Mine Design

Mine Site	Project Major Components	2019 Design	2023 Design
MacLellan (cont'd.)	Process Plant	-	Plant building and equipment layouts are different
	Haul Road	-	Road routes change with change to location or extents of stockpiles and pits
	Access Road	-	No significant changes
Gordon	PDA	-	Changes
	LAA	-	No changes
	Open Pit	-	Changes – new area is larger
	MRSA	-	Changes
	Overburden Stockpile	-	Changes – new area is larger
	Topsoil Storage Area	N/A	Added to site
	Ore Storage Area	-	Changes – location is moved
	Diesel Generators	-	Location of diesel generator changed
	Disel Generator (Power output)	300 kW (Tier 2)	1 MW (Tier 4)
	Facility Area	-	Changes – location is moved from center to southeast of the MRSA
	Stockpile Borrow Source	N/A	Added to site but not relevant to air quality assessment
	Haul Road	-	Road routes change with change to location or extents of the stockpiles and pit
	Access Road	-	No significant changes

Notes:

"-": as a comparison base

"N/A": not included or not shown on design drawings of the 2019 design

1.2 Mining Production

Based on the review of the Project mine production data during the operation phase, the years with the highest production rates are different from the 2019 design at both sites. Table 3 compares the highest production rate year for the 2019 design with the 2023 design.

Table 3 Comparison of Mining Production between 2019 Design and 2023 Design

Mine Site	Unit	2019 Design		2023 Design	
		Total Material Mined	Highest Year	Total Material Mined	Highest Year
MacLellan	kt/y[1]	28,000	7	33,941	5
Gordon	kt/y[1]	16,000	2	16,001	3

Notes:

[1] kt/y: thousands of tonnes per year

In the air quality dispersion model, the production years with the highest production rates are considered representative of the worst-cases for air emissions. Therefore, in the assessment update, Year 5 of the MacLellan site operation and Year 3 of the Gordon site operation are selected. These years differ from the 2019 design, which used Year 7 for the MacLellan site and Year 2 for the Gordon site.

1.3 Ore Transport from Gordon to the Mill

Table 4 compares the 2019 design for ore transportation from the Gordon site along Provincial Road (PR) 391 to the Mill at the MacLellan site with the 2023 design. The maximum tonnage of ore transported from the Gordon site to the Mill in a year of operation has changed. In the 2019 design, the maximum tonnage of ore transported from the Gordon site to the Mill was 1,500 kt/y in Year 2. In the 2023 design, a maximum of 1,696 kt of ore will be transported from the Gordon site to the Mill in Year 4.

Table 4 Comparison of Ore Transport from the Gordon Site to the Mill – 2019 Design to 2023 Design

Mine Site	Unit	2019 Design		2023 Design	
		Total Material Mined	Highest Year	Total Material Mined	Highest Year
Ore	kt/y[1]	1,500	2	1,696	4

Notes:

[1] kt/y: thousands of tonnes per year

1.4 Mining Equipment

The number of pieces of mining equipment and make/model have changed from the 2019 design. Table 5 summarizes the mining equipment and quantities associated with the 2023 design in the years with the highest production rates for the MacLellan and Gordon sites.

Table 5 Mining Equipment of 2023 Design

Equipment	Number of Units		
	MacLellan Site (Year 5)	Gordon Site (Year 3)	PR 391 (Year 4)
Open Pit Mining			
Hydraulic Electric Shovel (PC4000 shovel)	2	-	-
Hydraulic Excavator (PC1250LC-8)	-	4	-
Ore Haul Truck (HD1500-7)	16	-	-
Ore Haul Truck (HD605-8)	-	15	-
Crawler Dozer (D375-6)	5	4	-
Small Water Truck (15,000 L)	2	2	-
Waste Rock Removal	-	-	-
Hydraulic Excavator (PC1250LC-8)	1	1	-
Hydraulic Excavator (PC490LC-11)	1	1	-
Dump Truck - 20 ton	3	2	-
Drilling and Blasting	-	-	-
Production HP Electric Drill (PV275)	4		-
Drill (Epiroc SmartRoc D65)	1	3	-
Forklift/Telehandler (Blasting Loader)	1	1	-
Stockpile Rehandle	-	-	-
Transfer Loader	2		-
Transfer Loader (WA600)	-	1	-
Articulated Dump Truck (ADT) 40 tonne (t)	2	-	-
General Equipment	-	-	-
Lube/Fuel Truck (20,000 litres (L))	1	1	-
Welding Service Truck	1	1	-
Explosives Delivery Truck (20 t) (Blaster Truck)	1	1	-
Mechanic Truck	1	1	-
Super B Train Fuel Truck (40,000 L)	1	1	-

Reference: Summary of Air Dispersion Model Results for the Lynn Lake Gold Project Revised 2023 Mine Design

Equipment	Number of Units		
	MacLellan Site (Year 5)	Gordon Site (Year 3)	PR 391 (Year 4)
Grinding Media Delivery Truck (40 t)	1	0	-
Reagents Delivery Truck (20 t)	1	0	-
Crew Change Vehicle	2	2	-
Pickup Trucks	14	10	-
Small Water Truck (15,000 L)	1	1	-
Pump Truck	1	1	-
Maintenance and Other Supporting Equipment			-
Crane 50 t	1	-	-
Crane 30 t	1	1	-
Integrated Tool Carrier WA200-7	1	1	-
Grader (GD655-6)	2	2	-
Loader (Tire Manipulator (WA500-8))	1	1	-
Loader (Road maintenance) WA500-8	1	1	-
Compactor (BW211)	1	1	-
Lighting Plant	8	6	-
ADT 40 t	-	1	-
Provincial Road			
Highway Haul Truck (122SD)	-	-	15
Explosives Delivery Truck (14 t)	-	-	1
Super B Train Fuel Truck (40,000 L)	-	-	1
Grinding Media Delivery Truck (40 t)	-	-	1
Reagents Delivery Truck (20 t)	-	-	1
Tow Truck/Flatbed (55 t)	-	-	1
Pickup Trucks	-	-	10
Intercity Bus	-	-	1

1.5 Processing Plant

The 2023 FSU provided new design and layouts for the processing plant at the MacLellan site. The processing plant consists of several buildings housing the mine processing equipment, including:

- Main Process Building
- Reagent Storage Building
- Primary Crushing Facility
- Secondary Crushing Building
- Fine Ore Storage Facility
- Oxygen Plant

The processing plant also includes other auxiliary buildings, such as warehouse and workshop, truck shop and truck wash, assay laboratory and administration building.

There are some changes to the buildings layout when compared to the 2019 design. The number of leach tanks increased from five in the 2019 design to seven in the 2023 design. The layout of the fine ore storage building has changed.

Section 7.3.3 in Stantec (2020) summarized the buildings and equipment in the processing plant. Map 7 in Appendix A in Stantec (2020) shows the processing plant layout. Compared with the 2019 design, the buildings in the 2023 design have different layouts, sizes, and equipment setups. Maps 1 and 2 show the plant layout based on 2023 design for the Gordon site and the MacLellan site, respectively. The gold room was a separate building in the 2019 design but is housed inside the main building in the 2023 design. The locations of the reagent building, and oxygen plant have also changed.

The capacity of the crushing plant and processing plant has changed from the 2019 design. Table 6 compares the crushing plant and processing plant capacity between the 2019 and 2023 designs.

Table 6 Comparison of Processing Plant Buildings between2019 and 2023 Designs at the MacLellan Site

Parameter	Unit	2019 Design	2023 Design
Crushing Plant Capacity	kt/y	2,738	2,920
	t/d	7,500	8,000
	t/h	474	481
Processing Plant Capacity	kt/y	2,738	2,920
	t/d	7,500	8,000
	t/h	474	362

kt/y: thousands of tonnes per year; t/d: tonnes per day; t/h: tonnes per hour

1.6 Blasting Parameters

During the operation phase, there are air emissions due to blasting activities within the open pit at the Gordon site and the MacLellan site. The primary factors affecting the air emissions due to blasting are the mass of explosives used for each hole, number of holes per blast, and the frequency of blasts.

Table 7 summarizes the differences for the blasting parameters between the 2019 design and the 2023 design.

Table 7 Comparison of Blasting Parameters in 2019 Design and 2023 Design

Blasting Parameter	2019 Design		2023 Design	
	MacLellan Site	Gordon Site	MacLellan Site	Gordon Site
Highest Explosive Charge	208 kg/hole	208 kg/hole	230 kg/hole	230 kg/hole
Holes per Blast	213	154	241	119
Frequency	Every third day	Every third day	3-4 times a week	3-4 times a week

kg: kilograms

2 Air Quality Modeling Update Results

The dispersion modelling methodology used to assess the potential effects of the 2023 design changes on air quality is identical to the methodology used in the EIS (Stantec 2020). The details of CALPUFF model setup, CALMET meteorological data, receptor grid, nitric oxide (NO) to nitrogen dioxide (NO_2) conversion, and particulate matter deposition can be found in the Air Quality TMR, Volume 5 Attachment A in the EIS (Stantec 2020).

The model predicted 1-hour and 8-hour average concentrations are based on the maximum hourly emission rates. The model predicted 24-hour, monthly and average concentrations are based on the daily average emission rates that consider the actual operating hours per day for each mining activity. Baseline concentrations are added to the model predicted maximum concentrations to account for other existing emission sources (natural and anthropogenic) that are not directly included in the model simulation. The model predicted maximum concentrations with the baseline contribution are compared to the Manitoba Ambient Air Quality Criteria (AAQC) and the Canadian Ambient Air Quality Standards (CAAQS). The CAAQS are reference values for regional air quality management and are applicable to measured ambient concentrations at human receptor locations away from the industrial facility boundaries. The maximum predicted concentrations in the LAA are compared to the CAAQS in this context and do not imply compliance with the AAQC at the Project Boundary. The maximum predicted concentrations are based on areas along and outside the Project Boundary (i.e., locations where public access is not restricted). The predicted maximum concentrations and dustfall are discussed separately for the Gordon site and MacLellan site in the following sections. The corresponding concentration contour maps are presented in Attachment A.

2.1 Gordon Site Operations

The model predicted maximum ground-level concentrations and dustfall from operation of the Gordon site are summarized in Table 8 and are compared with maximum predicted concentrations presented in the EIS TMR (Stantec 2020). The associated concentration and dustfall contours in the LAA are presented in Map 1 to Map 24 in Attachment A.

2.1.1 Maximum NO_2 Concentrations

The maximum predicted 1-hour NO_2 concentration, 415 micrograms per cubic metre (µg/m³), is greater than the Manitoba AAQC (400 µg/m³). The maximum predicted 24-hour and annual NO_2 concentrations are 74.2 and 10.4 µg/m³, respectively and are less than the Manitoba AAQC and the annual CAAQS. The maximum predicted 1-hour average NO_2 concentration in the metric of the CAAQS (284 µg/m³) is greater than the 1-hour CAAQS (79 µg/m³). The maximum predicted NO_2 concentrations at human health (HH) receptors for all averaging periods are less than the Manitoba AAQC. The maximum predicted NO_2 concentrations are greater than the 1-hour CAAQS at three HH receptors (receptor ID 73, 76 and 77 in TMR Appendix E Table E-2 (Stantec 2020)).

The maximum predicted 1-hour NO_2 concentration, 415 µg/m³, is 10% less than the maximum predicted value in the EIS TMR (Stantec 2020) and the maximum frequency of exceedance changed from 2 hours per year (h/y) to 1 h/y. The maximum predicted 1-hour CAAQS NO_2 concentration is 27% greater than the maximum predicted value in the EIS TMR and the maximum frequency of exceedance increases from 99 d/y to 101 d/y.

2.1.2 Maximum CO Concentrations

The maximum predicted 1-hour, and 8-hour carbon monoxide (CO) concentrations are 14,832 and 4,345 µg/m³, respectively and are less than the Manitoba AAQC. The predicted concentrations are 8 to 12% lower than the than maximum predicted values in EIS TMR (Stantec 2020).

2.1.3 Maximum SO_2 Concentrations

The maximum predicted 1-hour, 24-hour, and annual sulphur dioxide (SO_2) concentration are 422, 42.6, and 2.60 µg/m³, respectively, and are less than the Manitoba AAQC and annual CAAQS. The maximum predicted 1-hour average SO_2 concentration in the metric of the CAAQS (382 µg/m³) is greater than the 1-hour CAAQS (170 µg/m³). The maximum predicted SO_2 concentrations at HH receptors for all averaging periods are less than the Manitoba AAQC and CAAQS.

The maximum predicted 1-hour SO_2 CAAQS concentration, 415 µg/m³, is 12% greater than the maximum predicted value in the EIS TMR (Stantec 2020) and the maximum frequency of exceedance increases from 5 days per year (d/y) to 12 d/y.

2.1.4 Maximum Total Suspended Particulate (TSP) Concentrations

The maximum predicted 24-hour TSP concentration, 734 µg/m³, is greater than the Manitoba AAQC (120 µg/m³). The maximum predicted annual TSP concentration,15.8 µg/m³, is less than the Manitoba AAQC. The maximum predicted TSP concentrations are greater than the Manitoba 24-hour AAQC at three HH receptors (receptors ID 73, 76, and 77 in TMR Appendix E Table E-2 (Stantec 2020)).

The maximum predicted TSP concentrations are 7% to 21% greater than the maximum predicted TSP concentrations in the EIS TMR (Stantec 2020). The maximum frequency of exceedance increases from 73 d/y to 94 d/y.

2.1.5 Maximum PM_{10} Concentrations

The maximum predicted 24-hour particulate matter <10 microns (PM_{10}) concentration, 406 µg/m³, is greater than the Manitoba AAQC (50 µg/m³). The maximum predicted PM_{10} concentrations are greater than the Manitoba 24-hour AAQC at four HH receptors (receptors ID 72, 73, 76, and 77 in TMR Appendix E Table E-2 (Stantec 2020)).

The maximum predicted PM_{10} concentration is 12% greater than the maximum predicted PM_{10} concentrations in the EIS TMR (Stantec 2020). The maximum frequency of exceedance increases from 110 d/y to 119 d/y.

2.1.6 Maximum $PM_{2.5}$ Concentrations

The maximum predicted 24-hour and annual particulate matter less than 2.5 microns ($PM_{2.5}$) concentrations are 25.7 µg/m³ and 7.40 µg/m³, respectively, and are less than the CAAQS. The maximum predicted $PM_{2.5}$ concentrations at HH receptors for all averaging periods are less than the CAAQS.

The maximum predicted $PM_{2.5}$ concentrations are 8% to 9% greater than the maximum predicted $PM_{2.5}$ concentrations in the EIS TMR (Stantec 2020).

2.1.7 Maximum Dustfall

The maximum predicted 30-day and annual average dustfall are 6.50 grams per square metre per 30-day period (g/m²/30-day) and 4.51 g/m²/30-day, respectively, and are less than the Ontario AAQC.
The maximum predicted 30-day and annual average dustfall at HH receptors are less than the dustfall criteria.

The maximum predicted dustfall values are 33% to 36% greater than the maximum predicted dustfall concentrations in the EIS TMR (Stantec 2020).

Reference:Summary of Air Dispersion Model Results for the Lynn Lake Gold Project Revised 2023 Mine Design

Table 8 Predicted Maximum Ground-Level Concentrations from Gordon Site Operation (EIS vs 2023 Design)

Substance	Averaging Period	Existing/ Baseline Conditions (µg/m³)	Maximum Ground-level Concentration (µg/m³) (includes Baseline Conditions)											Ambient Air Quality Criteria [a] (µg/m³)
			Max. Value in LAA (EIS)	Max. Value in LAA (2023 Design)	% Change in Max Value in LAA from EIS	Max. Value at Human Receptors (EIS)	Max. Value at Human Receptors (2023 Design)	% Change in Max. Value at Human Receptors from EIS	Max. No. of Exceedances per Year (EIS)	Max. No. of Exceedances per Year (2023 Design)	% Change Max No. of Exceedances from EIS	% Max. Value of AAQC (EIS)	% Max. Value of AAQC (2023 Design)	
Gaseous CAC														
NO_2	1-hour [b]	7.5	**459**	**415**	-10%	180	287	59%	2 h/y	1 h/y	-50%	**115%**	**104%**	400
	1-hour [c]	7.5	**224**	**284**	27%	**95.5**	**91.1**	-5%	99 d/y	101 d/y	2%	**283%**	**360%**	79 [c,d]
	24-hour [e]	5.6	74.1	74.2	0.1%	34	36.2	6%	0	0	—	37%	37%	200
	Annual	1.9	11.2	10.4	-7%	3.61	3.42	-5%	0	0	—	19%	17%	60
									0	0	—	49%	45%	23 [d,f]
CO	1-hour [b]	406	**16,096**	14,832	-8%	6,040	8,643	43%	1 h/y	0	-100%	**107%**	99%	15,000
	8-hour	406	4,952	4,345	-12%	1,192	1,669	40%	0	0	—	83%	72%	6,000
SO_2	1-hour [b]	6	**460**	422	-8%	168	240	43%	1 h/y	0	-100%	**102%**	94%	450
	1-hour [g]	6	**342**	**382**	12%	44.7	44.9	0%	5 d/y	12 d/y	140%	**201%**	**224%**	170 [d,g]
	24-hour [e]	6	48.7	42.6	-13%	13.5	17.4	29%	0	0	—	32%	28%	150
	Annual	1.5	2.45	2.60	6%	1.60	1.63	2%	0	0	—	8%	9%	30
									0	0	—	25%	26%	10 [d,h]
Other Gaseous Species														
HCN	1-hour [b]	—	—	—	—	—	—	—	—	—	—	—	—	40
	24-hour [d]	—	—	—	—	—	—	—	—	—	—	—	—	8 [i]
	Annual	—	—	—	—	—	—	—	—	—	—	—	—	3
Particulate CAC														
TSP	24-hour [e]	10.5	**606**	**734**	21%	**162**	**228**	41%	73 d/y	94 d/y	29%	**505%**	**611%**	120
	Annual [j]	10.5	14.8	15.8	7%	11.9	12.0	1%	0	0	—	25%	26%	60 [j]
PM_{10}	24-hour [e]	4.6	**361**	**406**	12%	**100**	**129**	29%	110 d/y	119 d/y	8%	**721%**	**811%**	50
$PM_{2.5}$	24-hour [k]	2.9	23.5	25.7	9%	8.45	9.79	16%	0	0	—	87%	95%	27 [d,k]
	Annual [l]	2.9	6.87	7.40	8%	3.54	3.67	4%	0	0	—	78%	84%	8.8 [d,l]
Dustfall	30-day	0.99	4.90	6.50	33%	1.72	2.00	16%	0	0	—	61%	93%	7
(g/m²/30-day)	Annual [j]	0.99	3.32	4.51	36%	1.34	1.52	13%	0	0	—	26%	98%	4.6 [j]

Reference:Summary of Air Dispersion Model Results for the Lynn Lake Gold Project Revised 2023 Mine Design

Notes:

µg/m³: micrograms per cubic metre; EIS: Environmental Impact Statement; LAA: Local Assessment Area; AAQC: ambient air quality criteria; NO_2: nitrogen dioxide; CO: carbon monoxide; SO_2: sulphur dioxide; HCN: hydrogen cyanide; TSP: total suspended particulate; PM_{10}: particulate matter <10 microns; $PM_{2.5}$: particulate matter <2.5 microns; g/m^2/30-day: grams per square metre per 30 days.

a. Manitoba Ambient Air Quality Criteria (MSD 2005) unless otherwise noted

b. The maximum 1-hour concentration after eliminating 8 highest meteorological hours in each year

c. The 1-hour CAAQS for NO_2 is referenced to the three-year average of the annual 98th percentile of the NO_2 daily maximum 1-hour average concentrations (effective 2025) (CCME 2017).

d. CAAQS (CCME 2017)

e. The maximum 24-hour concentration after eliminating the 1st highest meteorological day in each year

f. The annual CAAQS for NO_2 is referenced to the arithmetic average over a single calendar year of all 1-hour average NO_2 concentrations (effective 2025) (CCME 2017).

g. The 1-hour CAAQS for SO_2 is referenced to the three-year average of the annual 99th percentile of the SO_2 daily maximum 1-hour average concentrations (effective 2025) (CCME 2017).

h. The annual CAAQS for SO_2 is referenced to the arithmetic average over a single calendar year of all 1-hour average SO_2 concentrations (effective 2025) (CCME 2017).

i. Ontario AAQC (MOECC 2012)

j. Annual geometric mean

k. The CAAQS for 24-hour $PM_{2.5}$ is referenced to the annual 98th percentile of daily 24-hour average concentrations, averaged over three years (effective 2020) (CCME 2017).

l. The CAAQS for annual $PM_{2.5}$ is referenced to the three-year mean of annual average concentrations (effective 2020) (CCME, 2017).

Predicted maximum 1-hour and 8-hour average concentrations are based on maximum hourly emission rates.

Predicted maximum 24-hour, 30-day and annual average concentrations are based on daily average emission rates.

"—" not applicable

Values in **BOLD** exceed the ambient air quality criteria

2.2 MacLellan Site Operations

The model predicted maximum ground-level concentrations and dustfall from operation of the MacLellan site are summarized in Table 9 and are compared with maximum predicted concentrations in the EIS TMR (Stantec 2020). The associated concentration and dustfall contours in the LAA are presented in Map 1 to Map 24 in Attachment A.

2.2.1 Maximum NO_2 Concentrations

The maximum predicted 1-hour NO_2 concentration, 435 µg/m³, is greater than the Manitoba AAQC (400 µg/m³). The maximum predicted 24-hour and annual NO_2 concentrations are 72.9 and 7.91 µg/m³, respectively and are less than the Manitoba AAQC and the annual CAAQS. The maximum predicted 1-hour average NO_2 concentration in the metric of the CAAQS (186 µg/m³) is greater than the 1-hour CAAQS (79 µg/m³). The maximum predicted NO_2 concentrations at HH receptors for all averaging periods are less than the Manitoba AAQC. The maximum predicted NO_2 concentrations are greater than the 1-hour CAAQS at six HH receptors (receptors ID 82, 85, 86, 117, 123, and 156 in TMR Appendix E Table E-2 (Stantec 2020)).

The maximum predicted 1-hour NO_2 concentration, 435 µg/m³, is 8% greater than maximum predicted value in the EIS TMR (Stantec 2020) and the maximum frequency of exceedance stays the same at 1 h/y. The maximum predicted 1-hour CAAQS NO_2 concentration is 27% greater than maximum predicted value in the EIS TMR (Stantec 2020) and the maximum frequency of exceedance decreases from 79 d/y to 70 d/y.

2.2.2 Maximum CO Concentrations

The maximum predicted 1-hour CO concentration is 15,406 µg/m³ and is 3% greater than the Manitoba AAQC. The maximum predicted 8-hour CO concentration is 4,567. The predicted concentrations are 10 to 16% higher than the than maximum predicted values in EIS TMR (Stantec 2020).

2.2.3 Maximum SO_2 Concentrations

The maximum predicted 1-hour, 24-hour, and annual SO_2 concentration are 437, 44.6, and 2.18 µg/m³, respectively, and are less than the Manitoba AAQC and annual CAAQS. The maximum predicted 1-hour average SO_2 concentration in the metric of the CAAQS (256 µg/m³) is greater than the 1-hour CAAQS (170 µg/m³). The maximum predicted SO_2 concentrations at HH receptors for all averaging periods are less than the Manitoba AAQC and CAAQS.

The maximum predicted 1-hour SO_2 CAAQS concentration, 256 µg/m³, is 74% greater than maximum predicted value in the EIS TMR (Stantec 2020) and the maximum frequency of exceedance increases from 0 d/y to 3 d/y. The increase is attributable to an increase in the blasting frequency and the amount of explosives used per blast associated with the 2023 design.

2.2.4 Maximum HCN Concentrations

The maximum predicted 1-hour, 24-hour and annual hydrogen cyanide (HCN) concentrations are 17.6, 6.79, and 0.553 µg/m³, respectively, and are less than the Manitoba AAQC and the 24-hour Ontario AAQC. The maximum predicted HCN concentrations at HH receptors for all averaging periods are less than the ambient criteria.

2.2.5 Maximum TSP Concentrations

The maximum predicted 24-hour TSP concentration, 437 µg/m³, is greater than the Manitoba AAQC (120 µg/m³). The maximum predicted annual TSP concentration, 14.1 µg/m³, is less than the Manitoba AAQC. The maximum predicted TSP concentrations are greater than the Manitoba 24-hour AAQC at three HH receptors (receptors ID 85, 86, and 117 in TMR Appendix E Table E-2 (Stantec 2020)).

The maximum predicted TSP concentrations are 1% to 15% less than the maximum predicted TSP concentrations EIS TMR (Stantec 2020). The maximum frequency of exceedance decreases from 64 d/y to 50 d/y.

2.2.6 Maximum PM_{10} Concentrations

The maximum predicted 24-hour PM_{10} concentration, 247 µg/m³, is greater than the Manitoba AAQC (50 µg/m³). The maximum predicted PM_{10} concentrations are greater than the Manitoba 24-hour AAQC at six HH receptors (receptors ID 82, 85, 86, 117, 123, and 156 in TMR Appendix E Table E-2 (Stantec 2020)).

The maximum predicted PM_{10} concentration is 21% less than the maximum predicted PM_{10} concentrations in the EIS TMR (Stantec 2020). The maximum frequency of exceedance decreases from 89 d/y to 70 d/y.

2.2.7 Maximum $PM_{2.5}$ Concentrations

The maximum predicted 24-hour and annual $PM_{2.5}$ concentrations are 18.6 µg/m³ and 5.57 µg/m³, respectively, and are less than the CAAQS. The maximum predicted $PM_{2.5}$ concentrations at HH receptors for all averaging periods are less than the CAAQS.

The maximum predicted $PM_{2.5}$ concentrations are 11% to 23% less than the maximum predicted $PM_{2.5}$ concentrations in the EIS TMR (Stantec 2020).

2.2.8 Maximum Dustfall

The maximum predicted 30-day and annual average dustfall are 5.57 g/m²/30-day and 3.95 g/m²/30-day and are less than the Ontario AAQC. The maximum predicted 30-day and annual average dustfall at HH receptors are less than the dustfall criteria.

The maximum predicted dustfall values are 1% to 3% greater than the maximum predicted dustfall concentrations in the EIS TMR (Stantec 2020).

Reference:Summary of Air Dispersion Model Results for the Lynn Lake Gold Project Revised 2023 Mine Design

Table 9 Predicted Maximum Ground-Level Concentrations from MacLellan Site Operation (EIS vs 2023 Design)

Substance	Averaging Period	Existing/ Baseline Conditions (µg/m³)	Maximum Ground-level Concentration (µg/m³) (includes Baseline Conditions)											Ambient Air Quality Criteria a (µg/m³)
			Max. Value in LAA (EIS)	Max. Value in LAA (2023 Design)	% Change in Max Value in LAA from EIS	Max. Value at Human Receptors (EIS)	Max. Value at Human Receptors (2023 Design)	% Change in Max. Value at Human Receptors from EIS	Max. No. of Exceedances per Year (EIS)	Max. No. of Exceedances per Year (2023 Design)	% Change Max No. of Exceedances from EIS	% Max. Value of AAQC (EIS)	% Max. Value of AAQC (2023 Design)	
NO2	1-hour [b]	7.5	**404**	**435**	8%	223	241	8%	1 h/y	1 h/y	0%	**101%**	**109%**	400
	1-hour [c]	7.5	**146**	**186**	27%	**91.5**	**96.9**	6%	79 d/y	70 d/y	-11%	**185%**	**236%**	79 [c,d]
	24-hour [e]	5.6	84.5	72.9	-14%	48.5	45.4	-6%	0	0	—	42%	36%	200
	Annual	1.9	9.03	7.91	8%	3.96	3.63	-8%	0	0	—	15%	13%	60
									0	0	—	39%	34%	23 [d,f]
CO	1-hour [b]	406	13,328	**15,406**	16%	6,282	7,284	16%	0	1 h/y	—	89%	**103%**	15,000
	8-hour	406	4,144	4,567	10%	1,445	1,686	17%	0	0	—	69%	76%	6,000
SO2	1-hour [b]	6	370	437	18%	173	205	18%	0	0	—	82%	97%	450
	1-hour [g]	6	147	**256**	74%	36.2	54.1	49%	0	3 d/y	—	86%	**150%**	170 [d,g]
	24-hour [e]	6	39.0	44.6	14%	15.7	17.9	14%	0	0	—	26%	30%	150
	Annual	1.5	1.95	2.18	12%	1.60	1.67	5%	0	0	—	7%	7%	30
									0	0	—	20%	22%	10 [d,h]
Other Gaseous Species														
HCN	1-hour [b]	0	14.4	17.6	22%	7.15	9.20	29%	0	0	—	36%	44%	40
	24-hour [d]	0	6.5	6.79	4%	2.92	3.11	7%	0	0	—	81%	85%	8 [i]
	Annual	0	0.55	0.553	0.5%	0.22	0.233	6%	0	0	—	18%	18%	3
Particulate CAC														
TSP	24-hour [e]	10.5	**513**	**437**	-15%	**205**	**194**	-6%	64 d/y	50 d/y	-22%	**428%**	**364%**	120
	Annual [j]	10.5	14.2	14.1	-1%	12.0	12.0	0%	0	0	—	24%	23%	60 [j]
PM10	24-hour [e]	4.6	**315**	**247**	-21%	**132**	**112**	-15%	89 d/y	70 d/y	-21%	**630%**	**495%**	50
PM2.5	24-hour [k]	2.9	24.1	18.6	-23%	8.4	8.20	-2%	0	0	—	89%	69%	27 [d,k]
	Annual [l]	2.9	6.23	5.57	-11%	3.74	3.71	-1%	0	0	—	71%	63%	8.8 [d,l]
Dustfall	30-day	0.99	5.51	5.57	1%	2.02	1.82	-10%	0	0	—	69%	80%	7
(g/m²/30-day)	Annual [j]	0.99	3.84	3.95	3%	1.52	1.46	-4%	0	0	—	28%	86%	4.6 [j]

Reference:Summary of Air Dispersion Model Results for the Lynn Lake Gold Project Revised 2023 Mine Design

Notes:

µg/m³: micrograms per cubic metre; EIS: Environmental Impact Statement; LAA: Local Assessment Area; AAQC: ambient air quality criteria; NO2: nitrogen dioxide; CO: carbon monoxide; SO2: sulphur dioxide; HCN: hydrogen cyanide; TSP: total suspended particulate; PM10: particulate matter <10 microns; PM2.5: particulate matter <2.5 microns; g/m2/30-day: grams per square metre per 30 days.

a. Manitoba Ambient Air Quality Criteria (MSD 2005) unless otherwise noted

b. The maximum 1-hour concentration after eliminating 8 highest meteorological hours in each year

c. The 1-hour CAAQS for NO2 is referenced to the three-year average of the annual 98th percentile of the NO2 daily maximum 1-hour average concentrations (effective 2025) (CCME 2017).

d. CAAQS (CCME 2017)

e. The maximum 24-hour concentration after eliminating the 1st highest meteorological day in each year

f. The annual CAAQS for NO2 is referenced to the arithmetic average over a single calendar year of all 1-hour average NO2 concentrations (effective 2025) (CCME 2017).

g. The 1-hour CAAQS for SO2 is referenced to the three-year average of the annual 99th percentile of the SO2 daily maximum 1-hour average concentrations (effective 2025) (CCME 2017).

h. The annual CAAQS for SO2 is referenced to the arithmetic average over a single calendar year of all 1-hour average SO2 concentrations (effective 2025) (CCME 2017).

i. Ontario AAQC (MOECC 2012)

j. Annual geometric mean

k. The CAAQS for 24-hour PM2.5 is referenced to the annual 98th percentile of daily 24-hour average concentrations, averaged over three years (effective 2020) (CCME 2017).

l. The CAAQS for annual PM2.5 is referenced to the three-year mean of annual average concentrations (effective 2020) (CCME, 2017).

Predicted maximum 1-hour and 8-hour average concentrations are based on maximum hourly emission rates.

Predicted maximum 24-hour, 30-day and annual average concentrations are based on daily average emission rates.

“—” not applicable

Values in **BOLD** exceed the ambient air quality criteria

3 Conclusion

This update of the air quality assessment focused on the potential changes of the Project air quality effects due to the updated Project 2023 design during the operation phase. Changes to the Project design include updates to the PDA, Project layouts, mining production quantities, major mine equipment, and operation blast parameters. The air quality model for the operation phase of the Project was updated, based on the same approach (i.e., receptor locations, regulatory framework, baseline conditions, and modelling method) as to the previous Stantec 2020 assessment.

For the 2023 mine design the air quality effects were assessed for NO_2, CO, SO_2, HCN, TSP, PM_{10}, $PM_{2.5}$ and dustfall. The predicted air quality during the operation phase on the air quality receptors were presented and summarized in isopleth maps and in summary tables with comparison to the ambient air quality criteria.

Compared with the results in Stantec 2020, the air quality effects from the Project activities marginally increased at some receptors. When there was an increase in the model predicted concentrations, the associated increase in the frequency of exceedance was low. In conclusion, the results of the updated air quality assessment do not change the characterization of residual effects, or the significance ratings summarized as presented in the EIS (Stantec 2020).

4 Limitations and Sign-off

This document entitled was prepared by *Stantec Consulting Ltd.* (“Stantec”) for the account of *Alamos Gold Inc.* (the “Client”) to support the permitting process for its Lynn Lake Gold Project (the “Project”). In connection therewith, this document may be reviewed and used by the *Impact Assessment Agency of Canada* and *Manitoba Conservation and Climate* participating in the review process in the normal course of its duties. Except as set forth in the previous sentence, any reliance on this document by any other party or use of it for any other purpose is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The information and conclusions in the document are based on the conditions existing at the time the document was published and does not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by the Client or others, unless expressly stated otherwise in the document. Any use which another party makes of this document is the responsibility and risk of such party. Such party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other party as a result of decisions made or actions taken based on this document.

Reference:Summary of Air Dispersion Model Results for the Lynn Lake Gold Project Revised 2023 Mine Design

If you have any questions or require additional information, please do not hesitate to contact us

Regards,

Stantec Consulting Ltd.

Prepared by: Bajwa, Kanwardeep Digitally signed by Bajwa, Kanwardeep Date: 2025.02.26 13:44:57 -07'00'

Signature

Kanwardeep Bajwa

Printed Name

Reviewed by: Digitally signed by Dan Jarratt Date: 2025.02.26 10:01:14 -08'00'

Signature

Dan Jarratt

Printed Name

Approved to transmit by: Mathers, Karen Digitally signed by Mathers, Karen Date: 2025.04.08 18:15:10 -05'00'

Signature

Karen Mathers

Printed Name

5 References

Alamos. 2023. Feasibility Study Update (FSU). NI 43-101 Technical Report for the Lynn Lake Project, Lynn Lake, Manitoba, Canada. August 22, 2023.

CCME (Canadian Council of Ministers of the Environment). 2017. Canada's Air: Canadian Ambient Air Quality Standards (CAAQS). Available at: https://ccme.ca/en/air-quality-report. Last accessed on September 9, 2024.

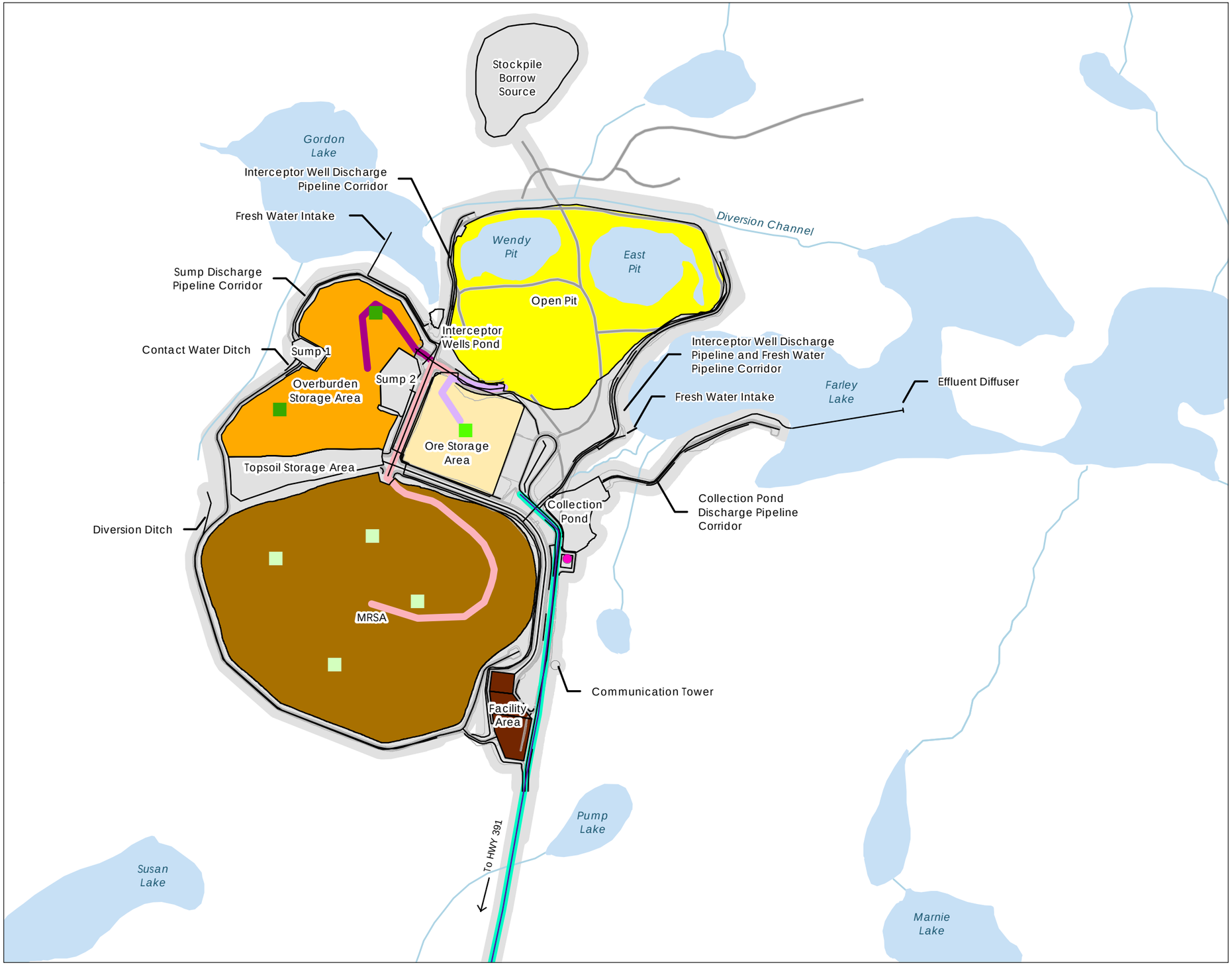
MOECC (Ontario Ministry of Environment and Climate Change formerly Ontario Ministry of the Environment). 2012. Ontario's Ambient Air Quality Criteria. April 2012. Available at: http://www.airqualityontario.com/downloads/AmbientAirQualityCriteria.pdf. Last accessed on September 9, 2024.

MSD (Manitoba Sustainable Development now Manitoba Conservation and Climate). 2005. Manitoba Ambient Air Quality Criteria. July 2005. Available at: http://www.gov.mb.ca/sd/envprograms/airquality/pdf/criteria_table_update_july_2005.pdf. Last accessed on September 9, 2024.

Pers comm. 2024. February 27 and April 10 and 11, 2024 email correspondence from Robert Halas, (Alamos Gold Inc. Sr. Project Engineer, Lynn Lake, Projects) to Karen Mathers (Stantec Senior Principal - Environmental Services).

Stantec (Stantec Consulting Inc.). 2020. Lynn Lake Gold Project Environmental Impact Statement, May 2020.

Attachment A Isopleths 2024



Stantec

Project Infrastructure

- Infrastructure Features
- Project Development Area (PDA)

Emission Source Type

Point Source
- Diesel Generator

Volume Source
- Material Handling at MRSA
- Material Handling at Ore Stockpile
- Material Handling at Overburden Stockpile

Haul Road Source
- Haul Road from the Open Pit to the MRSA
- Haul Road from the Open Pit to the Ore Stockpile
- Haul Road from the Open Pit to the Overburden Stockpile

Access Road Source
- Access Road to Gordon Site

Open Pit Source
- Open Pit at Gordon Site

Area Source
- Ore Stockpile Wind Erosion
- Overburden Wind Erosion
- MRSA Wind Erosion
- General Area

Landbase

- Existing Access Road
- Waterbody
- Watercourse

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. NOA Project Infrastructure features provided by Worley via Alamos.

Project Location
Lynn Lake, Manitoba

Prepared by ACampigotto on 2024-07-15
Technical Review by IYankova on 2024-07-15

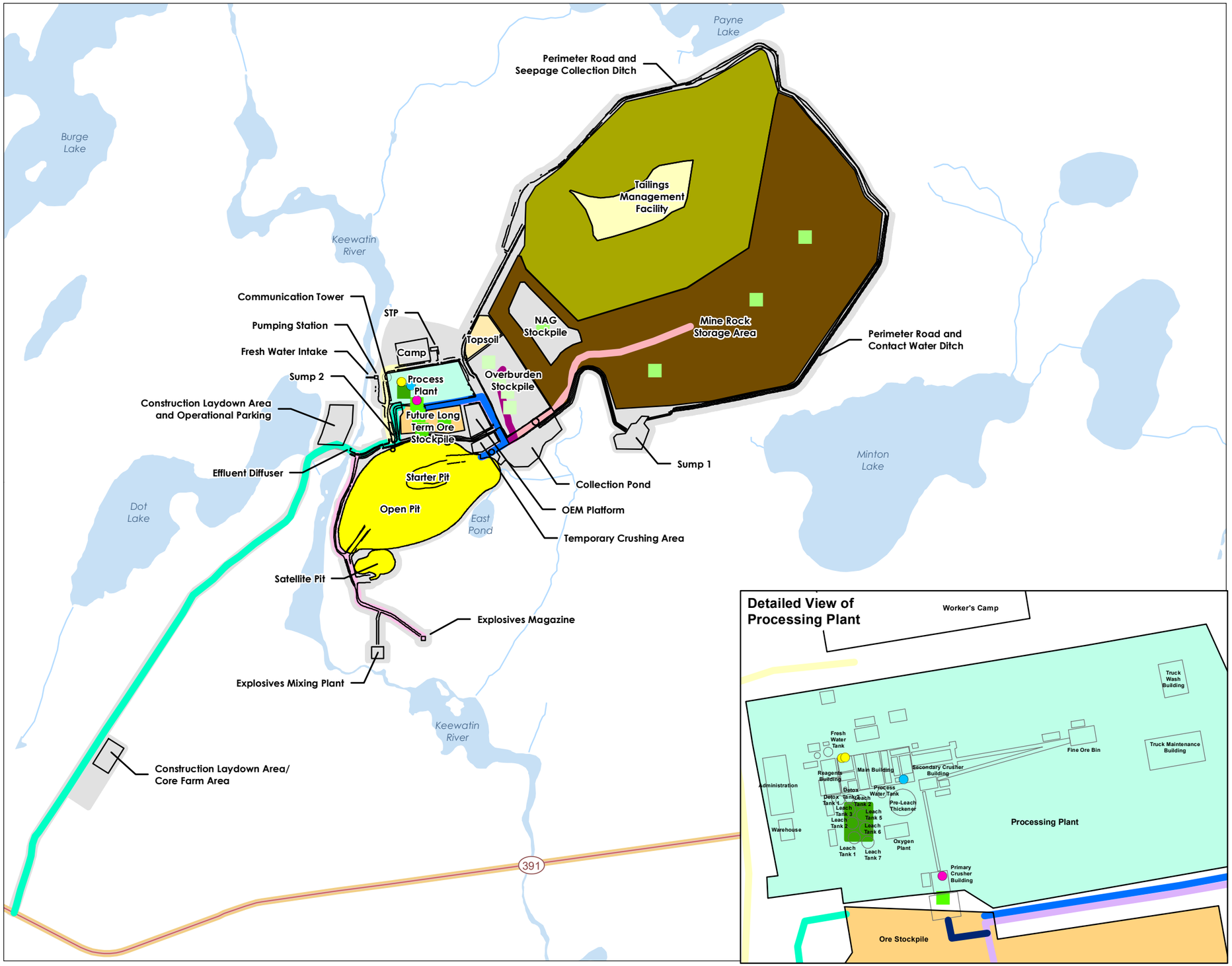
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
A

Title
Modelled Emission Sources for Gordon Site Operation

G:_GIS_Project_Folder\111473808_LGDP_EA\figures\Ch8_Atmospheric_Environment\Air_Quality_Management_Monitoring_Plan\Map3-1_AQMP_EmissionsGordon_Updated_NOA_20240715.mxd Revised: 2024-07-15 By: ACampigotto



Stantec

Project Infrastructure

- Infrastructure Features
- Project Development Area (PDA)

Emission Source Type

Point Source
- Gold Room Drying Oven Stack/Gold Room Dust Collector
- Primary Crusher Dust Collector
- Secondary Crusher Wet Scrubber

Volume Source
- Material handling at overburden stockpile
- Material handling at MRSA
- Material handling at primary crusher
- Material handling at Ore Stockpile
- Processing plant HCN fugitive emission

Haul Road Source
- Haul Road from Open Pit to MRSA
- Haul Road from Open Pit to Ore Stockpile
- Haul Road from Open Pit to Overburden Stockpile
- Haul Road from Open Pit to the Primary Crusher
- Haul Road from Ore Stockpile to the ROM Stockpile

Access Road Source
- Access Road to Mill at MacLellan Site
- Access Road to Explosives Facilities
- Access Road to Worker's Camp

PR 391 Source
- Provincial Road 391

Open Pit Source
- Open Pit and Satellite Pit

Area Source
- Topsoil Stockpile/ROM Wind Erosion
- TMF Pond and HCN Fugitive Emissions
- TMF Dry Banks Wind Erosion
- MRSA Wind Erosion
- Ore Stockpile Wind Erosion
- General Area

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 2025-02-26
Technical Review by IYankova on 2025-02-26

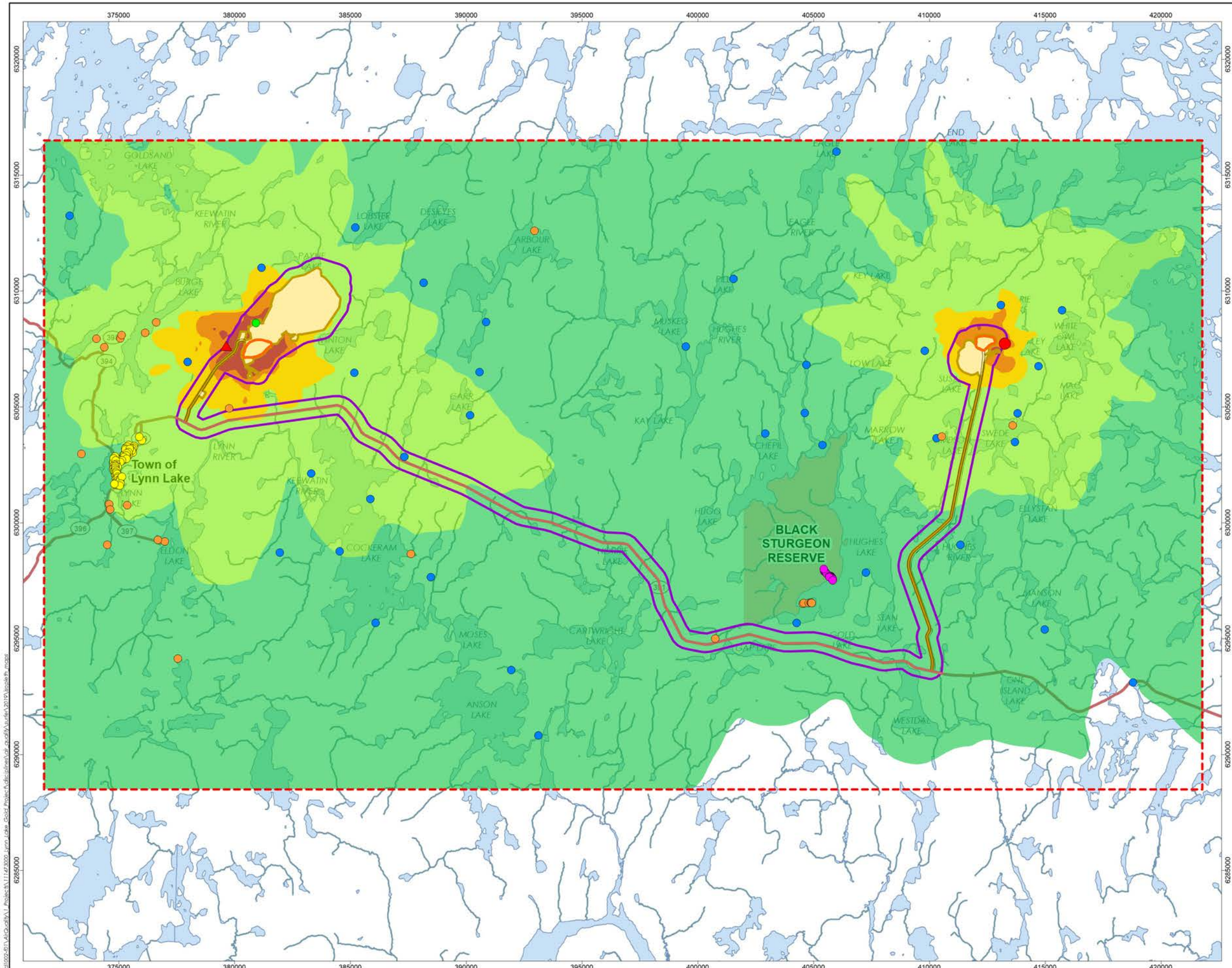
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473084

Map No.
B

Title
Modelled Emission Sources for MacLellan Site Operation

G:_GIS Project Folder\111473008_LGP_EA\figures\Chx_Atmospheric_Environment\Air Quality Management Monitoring Plan\Map8_AQMP Emissions\Map8_AQMP Emissions\Map8_AQMP Emissions_Updated NOA_20250226.mxd Revised: 2025-02-26 By: ACampigotto



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 415 µg/m³
- Maximum Concentration (MacLellan Site): 435 µg/m³
- Background Concentration: 7.5 µg/m³
- 1-hour NO_2 MAAQC: 400 µg/m³

40 100 200 300 400

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

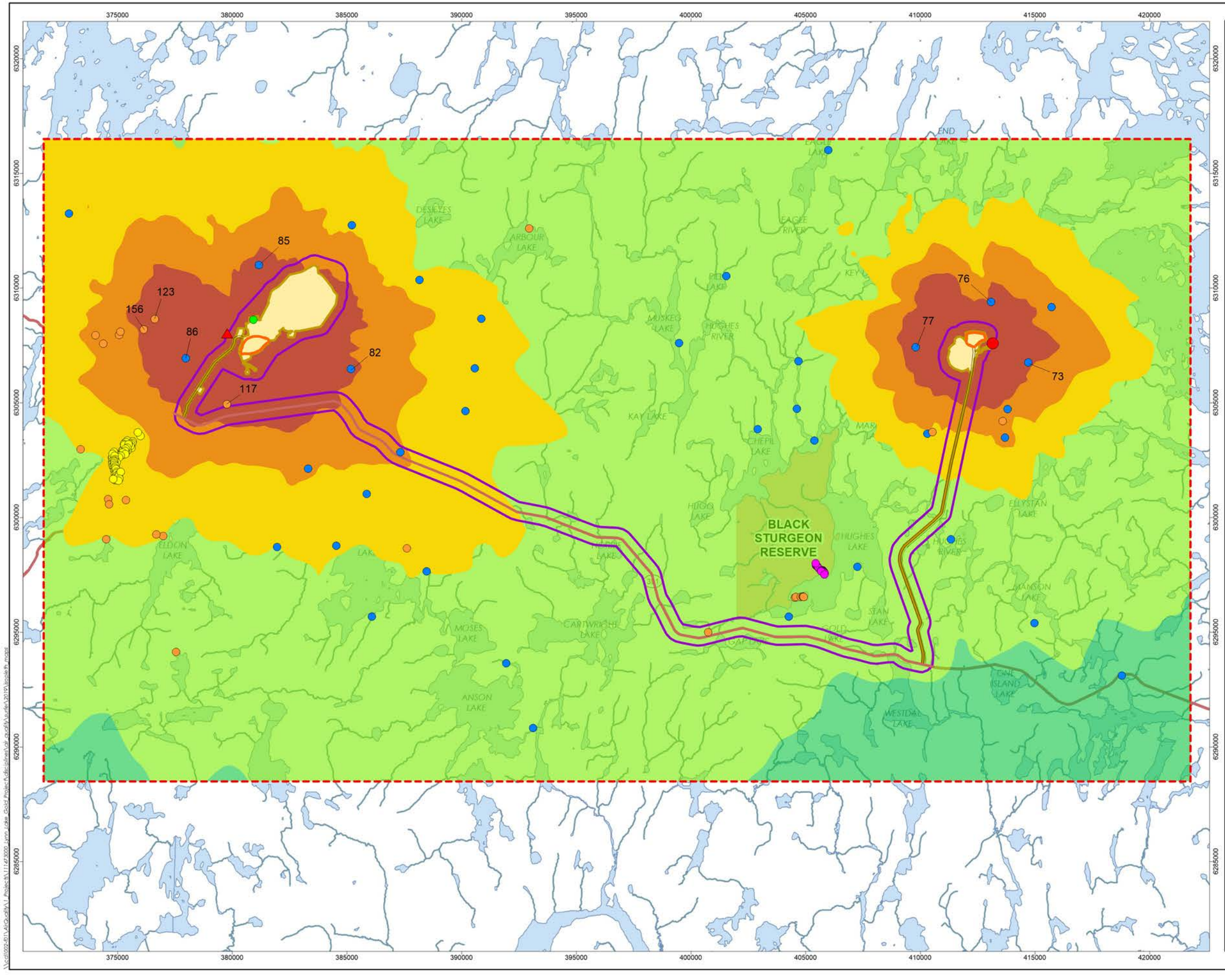
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
1

Title
Maximum Predicted 1-hour Average NO_2 Concentrations (µg/m³) (Project Operation + Baseline Conditions)

\\cd1002-f01\ACAD\Projects\111473076_Lynn_Lake_Gold_Project\Active\2024\Isolate\mxd\



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 284 µg/m³
- Maximum Concentration (MacLellan Site): 186 µg/m³
- Background Concentration: 7.5 µg/m³
- 1-hour NO_2 CAAQS: 79 µg/m³

7.9 | 19.8 | 39.5 | 59.3 | 79

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
2

Title
Maximum Predicted 98% Daily 1-hour Average NO_2 Concentrations (Project Operation + Baseline Conditions)

\\cdfs02-01\AGdata\1 Projects\111473076 Lynn Lake Gold Project\Deliverables\Air Quality\Figures\2024\Figure 2 - Max Predicted 98% Daily 1-hour Average NO2 Concentrations (Project Operation + Baseline Conditions).mxd

Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Exceedances (Gordon Site): 101 days/year
- Maximum Exceedances (MacLellan Site): 70 days/year

Background Concentration: 7.5 µg/m³

1-hour NO_2 CAAQS: 79 µg/m³

1 | 15 | 30 | 50 | 90

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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

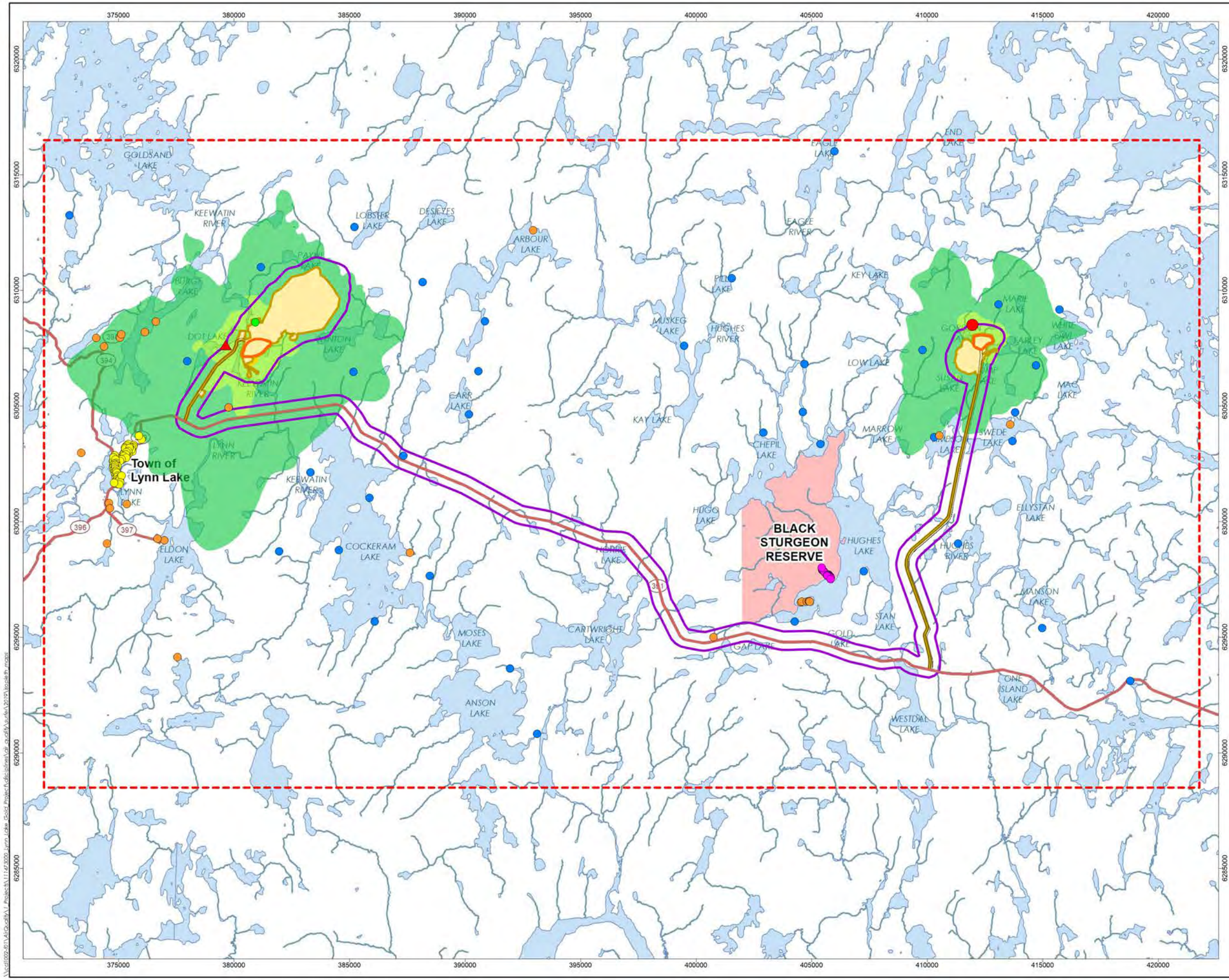
Prepared by KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
3

Title
Maximum Frequency Exceedance of 98% Daily 1-hour Average NO_2 Concentrations (Project Operation + Baseline Conditions)



Stantec

ALAMOS GOLD INC.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 74.2 µg/m³
- Maximum Concentration (MacLellan Site): 72.9 µg/m³

Background Concentration: 5.6 µg/m³

24-hour NO_2 MAAQC: 200 µg/m³

20 50 100 150 200

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

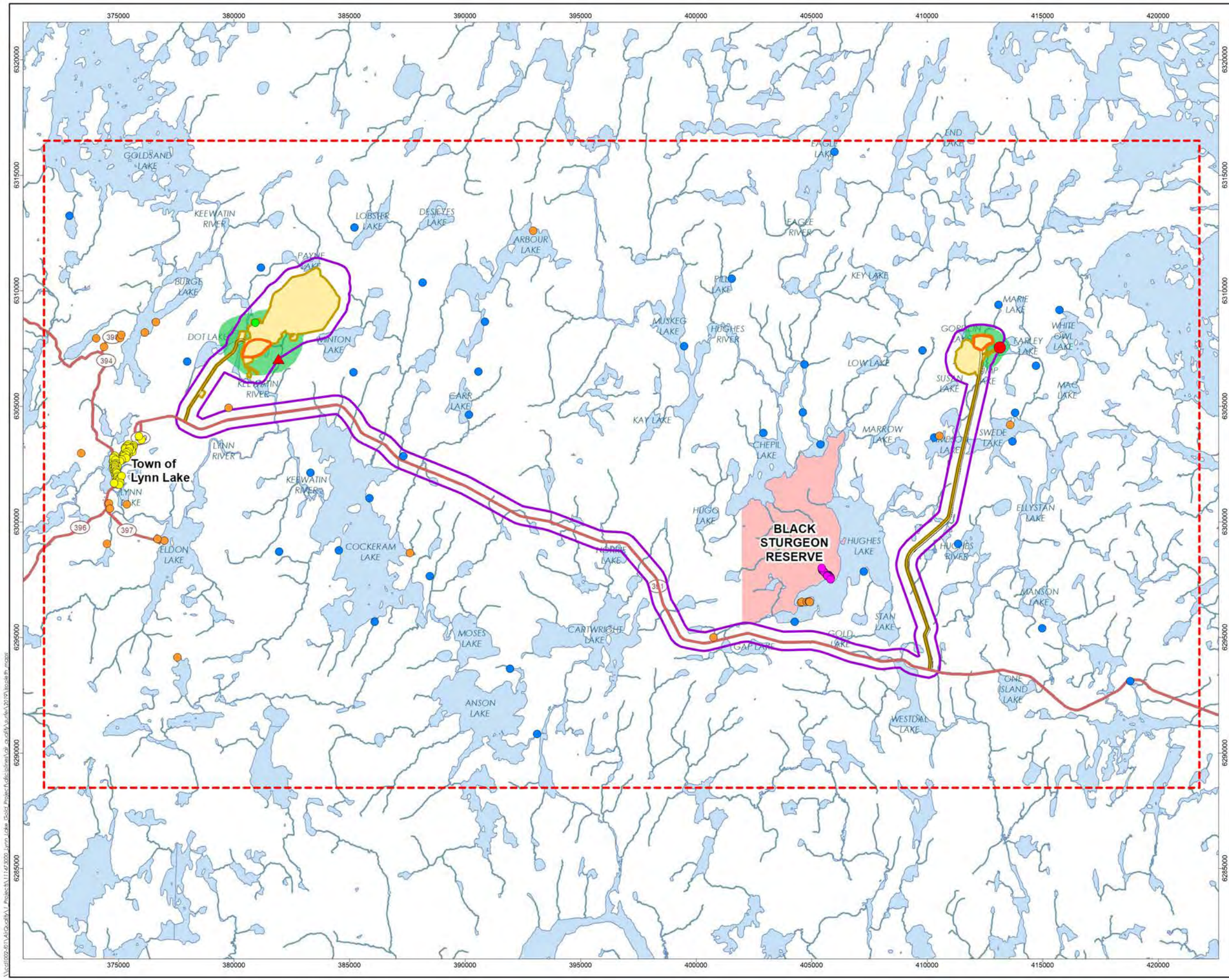
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
4

Title
Maximum Predicted 24-hour Average NO_2 Concentrations (µg/m³) (Project Operation + Baseline Conditions)

\\cd1002-f01.ad.cdn\active_projects\111473076_lynn_lake_gold_project\discipline\air_quality\active\2019\issued\fig_mxds



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 10.4 µg/m³
- Maximum Concentration (MacLellan Site): 7.91 µg/m³
- Background Concentration: 1.9 µg/m³
- Annual NO_2 MAAQC: 60 µg/m³

6 15 30 45 60

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

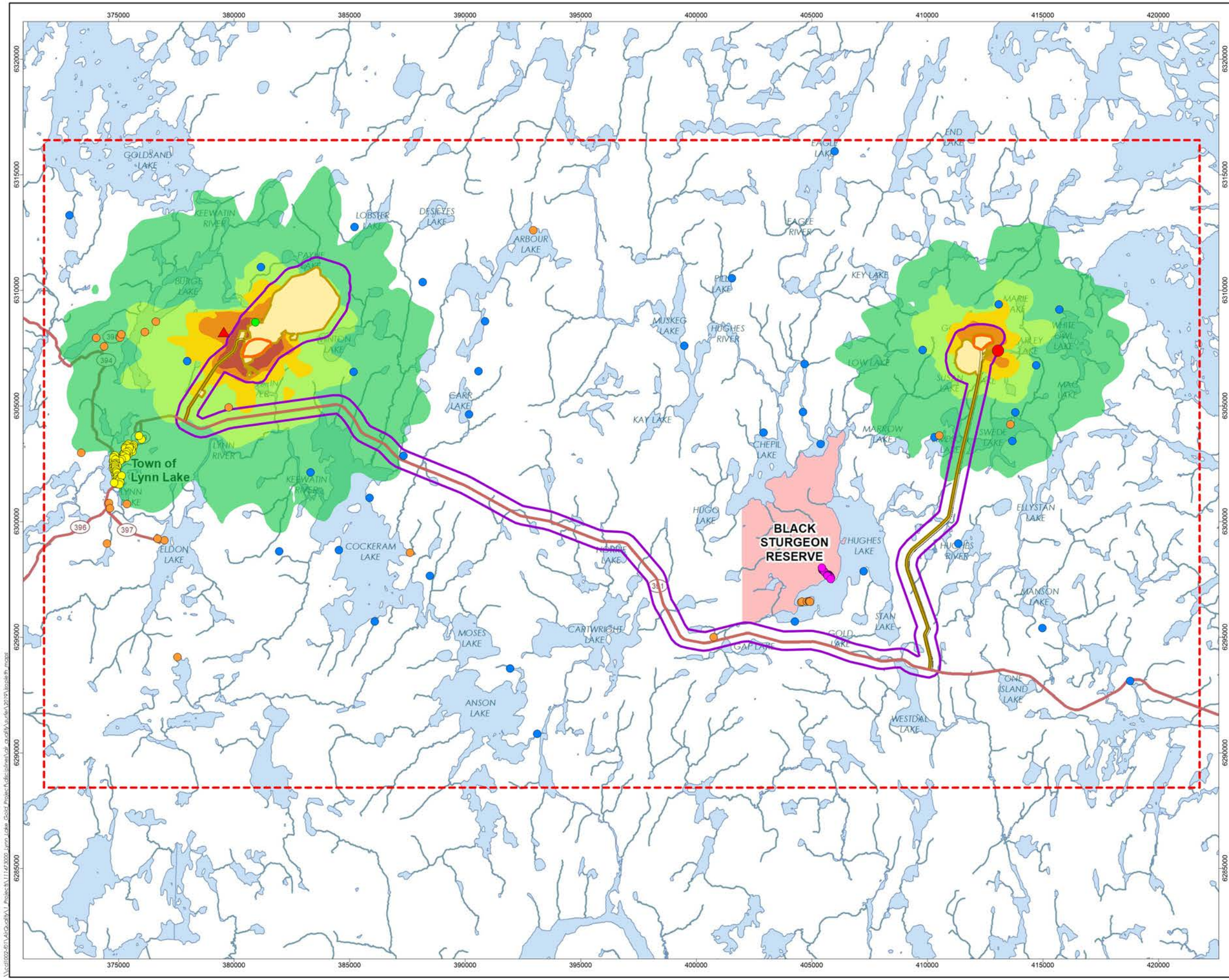
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
5

Title
Maximum Predicted Annual Average NO_2 Concentrations (µg/m³) (Project Operation + Baseline Conditions)

\\cd1220-f01\AGCad\1_Projects\111473076_lynn_lake_Gold_Project\Air_quality\Figures\Air_quality_figures_2024\Figure_5_Max_Annual_NO2_Project_Operation_Baseline_Conditions.mxd



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 14832 µg/m³
- Maximum Concentration (MacLellan Site): 15406 µg/m³
- Background Concentration: 406 µg/m³
- 1-hour CO MAAQC: 15000 µg/m³

1500 3750 7500 11250 15000

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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

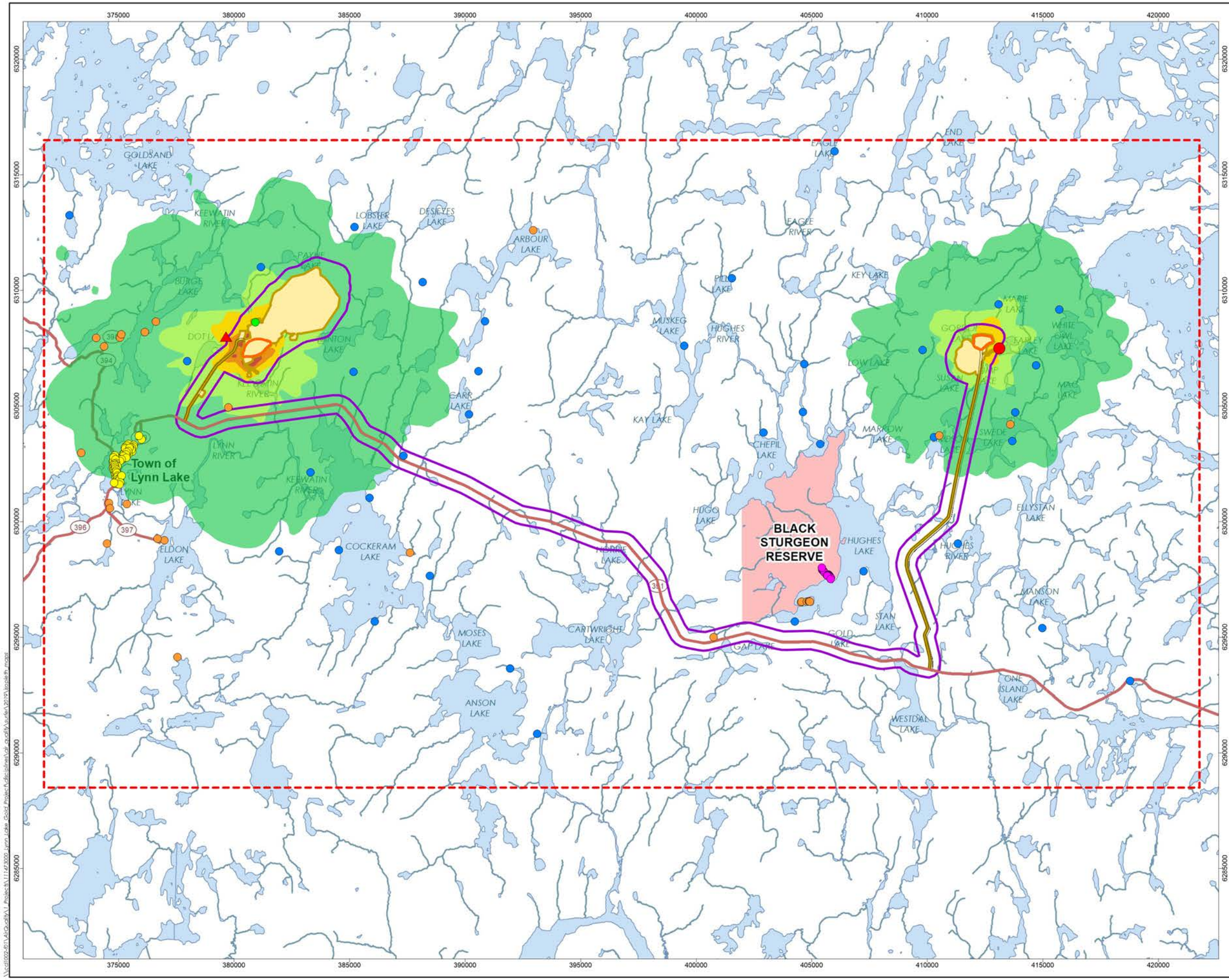
Prepared by KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
6

Title
Maximum Predicted 1-hour Average CO Concentrations (µg/m³) (Project Operation + Baseline Conditions)



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 4345 µg/m³
- Maximum Concentration (MacLellan Site): 4567 µg/m³
- Background Concentration: 406 µg/m³
- 8-hour CO MAAQC: 6000 µg/m³

600 1500 3000 4500 6000

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

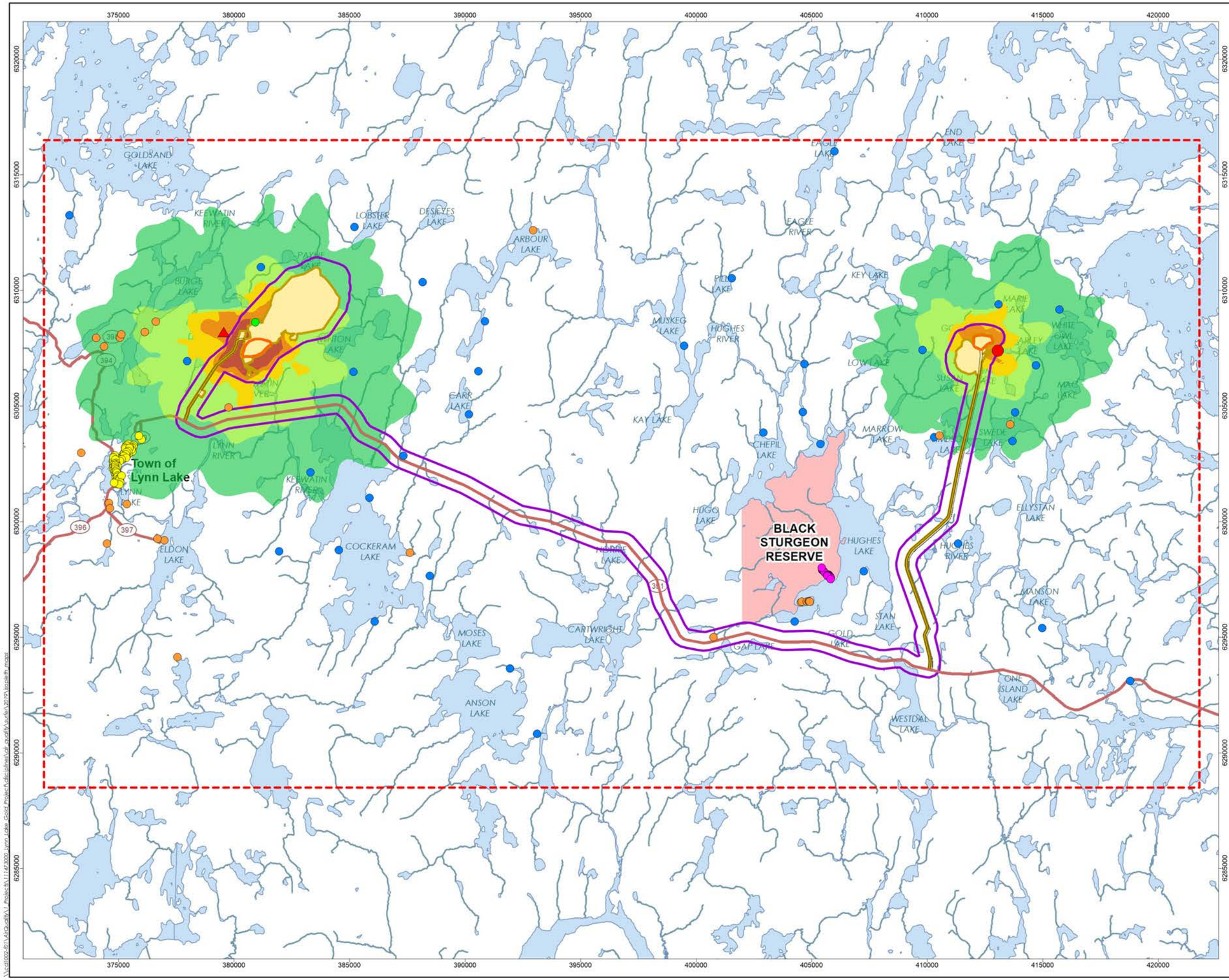
111473076

Map No.
7

Title

Maximum Predicted 8-hour Average CO Concentrations (µg/m³) (Project Operation + Baseline Conditions)

\\cd002-f01.ad.cdu.ca\...\Project\111473000_Lynn_Lake_Gold_Project_Description\...\2019\...



Stantec

ALAMOS GOLD INC.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 422 µg/m³
- Maximum Concentration (MacLellan Site): 437 µg/m³
- Background Concentration: 6 µg/m³
- 1-hour SO_2 MAAQC: 450 µg/m³

45 113 225 338 450

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
8

Title

Maximum Predicted 1-hour Average SO_2 Concentrations (µg/m³) (Project Operation + Baseline Conditions)

Stantec

ALAMOS GOLD INC.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 382 µg/m³
- Maximum Concentration (MacLellan Site): 256 µg/m³
- Background Concentration: 6 µg/m³
- 1-hour SO_2 CAAQS: 170 µg/m³

17 42.5 85 128 170

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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

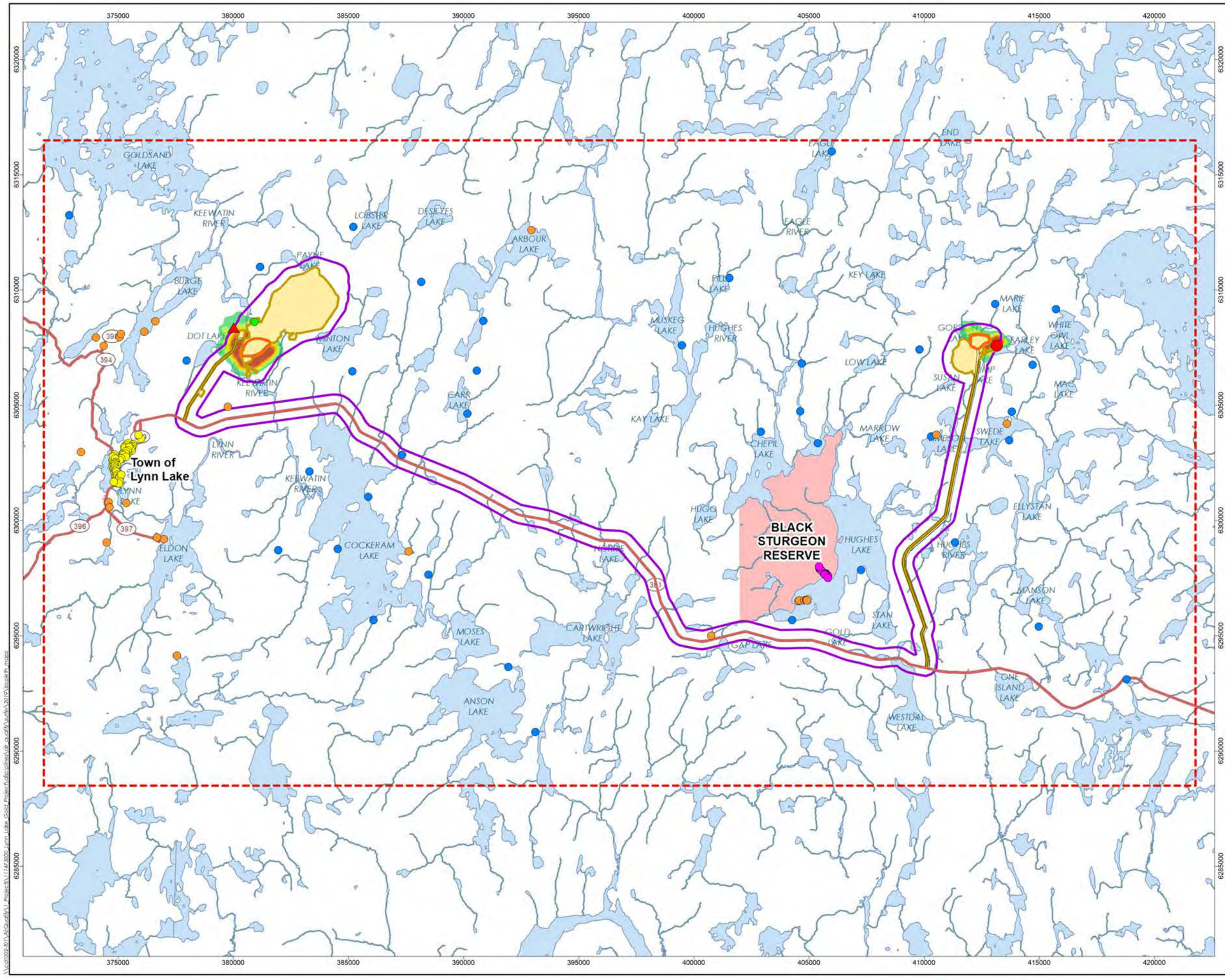
Prepared by KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
9

Title
Maximum Predicted 99% Daily 1-hour Average SO_2 Concentrations (Project Operation + Baseline Conditions)



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Exceedances (Gordon Site): 12 days/year
- Maximum Exceedances (MacLellan Site): 3 days/year

Background Concentration: 6 µg/m³

1-hour SO_2 CAAQS: 170 µg/m³

1 2 3 4 5

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

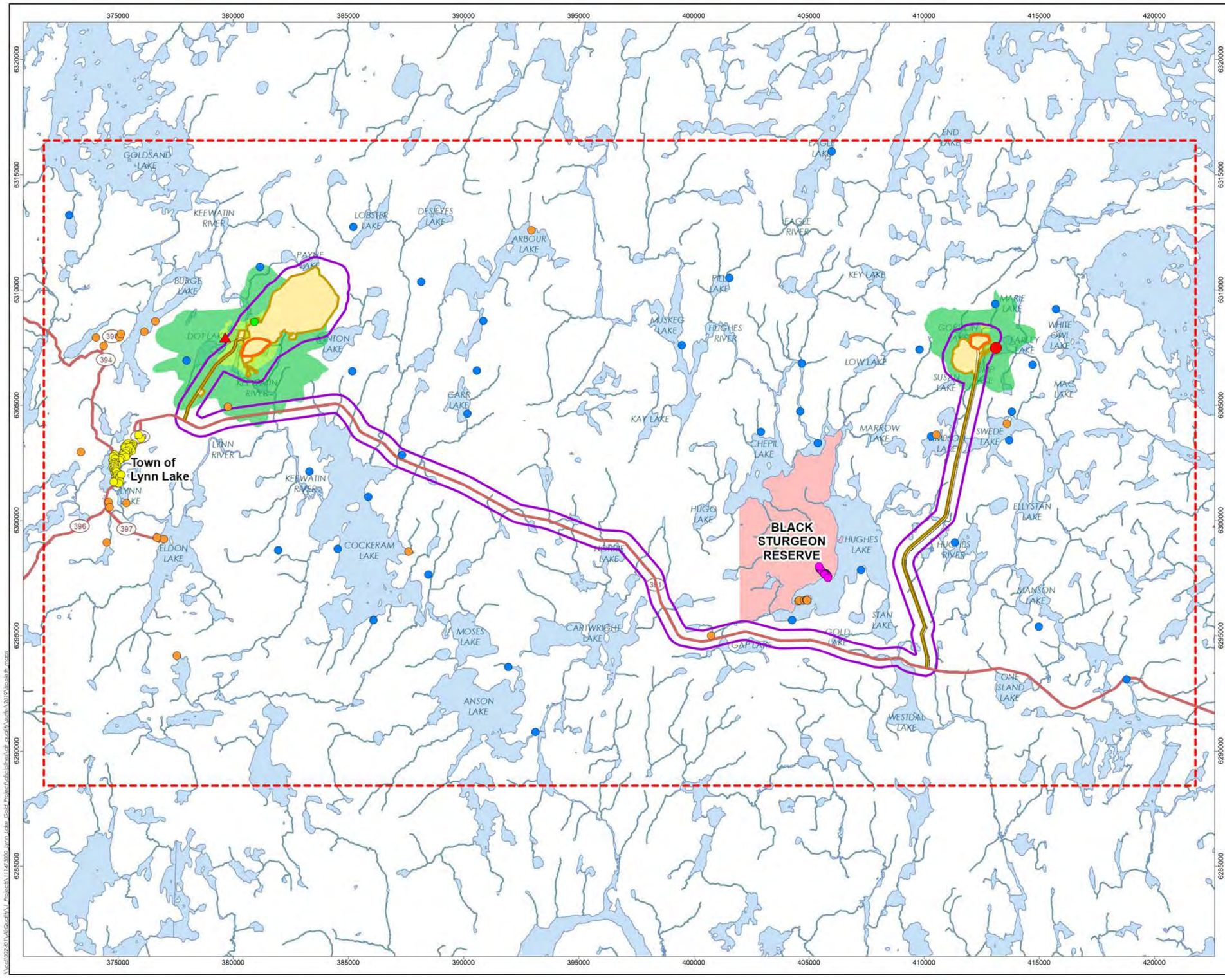
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
10

Title
Maximum Frequency Exceedance of 99% Daily 1-hour Average SO_2 Concentrations (Project Operation + Baseline Conditions)

\\cd1220-f01\AirQuality\1 Projects\111473076 Lynn Lake Gold Project\Reports\Air quality\Figures\Updated figures\Figure 10.mxd



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 42.6 µg/m³
- Maximum Concentration (MacLellan Site): 44.6 µg/m³
- Background Concentration: 6 µg/m³
- 24-hour SO_2 MAAQC: 150 µg/m³

15 37.5 75 113 150

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

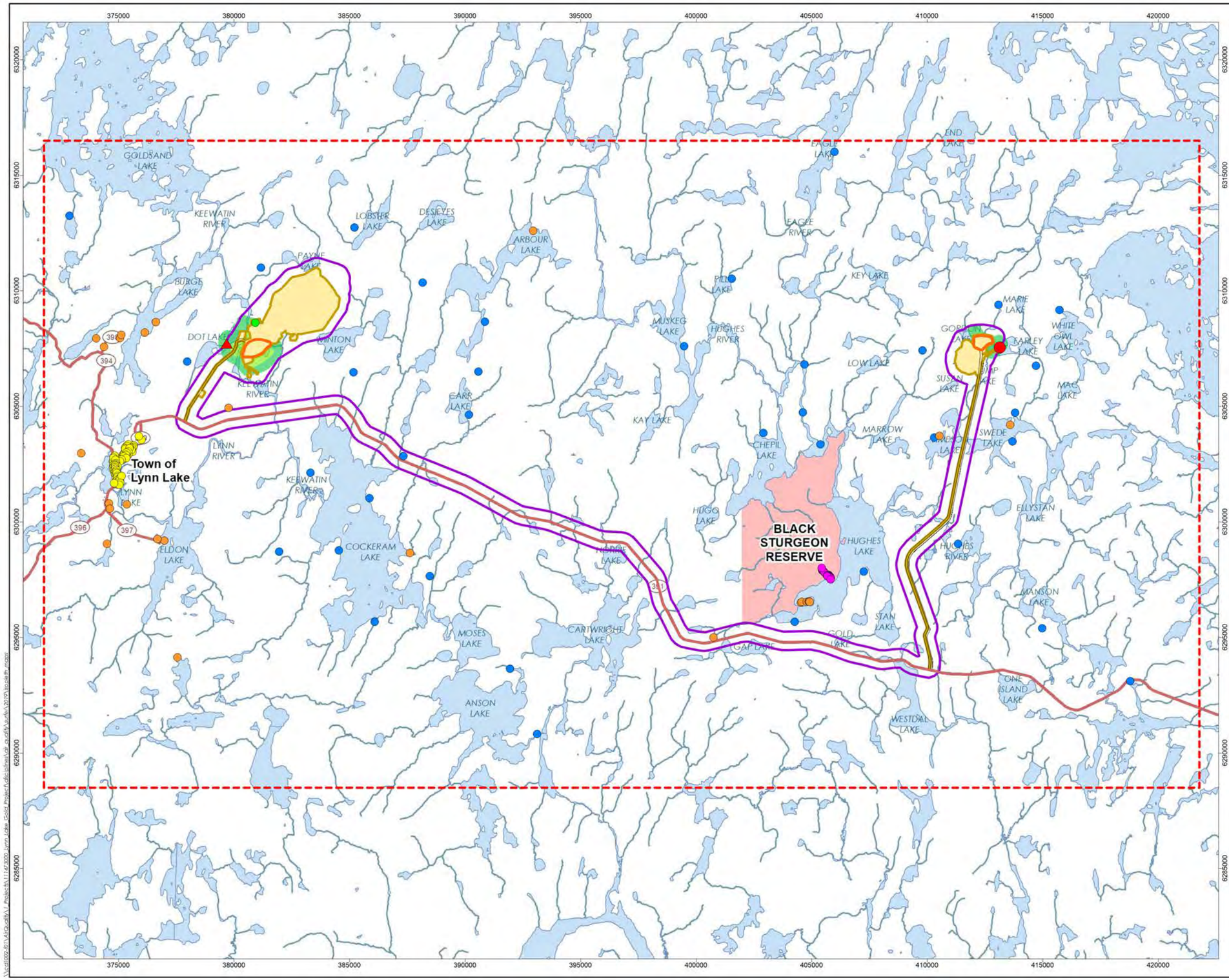
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
11

Title
Maximum Predicted 24-hour Average SO_2 Concentrations (µg/m³) (Project Operation + Baseline Conditions)

\\cd1220-f01.ad.idom.com\Projects\111473076_lynn_lake_Gold_Project\Figures\Air_quality\Air_quality_figures\2019\Issued\Fig_maps



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 2.60 µg/m³
- Maximum Concentration (MacLellan Site): 2.18 µg/m³
- Background Concentration: 1.5 µg/m³
- Annual SO_2 CAAQS: 10 µg/m³

2 2.5 5 7.5 10

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

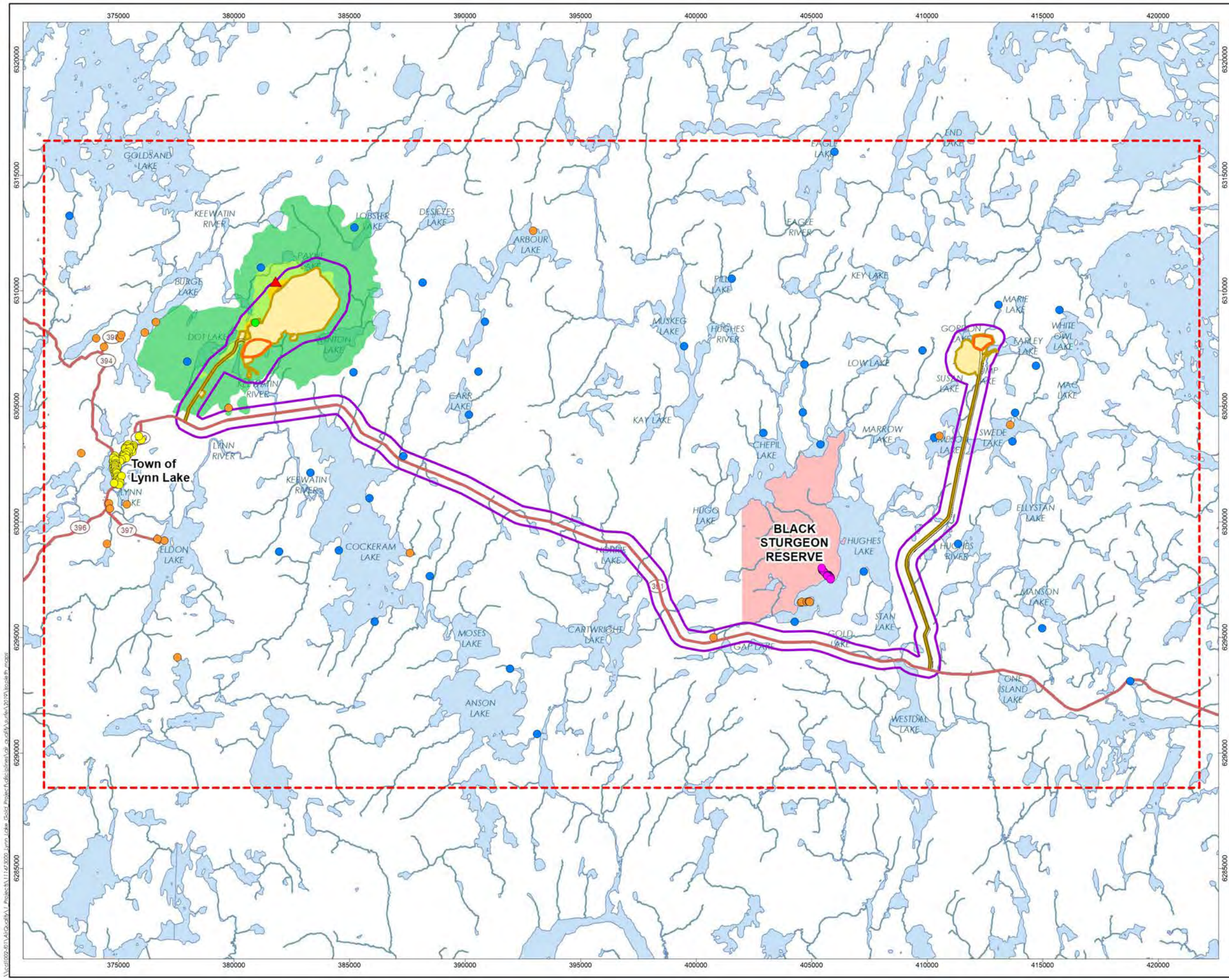
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
12

Title
Maximum Predicted Annual Average SO_2 Concentrations (µg/m³) (Project Operation + Baseline Conditions)

V:\active\2024\01\AIR\Cadd\Arc Projects\111473076_lynn_lake_Gold_Project\Figures\Air_quality\Air_Quality_Figures.aprx\Layout\Figure 12 - Maximum Predicted Annual Average SO2 Concentrations (Project Operation + Baseline Conditions)



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 0 µg/m³
- Maximum Concentration (MacLellan Site): 17.6 µg/m³
- Background Concentration: 0 µg/m³
- 1-hour HCN MAAQC: 40 µg/m³

4 10 20 30 40

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

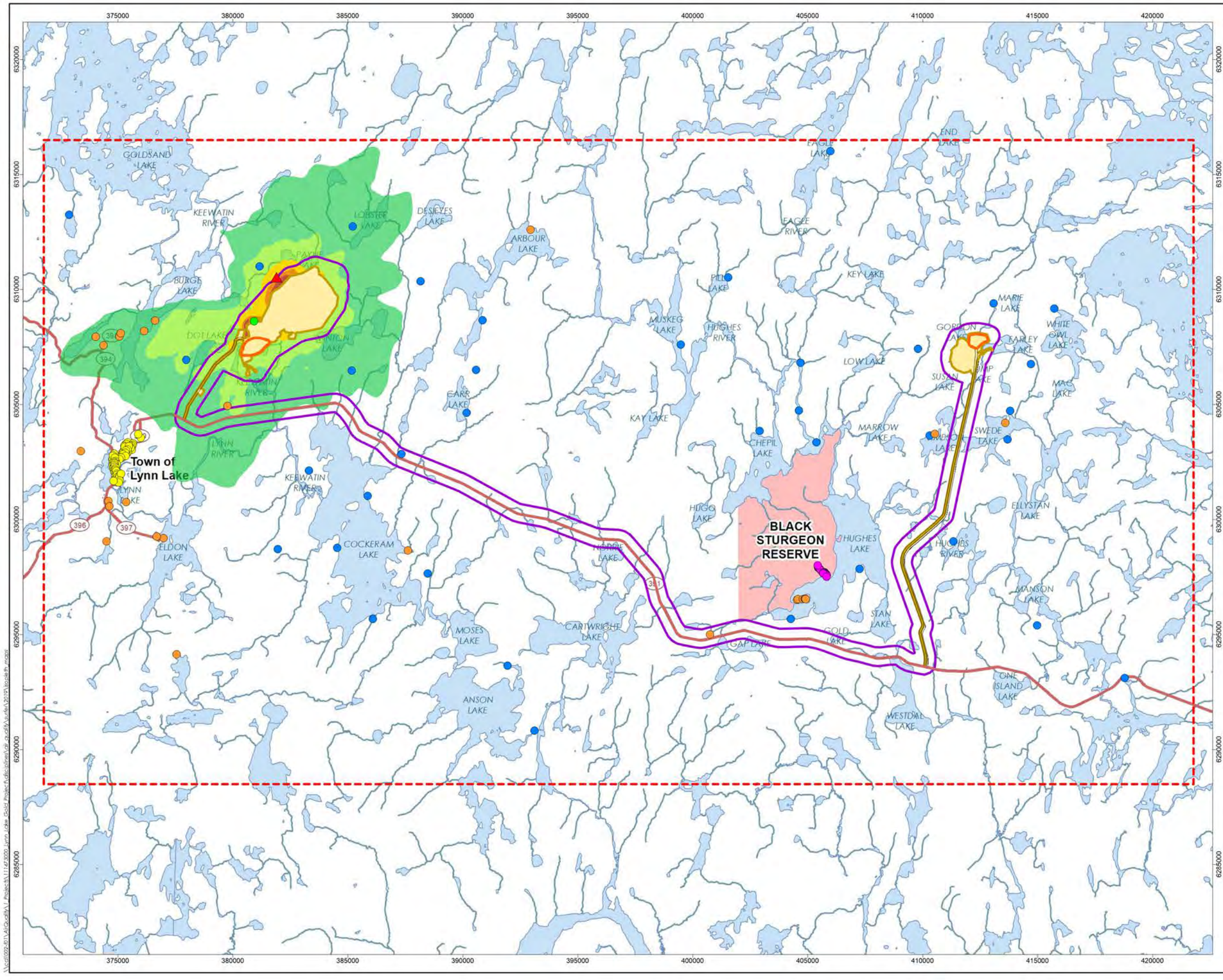
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
13

Title
Maximum Predicted 1-hour Average HCN Concentrations (µg/m³) (Project Operation + Baseline Conditions)

\\cd1220-f01\AGOpath\1 Projects\111473076\gis\mxd\air quality\Lynn Lake Gold Project\Lynn Lake Gold Project_Air Quality_Updated_2024\Report Figures\Figure 13 - Maximum Predicted 1-hour Average HCN Concentrations (µg-m3) (Project Operation + Baseline Conditions).mxd



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 0 µg/m³
- Maximum Concentration (MacLellan Site): 6.79 µg/m³
- Background Concentration: 0 µg/m³
- 24-hour HCN OAAQC: 8 µg/m³

0.8 2 4 6 8

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

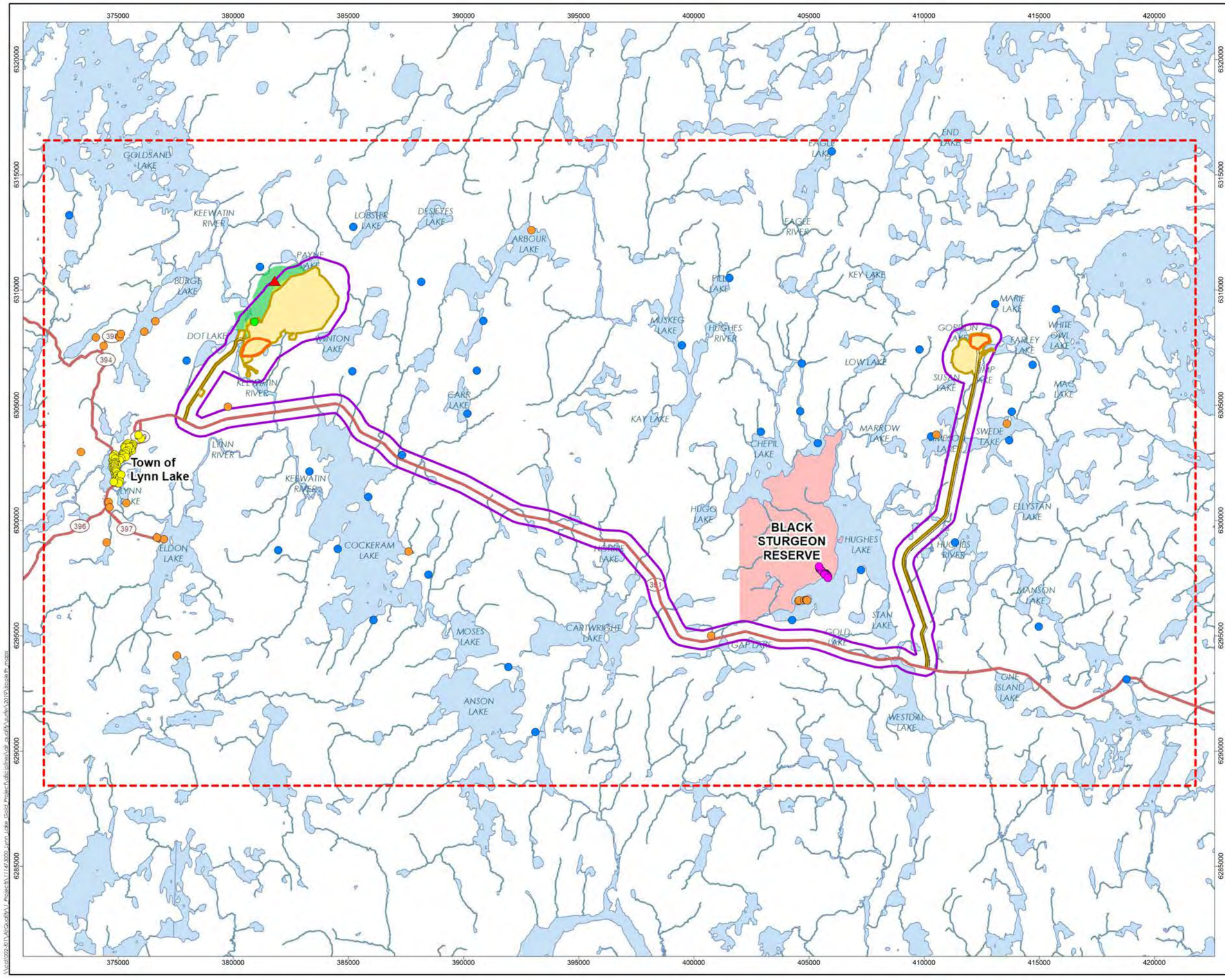
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
14

Title
Maximum Predicted 24-hour Average HCN Concentrations (µg/m³) (Project Operation + Baseline Conditions)

V:\2024\03\AB\Cadd\Lynn Lake Gold Project\Figures\Air quality\Updated\2024\Figure 14 - Maximum Predicted 24-hour Average HCN Concentrations (µg-m3) (Project Operation + Baseline Conditions).mxd



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 0 µg/m³
- Maximum Concentration (MacLellan Site): 0.553 µg/m³
- Background Concentration: 0 µg/m³
- Annual HCN MAAQC: 3 µg/m³

0.3 | 0.75 | 1.2 | 2.25 | 3

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

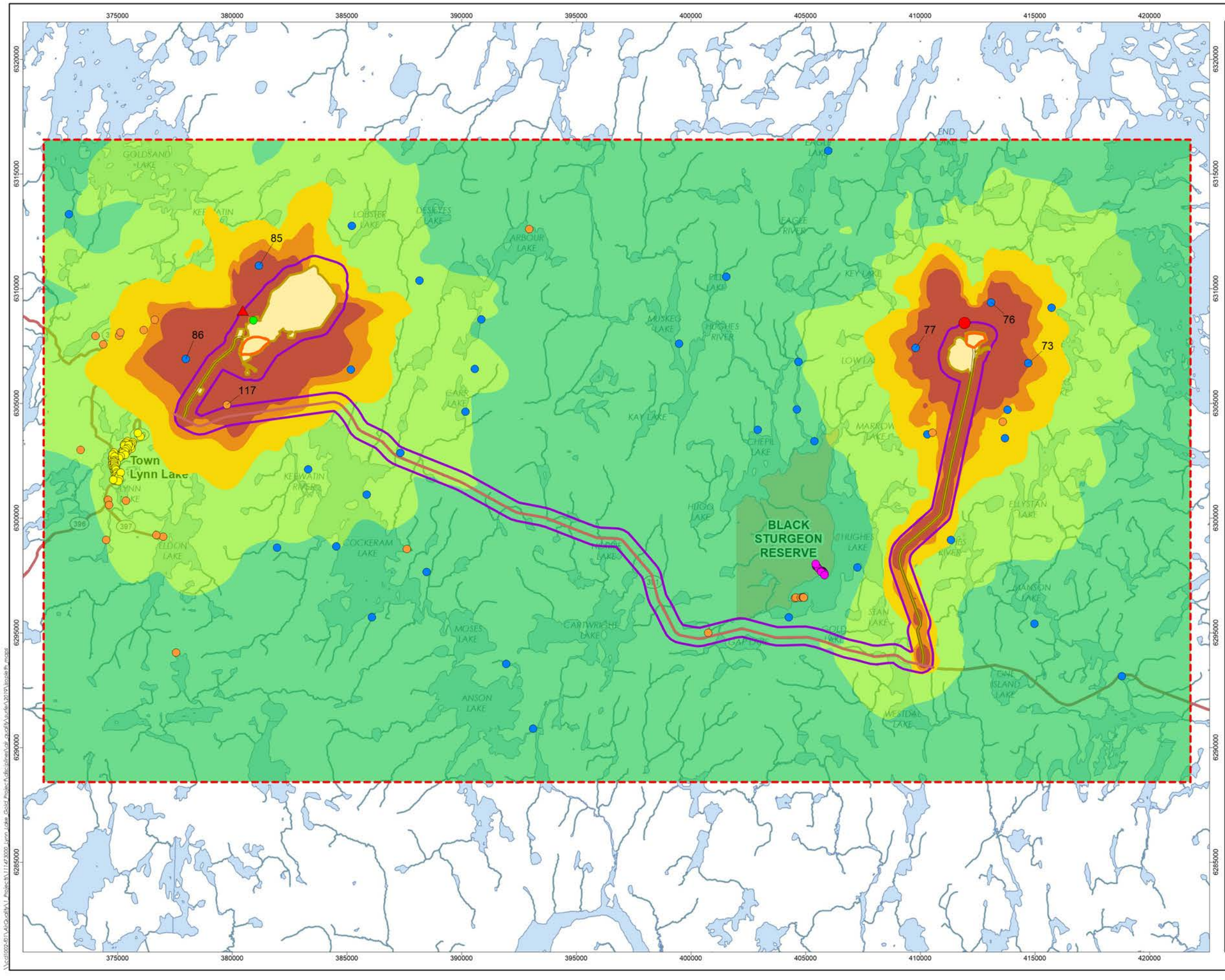
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
15

Title
Maximum Predicted Annual Average HCN Concentrations (µg/m³) (Project Operation + Baseline Conditions)

V:\2024\03\111473076\1 Project\11 of 999 Lynn Lake Gold Project\Figures\Air quality\Air\2015\Figure 15 maps



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 734 µg/m³
- Maximum Concentration (MacLellan Site): 437 µg/m³
- Background Concentration: 10.5 µg/m³
- 24-hour TSP MAAQC: 120 µg/m³

12 30 60 90 120

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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

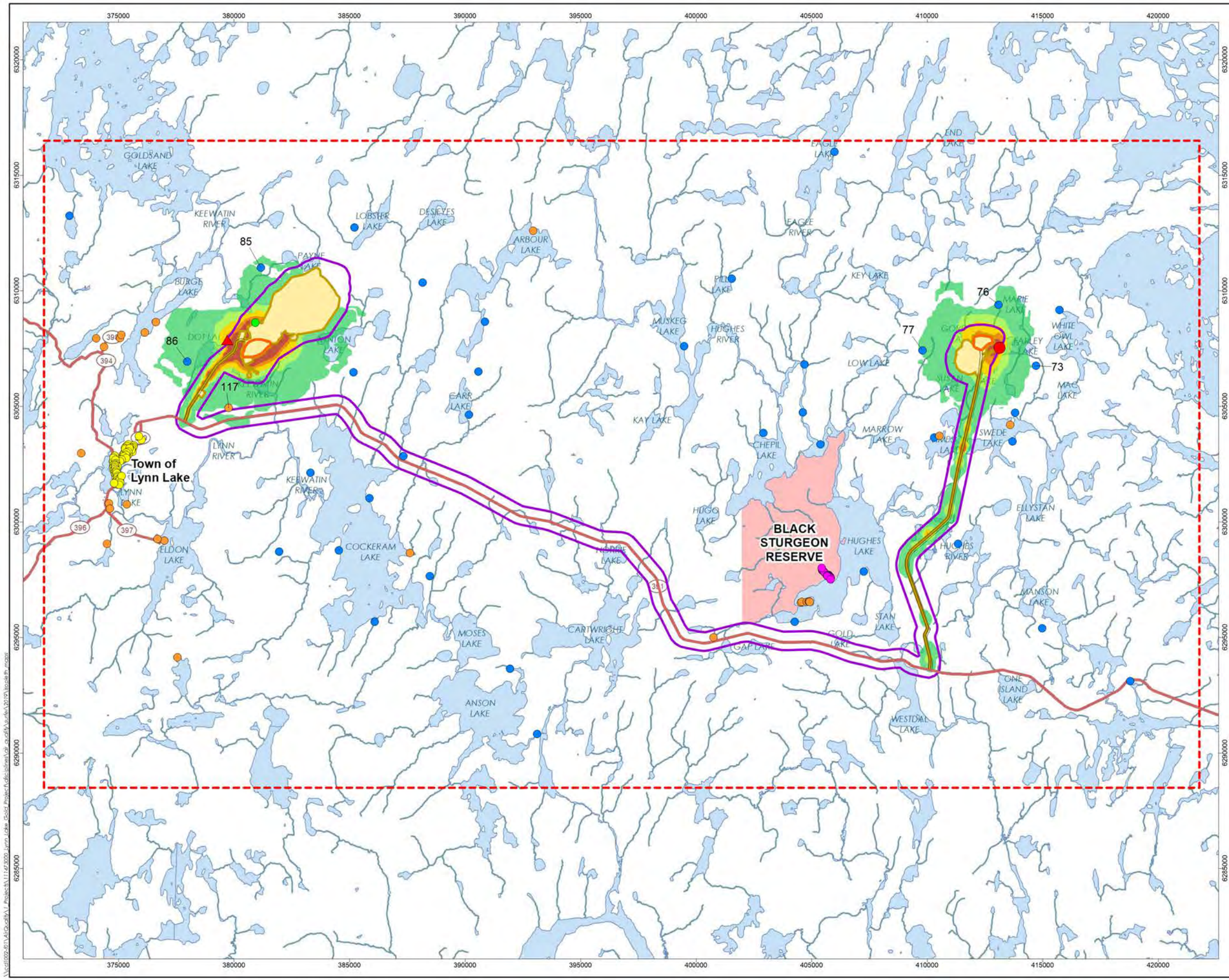
Prepared by KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
16

Title
Maximum Predicted 24-hour Average TSP Concentrations (µg/m³) (Project Operation + Baseline Conditions)



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Exceedances (Gordon Site): 94 days/year
- Maximum Exceedances (MacLellan Site): 50 days/year

Background Concentration: 10.5 µg/m³

24-hour TSP MAAQC: 120 µg/m³

1 15 30 45 60

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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

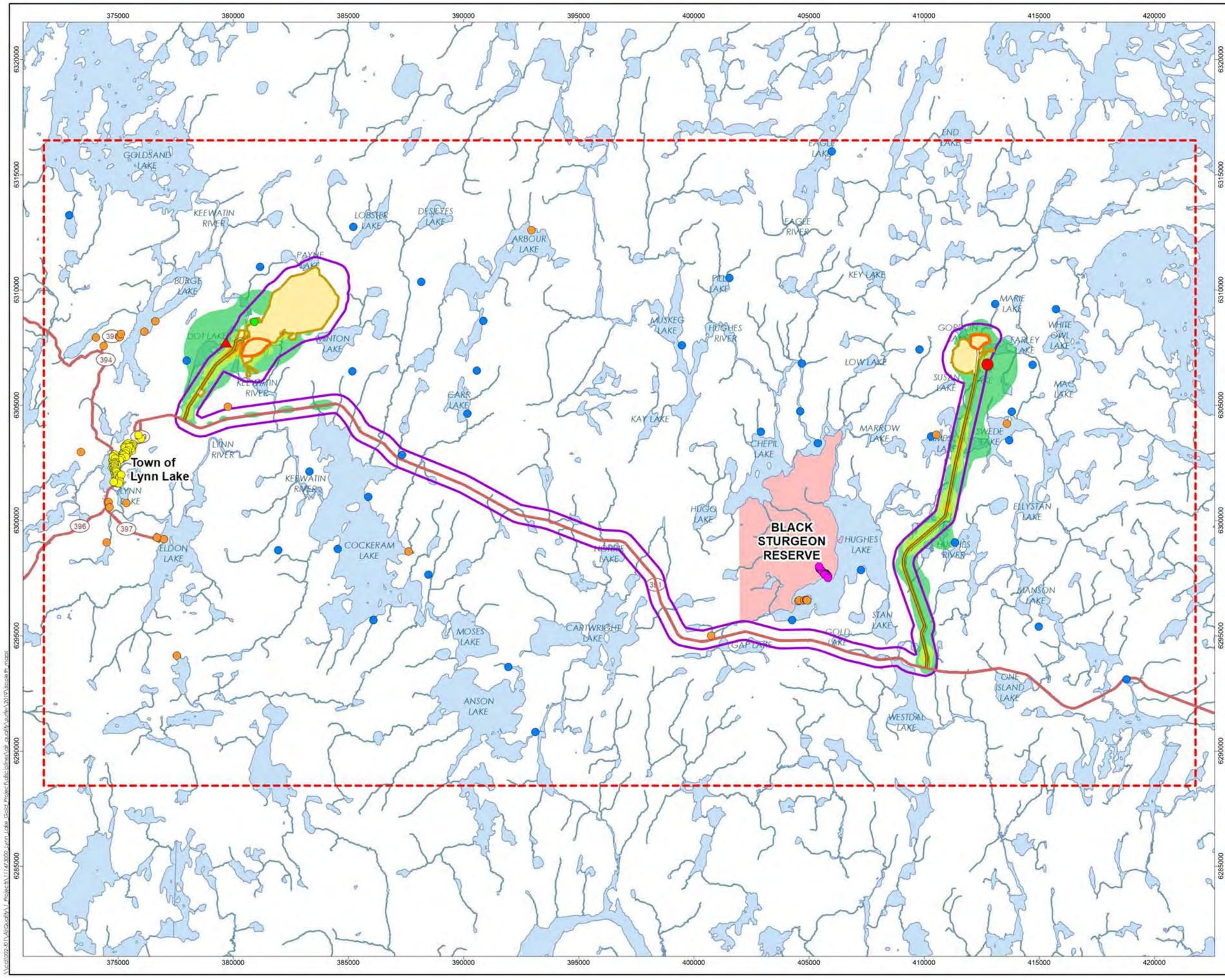
Prepared by KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

Client/Project 111473076
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
17

Title
Maximum Frequency Exceedance of 24-hour Average Level TSP Concentrations (Project Operation + Baseline Conditions)

\\cd1002-f01.ad.ca.stantec.com\Projects\111473076_lynn_lake_Gold_Project\Publications\Air_Quality\Vuolen2019\Issued\mxd\



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 15.8 µg/m³
- Maximum Concentration (MacLellan Site): 14.1 µg/m³
- Background Concentration: 10.5 µg/m³
- Annual TSP MAAQC: 60 µg/m³

12 15 30 45 60

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

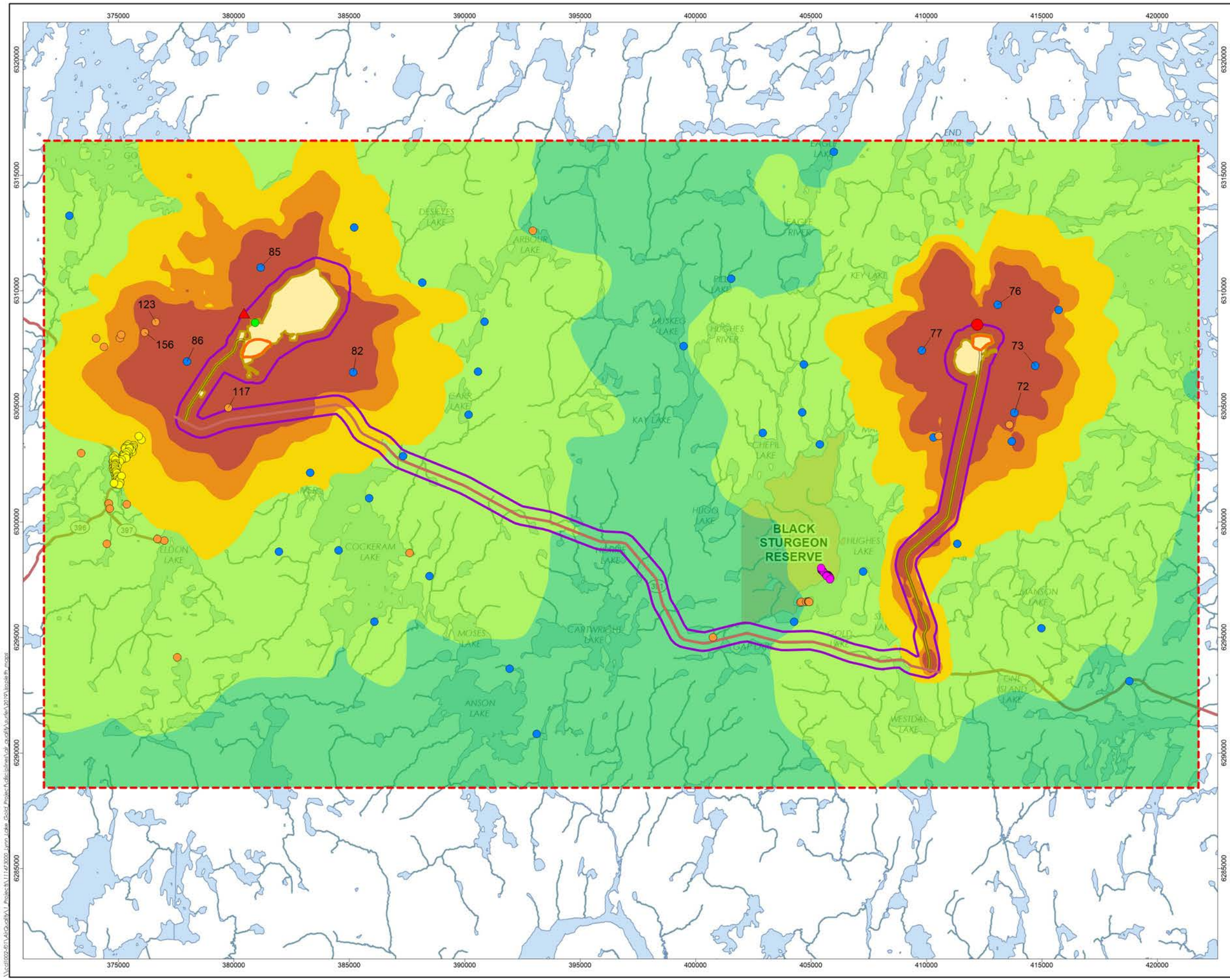
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
18

Title
Maximum Predicted Annual Average TSP Concentrations (µg/m³) (Project Operation + Baseline Conditions)

V:\active\2024\01\AIR\Cadd\Arc\Projects\111473076_lynn_lake_Gold_Project\Air_quality\Assessment\Figures\Air_quality_figures.aprx\Layout\Figure 18_maps



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 406 µg/m³
- Maximum Concentration (MacLellan Site): 247 µg/m³
- Background Concentration: 4.6 µg/m³
- 24-hour PM_{10} MAAQC: 50 µg/m³

5 12.5 25 37.5 50

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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

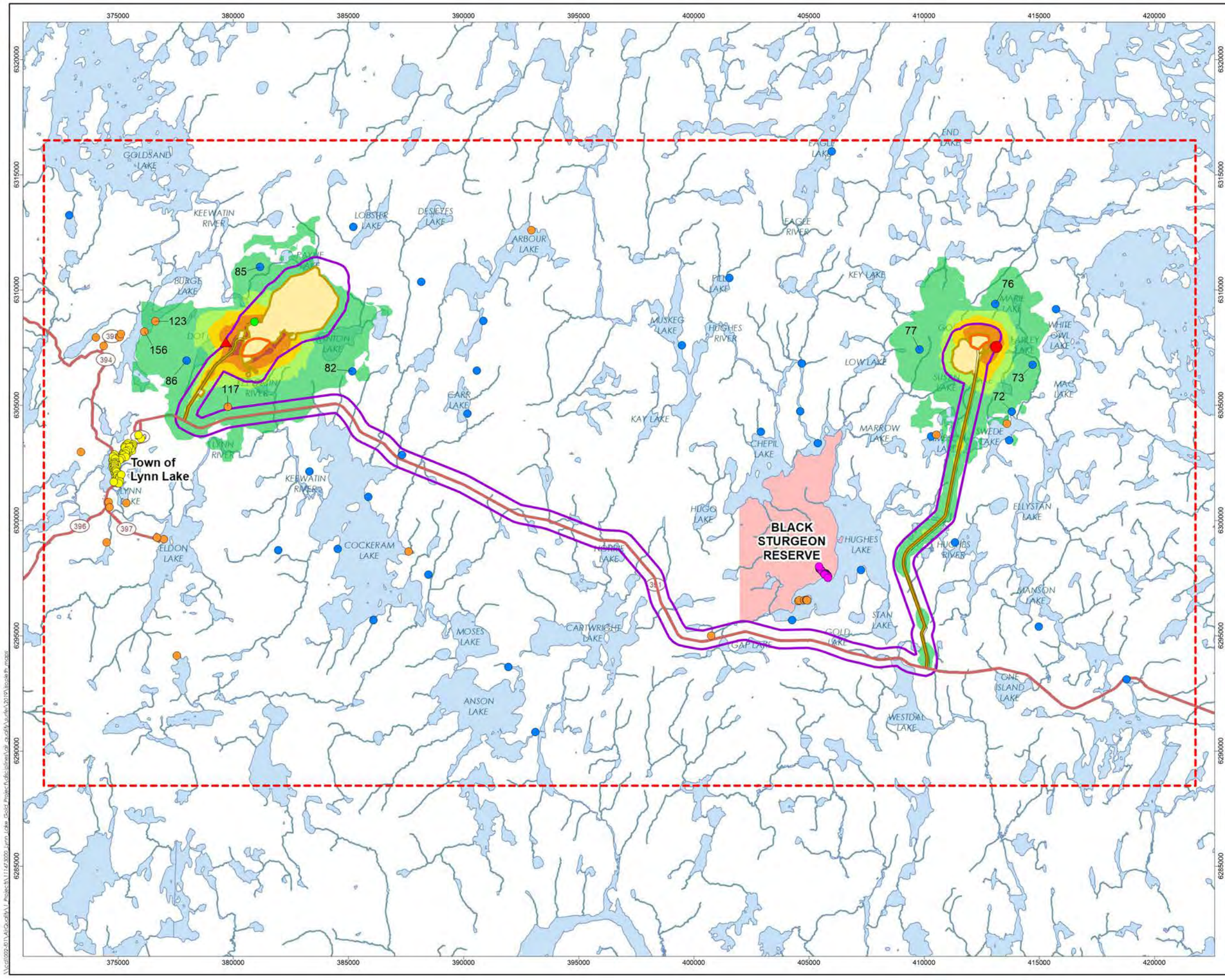
Prepared by KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

Client/Project 111473076
ALAMOS GOLD INC.
Lynn Lake Gold Project

Map No.
19

Title
Maximum Predicted 24-hour Average PM_{10} Concentrations (µg/m³) (Project Operation + Baseline Conditions)

\\cd1002-f01.ad.qc.stantec.com\Projects\111473076_lynn_lake_Gold_Project\Active\Air_Quality\Vuolen\2019\Vuolen_mxd



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Exceedances (Gordon Site): 119 days/year
- Maximum Exceedances (MacLellan Site): 70 days/year

Background Concentration: 4.6 µg/m³

24-hour PM_{10} MAAQC: 50 µg/m³

1 | 15 | 30 | 50 | 100

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

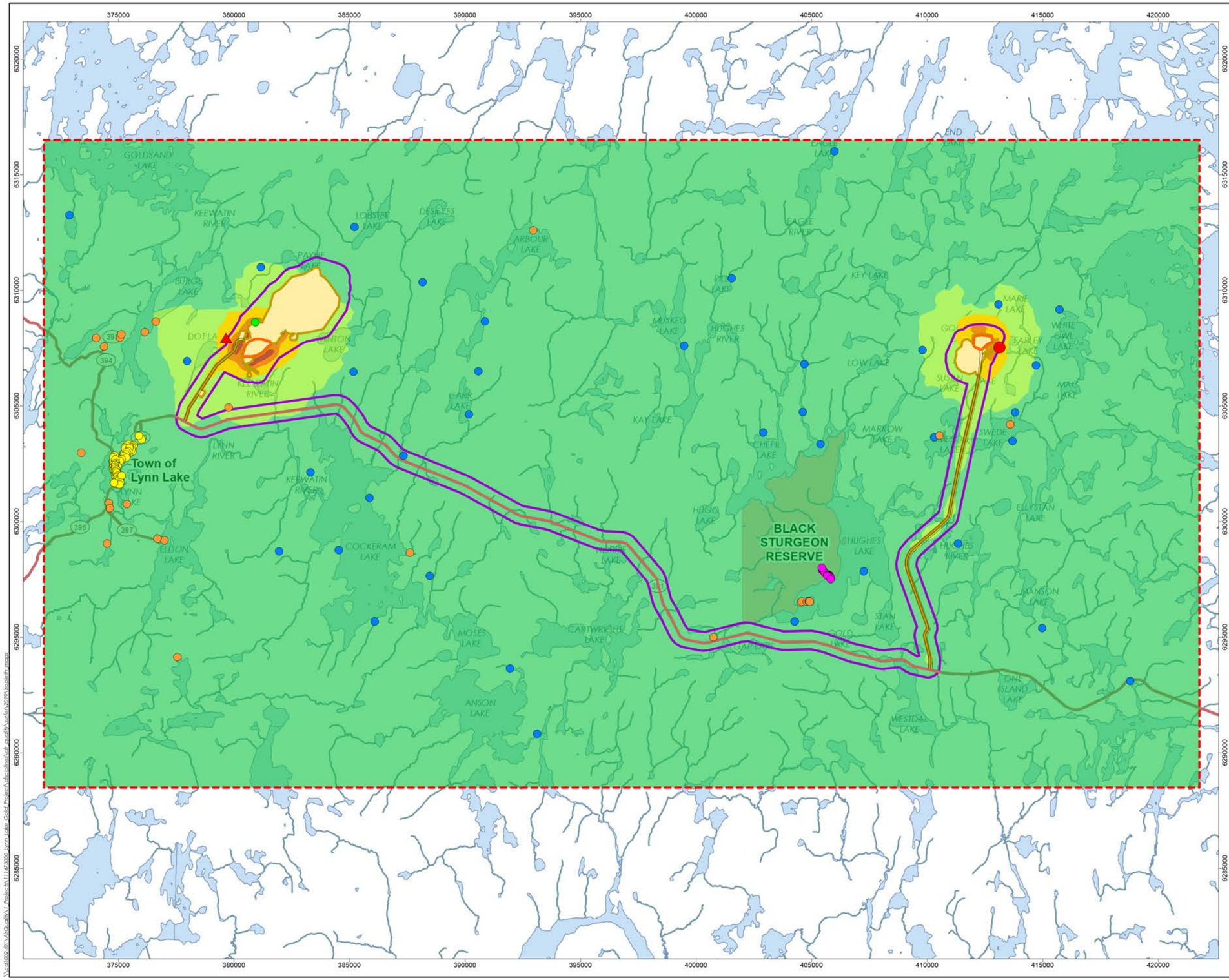
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
20

Title
Maximum Frequency Exceedance of 24-hour Average Level PM_{10}Concentrations (Project Operation + Baseline Conditions)

\\cd1220-f01\AGC\active\1 Projects\111473076 lynn lake Gold Project\Figures\Air quality\Air\20191\mxd\fig 20 maps



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 25.7 µg/m³
- Maximum Concentration (MacLellan Site): 18.6 µg/m³
- Background Concentration: 2.9 µg/m³
- 24-hour $PM_{2.5}$ CAAQS: 27 µg/m³

3 | 6.75 | 13.5 | 20.3 | 27

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

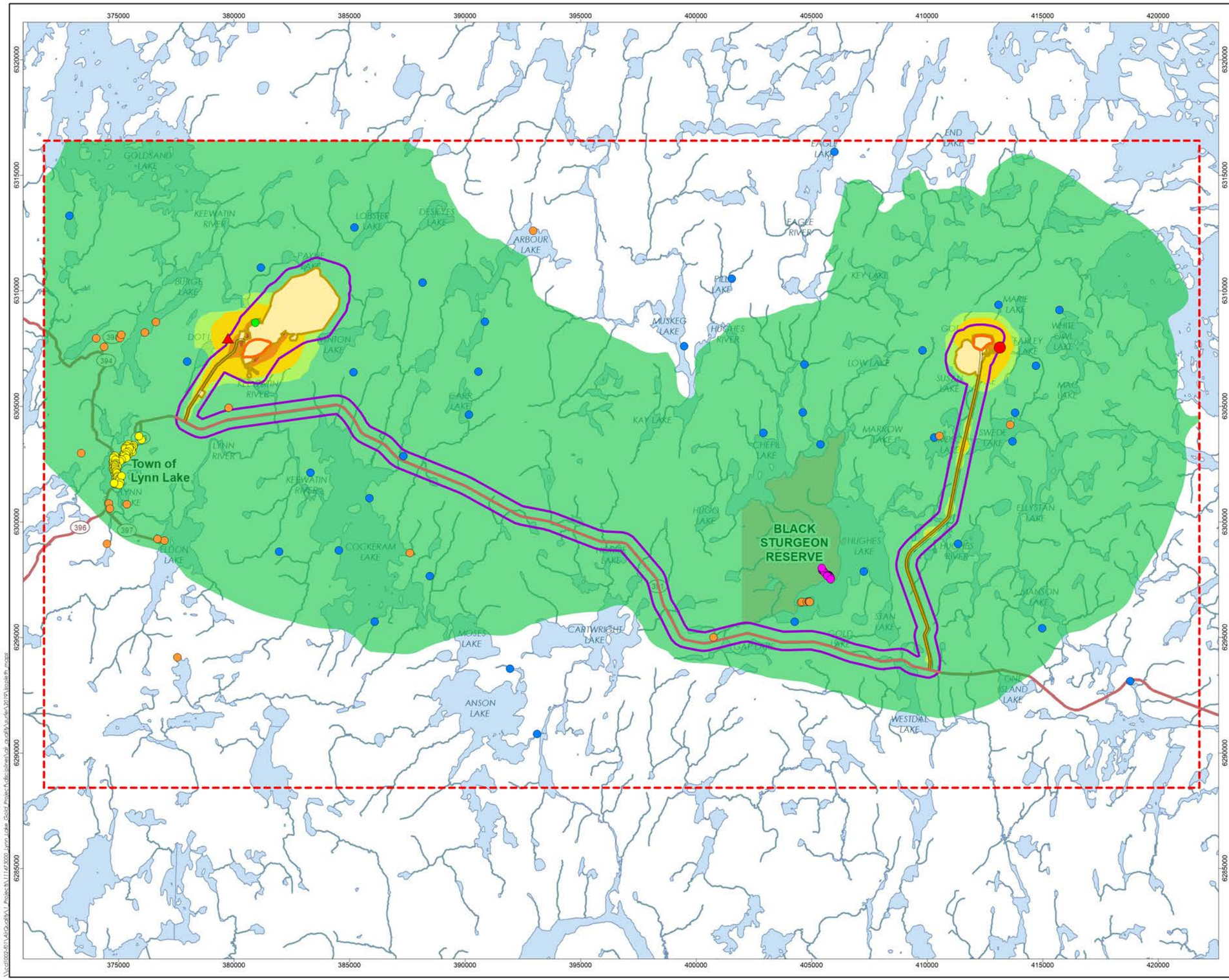
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
21

Title
Maximum Predicted 98% 24-hour Average $PM_{2.5}$ Concentrations (Project Operation + Baseline Conditions)

\\cd1002-f01\Active\active\1_Projects\111473009_lynn_lake_Gold_Project\Discipline\Air_quality\surface\2019\location.mxd



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Concentration (Gordon Site): 7.40 µg/m³
- Maximum Concentration (MacLellan Site): 5.57 µg/m³
- Background Concentration: 2.9 µg/m³
- Annual $PM_{2.5}$ CAAQS: 8.8 µg/m³

3 4 4.4 6.6 8.8

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

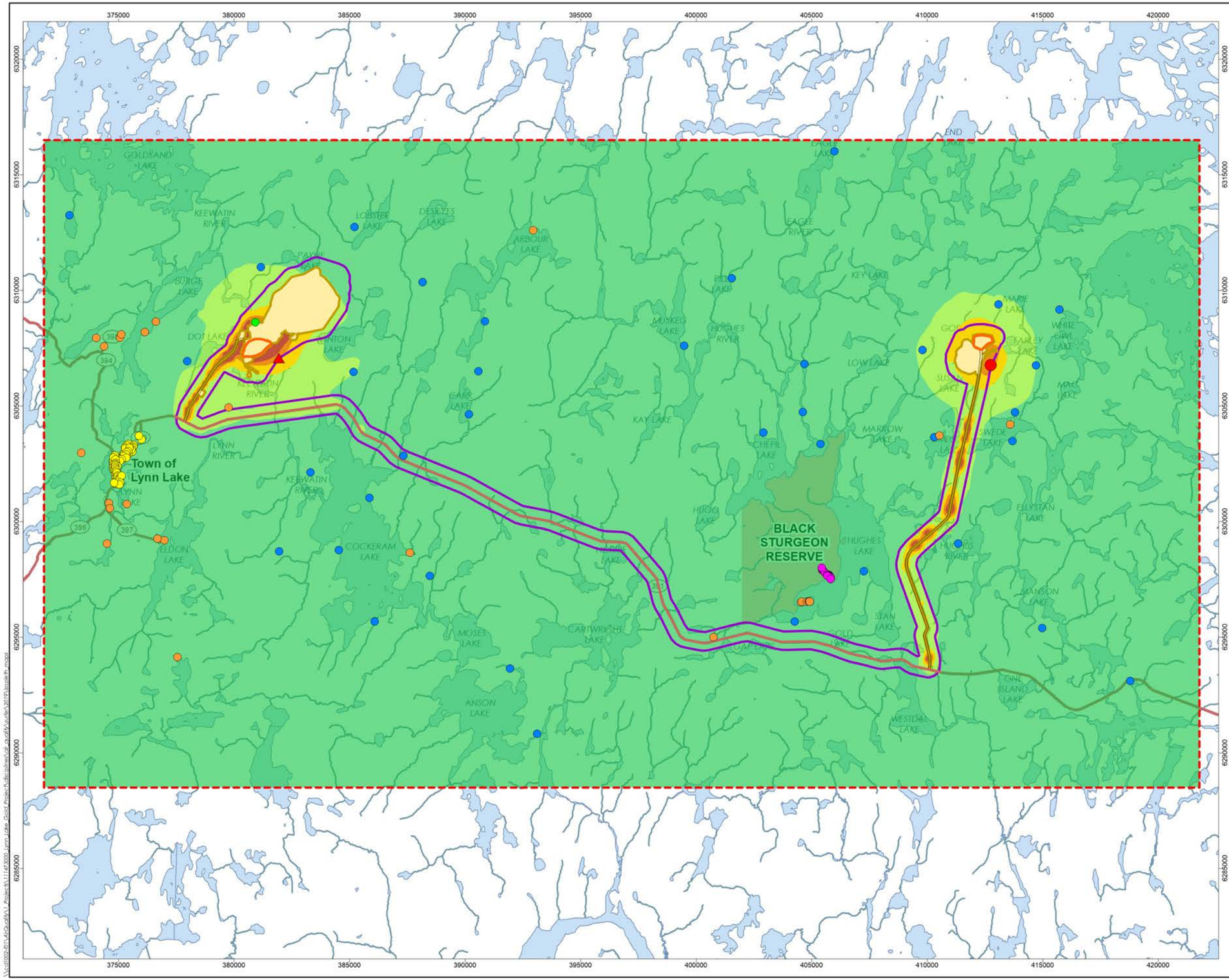
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
22

Title
Maximum Predicted Annual Average $PM_{2.5}$ Concentrations (µg/m³) (Project Operation + Baseline Conditions)

\\cd1002-f01\Active\V\Projects\111473000_lynn_lake_Gold_Project\Deliverables\Air_Quality\Figures\Baseline_maps



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Deposition (Gordon Site): 6.50 g/m²/30-day
- Maximum Deposition (MacLellan Site): 5.57 g/m²/30-day
- Background Concentration: 0.99 g/m²/30-day
- 30-day Dustfall OAAQC: 7 g/m²/30-day

1 1.75 3.5 5.25 7

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

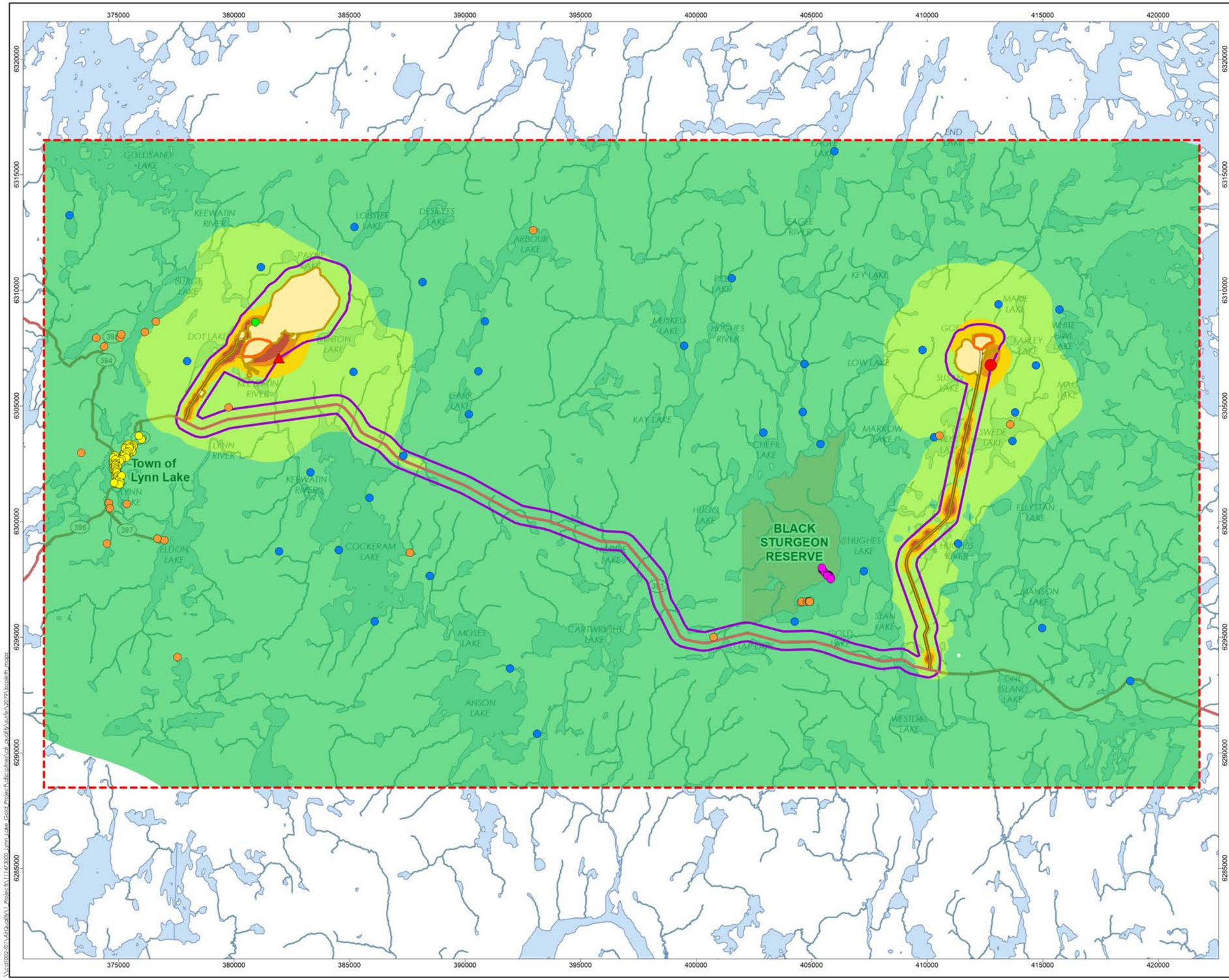
111473076

Map No.
23

Title

Maximum Predicted 30-day Average Dustfall Depositions (g/m²/30-day) (Project Operation + Baseline Conditions)

\\cd1002-f01\Active\active\1_Projects\111473009_Lynn_Lake_Gold_Project\Discipline\Air_quality\Lynn_2019\Update\fh.mxd



Stantec

Alamos Gold Inc.

Study Area

- Proposed Open Pit
- Project Development Area
- Project Boundary
- Air Quality Local Assessment Area

Human Receptors

- Lynn Lake Receptors
- Black Sturgeon Reserve Receptors
- Human Receptors
- Potential Indigenous Receptor
- Worker Camp

Landbase

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

Maximum Concentrations

- Maximum Deposition (Gordon Site): 4.51 g/m²/30-day
- Maximum Deposition (MacLellan Site): 3.95 g/m²/30-day
- Background Concentration: 0.99 g/m²/30-day
- Annual Dustfall OAAQC: 4.6 g/m²/30-day

1 | 1.15 | 2.3 | 3.45 | 4.6

N

0 1500 3000 4500 6000 Metres

(At original document size of 11x17)

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 KBajwa on 2024-07-11
Technical Review by IYankova on 2024-07-12
Senior Review by DJarratt on 2024-07-11

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
24

Title
Maximum Predicted Annual Average Dustfall Depositions (g/m²/30-day) (Project Operation + Baseline Conditions)

\\cd1002-f01\Active\active\1_Projects\111473009_lynn_lake_Gold_Project\Discipline\Air_quality\surface\2019\locations.mxpr

Appendix D Lynn Lake Gold Project – Noise and Vibration Impact Assessment Update

Stantec

Memo

To:	Alamos Gold Inc., Micheal Raess, Manager, Environment & Community Relations, Development Lynn Lake, Manitoba	From:	Yong Ma, P.Eng. Stantec Consulting Ltd. Calgary, AB
Project/File:	Lynn Lake Gold Project/111473076	Date:	December 11, 2024

Reference: Lynn Lake Gold Project – Noise and Vibration Impact Assessment Update

The Lynn Lake Gold Project (LLGP; the Project) consists of two primary deposit sites, the MacLellan site and Gordon site, which are both located near the Town of Lynn Lake, Manitoba. Alamos Gold Inc. (Alamos) will construct (redevelop), operate and eventually close/reclaim open-pit gold mines at both of these historical mine sites. The Project will be built as two open pit mines with a centralized processing plant and a tailings management facility (TMF). The processing plant, located at the MacLellan site has an expected nominal processing throughput of 8,000 tonnes/day with an estimated 17-year production life.

Stantec Consulting Ltd. (Stantec) completed an Environmental Impact Statement (EIS) for the Project (Stantec 2020). The corresponding Noise and Vibration Valued Component sections include Chapter 7, Volume 1 of the EIS and a Technical Modelling Report in Appendix C, Volume 5 of the EIS. The assessment provides an overview of the existing conditions in the Project area and identifies the changes in noise and vibration levels at key receptor locations to determine potential residual and cumulative changes to noise and vibration as a result of the Project.

Since the submission of the EIS in 2020, Alamos has completed a 2023 Feasibility Study Update (FSU 2023) for the Project. The 2023 FSU includes design updates to the 2019 design. The design updates include, but are not limited to the following:

- Project Development Area (PDA) layouts
- Processing plant
- TMF (MacLellan site)
- General infrastructures
- Major equipment lists
- Mine production capacities

Stantec has been engaged to update the noise and vibration assessment based on the design updates. This assessment updated the noise and vibration models for the construction and operation phases of the Project, and predicted the noise and vibration effects at selected noise receptors. As an amendment to the EIS (Stantec 2020), this memo summarizes the results of the Noise and Vibration Impact Assessment Update for the Project.

This memo update is based on the 2023 design of the Project, including the 2023 Feasibility Study Update technical report, and also integrates additional detailed engineering changes in 2024.

1 Summary of Key Changes to Project Design

The Noise and Vibration Impact Assessment Update focused on two Project phases: construction and operation. The noise model considered noise emissions from the mobile and stationery equipment during construction and operation activities at both the Gordon site and MacLellan site. Mobile equipment included the trucks travelling around the Project area (e.g., haul trucks, loaders, excavators). Stationery equipment included the processing equipment (e.g.., crushers, mills, pumps, compressors). The vibration model considered open pit production blast-induced ground vibration and air blast overpressure effects on human habitats during the operation phase.

This noise and vibration assessment update is based on the following design information (e.g., excel spreadsheet provided by Alamos for the Project:

- Feasibility Study Update, NI 43-101 Technical Report for the Lynn Lake Project. Issue date: August 22, 2023 (Alamos 2023).
- Capital and Operating Cost Estimate – Gordon 13Aug2023 V1.9 update (Excel Spreadsheet, pers. comm. 2024).
- Capital and Operating Cost Estimate – MacLellan 13Aug2023 V1.9 update (Excel Spreadsheet, pers. comm. 2024).
- Gordon Highway Haul Calculator 26Apr2023 Plan V1.9 (Excel Spreadsheet, pers. comm. 2024).
- Schedule MacLellan 13Apr2023 V1.9 (Excel Spreadsheet, pers. comm. 2024).
- Schedule Gordon 13Apr2023 V1.9 (Excel Spreadsheet, pers. comm. 2024).
- LLGP Process Plant Noise Sources Summary_2023 (Excel Spreadsheet, pers. comm. 2024).

Stantec reviewed and compared the Project design parameters for 2019 and 2023. Changes that may affect the results of the noise and vibration assessment as presented in the EIS are described in the following sections.

1.1 Project Development Area and Project Layouts

Comparison of the updated PDA drawings for both Gordon site and MacLellan site with the 2019 designs indicates changes to the overall Project footprint and Project components (i.e., access road, haul road, open pit area, mine rock storage areas [MRSA], overburden stockpiles, ore stockpiles, TMF, and ore milling and processing plant). The corresponding Local Assessment Area (LAA) and Regional Assessment Area (RAA) for noise and vibration as presented in the EIS are affected by these changes.

Table 1 summarizes the key changes to major Project components based on the 2023 design. These changes may alter the noise and vibration effects at the receptors.

Table 1 Key Changes of Project Major Components in 2023 Design

Mine Site	Project Major Components	2023 Design
Gordon	PDA	Changes
	LAA and RAA	Changes associated with PDA
	Open Pit	Increased area
	MRSA	Changes – new area is larger
	Overburden Stockpile	Increased area
	Topsoil Storage Area	New added to site
	Ore Storage Area	Relocated
	Fresh Water System	New collection pond and discharge pipeline corridor
	Facility Area	Relocated from center to southeast of MRSA
	Stockpile Borrow Source	Added to site
	Access Road and Haul Road	New road alignment – haul road routes change with change to location or extents of the stockpiles and pit; access road has no significant changes
MacLellan	PDA	Changes
	LAA and RAA	Changes associated with PDA
	Open Pit	Increased area
	Satellite Pit	New pit located at south of Open Pit
	TMF and MRSA	Changes – changes to the extents of the MRSA, TMF pond, and TMF bank area
	Mine Rock Storage	Changes – new area is larger
	Overburden Stockpile	Increased area
	Topsoil Storage Area	Relocated from south to north of Overburden Stockpile
	Collection Pond and Sump Pond	New
	Construction Laydown Area	New
	Processing Plant	Building and equipment layouts are different
	Access Road and Haul Road	New road alignment - – haul road routes change with change to location or extents of the stockpiles and pit; access road has no significant changes

Note:

PDA = Project Development Area; LAA = Local Assessment Area; RAA = Regional Assessment Area

1.2 Mining Production

Based on the review of the Project mine production data during the operation phase, the years with the highest production rates have changed. Table 2 compares the highest production rate year for the 2019 design with the 2023 design.

Table 2 Comparison of Mining Production between 2019 Design and 2023 Design

Mine Site	2019 Design		2023 Design	
	Total Material Mined (kt/y[1])	Highest Year	Total Material Mined (kt/y[1])	Highest Year
Gordon	16,000	2	16,001	3
MacLellan	28,000	7	33,941	5

Note:

[1] kt/y: thousands of tonnes per year

In the noise model, production year with the highest production rates represents the worst-case noise emission scenario due to higher equipment quantity and activity level. In this assessment update, Gordon site operation Year 3 and MacLellan site operation Year 5 were selected for the noise model.

1.3 Mining Equipment

The 2023 design data sheets “Schedule MacLellan13Apr2023 V1.9.xlsx” and “Schedule Gordon 13Apr2023 V1.9.xlsx” provide the Project mining equipment summary during the operation phase. The summary includes equipment associated with mine general equipment, mine support equipment, drills, loading equipment and hauling equipment for different operation years.

Table 3 summarizes the mining equipment and quantities for the 2023 design in the years with the highest production rates for the MacLellan and Gordon sites. The 2023 design mining equipment type and quantity are different from the 2019 design. Section 5.1.3.2 of Stantec 2020 summarized the mining equipment for the operation phase of the 2019 design.

Table 3 Mining Equipment Included in 2023 Design

Equipment	Gordon Site Quantity (Year 3)	MacLellan Site Quantity (Year 5)
Mine General Equipment		
Lube/Fuel Truck	1	1
Mechanic's Truck	1	1
Welding Truck	1	1
Blasting Loader	1	1

Reference: Lynn Lake Gold Project – Noise and Vibration Impact Assessment Update

Equipment	Gordon Site Quantity (Year 3)	MacLellan Site Quantity (Year 5)
Blasters Truck	1	1
Integrated Tool Carrier WA200-7	1	1
Compactor (BW 211)	1	1
Lighting Plants	6	8
Tire Manipulator (980) (WA500-8)	1	1
Man Bus	2	2
Pickup Trucks	10	16
Crane - 50T	1	1
Crane - 35T	1	1
Pump Truck	1	1
ADT 40 tonne (t)	1	2
Lowboy and tractor (75-100 ton)	1	1
Mine Support Equipment		
Track Dozer - D375A-6	-[1]	5
Grader - GD655-6 - 14'	-	2
Transfer Loader - WA900-3	-	1
Snow Plow/Water Truck	-	3
PC1250LC-8 (6.7 cubic metre (m^3))	-	1
PC490LC-11 (w/hammer)	1	1
Dump Truck - 20 ton	2	3
Road Maintenance Loader - WA500-8	1	1
Drills		
Drill – 178 millimetre (mm) SmartROC D65	3	1
PV275 - 178 mm	-	4
Loading Equipment		
PC4000 shovel - 22 m^3 (150/200 t)	-	2
PC1250LC-8 (6.7 m^3)	4	-
WA900 loader - 11.5 m^3 (100/150t)	-	1

Equipment	Gordon Site Quantity (Year 3)	MacLellan Site Quantity (Year 5)
Hauling Equipment		
HD1500-7 150t	-	17[2]
HD605-8	15	-

Notes:

[1] "-": not applicable

[2] Year 8 has the most quantity of 17. Year 5 has 14, however, 17 is used in the mode conservatively

1.4 Processing Plant

The 2023 FSU provides new design and layouts for the processing plant at the MacLellan site. The equipment list for each building in the 2023 design is provided in the spreadsheet "LLGP Process Plant Noise Sources Summary_2023.xlsx". The processing plant consists of multiple buildings housing different mine processing equipment, including:

- Main Process Building
- Reagent Storage Building
- Primary Crushing Facility
- Secondary Crushing Building
- Fine Ore Storage Facility
- Oxygen Plant
- The processing plant also includes other auxiliary buildings, such as warehouse and workshop, truck maintenance building and truck wash building, laboratory building and administration building. These buildings are not considered as noise sources in the acoustic model.

Section 5.1.3.2 in Stantec 2020 summarized the buildings and equipment in the processing plant associated with the 2019 design. In comparison to the 2019 design, buildings in the 2023 design have different location, sizes, and equipment layout.

Table 4 compares the major buildings associated with the processing plant for the 2019 design with those of the 2023 design.

Table 4 Comparison of Processing Plant Buildings between 2019 and 2023 Designs at MacLellan Site

Building/Equipment	2019 Design	2023 Design
Primary Crusher Building	-[1]	Different building size and equipment setup
Secondary Crusher Building	-[1]	Different building size and equipment setup
Fine Ore Storage Facility	Ore Stockpile, no building	New building with equipment
Main Process Building	Mill Building	Different building size and equipment setup
Reagent Storage Building	Located at northwest of Mill Building	Relocated adjacent to Main Process Building; different building size and equipment setup
Gold Room	Detached building	Relocated inside Main Process Building
Oxygen Plant	Southwest of Mill Building	Relocated south of Main Process Building; different building size and equipment setup
Service Equipment	Not listed	Different locations and equipment setup

Note:
"-": as a comparison base

Table 5 summarizes the processing plant mobile equipment list associated with the 2023 design. A mobile equipment list was not available for the 2019 design.

Table 5 Processing Plant Mobile Equipment List for 2023 Design at MacLellan Site

Equipment	Capacity	Quantity
Single Cab 4WD Pickup	-[1]	6
Twin Cab 4WD Hiab Truck	8 t	1
Bus	22-seat	1
Fire Trailer	5 cubic metres (m^3)	1
All Terrain Crane	40/50 tonne (t)	1
Crane	150 t	-
Plant Forklift	4 t	2
Warehouse Forklift	4 t	1
Front-End Loader	10 t	1
Skid-Steer Loader (Bobcat)	1 t	1
Tip Truck	3 t	2

Equipment	Capacity	Quantity
Telescopic Handler	3 t	1
Boom/Scissor Lift	-	2
Fusion Butt Welder	90/315	1
Portable Compressor	-	1
Diesel Welder	-	2
Portable Pumps Generator	200 kilovolt amperes	1
Gravel truck	10 m^3	2
Water Truck	15,000 litres (L)	1
Potable water Trailers	5,000 L	4
Franna Crane	15 t	1
Yard Crane – Hydraulic	20 t	1
Pick-n Carry Mobile Crane	-	1
Backhoe	11 t	1
Forklift/Telescopic Handler	20 t	1

Note:
"-": data is unavailable

1.5 Pre-production Equipment

The 2023 design data sheets "Schedule MacLellan13Apr2023 V1.9.xlsx" and "Schedule Gordon 13Apr2023 V1.9.xlsx" summarize the mining equipment during the pre-production, including Mine General Equipment, Mine Support Equipment, Drills, Loading Equipment and Hauling Equipment. Table 6 summarizes the 2023 design equipment and quantities associated with the pre-production phase at the MacLellan and Gordon sites.

Section 5.1.2.3 of the Stantec 2020 summarized the mining equipment during the pre-production phase for the 2019 design.

Table 6 Pre-Production Mining Equipment of 2023 Design

Equipment	Gordon Site Quantity (Year -1)	MacLellan Site Quantity (Year -1)
Mine General Equipment		
Lube/Fuel Truck	1	1
Mechanic's Truck	1	1
Welding Truck	1	1

Equipment	Gordon Site Quantity (Year -1)	MacLellan Site Quantity (Year -1)
Blasting Loader	1	1
Blasters Truck	1	1
Integrated Tool Carrier WA200-7	1	1
Compactor (BW 211)	1	1
Lighting Plants	6	8
Tire Manipulator (980) (WA500-8)	1	1
Man Bus	2	2
Pickup Trucks	10	16
Crane - 50T	1	1
Crane - 35T	1	1
Pump Truck	1	1
ADT 40t	1	2
Lowboy and tractor (75-100 ton)	1	1
Mine Support Equipment		
Track Dozer - D375A-6	-	5
Grader - GD655-6 - 14'	-	2
Transfer Loader - WA900-3	-	1
Snow Plow/Water Truck	-	3
PC1250LC-8 (6.7 m^3)	-	1
PC490LC-11 (w/hammer)	1	1
Dump Truck - 20 ton	2	3
Road Maintenance Loader - WA500-8	1	1
Drills		
Drill - 178mm SmartROC D65	1	1
PV275 - 178 mm	-	1
Loading Equipment		
PC4000 shovel - 22 m^3 (150/200 t)	1	1
PC1250LC-8 (6.7 m^3)	2	-
WA900 loader - 11.5 m^3 (100/150t)	1	1

Equipment	Gordon Site Quantity (Year -1)	MacLellan Site Quantity (Year -1)
Hauling Equipment		
HD1500-7 150t	-	4
HD605-8	3	-

1.6 Blasting Parameters

During the operation phase, the primary vibration effects associated with the Project are ground vibration and air overpressure due to blasting activities within the open pit at the Gordon site and the MacLellan site. The primary factors affecting vibration due to blasting are the highest explosive charge per delay and the distance from a blast to the receptor. Table 7 compares the blasting parameters between the 2019 and 2023 designs.

Table 7 Comparison of Blasting Parameters in 2019 Design and 2023 Design

Blasting Parameter	2019 Design (Gordon Site and MacLellan Site)	2023 Design (Gordon Site and MacLellan Site)
Highest Explosive Charge	208 kilogram (kg)/hole	230 kg/hole
Closest distances from blast to receptors (Open Pit Boundary to Receptor)	-[1]	Marginal changes in distances due to different open pit layout. The distance decreases for the closest receptors (ID 73 and ID 76) at the Gordon site and decreases for the closest receptor at the permanent work camp.

Note:
[1] "-": as a comparison base

1.7 Access Road and PR391 Traffic

Table 8 compares the Project-related operation phase access road and PR 391 road traffic between the 2019 and 2023 design. As a conservative approach, the 2023 design road traffic volume is based on the highest mine production year (1,696 kilotonnes per year (kt/yr) in Year 4) from the Gordon site stockpile to MacLellan site mill. Low traffic volume associate with Gordon Mine Year 3 was not used.

Table 8 Project-Related Operation Access Roads and PR391 Road Traffic

Item	Description	2019 Design Volume (Trucks/hr)	2023 Design Volume (Trucks/hr)
1	Access Road Traffic for Gordon and MacLellan	12	13
2	PR391 Road Traffic	12	13

2 Assessment Approach

The Noise and Vibration Impact Assessment Update was based on an identical approach (i.e., receptor locations, regulatory framework, baseline conditions, and modelling method) to that applied for the Stantec 2020 assessment. Some assessment parameters remain the same as the 2019 design. For example, Project construction phase equipment listings for the processing plant, open pit area and TMF area remain the same as in the 2019 design. Table 9 summarizes the assessment approach for Noise and Vibration Impact Assessment Update; the approach is identical to the approach applied in Stantec 2020. The corresponding sections for Stantec 2020 are provided as references in the table.

Table 9 Assessment Approach

Assessment Method or Parameter	Descriptions	Reference in Stantec 2020
Noise and Vibration Receptors	Selected noise receptors near Gordon site and MacLellan site remain the same, including Receptor ID, Description and Location UTM Coordinates	Table 2-1 – Gordon Site Table 2-2 – MacLellan Site
Regulatory Framework Noise Criteria	Manitoba noise guideline Health Canada Change in percent highly annoyed (%HA) Health Canada Low Frequency Noise	Section 3.1 Section 6.1.4
Regulatory Framework Vibration Criteria	MECP Guidance vibration targets for blasting Health Canada blast overpressure target FTA 2018 structural damage threshold	Section 3.2 Section 6.2.1 Section 6.2.2
Baseline Conditions	Same baseline conditions for all receptors	Section 4.0
Noise Modelling Parameters	Same noise modelling software parameters	Section 5.1.1
Vibration Modelling	Same vibration modelling/calculation methods	Section 5.2.1
Decommissioning/Closure	Quantitative noise modelling of decommissioning/closure phase was not conducted	Section 5.1.4 Section 5.2.4
Construction Equipment List	Remains the same as Stantec 2020 for processing plant and TMF area at MacLellan site	Section 5.1.2
Pile Driving Activity	Activity remains the same as Stantec 2020 for Gordon site and MacLellan site	Table 6-2 Table 6-3
Construction Phase Access Road Traffic Volume	Remain the same as Stantec 2020 for Gordon site and MacLellan site: 2 Trucks/hour – Gordon Site 6 Trucks/hour – MacLellan Site	Table 5-8 Table 5-9
Construction Phase PR391 Road Traffic Volume	Remain the same as Stantec 2020 between Gordon site and MacLellan site: 2 Trucks/hour	Table 5-10

Table 10 summarizes the assessment assumptions; the assumptions for this update are identical to those applied in Stantec 2020. The corresponding sections for the assumptions in Stantec 2020 are provided as references in the table.

Table 10 Assessment Assumptions (Stantec 2020)

Assessment Parameter	Assessment Assumptions (Gordon Site and MacLellan)	Reference in Stantec 2020
Construction Phase		
Processing Plant (MacLellan Site)	• Worst case scenario is based on the period of Year -2 and Year -1. • Mobile equipment operates 10 hours (6 hours daytime and 4 hours nighttime) during a 24-hour period. • Stationery equipment operates at 100% capacity • Piling activities were assumed to be less than 12 months • Active piling is assumed to be 30% of the equipment operating time, with a 12 decibel (dB) tonality penalty added to noise emissions • Back-up alarms are assumed to be 20% of the equipment operating time, with a 5 dB tonality penalty added to noise emissions	Section 5.1.2.1
TMF (MacLellan Site)	• Equipment operates 10 hours (6 hours daytime and 4 hours nighttime) during a 24-hour period. • Equipment operates at 100% capacity • Back-up alarms are assumed to be 20% of the equipment operating time, with a 5 dB tonality penalty added to noise emissions	Section 5.1.2.2
Pre-Production (MacLellan and Gordon Sites)	• Equipment operates 20 hours (12.5 hours daytime and 7.5 hours nighttime) during a 24-hour period. • Equipment operates at 100% capacity • Stationery equipment operates at 100% capacity continuously during 24-hour period • Back-up alarms are assumed to be 20% of the equipment operating time, with a 5 dB tonality penalty added to noise emissions	Section 5.1.2.3
Haul Road Traffic Access Road Traffic PR 391 Road Traffic	• Equipment operates 24 hours continuously in 365 days • Equipment operates at 100% capacity • Highest road traffic volumes were used	Section 5.1.2.4 Section 5.1.2.5 Section 5.1.2.6

Assessment Parameter	Assessment Assumptions (Gordon Site and MacLellan)	Reference in Stantec 2020
Operation Phase		
Processing Plant and Primary Mining Equipment Support Equipment	• Stationery equipment (i.e., Processing Plant) operates at 100% capacity continuously during 24-hour period • Equipment operates at 100% capacity • Mobile equipment operates 20 hours (12.5 hours daytime and 7.5 hours nighttime) during a 24-hour period • Back-up alarms are assumed to be 20% of the equipment operating time, with a 5 dB tonality penalty added to noise emissions	Section 5.1.3.2
Vibration		
Blast-related Vibration	• Vibration prediction used a conservative method with the highest explosive charge weight. The actual blast charges could be lower • Blast-related vibration prediction was based on the shortest distance between receptor and the pit boundary	Section 5.2.1

3 Noise Emissions

3.1 Mine Equipment Noise Sources

As described in the previous sections, this Noise and Vibration Impact Assessment Update will only present the differences between the 2019 design and 2023 design for the Project. Therefore, only noise emissions for the Project equipment that are different with those listed in Stantec 2020 are summarized herein. Updated noise emission sound power levels are summarized and included in Attachment A.

Updated noise emission data for the Pre-Production and Operation Phase equipment is presented in Table A-1 to Table A-4 in Attachment A. Construction phase equipment for the Processing Plant and TMF, and construction haul road traffic noise remains unchanged from the Stantec 2020 assessment, therefore this noise emission information is not included in Attachment A.

3.2 Mine Haul Road Traffic

Based on the highest annual production year of the 2023 design, the operation haul road traffic for the Gordon site and MacLellan site were updated. Table 11 and Table 12 summarize the operation haul road traffic volumes and associated noise emission (e.g., sound power level per equipment unit) at the Gordon site and MacLellan site, respectively.

Table 11 Haul Road Traffic Summary at Gordon Site

Item	Description	Equipment	Year 3 Volume (Trucks/hr)	Sound Power Level [1] (a-weighted decibel sound level [dBA])
1	Open Pit	Haul Truck (69 Ton)	66	116
2	Open Pit to Waste Rock Stockpile	Haul Truck (69 Ton)	54	116
3	Open Pit to Ore Stockpile	Haul Truck (69 Ton)	6	116
4	Open Pit to Overburden Stockpile	Dump Truck (20 Ton)	21	113

Note:

[1] Represent sound power level per unit of mobile equipment

Table 12 Haul Road Traffic Summary at MacLellan Site

Item	Description	Equipment	Year 5 Volume (Trucks/hr)	Sound Power Level [1] (a-weighted decibel sound level [dBA])
1	Within Open Pit	Haul Truck (150 Ton)	64	120
2	Ore Stockpile to Processing Plant	Dump Truck (20 Ton)	11	113
3	Open Pit to Waste Rock Stockpile	Haul Truck (150 Ton)	59	120
4	Open Pit to Low Grade Ore Stockpile	Haul Truck (150 Ton)	2	120
5	Open Pit to Overburden Stockpile	Dump Truck (20 Ton)	11	113
6	Open Pit to Mill	Haul Truck (150 Ton)	1	120

Note:

[1] Represent sound power level per unit of mobile equipment

The operation haul road traffic noise emissions are based on the same assumption or condition as 2019 Desing except equipment operates 350/365 yearly instead of 365/365 in 2019 Design).

4 Noise Model Results

4.1 Construction

Table 13 and Table 14 summarize the Project only daytime, nighttime, and day-night average sound level results at the receptors for the Gordon site and MacLellan site during the construction phase, respectively. Figure B.1 and Figure B.2 in Attachment B illustrate the construction phase only noise contour maps for the Gordon site and MacLellan site, respectively.

Table 13 Constructon Phase Sound Level at Gordon Site

Receptor ID	Description	Project Daytime Sound Level, L_d (dBA)	Project Nighttime Sound Level, L_n (dBA)	Project Day-Night Sound Level, L_{dn} (dBA)
59	Potential Indigenous Receptor	22.9	22.9	29.3
61	Potential Indigenous Receptor	16.5	16.5	22.9
62	Potential Indigenous Receptor	12.6	12.6	19
72	Potential Indigenous Receptor	28.9	28.9	35.3
73	Potential Indigenous Receptor	29.2	29.2	35.6
74	Potential Indigenous Receptor	23.4	23.4	29.8
76	Potential Indigenous Receptor	33.3	33.3	39.7
77	Potential Indigenous Receptor	33.8	33.8	40.2
93	Black Sturgeon Reserve Residence	14.1	14.1	20.6
101	Black Sturgeon Reserve Residence	16.1	16.1	22.5
104	Remote Cottage	4.5	4.5	10.9
126	Recreation Lot	13.6	13.6	20
130	Remote Cottage	13.6	13.6	20.1
131	Remote Cottage	28	28	34.5
132	Trapper Cabin	28.2	28.2	34.6
139	Park Vacation Home	13.7	13.7	20.1

Note:

L_d = daytime equivalent sound level; L_{dn} day-night average sound level; dBA = A-weighted decibel sound level

Table 14 Construction Phase Sound Level at MacLellan Site

Receptor ID	Description	Project Daytime Sound Level, L_d (dBA)	Project Nighttime Sound Level, L_n (dBA)	Project Day-Night Sound Level, L_{dn} (dBA)
66	Potential Indigenous Receptor	21.8	21.8	28.2
67	Potential Indigenous Receptor	23.2	23.2	29.6
68	Potential Indigenous Receptor	26.1	26.1	32.5
69	Potential Indigenous Receptor	21.0	21.0	27.4
78	Potential Indigenous Receptor	20.9	20.9	27.3
79	Potential Indigenous Receptor	16.8	16.8	23.2
81	Potential Indigenous Receptor	22.8	22.8	29.2
82	Potential Indigenous Receptor	31.0	31.0	37.4
83	Potential Indigenous Receptor	25.0	25.0	31.4
84	Potential Indigenous Receptor	28.2	28.2	34.6
85	Potential Indigenous Receptor	37.7	37.7	44.1
86	Potential Indigenous Receptor	35.1	35.1	41.5
105	Remote Cottage	19.4	19.4	25.8
115	Museum Site	23.0	23.0	29.4
116	Communication Site	25.1	25.1	31.5
121	Recreation Lot	26.5	26.5	32.9
123	Potential Indigenous Receptor	28.4	28.4	34.8
135	Park Vacation Home	26.3	26.3	32.7
163	Lynn Lake Friendship Center	23.6	23.6	30.0
166	Lynn Lake Gospel Church	23.4	23.4	29.8
169	Lynn Lake Library	23.1	23.1	29.5
172	West Lynn Lake High School	22.3	22.3	28.7
173	Lynn Lake Hospital	24.6	24.6	31.0
177	Lynn Lake Residence	23.9	23.9	30.3
178	Lynn Lake Residence	24.4	24.4	30.8
225	Lynn Lake Residence	22.2	22.2	28.6
--	Temporary Work Camp (outdoor)	57.1	57.1	63.5

Note:

L_d = daytime equivalent sound level; L_{dn} day-night average sound level; dBA = A-weighted decibel sound level

4.2 Operation

Table 15 and Table 16 and summarize the Project only daytime, nighttime, and day-night average sound level results at the receptors for the Gordon site and MacLellan site during the operation phase, respectively. Figure B.3 and Figure B.4 in Attachment B illustrate the operation phase only noise contour maps for the Gordon site and MacLellan site, respectively.

Table 15 Operation Phase Sound Level at Gordon Site

Receptor ID	Description	Project Daytime Sound Level, L_d (dBA)	Project Nighttime Sound Level, L_n (dBA)	Project Day-Night Sound Level, L_{dn} (dBA)
59	Potential Indigenous Receptor	30.4	30.4	36.8
61	Potential Indigenous Receptor	22	22	28.4
62	Potential Indigenous Receptor	18.6	18.6	25
72	Potential Indigenous Receptor	32	32	24.8
73	Potential Indigenous Receptor	31.4	31.4	38.5
74	Potential Indigenous Receptor	27.6	27.6	37.8
76	Potential Indigenous Receptor	39.9	39.9	34
77	Potential Indigenous Receptor	38.7	38.7	46.3
93	Black Sturgeon Reserve Residence	19.6	19.6	45.2
101	Black Sturgeon Reserve Residence	21.7	21.7	26
104	Remote Cottage	7	7	28.1
126	Recreation Lot	18.6	18.6	13.4
130	Remote Cottage	18.9	18.9	25
131	Remote Cottage	33.7	33.7	25.3
132	Trapper Cabin	32.2	32.2	40.1
139	Park Vacation Home	19	19	25.4

Note:

L_d = daytime equivalent sound level; L_{dn} day-night average sound level; dBA = A-weighted decibel sound level

Table 16 Operation Phase Sound Level at MacLellan Site

Receptor ID	Description	Project Daytime Sound Level, L_d (dBA)	Project Nighttime Sound Level, L_n (dBA)	Project Day-Night Sound Level, L_{dn} (dBA)
66	Potential Indigenous Receptor	25.8	25.8	32.2
67	Potential Indigenous Receptor	27.4	27.4	33.8
68	Potential Indigenous Receptor	29.6	29.6	36
69	Potential Indigenous Receptor	25.2	25.2	31.6
78	Potential Indigenous Receptor	24.7	24.7	31.1
79	Potential Indigenous Receptor	20.5	20.5	26.9
81	Potential Indigenous Receptor	26.5	26.5	33
82	Potential Indigenous Receptor	34.7	34.7	41.2
83	Potential Indigenous Receptor	28.7	28.7	35.1
84	Potential Indigenous Receptor	30.5	30.5	36.9
85	Potential Indigenous Receptor	38.4	38.4	44.8
86	Potential Indigenous Receptor	38.8	38.8	45.2
105	Remote Cottage	23.8	23.8	30.2
115	Museum Site	27	27	33.4
116	Communication Site	29.2	29.2	35.6
121	Recreation Lot	30.4	30.4	36.8
123	Potential Indigenous Receptor	31.5	31.5	37.9
135	Park Vacation Home	28.4	28.4	34.8
163	Lynn Lake Friendship Center	27.1	27.1	33.5
166	Lynn Lake Gospel Church	27.3	27.3	33.7
169	Lynn Lake Library	27.1	27.1	33.5
172	West Lynn Lake High School	26.1	26.1	32.5
173	Lynn Lake Hospital	29.2	29.2	35.6
177	Lynn Lake Residence	27.3	27.3	33.8
178	Lynn Lake Residence	27.4	27.4	33.8
225	Lynn Lake Residence	26.9	26.9	33.3
--	Temporary Work Camp (outdoor)	59.7	59.7	66.1

Note:

L_d = daytime equivalent sound level; L_{dn} day-night average sound level; dBA = A-weighted decibel sound level

4.3 Comparison to Regulatory Framework

4.3.1 Manitoba

During the construction phase the predicted Project L_d and L_n sound levels (see Table 13 and Table 14) at all residential receptors near both Gordon site and MacLellan site are below the Manitoba noise guideline (i.e., Manitoba Guidelines for Sound Pollution) target of 55 dBA daytime and 45 dBA nighttime. During the operation phase the predicted Project L_d and L_n sound levels (see Table 15 and Table 16) at all residential receptors are below the Manitoba noise guideline target of 55 dBA daytime and 45 dBA nighttime.

4.3.2 Health Canada Change in Percent Highly Annoyed Noise Level

For the construction and operation phases, change in percent highly annoyed (%HA) associated with the Project is compared with the threshold of 6.5% advised by Health Canada guidance (i.e., Guidance for Evaluating Human Health Effects in Impact Assessment: NOISE). The change is %HA at a receptor is based on the difference between the baseline %HA and total (Project and Baseline) %HA.

The changes in %HA associated with the Project construction phase at the Gordon site and the MacLellan site are summarized in Table 17 and Table 18, respectively. The changed in %HA results are compared to the target for change in %HA of 6.5% advised in the Health Canada noise guidance. The changes in %HA at all receptors are below the 6.5% target for the construction phase. The results indicate compliance with the Health Canada guidance.

Table 17 Construction Phase – Change in %HA at Gordon Site

Receptor ID	Description	Baseline			Project L_{dn} (dBA)	Total			Change in %HA (Between Total and Baseline)
		L_{dn} (dBA)	$L_{dn,\ adjusted}$ [1] (dBA)	%HA		L_{dn} (dBA)	$L_{dn,\ adjusted}$ [1] (dBA)	%HA	
59	Potential Indigenous Receptor	40.0	50.0	2.17	29.3	40.3	50.3	2.28	0.1
61	Potential Indigenous Receptor	40.0	50.0	2.17	22.9	40.0	50.0	2.20	0.0
62	Potential Indigenous Receptor	40.0	50.0	2.17	19	40.0	50.0	2.18	0.0
72	Potential Indigenous Receptor	40.0	50.0	2.17	35.3	41.2	51.2	2.56	0.4
73	Potential Indigenous Receptor	40.0	50.0	2.17	35.6	41.3	51.3	2.59	0.4
74	Potential Indigenous Receptor	40.0	50.0	2.17	29.8	40.4	50.4	2.29	0.1
76	Potential Indigenous Receptor	40.0	50.0	2.17	39.7	42.8	52.8	3.15	1.0
77	Potential Indigenous Receptor	40.0	50.0	2.17	40.2	43.1	53.1	3.26	1.1
93	Black Sturgeon Reserve Residence	44.6	54.6	3.92	20.6	44.6	54.6	3.93	0.0

Receptor ID	Description	Baseline			Project	Total			Change in %HA (Between Total and Baseline)
		L_{dn} (dBA)	$L_{dn, adjusted}$ [1] (dBA)	%HA	L_{dn} (dBA)	L_{dn} (dBA)	$L_{dn, adjusted}$ [1] (dBA)	%HA	
101	Black Sturgeon Reserve Residence	44.6	54.6	3.92	22.5	44.6	54.6	3.94	0.0
104	Remote Cottage	40.0	50.0	2.17	10.9	40.0	50.0	2.18	0.0
126	Recreation Lot	40.0	50.0	2.17	20	40.0	50.0	2.19	0.0
130	Remote Cottage	40.0	50.0	2.17	20.1	40.0	50.0	2.19	0.0
131	Remote Cottage	40.0	50.0	2.17	34.5	41.0	51.0	2.50	0.3
132	Trapper Cabin	40.0	50.0	2.17	34.6	41.1	51.1	2.51	0.3
139	Park Vacation Home	40.0	50.0	2.17	20.1	40.0	50.0	2.19	0.0

Notes:

[1] The + 10 dB “peace and quiet” adjustment is included

L_{dn} day-night average sound level; dBA = A-weighted decibel sound level; %HA = percent highly annoyed

Table 18 Construction Phase – Change in %HA at MacLellan Site

Receptor ID	Description	Baseline			Project	Total			Change in %HA (Between Total and Baseline)
		L_{dn} (dBA)	$L_{dn, adjusted}$ [1] (dBA)	%HA	L_{dn} (dBA)	L_{dn} (dBA)	$L_{dn, adjusted}$ [1] (dBA)	%HA	
66	Potential Indigenous Receptor	40.0	50.0	2.17	28.2	40.2	50.2	2.25	0.1
67	Potential Indigenous Receptor	40.0	50.0	2.17	29.6	40.3	50.3	2.28	0.1
68	Potential Indigenous Receptor	40.0	50.0	2.17	32.5	40.7	50.7	2.39	0.2
69	Potential Indigenous Receptor	40.0	50.0	2.17	27.4	40.2	50.2	2.24	0.1
78	Potential Indigenous Receptor	40.0	50.0	2.17	27.3	40.2	50.2	2.24	0.1
79	Potential Indigenous Receptor	40.0	50.0	2.17	23.2	40.0	50.0	2.20	0.0
81	Potential Indigenous Receptor	40.0	50.0	2.17	29.2	40.3	50.3	2.28	0.1
82	Potential Indigenous Receptor	40.0	50.0	2.17	37.4	41.9	51.9	2.78	0.6
83	Potential Indigenous Receptor	40.0	50.0	2.17	31.4	40.5	50.5	2.34	0.2
84	Potential Indigenous Receptor	40.0	50.0	2.17	34.6	41.1	51.1	2.51	0.3
85	Potential Indigenous Receptor	40.0	50.0	2.17	44.1	45.5	55.5	4.43	2.3
86	Potential Indigenous Receptor	40.0	50.0	2.17	41.5	43.8	53.8	3.57	1.4
105	Remote Cottage	40.0	50.0	2.17	25.8	40.1	50.1	2.22	0.0
115	Museum Site	45.0	55.0	4.15	29.4	45.1	55.1	4.21	0.1
116	Communication Site	45.0	55.0	4.15	31.5	45.2	55.2	4.25	0.1
121	Recreation Lot	42.9	52.9	3.18	32.9	43.3	53.3	3.36	0.2

Receptor ID	Description	Baseline			Project	Total			Change in %HA (Between Total and Baseline)
		L_{dn} (dBA)	$L_{dn, adjusted}$ [1] (dBA)	%HA	L_{dn} (dBA)	L_{dn} (dBA)	$L_{dn, adjusted}$ [1] (dBA)	%HA	
123	Potential Indigenous Receptor	42.9	52.9	3.18	34.8	43.5	53.5	3.45	0.3
135	Park Vacation Home	42.9	52.9	3.18	32.7	43.3	53.3	3.35	0.2
163	Lynn Lake Friendship Center	45.0	55.0	4.15	30.0	45.1	55.1	4.22	0.1
166	Lynn Lake Gospel Church	45.0	55.0	4.15	29.8	45.1	55.1	4.22	0.1
169	Lynn Lake Library	45.0	55.0	4.15	29.5	45.1	55.1	4.21	0.1
172	West Lynn Lake High School	45.0	55.0	4.15	28.7	45.1	55.1	4.20	0.1
173	Lynn Lake Hospital	45.0	55.0	4.15	31.0	45.2	55.2	4.24	0.1
177	Lynn Lake Residence	45.0	55.0	4.15	30.3	45.1	55.1	4.23	0.1
178	Lynn Lake Residence	45.0	55.0	4.15	30.8	45.2	55.2	4.23	0.1
225	Lynn Lake Residence	45.0	55.0	4.15	28.6	45.1	55.1	4.20	0.1

Notes:

[1] The + 10 dB “peace and quiet” adjustment is included

L_{dn} day-night average sound level; dBA = A-weighted decibel sound level; %HA = percent highly annoyed

The changes in %HA associated with the Project operation phase at the Gordon site and MacLellan site are summarized in Table 19 and Table 20, respectively. The changed in %HA results are compared to the target for change in %HA of 6.5% advised in the Health Canada noise guidance. The changes in %HA at all receptors are below the 6.5% target for the operation phase. The results indicate compliance with the Health Canada guidance.

Table 19 Operation Phase – Change in %HA at Gordon Site

Receptor ID	Description	Baseline			Project	Total			Change in %HA (Between Total and Baseline)
		L_{dn} (dBA)	$L_{dn, adjusted}$ [1] (dBA)	%HA	L_{dn} (dBA)	L_{dn} (dBA)	$L_{dn, adjusted}$ [1] (dBA)	%HA	
59	Potential Indigenous Receptor	40.0	50.0	2.17	37.1	41.8	51.8	2.75	0.6
61	Potential Indigenous Receptor	40.0	50.0	2.17	28.7	40.3	50.3	2.26	0.1
62	Potential Indigenous Receptor	40.0	50.0	2.17	25	40.1	50.1	2.21	0.0
72	Potential Indigenous Receptor	40.0	50.0	2.17	38.5	42.3	52.3	2.94	0.8
73	Potential Indigenous Receptor	40.0	50.0	2.17	37.8	42.0	52.0	2.84	0.7
74	Potential Indigenous Receptor	40.0	50.0	2.17	34	40.9	50.9	2.47	0.3
76	Potential Indigenous Receptor	40.0	50.0	2.17	46.3	47.2	57.2	5.48	3.3
77	Potential Indigenous Receptor	40.0	50.0	2.17	45.2	46.3	56.3	4.87	2.7

Receptor ID	Description	Baseline			Project	Total			Change in %HA (Between Total and Baseline)
		L_{dn} (dBA)	$L_{dn, adjusted}$ [1] (dBA)	%HA	L_{dn} (dBA)	L_{dn} (dBA)	$L_{dn, adjusted}$ [1] (dBA)	%HA	
93	Black Sturgeon Reserve Residence	44.6	54.6	3.92	26.2	44.6	54.6	3.95	0.0
101	Black Sturgeon Reserve Residence	44.6	54.6	3.92	28.3	44.7	54.7	3.97	0.1
104	Remote Cottage	40.0	50.0	2.17	13.4	40.0	50.0	2.18	0.0
126	Recreation Lot	40.0	50.0	2.17	25.3	40.1	50.1	2.21	0.0
130	Remote Cottage	40.0	50.0	2.17	25.5	40.1	50.1	2.22	0.0
131	Remote Cottage	40.0	50.0	2.17	40.4	43.2	53.2	3.30	1.1
132	Trapper Cabin	40.0	50.0	2.17	38.7	42.4	52.4	2.97	0.8
139	Park Vacation Home	40.0	50.0	2.17	25.7	40.1	50.1	2.22	0.0

Note:

[1] The + 10 dB “peace and quiet” adjustment is included

L_{dn} day-night average sound level; dBA = A-weighted decibel sound level; %HA = percent highly annoyed

Table 20 Operation Phase – Change in %HA at MacLellan Site

Receptor ID	Description	Baseline			Project	Total			Change in %HA (Between Total and Baseline)
		L_{dn} (dBA)	$L_{dn, adjusted}$ [1] (dBA)	%HA	L_{dn} (dBA)	L_{dn} (dBA)	$L_{dn, adjusted}$ [1] (dBA)	%HA	
66	Potential Indigenous Receptor	40.0	50.0	2.17	32.2	40.6	50.6	2.37	0.2
67	Potential Indigenous Receptor	40.0	50.0	2.17	33.8	40.9	50.9	2.46	0.3
68	Potential Indigenous Receptor	40.0	50.0	2.17	36.0	41.4	51.4	2.63	0.5
69	Potential Indigenous Receptor	40.0	50.0	2.17	31.6	40.5	50.5	2.35	0.2
78	Potential Indigenous Receptor	40.0	50.0	2.17	31.1	40.5	50.5	2.33	0.2
79	Potential Indigenous Receptor	40.0	50.0	2.17	26.9	40.2	50.2	2.23	0.1
81	Potential Indigenous Receptor	40.0	50.0	2.17	32.9	40.7	50.7	2.41	0.2
82	Potential Indigenous Receptor	40.0	50.0	2.17	41.1	43.6	53.6	3.46	1.3
83	Potential Indigenous Receptor	40.0	50.0	2.17	35.1	41.2	51.2	2.55	0.4
84	Potential Indigenous Receptor	40.0	50.0	2.17	36.9	41.7	51.7	2.72	0.5
85	Potential Indigenous Receptor	40.0	50.0	2.17	44.8	46.0	56.0	4.73	2.6
86	Potential Indigenous Receptor	40.0	50.0	2.17	45.2	46.3	56.3	4.91	2.7

Receptor ID	Description	Baseline			Project	Total			Change in %HA (Between Total and Baseline)
		L_{dn} (dBA)	$L_{dn, adjusted}$ [1] (dBA)	%HA	L_{dn} (dBA)	L_{dn} (dBA)	$L_{dn, adjusted}$ [1] (dBA)	%HA	
105	Remote Cottage	40.0	50.0	2.17	30.2	40.4	50	2.30	0.1
115	Museum Site	45.0	55.0	4.15	33.4	45.3	55.3	4.30	0.2
116	Communication Site	45.0	55.0	4.15	35.6	45.5	55.5	4.40	0.3
121	Recreation Lot	42.9	52.9	3.18	36.8	43.9	53.9	3.60	0.4
123	Potential Indigenous Receptor	42.9	52.9	3.18	37.9	44.1	54.1	3.71	0.5
135	Park Vacation Home	42.9	52.9	3.18	34.8	43.5	53.5	3.45	0.3
163	Lynn Lake Friendship Center	45.0	55.0	4.15	33.5	45.3	55.3	4.31	0.2
166	Lynn Lake Gospel Church	45.0	55.0	4.15	33.7	45.3	55.3	4.32	0.2
169	Lynn Lake Library	45.0	55.0	4.15	33.5	45.3	55.3	4.31	0.2
172	West Lynn Lake High School	45.0	55.0	4.15	32.5	45.2	55.2	4.28	0.1
173	Lynn Lake Hospital	45.0	55.0	4.15	35.6	45.5	55.5	4.40	0.3
177	Lynn Lake Residence	45.0	55.0	4.15	33.7	45.3	55.3	4.32	0.2
178	Lynn Lake Residence	45.0	55.0	4.15	33.8	45.3	55.3	4.32	0.2
225	Lynn Lake Residence	45.0	55.0	4.15	33.3	45.3	55.3	4.30	0.2

Notes:

[1] The + 10 dB “peace and quiet” adjustment is included

L_{dn} day-night average sound level; dBA = A-weighted decibel sound level; %HA = percent highly annoyed

4.3.3 Health Canada Low Frequency Noise

As a target for the low frequency noise (LFN) issue, Health Canada noise guidance recommends that the energy sum of the linear sound levels in the 16, 31.5 and 63-Hz octave bands at a receptor location not exceed 70 dBL.

Table 21 summarizes the predicted octave band sound level at 16 Hz, 31.5 Hz, and 63 Hz for the receptors near the Gordon sites during the construction and operation phases; and Table 22 summarizes the predicted octave band sound level at 16 Hz, 31.5 Hz, and 63 Hz for the receptors near the MacLellan sites during the construction and operation phases.

Assessment of the 16 Hz sound pressure level is not possible because no sound power data is available for the proposed equipment and this octave band is outside of the ISO 9613-2 calculation standard. However, Stantec’s professional experience suggests that the 16 Hz octave band sound pressure level will be similar to that of the 31.5 Hz octave band. The sound levels at 16 Hz octave band were therefore assumed to be the same as the sound levels at 31.5 Hz octave band.

Potential for LFN noise effect is low at receptors near both the Gordon site and MacLellan site because the predicted sound level results are below the Health Canada target of 70 dBL.

Table 21 Sound Level at 16 Hz, 31.5 Hz and 63 Hz Octave Band Frequency at Gordon Site

Receptor ID	Description	Construction Phase Predicted Daytime or Nighttime Sound Level, L_d or L_n (dB)				Operation Phase Predicted Daytime or Nighttime Sound Level, L_d or L_n (dB)			
		16 Hz	31.5 Hz	63 Hz	Sum of 16 Hz to 63 Hz	16 Hz	31.5 Hz	63 Hz	Sum of 16 Hz to 63 Hz
59	Potential Indigenous Receptor	36.4	36.4	39.5	42.5	39.9	39.9	44.4	46.7
61	Potential Indigenous Receptor	34.6	34.6	36.9	40.3	38.3	38.3	41	44.2
62	Potential Indigenous Receptor	32	32	33.9	37.5	35.6	35.6	38	41.3
72	Potential Indigenous Receptor	44.4	44.4	47	50.2	47.1	47.1	49.6	52.9
73	Potential Indigenous Receptor	45	45	47.4	50.7	47.7	47.7	49.6	53.2
74	Potential Indigenous Receptor	41.1	41.1	43.2	46.7	44.8	44.8	46.8	50.3
76	Potential Indigenous Receptor	49	49	51.4	54.7	53	53	55.6	58.8
77	Potential Indigenous Receptor	48.9	48.9	51.5	54.7	52.3	52.3	55	58.2
93	Black Sturgeon Reserve Residence	32.6	32.6	34.6	38.1	35.7	35.7	38	41.4
101	Black Sturgeon Reserve Residence	34	34	36.3	39.7	37.7	37.7	40.4	43.6
104	Remote Cottage	27.1	27.1	28.6	32.4	29.2	29.2	30.5	34.4
126	Recreation Lot	32.5	32.5	34.5	38.0	36.1	36.1	38.4	41.8
130	Remote Cottage	32.6	32.6	34.6	38.1	36.2	36.2	38.5	41.9
131	Remote Cottage	42.7	42.7	45.5	48.6	46.1	46.1	49.3	52.2
132	Trapper Cabin	43.6	43.6	46.3	49.5	46.6	46.6	49.3	52.5
139	Park Vacation Home	32.6	32.6	34.6	38.1	36.2	36.2	38.5	41.9

Notes:

L_d = daytime equivalent sound level; L_n nighttime equivalent sound level; dBA = A-weighted decibel sound level; dB = decibel; Hz = Hertz

Table 22 Sound Level at 16 Hz, 31.5 Hz and 63 Hz Octave Band Frequency at MacLellan Site

Receptor ID	Description	Construction Phase Predicted Daytime or Nighttime Sound Level, L_d or L_n (dB)				Operation Phase Predicted Daytime or Nighttime Sound Level, L_d or L_n (dB)			
		16 Hz	31.5 Hz	63 Hz	Sum of 16 Hz to 63 Hz	16 Hz	31.5 Hz	63 Hz	Sum of 16 Hz to 63 Hz
66	Potential Indigenous Receptor	42.2	42.2	44.3	47.8	47.3	47.3	48.6	52.5
67	Potential Indigenous Receptor	42.7	42.7	44.9	48.3	48.4	48.4	49.8	53.7
68	Potential Indigenous Receptor	44.1	44.1	46.5	49.8	49.1	49.1	50.7	54.5
69	Potential Indigenous Receptor	40.9	40.9	43	46.5	46.4	46.4	47.8	51.7
78	Potential Indigenous Receptor	40.9	40.9	43	46.5	45.9	45.9	47.3	51.2
79	Potential Indigenous Receptor	37.7	37.7	39.5	43.2	42.5	42.5	43.7	47.7
81	Potential Indigenous Receptor	42.1	42.1	44.3	47.7	47	47	48.6	52.4
82	Potential Indigenous Receptor	47.7	47.7	50.2	53.5	52.8	52.8	54.8	58.3
83	Potential Indigenous Receptor	43.9	43.9	46.3	49.6	48.9	48.9	50.6	54.3
84	Potential Indigenous Receptor	46.7	46.7	49.3	52.5	50.1	50.1	51.9	55.6
85	Potential Indigenous Receptor	53.2	53.2	56	59.1	56.9	56.9	57.5	61.9
86	Potential Indigenous Receptor	49.7	49.7	52.4	55.6	56.2	56.2	57.7	61.5
105	Potential Indigenous Receptor	40	40	42	45.5	45.8	45.8	46.9	51.0
115	Museum Site	41.8	41.8	44.1	47.5	47.5	47.5	49	52.8
116	Communication Site	43.3	43.3	45.7	49.0	49.2	49.2	50.6	54.5
121	Recreation Lot	44.4	44.4	46.8	50.1	50.1	50.1	51.8	55.5
123	Potential Indigenous Receptor	46.1	46.1	48.4	51.8	50.9	50.9	52.2	56.1
135	Park Vacation Home	45	45	46.9	50.5	48.8	48.8	49.4	53.8

Receptor ID	Description	Construction Phase Predicted Daytime or Nighttime Sound Level, L_d or L_n (dB)				Operation Phase Predicted Daytime or Nighttime Sound Level, L_d or L_n (dB)			
		16 Hz	31.5 Hz	63 Hz	Sum of 16 Hz to 63 Hz	16 Hz	31.5 Hz	63 Hz	Sum of 16 Hz to 63 Hz
163	Lynn Lake Friendship Center	42.3	42.3	44.6	48.0	47.4	47.4	48.9	52.7
166	Lynn Lake Gospel Church	42	42	44.3	47.7	47.8	47.8	49.4	53.2
169	Lynn Lake Library	41.9	41.9	44.2	47.6	47.5	47.5	49.1	52.9
172	West Lynn Lake High School	41.5	41.5	43.7	47.1	46.8	46.8	48.2	52.1
173	Lynn Lake Hospital	42.7	42.7	45	48.4	49.5	49.5	50.9	41.3
177	Lynn Lake Residence	42.7	42.7	44.9	48.3	47.6	47.6	49	39.5
178	Lynn Lake Residence	42.6	42.6	45	48.3	47.6	47.6	49	39.5
225	Lynn Lake Residence	41.4	41.4	43.6	47.0	47.4	47.4	49	39.1

Notes:

L_d = daytime equivalent sound level; L_n nighttime equivalent sound level; DBA = a-weighted decibel sound level; Hz = Hertz

4.3.4 WHO Sleep Disturbance

The outdoor nighttime annual sound level of 40 dBA was used as the sleep disturbance noise target for this assessment update, based on the World Health Organization Night Guidelines for Europe (WHO 2009). The L_n results in Table 14 and Table 15 indicate that the nighttime equivalent sound level from the Project is below 40 dBA at all residential receptors. No noise-related sleep disturbances of residential receptors are expected from the Project construction and operation during the nighttime period.

It is assumed that a minimum of 30-dB noise reduction is expected for the work camp building walls with the windows closed. Air conditioning units are recommended for the work camp building such that exterior windows and doors can be closed during summer season. The WHO (1999) recommends a target for sleep disturbance as being an indoor sound level of no more than 30 dBA. The predicted daytime or nighttime sound level at the temporary work camp is 57.1 dBA outdoor during the construction phase. The predicted daytime or nighttime sound level at the permanent work camp and 59.7 dBA outdoor during the operation phase. The construction phase noise level inside the temporary work camp is predicted to be 27.1 dBA. The operation phase noise level inside the temporary work camp is predicted to be 29.7 dBA. The indoor level predicted is based on a building transmission loss of 30 dB with the exterior windows and doors closed.

Therefore, the predicted results during both construction and operation phases are below the WHO 1999 indoor sound level target of 30 dBA. No noise-related sleep disturbances of workers are expected from the Project during the daytime and nighttime periods.

5 Vibration Model Results

5.1 Operation Phase

During the operation phase, as described in Section 1.6 due to the increase of the highest blasting charge per hole (i.e., increased from 208 kg in the 2019 design to 230 kg in the 2023 design), and changes to the shortest distances from the receptors to the open pit boundary, the predicted results of the ground-borne vibration and air overpressure levels marginally increase for some receptors in comparison to the Stantec 2020 assessment.

Table 23 and Table 24 present the predicted ground-borne vibration and air overpressure for receptors at the Gordon site and MacLellan site, respectively. To be conservative in the predictions, the distance to each receptor was taken from the final pit boundary, and blasts were assumed to be fired with 230 kg of explosives.

Table 23 Blast Related Vibration Levels for Receptors near Gordon Site

Receptor ID	Description	Distance to Open Pit (m)	Ground-borne Vibration (mm/s)	Air Overpressure with blast charge of 230 kg per hole per delay (dBL)	Air Overpressure with blast charge of 43 kg per hole per delay (dBL)
59	Potential Indigenous Receptor	8465	0.2	113	109
61	Potential Indigenous Receptor	10855	0.2	111	108
62	Potential Indigenous Receptor	10855	0.1	109	106
72	Potential Indigenous Receptor	3080	1.0	119	115
73	Potential Indigenous Receptor	2125	1.8	121[a]	118
74	Potential Indigenous Receptor	3135	1.0	119	115
76	Potential Indigenous Receptor	1420	3.4	124[a]	120
77	Potential Indigenous Receptor	2255	1.7	121[a]	117
93	Black Sturgeon Residence Reserve	11720	0.1	111	107
101	Black Sturgeon Residence Reserve	11655	0.1	111	107
104	Remote Cottage	17070	0.1	108	105
126	Recreation Lot	13345	0.1	110	106
130	Remote Cottage	13155	0.1	110	106

Receptor ID	Description	Distance to Open Pit (m)	Ground-borne Vibration (mm/s)	Air Overpressure with blast charge of 230 kg per hole per delay (dBL)	Air Overpressure with blast charge of 43 kg per hole per delay (dBL)
131	Remote Cottage	4135	0.7	117	113
132	Trapper Cabin	3470	0.9	118	115
139	Park Vacation Home	13140	0.1	110	106

Notes:

[a] exceeds the target of 120 dBL based on the blast charge of 230 kg per hole per delay. However, the reduced charge as recommended in the mitigation section will lower the air overpressure to 120 dBL at Receptor ID 73, ID 76 and ID 77.

m = metres; mm/s = millimetres per second; kg = kilograms; dBL = linear (unweighted) decibel sound level

Table 24 Blast Related Vibration Levels for Receptors near MacLellan Site

Receptor ID	Description	Distance to Open Pit (m)	Ground-borne Vibration (mm/s)	Air Overpressure with blast charge of 230 kg per hole per delay (dBL)	Air Overpressure with blast charge of 85 kg per hole per delay (dBL)
66	Potential Indigenous Receptor	9090	0.2	112	110
67	Potential Indigenous Receptor	7790	0.3	113	111
68	Potential Indigenous Receptor	5520	0.4	115	113
69	Potential Indigenous Receptor	9100	0.2	112	110
78	Potential Indigenous Receptor	9100	0.2	112	110
79	Potential Indigenous Receptor	12050	0.1	110	108
81	Potential Indigenous Receptor	7520	0.3	113	111
82	Potential Indigenous Receptor	3785	0.8	117	115
83	Potential Indigenous Receptor	7085	0.3	114	112
84	Potential Indigenous Receptor	6230	0.4	114	112
85	Potential Indigenous Receptor	3050	1.1	119	117
86	Potential Indigenous Receptor	2350	1.6	120	118
105	Remote Cottage	10730	0.2	111	109
115	Museum Site	6875	0.3	114	112
116	Communication Site	5585	0.4	115	113
121	Recreation Lot	5255	0.5	115	113
123	Potential Indigenous Receptor	3935	0.7	117	115

Receptor ID	Description	Distance to Open Pit (m)	Ground-borne Vibration (mm/s)	Air Overpressure with blast charge of 230 kg per hole per delay (dBL)	Air Overpressure with blast charge of 85 kg per hole per delay (dBL)
135	Park Vacation Home	3960	0.7	117	115
163	Lynn Lake Friendship Center	6350	0.3	114	112
166	Lynn Lake Gospel Church	6715	0.3	114	112
169	Lynn Lake Library	6765	0.3	114	112
172	West Lynn Lake High School	7125	0.3	114	112
173	Lynn Lake Hospital	6165	0.4	114	112
177	Lynn Lake Residence	6005	0.4	115	113
178	Lynn Lake Residence	6060	0.4	115	113
225	Lynn Lake Residence	7355	0.3	113	111
	Permanent Work Camp (outdoor)	750	8.9	127 [a]	125

Notes:

[a] exceeds the Health Canada target of 125 dBL based on the blast charge of 230 kg per hole per delay. However, the reduced charge of 85 kg per hole per delay will lower the air overpressure to 125 dBL at the Permanent Work Camp.

m = metres; mm/s = millimetres per second; kg = kilograms; dBL = linear (unweighted) decibel sound level

The highest blast charge of 230 kg will result in ground-borne vibration below the vibration target of 10 mm/s at all receptors for the Gordon site. The predicted air overpressures are below the vibration target of 120 dBL at all receptors, with the exception of receptor ID 73, ID 76 and ID 77 near the Gordon site. The predicted air overpressure at receptor ID 73 and ID 77 is 121 dBL and ID 76 is 124 dBL, respectively. When the blast charge is reduced from 230 kg to 43 kg per hole per delay, the predicted overpressures at receptor ID 73, ID 76 and ID 77 meet the 120 dBL target.

The highest blast charge of 230 kg will result in ground-borne vibration below the vibration target of 10 mm/s at all receptors for the MacLellan site. The predicted air overpressures are below the vibration target of 120 dBL at all receptors, with the exception of the Permanent Work Camp at the MacLellan Site. The predicted air overpressure at the Permanent Work Camp is 127 dBL. This level is also above the Health Canada target of 125 dBL for one blast per day. In order to meet the Health Canada target of 125 dBL, the blast charge reduction to 85 kg per hole per delay is required. The reduced blast charge of 85 kg can be implemented initially to achieve the overpressure level of 125 dBL at the Permanent Work Camp. Reduced blast charge of 85 kg can be increased if monitoring results indicate air overpressure level below 125 dBL at Permanent Work Camp.

5.2 Mitigation

The modelling results presented in Section 5.1 include a scenario with mitigation. In an adaptive management approach, mitigation measures presented in this section will be implemented as needed, and monitoring will help to confirm effectiveness. Mitigation will be achieved by blast design. The mitigation measures that apply to both the Gordon and MacLellan sites are summarized as follows:

- Highest blasting charge per hole that do not exceed 230 kg.
- Only one hole/delay will be fired in the blast.
- Minimum time delay between holes in blasts will not be less than 8 milliseconds (ms).
- The specific mitigation measures for the Permanent Work Camp within the MacLellan site are as follows:
    - Reduced blast charge of 85 kg can be increased if the distance between the blast and the Permanent Work Camp is more than 750 m.
    - The reduced blast charge of 85 kg can be increased if monitoring results indicate air overpressure level is below 125 dBL at the Permanent Work Camp.
    - Blasting will be scheduled during shift change (e.g., less worker sleeping and more local activities) to reduce potential annoyance at the Permanent Work Camp.

The specific mitigation measures for receptor ID 73, ID 76 and ID 77 near the Gordon site are as follows:

- The reduced blast charge of 43 kg can be increased if the distances between the blast and closest receptor ID 76, ID 73 and ID 77 are more than 1,420 m, 2125 m and 2,255 m, respectively (distance based on receptor location to pit boundary).
- The reduced blast charge of 43 kg can be increased if monitoring results indicate air overpressure level is below 120 dBL at ID 73, ID 76 and ID 77.
- Engagement with Marcel Colomb First Nation to discuss the potential of a seasonal mitigation approach, which relaxes the reduced blast charge of 43 kg during off-season period when trapping activities at receptors (ID 73, ID 76 and ID 77) is not expected.

6 Discussion

This Noise and Vibration Impact Assessment Update predicted the noise and vibration effects to the environment based on the Project 2023 design. Due to the design changes (see Section 1), the predicted results are different from the Stantec 2020 assessment results. Table 25 and Table 26 assessment update and the Stantec 2020 assessment for the construction and operation phase, respectively.

Table 25 Comparison of Predicted Results of Project Construction Phase

Mine Site	Receptor	L_d or L_d (dBA)			L_{dn} (dBA)			Change in %HA (%)		
		2020	Update	Changes	2020	Update	Change	2020	Update	Change
Gordon	ID77	30.7	33.8	+3.1	37.1	40.2	+3.1	2.2	3.3	1.1
MacLellan	ID85	35.5	37.7	+2.2	41.9	44.1	+2.2	3.7	4.4	0.7
	Work Camp	56.7	57.1	+0.4	63.1	63.5	+0.4	-[1]	-	-

Notes:

[1] "-": Not Applicable

dBA = A-weighted decibel sound level; %HA = percent highly annoyed

Table 26 Comparison of Predicted Results of Project Operation Phase

Mine Site	Receptor	L_d or L_d (dBA)			L_{dn} (dBA)			Change in %HA (%)		
		2020	Update	Changes	2020	Update	Change	2020	Update	Change
Gordon	ID76	38.5	39.9	+1.4	44.9	46.3	+1.4	4.8	5.5	+0.7
MacLellan	ID86	37.3	38.8	+1.5	43.7	45.2	+1.5	4.3	4.9	+0.6
	Work Camp	53.5	59.7	+6.2	59.9	66.1	+6.2	-[1]	-	-

Notes:

[1] "-": Not Applicable

dBA = A-weighted decibel sound level; %HA = percent highly annoyed

Table 27 compares that the highest vibration results between this assessment update and the Stantec 2020 assessment.

Table 27 Comparison of Vibration Results

Mine Site	Receptor	Ground-borne Vibration (mm/s)			Overpressure (dBL)		
		2020	Update	Changes	2020	Update	Changes
Gordon	ID76	3.1	3.4	+0.3	123	124	+1
MacLellan	ID86	1.4	1.6	+0.2	120	120	0
	Work Camp	7.4	8.9	+1.5	127	127	0

Notes:

mm/s = millimetres per second; dBL = linear (unweighted) decibel sound level

The Project 2023 design marginally increases both noise and vibration effects at some receptors in comparison to the Stantec 2020 assessment. This is because of the changes described in Section 1. However, the assessment update results indicate that the Project will remain compliant with the applicable noise and vibration thresholds (Section 4) at all receptors.

7 Conclusion

This Noise and Vibration Impact Assessment Update focused on the potential changes of the Project noise and vibration effects due to the updated Project 2023 design during the operation and construction phases. Key changes of the Project design include updates to the PDA, Project layouts, mining production quantities, major mine equipment, operation blast parameters. The noise and vibration models for the construction and operation phases of the Project were updated based on identical approach (i.e., receptor locations, regulatory framework, baseline conditions, and modelling method) to the Stantec 2020 assessment.

Noise effects such as community annoyance, sleep disturbance, and low frequency noise were assessed. The predicted noise level during the construction and operation phases on the selected 32 noise receptors were presented.

The operation phase vibration for the blast induced ground vibration and air blast overpressure effects were evaluated for same 32 noise receptors. Blast designs were recommended to avoid structural damage and reduce annoyance effects from blast induced ground vibrations and air blast overpressure.

Compared with the results in Stantec 2020, the noise and vibration effects of the Project activities marginally increased at some receptors. However, the updated results comply with the applicable noise and vibration thresholds during all Project phases. In conclusion, the Noise and Vibration Impact Assessment Update results do not change the characterization of residual effects or the significance ratings as presented in the EIS (Stantec 2020).

8 Limitations and Sign-off

This document entitled mem_ was prepared by Stantec Consulting Ltd. (“Stantec”) for the account of Alamos Gold Inc. (the “Client”) for regulatory submission. Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by Yong Ma, P.Eng. Digitally signed by Yong Ma, P.Eng. Date: 2025.02.24 12:25:39 -07'00'

(signature)

Yong Ma, P.Eng.

Reviewed by Chui, Jonathan Digitally signed by Chui, Jonathan

(signature)

Jonathan Chui, P.Eng.

Approval to transmit by Mathers, Karen Digitally signed by Mathers, Karen Date: 2025.04.08 18:14:09 -05'00'

(signature)

Karen Mathers, M.Sc., P.Geo. FGC, PMP

9 References

FSU 2023, Feasibility Study Update (FSU). NI 43-101 Technical Report for the Lynn Lake Project, Lynn Lake, Manitoba, Canada. August 22, 2023.

Stantec (Stantec Consulting Ltd.). 2020a. Lynn Lake Gold Project Environmental Impact Statement, Stantec Consulting Inc., May 2020.

Reference: Lynn Lake Gold Project – Noise and Vibration Impact Assessment Update

Attachment A Noise Emission Sources

Reference: Lynn Lake Gold Project – Noise and Vibration Impact Assessment Update

Table A.1 Equipment Sound Power Level Summary – Pre-Construction at Gordon Site

Source	Quantity	Sound Power Levels at Octave Band Center Frequencies for Each Unit (Hz) (dB re 1 pW)									Total dBA
		31.5	63	125	250	500	1000	2000	4000	8000	
Loading Equipment											
Material Loader PC1250LC-8 (6.7 m3)	2	117	120	121	112	104	105	101	99	95	111
Mine Support Equipment											
Graders - GD655-6	1	108	111	110	106	102	107	101	97	88	109
Tracked Dozer - D375A-6	1	117	120	121	112	104	105	101	99	95	111
Transfer Loader (WA600)	1	113	116	121	112	112	111	109	107	97	116
Snow Plow/Water Truck	1	101	106	106	106	106	104	100	98	99	109
Material Handler PC1250LC-8 (6.7 m3)	1	117	120	121	112	104	105	101	99	95	111
Hydraulic Excavators (PC490LC-11 whammer)	1	113	116	121	112	112	111	109	107	97	116
Road Maint Loader - WA500-8	1	114	117	112	106	107	105	102	97	89	110
Drills											
Drill (178 mm SmartROC D65)	1	112	115	121	113	115	111	108	103	100	117
Hauling Equipment											
Dump Trucks (20 t)	2	111	114	112	114	111	107	104	100	95	113
Articulated Trucks (HD605-8 69 t)	3	118	121	118	113	112	111	109	105	97	116
Mine General Equipment											
Pump Truck	1	113	116	112	103	101	103	100	96	88	107
Lube/Fuel Truck	1	109	111	119	108	101	103	98	92	83	108
Man Bus	2	95	109	106	103	102	101	92	90	85	104
Pickup Trucks	10	106	109	100	96	96	94	92	88	83	99
Welding Truck	1	106	109	100	96	96	94	92	88	83	99
Blasting Truck	1	106	109	100	96	96	94	92	88	83	99
Blasting Loader	1	106	109	100	96	96	94	92	88	83	99
Mechanics Truck	1	106	109	100	96	96	94	92	88	83	99
Diesel Cranes - 35T	1	91	94	93	86	85	83	80	71	62	88

Source	Quantity	Sound Power Levels at Octave Band Center Frequencies for Each Unit (Hz) (dB re 1 pW)									Total dBA
		31.5	63	125	250	500	1000	2000	4000	8000	
Tire Manipulator (980 WA5000-8)	1	98	101	93	91	91	90	87	86	77	95
Integrated Tool Carrier WA200-7 (wheel loader)	1	107	110	109	105	101	106	100	96	87	108
Compactor (BW211)	1	102	105	109	107	107	104	101	95	87	109
Lowboy and Tractor (75-100t)	1	117	120	121	112	104	105	101	99	95	111
ADT 40t	1	101	104	107	103	103	104	101	98	93	108
Light Plants	6	98	101	96	88	84	83	81	78	66	89

Note:

dB – linear sound level; dBA- A-weighted sound level

Table A.2 Equipment Sound Power Level Summary – Pre-Construction at MacLellan Site

Source	Quantity	Sound Power Levels at Octave Band Center Frequencies for Each Unit (Hz) (dB re 1 pW)									Total dBA
		31.5	63	125	250	500	1000	2000	4000	8000	
Loading Equipment											
WA900 Loader (11.5 m3)	1	114	117	112	106	107	105	102	97	89	110
Shovel (PC4000 22 m3)	1	113	116	121	112	112	111	109	107	97	116
Mine Support Equipment											
Graders - GD655-6	2	108	111	110	106	102	107	101	97	88	109
Tracked Dozer - D375A-6	5	117	120	121	112	104	105	101	99	95	111
Transfer Loader (WA600)	1	113	116	121	112	112	111	109	107	97	116
Snow Plow/Water Truck	3	101	106	106	106	106	104	100	98	99	109
Material Handler PC1250LC-8 (6.7 m3)	1	117	120	121	112	104	105	101	99	95	111
Hydraulic Excavators (PC490LC-11 whammer)	1	113	116	121	112	112	111	109	107	97	116
Road Maint Loader - WA500-8	1	114	117	112	106	107	105	102	97	89	110

Reference: Lynn Lake Gold Project – Noise and Vibration Impact Assessment Update

Source	Quantity	Sound Power Levels at Octave Band Center Frequencies for Each Unit (Hz) (dB re 1 pW)									Total dBA
		31.5	63	125	250	500	1000	2000	4000	8000	
Drills											
Drill (178 mm SmartROC D65)	1	112	115	121	113	115	111	108	103	100	117
Drill Rigs (178 mm PV275)	1	110	113	121	106	107	108	107	104	102	114
Hauling Equipment											
Dump Trucks (20 t)	3	111	114	112	114	111	107	104	100	95	113
Articulated Trucks (HD1500-150 t)	4	122	125	123	119	119	114	112	107	103	120
Mine General Equipment											
Pump Truck	1	113	116	112	103	101	103	100	96	88	107
Lube/Fuel Truck	1	109	111	119	108	101	103	98	92	83	108
Man Bus	2	95	109	106	103	102	101	92	90	85	104
Pickup Trucks	16	106	109	100	96	96	94	92	88	83	99
Welding Truck	1	106	109	100	96	96	94	92	88	83	99
Blasting Truck	1	106	109	100	96	96	94	92	88	83	99
Blasting Loader	1	106	109	100	96	96	94	92	88	83	99
Mechanics Truck	1	106	109	100	96	96	94	92	88	83	99
Diesel Cranes - 35T	1	91	94	93	86	85	83	80	71	62	88
Tire Manipulator (980 WA5000-8)	1	98	101	93	91	91	90	87	86	77	95
Integrated Tool Carrier WA200-7 (wheel loader)	1	107	110	109	105	101	106	100	96	87	108
Compactor (BW211)	1	102	105	109	107	107	104	101	95	87	109
Lowboy and Tractor (75-100t)	1	117	120	121	112	104	105	101	99	95	111
ADT 40t	2	101	104	107	103	103	104	101	98	93	108
Light Plants	8	98	101	96	88	84	83	81	78	66	89

Notes:

dB – linear sound level; dBA- A-weighted sound level

Reference: Lynn Lake Gold Project – Noise and Vibration Impact Assessment Update

Table A.3 Equipment Sound Power Level Summary – Operation, Processing Plant

Source	Quantity	Sound Levels at Octave Band Center Frequencies for Each Unit (Hz) (dB re 1 pW)									Total dBA
		31.5	63	125	250	500	1000	2000	4000	8000	
Primary Crusher Building											
Primary & Secondary Crusher Overhead Crane	1	96	99	90	88	85	83	78	70	61	88
Primary Crusher	1	115	115	115	111	109	106	104	100	91	112
Primary Crusher Transfer Conveyor	1	90	90	93	95	98	98	97	92	84	103
Apron Feeder	1	113	113	113	111	109	108	106	100	93	112
Vibrating Grizzly Screen	2	107	110	108	105	105	100	100	97	90	107
Rock Breaker	1	113	116	116	114	117	111	111	108	104	118
Secondary Screen Feed Conveyor	1	90	90	93	95	98	98	97	92	84	103
Pre-leach Thickener mechanism	1	81	81	84	86	89	89	88	83	75	93
Secondary Crusher Building											
Secondary Crusher Overhead Crane	1	96	99	90	88	85	83	78	70	61	88
Secondary Crusher	1	118	118	118	114	112	109	107	103	94	115
Fine Ore Stockpile Feed Conveyor	1	91	91	94	96	99	99	98	93	85	104
Secondary Crusher Bag House	1	104	107	100	100	97	97	92	90	89	101
Secondary Crusher Belt Feeder	1	107	107	107	105	103	102	100	94	87	107
Secondary Screen	1	104	107	105	102	102	97	97	94	87	104
Mill Building											
Cyclone Feed Pump Box	1	78	79	81	83	84	86	83	79	72	90
Cyclone Feed Pump	2	100	101	103	104	104	106	104	100	94	110
Grinding Area Pump	2	100	100	103	105	107	108	106	101	94	112
CIP Tailings Pump	2	97	98	100	102	104	105	103	98	91	109
CIP Area Sump Pump	1	80	81	82	84	85	87	85	81	74	91
Pre-leach Thickener Area Sum Pump	2	85	86	88	90	91	93	91	86	79	97

Reference: Lynn Lake Gold Project – Noise and Vibration Impact Assessment Update

Source	Quantity	Sound Levels at Octave Band Center Frequencies for Each Unit (Hz) (dB re 1 pW)									Total dBA
		31.5	63	125	250	500	1000	2000	4000	8000	
Pre-leach Thickener Underflow Pump	2	85	86	88	90	91	93	91	86	79	97
Flocculant Dosing Pump	1	86	87	89	91	92	94	92	87	80	98
Elution Area Sump Pump	2	89	90	92	94	95	97	95	90	83	101
Carbon Transfer Pump	2	82	83	84	86	87	89	87	83	76	93
Carbon Area Sump Pump	2	82	83	84	86	87	89	87	83	76	93
Process Building Overhead Crane	1	103	106	97	95	92	90	85	77	68	95
Cyclone Cluster	1	81	81	84	86	89	89	88	83	75	93
Pre-leach Sampler	2	81	81	84	86	89	89	88	83	75	93
Flocculant Mixing System	1	107	110	108	105	105	100	100	97	90	107
Carbon Safety Screen	1	104	107	105	102	102	97	97	94	87	104
Pebble Conveyor	2	75	75	78	80	83	83	82	77	69	88
Carbon Regen Exhaust Fan	1	85	85	91	92	91	89	88	82	80	94
Ball Mill	1	113	114	113	112	110	111	110	101	91	115
Sag Mill	1	110	111	110	109	107	108	108	99	89	113
Ball Hopper	2	107	110	103	103	100	100	95	93	92	104
Ball Kibble	2	107	110	103	103	100	100	95	93	92	104
Sag Mill Liner Handler	1	103	106	97	95	92	90	85	77	68	95
Carbon Regen Kilin Package	1	107	110	108	105	105	100	100	97	90	107
Trash Screen	1	99	102	100	97	97	92	92	89	82	99
Loaded Carbon Screen	1	99	102	100	97	97	92	92	89	82	99
Stripped Carbon Screen	1	107	110	108	105	105	100	100	97	90	107
CIP Intertank Screen	6	111	114	112	109	109	104	104	101	94	112
Carbon Fines Filter Press	1	107	110	108	105	105	100	100	97	90	107
Air Receiver	5	105	101	106	105	103	106	111	108	101	114
Air Dryer	2	100	96	101	100	98	101	106	103	96	109
Elution Circuit Package	1	94	94	97	99	102	102	101	96	88	107

Reference: Lynn Lake Gold Project – Noise and Vibration Impact Assessment Update

Source	Quantity	Sound Levels at Octave Band Center Frequencies for Each Unit (Hz) (dB re 1 pW)									Total dBA
		31.5	63	125	250	500	1000	2000	4000	8000	
Reagent Building											
Lime Distribution Pump	2	87	88	89	91	93	94	92	88	81	99
Lime Slaking System	1	95	96	98	100	102	103	101	97	89	107
Sodium Cyanide Dissolution System	1	95	96	98	100	102	103	101	97	89	107
Sodium Cyanide Dosing Pump	4	90	91	93	95	96	98	95	91	84	102
Tailings Pump	2	84	85	87	88	90	88	84	77	94	96
Regent Area Overhead Crane	6	101	102	104	106	108	109	107	102	95	113
Sambs Exhaust Fan	1	93	96	87	85	82	80	75	67	58	85
Copper Sulphate Transfer Pump	1	81	81	82	74	71	71	66	64	63	76
Copper Sulphate Dosing Pump	1	94	94	96	98	100	101	99	95	88	105
Tailings Sampler	1	94	94	96	98	100	101	99	95	88	105
Tailings Sum Pump	1	81	81	84	86	89	89	88	83	75	93
Process Plan Air Compressor	1	97	98	100	101	101	103	101	97	91	107
Oxygen Plant											
Oxygen Plant	1	105	101	106	105	103	106	111	108	101	115
Fine Ore Bin Building											
Fine Ore Bin	2	115	115	115	113	111	110	108	102	95	115
Fine Ore Reclaim Feeder	2	115	115	115	113	111	110	108	102	95	115
Fine Ore Bin Ven Fan	1	92	92	90	84	78	73	73	68	65	81
Sag Mill Conveyor	1	88	88	91	93	96	96	95	90	82	101
Quick Lime Screw Feder	1	113	113	113	111	109	108	106	100	93	112
Reclaim Area Baghouse	2	115	115	115	113	111	110	108	102	95	115
Gold Room (inside Main Building)											
Electrowinning Cell	2	98	98	96	90	84	79	79	74	71	88
Electrowinning Hoist	1	93	96	87	85	82	80	75	67	58	85
Extraction Fan	2	99	99	97	91	85	80	80	75	72	89
Electrowinning Sludge Pump	1	82	83	84	86	86	89	86	82	76	93
Electrowinning Sludge Filer	1	77	78	79	81	81	84	81	77	71	88

Reference: Lynn Lake Gold Project – Noise and Vibration Impact Assessment Update

Source	Quantity	Sound Levels at Octave Band Center Frequencies for Each Unit (Hz) (dB re 1 pW)									Total dBA
		31.5	63	125	250	500	1000	2000	4000	8000	
Electrowinning Cell Rectifier	2	98	98	96	90	84	79	79	74	71	88
Induction Furnace Dust Collector	1	104	107	100	100	97	97	92	90	89	101
Outdoor Service Equipment											
Diesel Feed Pump	2	84	85	86	88	90	91	89	85	78	96
Diesel Station	2	79	80	81	83	84	86	84	80	73	90
Gasoline Feed Pump	1	84	85	86	88	90	91	89	85	78	96
Gasoline Pump	1	84	85	86	88	90	91	89	85	78	96
Freshwater Pump	2	94	94	96	98	100	101	99	95	88	105
Potable Water Feed Pump	1	82	83	84	86	88	89	87	83	76	93
Potable Water Feed Plant (enclosed)	1	77	78	79	81	82	84	82	77	71	88
Firewater Pump (enclosed)	4	71	72	74	76	77	79	77	72	65	83
Quick Lime Vent	1	85	85	91	92	91	89	88	82	80	94
Air Compressor	1	82	78	83	82	80	83	88	85	78	91
Freshwater Pump (enclosed)	2	76	76	78	80	82	83	81	77	70	87
Freshwater Pump	1	94	94	96	98	100	101	99	95	88	105
Potable Water Pump	1	82	83	84	86	88	89	87	83	76	93
Air Compressor (inside truck shop)	1	82	78	83	82	80	83	88	85	78	91
Process Plan Mobile Equipment											
Single Cab 4WD Pickup	6	106	109	100	96	96	94	92	88	83	99
Twin Cab 4WD Hiab Truck	1	106	109	100	96	96	94	92	88	83	99
Bus	1	95	109	106	103	102	101	92	90	85	104
Fire Trailer	1	109	111	119	108	101	103	98	92	83	108
All Terrain Crane	1	103	106	97	95	92	90	85	77	68	95
Crane	1	105	108	107	101	102	101	101	92	83	106
Plant Forklift	2	100	103	94	92	89	87	82	74	65	92
Warehouse Forklift	1	100	103	94	92	89	87	82	74	65	92
Front-End Loader	1	113	116	121	112	112	111	109	107	97	116
Skid-Steer Loader (Bobcat)	1	114	117	112	107	108	103	100	94	87	109

Source	Quantity	Sound Levels at Octave Band Center Frequencies for Each Unit (Hz) (dB re 1 pW)									Total dBA
		31.5	63	125	250	500	1000	2000	4000	8000	
Tip Truck	2	109	111	119	108	101	103	98	92	83	108
Telescopic Handler	1	100	103	94	92	89	87	82	74	65	92
Boom/Scissor Lift	2	100	103	94	92	89	87	82	74	65	92
Fusion Butt Welder	1	92	95	96	97	96	97	94	89	84	101
Portable Compressor	1	106	109	110	95	100	99	102	101	94	107
Diesel Welder	2	92	95	96	97	96	97	94	89	84	101
Portable Pumps Generator	1	103	106	99	94	90	87	83	84	77	93
Gravel truck	2	109	111	119	108	101	103	98	92	83	108
Water Truck	1	101	106	106	106	106	104	100	98	99	109
Potable water Trailers	4	101	106	106	106	106	104	100	98	99	109
Franna Crane	1	102	105	96	94	91	89	84	76	67	94
Yard Crane – Hydraulic	1	102	105	96	94	91	89	84	76	67	94
Pick-n Carry Mobile Crane	1	102	105	96	94	91	89	84	76	67	94
Backhoe	1	114	117	112	106	107	105	102	97	89	110
Forklift/Telescopic Handler	1	102	105	96	94	91	89	84	76	67	94

Notes:

dB – linear sound level; dBA- A-weighted sound level

Table A.4 Equipment Sound Power Level Summary – Operation

Source	Quantity	Sound Levels at Octave Band Center Frequencies for Each Unit (Hz) (dB re 1 pW)									Total dBA
		31.5	63	125	250	500	1000	2000	4000	8000	
Primary Equipment – Gordon Site											
Material Loader PC1250LC-8 (6.7 m^3)	4	117	120	121	112	104	105	101	99	95	111
Ore Haul Truck (HD605-8, 69 t)	15	118	121	118	113	112	111	109	105	97	116
Hydraulic Excavators (PC490LC-11 whammer)	1	113	116	121	112	112	111	109	107	97	116
Tracked Dozer D375A	2	117	120	121	112	104	105	101	99	95	111
Articulated Truck (69t)	2	118	121	118	113	112	111	109	105	97	116

Reference: Lynn Lake Gold Project – Noise and Vibration Impact Assessment Update

Source	Quantity	Sound Levels at Octave Band Center Frequencies for Each Unit (Hz) (dB re 1 pW)									Total dBA
		31.5	63	125	250	500	1000	2000	4000	8000	
Drill (178 mm SmartROC D65)	3	112	115	121	114	117	113	112	107	106	119
Blaster Loader	1	106	109	100	96	96	94	92	88	83	99
Blaster Truck	1	106	109	100	96	96	94	92	88	83	99
Dump Truck (20 t)	2	111	114	112	114	111	107	104	100	95	113
Maintenance and Other General Equipment – Gordon Site											
Pump Truck	1	113	116	112	103	101	103	100	96	88	107
Lube/Fuel Truck	1	109	111	119	108	101	103	98	92	83	108
Man Bus	2	95	109	106	103	102	101	92	90	85	104
Pickup Trucks	10	106	109	100	96	96	94	92	88	83	99
Welding Truck	1	106	109	100	96	96	94	92	88	83	99
Mechanics Truck	1	106	109	100	96	96	94	92	88	83	99
Snow Plow/Water Truck	2	101	106	106	106	106	104	100	98	99	109
Diesel Cranes - 35T	1	91	94	93	86	85	83	80	71	62	88
Tire Manipulator (980 WA5000-8)	1	98	101	93	91	91	90	87	86	77	95
Integrated Tool Carrier WA200-7 (wheel loader)	1	107	110	109	105	101	106	100	96	87	108
Compactor (BW211)	1	102	105	109	107	107	104	101	95	87	109
Lowboy and Tractor (75-100t)	1	117	120	121	112	104	105	101	99	95	111
Light Plants	8	98	101	96	88	84	83	81	78	66	89
Road Maint Loader - WA500-8	1	114	117	112	106	107	105	102	97	89	110
ADT 40t	2	101	104	107	103	103	104	101	98	93	108
Primary Equipment – MacLellan Site											
Shovel (PC4000 22 m3)	2	113	116	121	112	112	111	109	107	97	116
Transfer Loader (WA900-3)	1	114	117	112	106	107	105	102	97	89	110
Ore Haul Truck (150 t)	17	122	125	123	119	119	114	112	107	103	120
Graders - GD655-6	2	108	111	110	106	102	107	101	97	88	109
Hydraulic Excavators (PC490LC-11 whammer)	1	113	116	121	112	112	111	109	107	97	116

Reference: Lynn Lake Gold Project – Noise and Vibration Impact Assessment Update

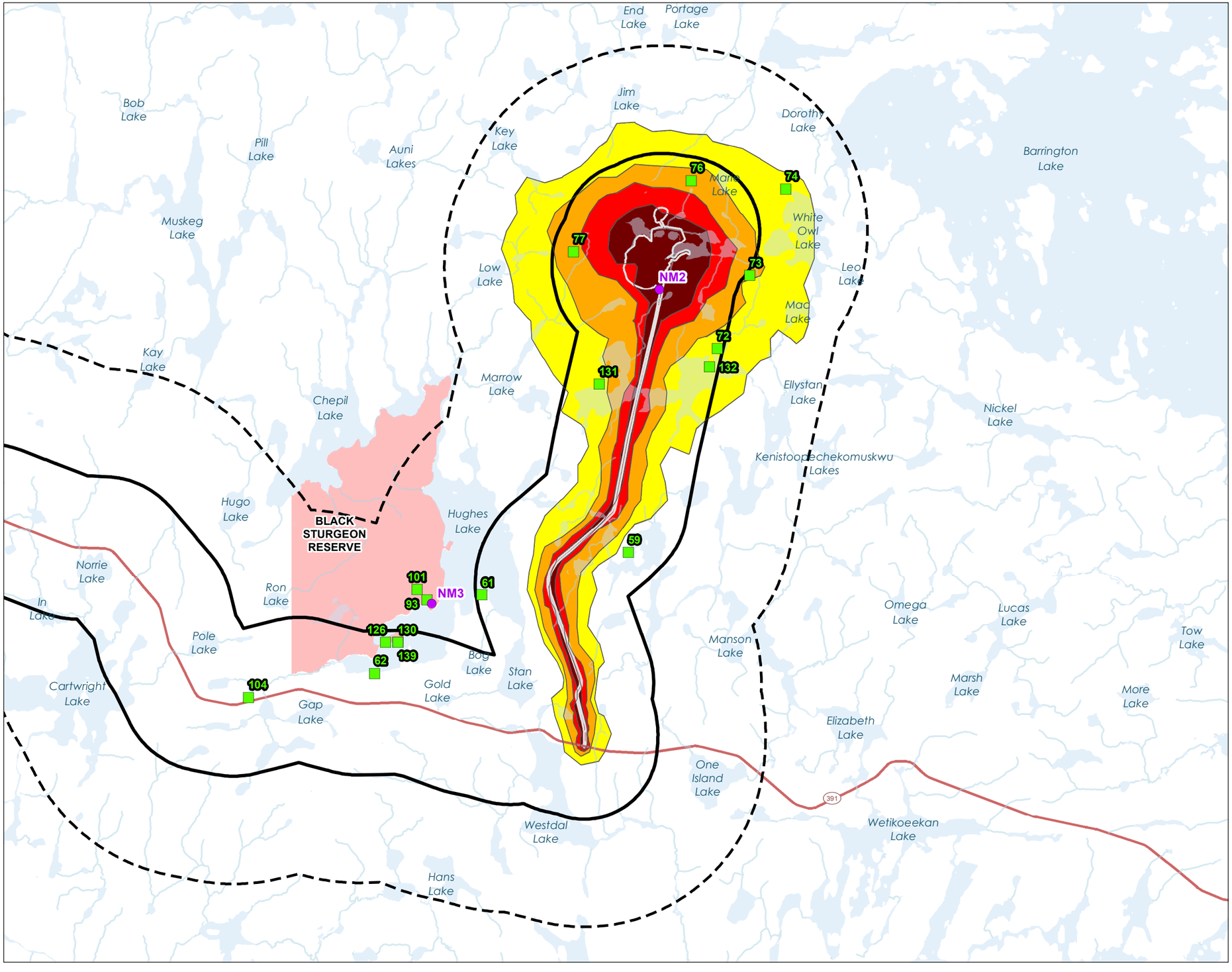
Source	Quantity	Sound Levels at Octave Band Center Frequencies for Each Unit (Hz) (dB re 1 pW)									Total dBA
		31.5	63	125	250	500	1000	2000	4000	8000	
Tracked Dozer D375A	5	117	120	121	112	104	105	101	99	95	111
WA900 Loader (11.5 m3	1	114	117	112	106	107	105	102	97	89	110
Drill Rigs (178 mm PV275)	4	113	116	122	115	118	114	113	108	107	120
Drill (178 mm SmartROC D65)	1	112	115	121	114	117	113	112	107	106	119
Blaster Loader	1	106	109	100	96	96	94	92	88	83	99
Blaster Truck	1	106	109	100	96	96	94	92	88	83	99
Maintenance and Other General Equipment – MacLellan Site											
Pump Truck	1	113	116	112	103	101	103	100	96	88	107
Lube/Fuel Truck	1	109	111	119	108	101	103	98	92	83	108
Man Bus	2	95	109	106	103	102	101	92	90	85	104
Pickup Trucks	16	106	109	100	96	96	94	92	88	83	99
Welding Truck	1	106	109	100	96	96	94	92	88	83	99
Mechanics Truck	1	106	109	100	96	96	94	92	88	83	99
Snow Plow/Water Truck	3	101	106	106	106	106	104	100	98	99	109
Diesel Cranes - 35T	1	91	94	93	86	85	83	80	71	62	88
Tire Manipulator (980 WA5000-8)	1	98	101	93	91	91	90	87	86	77	95
Integrated Tool Carrier WA200-7 (wheel loader)	1	107	110	109	105	101	106	100	96	87	108
Compactor (BW211)	1	102	105	109	107	107	104	101	95	87	109
Lowboy and Tractor (75-100t)	1	117	120	121	112	104	105	101	99	95	111
Light Plants	8	98	101	96	88	84	83	81	78	66	89
Road Maint Loader - WA500-8	1	114	117	112	106	107	105	102	97	89	110
ADT 40t	2	101	104	107	103	103	104	101	98	93	108

Note:

dB – linear sound level; dBA- A-weighted sound level

Reference: Lynn Lake Gold Project – Noise and Vibration Impact Assessment Update

Attachment B Figures



Stantec

Study Area

- Project Development Area at Mine Site
- Noise and Vibration Local Assessment Area (LAA)
- Noise and Vibration Regional Assessment Area (RAA)

Locations

- Noise Monitoring Location
- Receptor Location

Noise Level (dBA)

- >40 dBA
- >35 dBA
- >30 dBA
- >25 dBA

Landbase

- Highway
- Watercourse
- Waterbody
- First Nation Reserve

N

0 2 4 Kilometres

(At original document size of 11x17)
1:110,000

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 2024-09-03
Technical Review by YMa on 2024-09-03

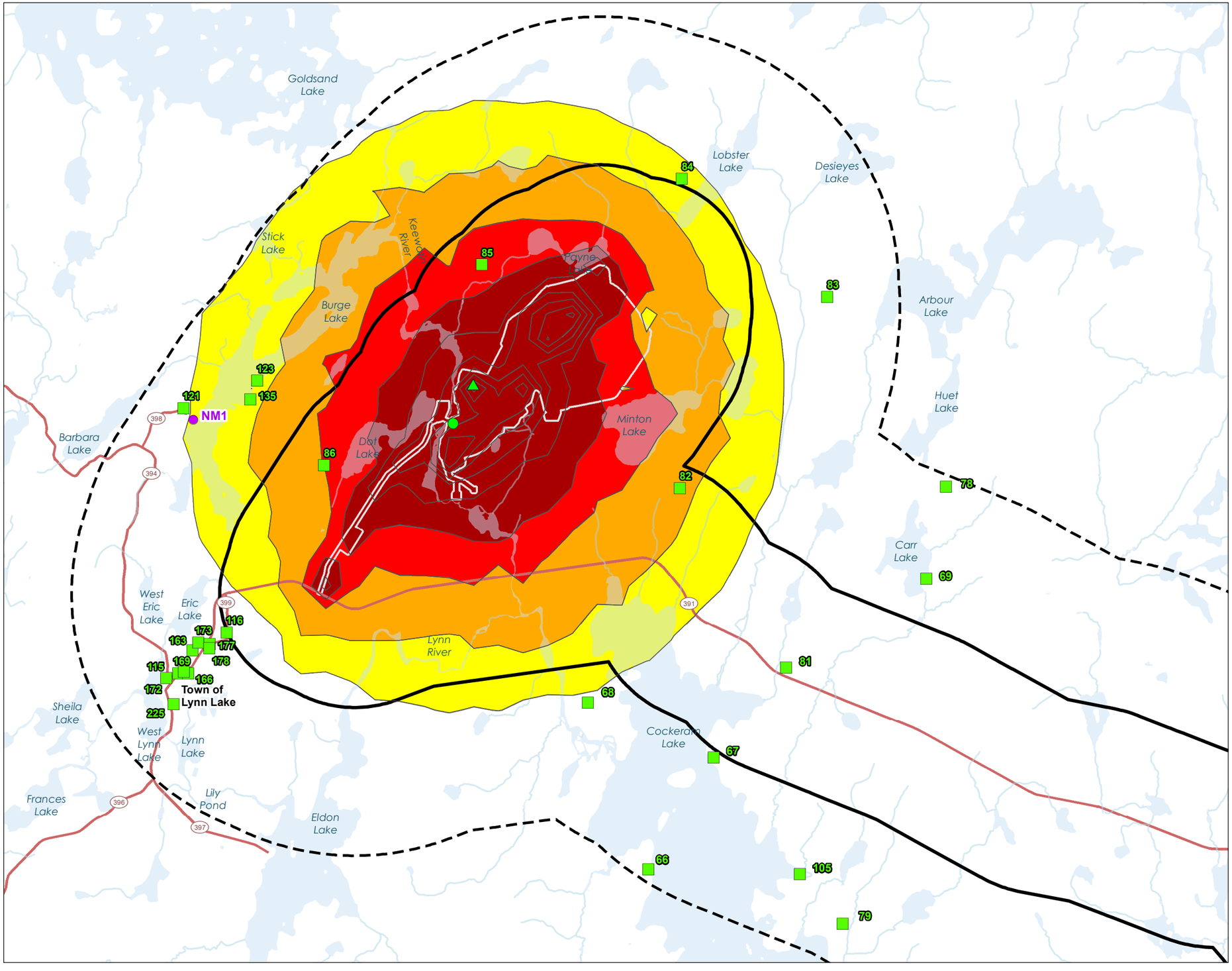
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
1

Title
Construction Phase Noise Contours - Gordon Site

G:_GIS_Project Folder\111473008_LLGP_EA\figures\Chi_Atmospheric Environment\TKR Report Nosa 2024 updates\Map1_NOISE ConstructionPhase_Gordon_2024093.mxd Revised: 2024-09-03 By: ACampigotto



Stantec

Study Area

- Project Development Area at Mine
- Noise and Vibration Local Assessment Area (LAA)
- Noise and Vibration Regional Assessment Area (RAA)

Locations

- Noise Monitoring Location
- Receptor Location
- Future Worker Camp
- Temporary Worker Camp

Noise Level (dBA)

- >40 dBA
- >35 dBA
- >30 dBA
- >25 dBA

Landbase

- Highway
- Watercourse
- Waterbody

N

0 1.5 3 Kilometres

(At original document size of 11x17)
1:80,000

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 2025-02-24
Technical Review by YMa on 2025-02-24

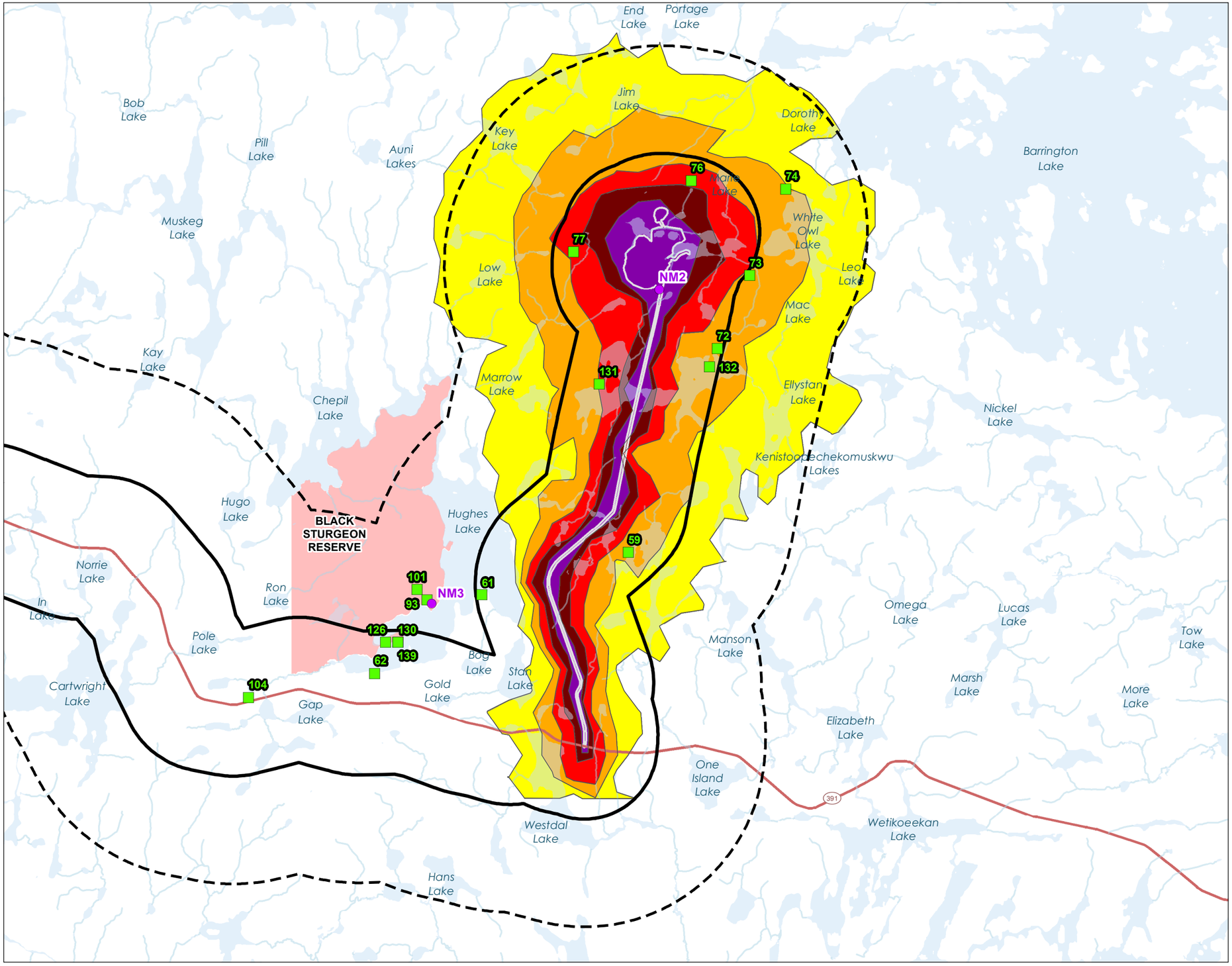
Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
2

Title
Construction Phase Noise Contours - MacLellan Site

G:_GIS_Project_Folder\111473008_LGP_EA\Figures\Ch4_Atmospheric_Environment\NWR Report Notes\2024 updates\Map2_NOISE_ConstructionPhase_MacLellan_20250224.mxd Revised: 2025-02-24 By: ACampigotto



Stantec

Study Area

- Project Development Area at Mine
- Noise and Vibration Local Assessment Area (LAA)
- Noise and Vibration Regional Assessment Area (RAA)

Locations

- Noise Monitoring Location
- Receptor Location

Noise Level (dBA)

- >45 dBA
- >40 dBA
- >35 dBA
- >30 dBA
- >25 dBA

Landbase

- Highway
- Watercourse
- Waterbody
- First Nation Reserve

N

0 2 4 Kilometres

(At original document size of 11x17)
1:110,000

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 2024-09-03
Technical Review by YMa on 2024-09-03

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
3

Title
Operation Phase Noise Contours - Gordon Site

G:_GIS_Project Folder\111473008_LLGP_EA\figures\Ch6_Atmospheric Environment\TKR Report Notes\2024 updates\Map3 NOISE Operation\Phase_Gordon_20240903.mxd Revised: 2024-09-06 By: ACampigotto

Goldsand Lake
Lobster Lake
Desieyes Lake
Stick Lake
Keewatin Rapids
Payne Lake
Burge Lake
Arbour Lake
Huet Lake
Minton Lake
Barbara Lake
Dot Lake
Carr Lake
West Eric Lake
Eric Lake
Lynn River
Sheila Lake
West Lynn Lake
Lynn Lake
Cockeram Lake
Frances Lake
Lily Pond
Eldon Lake
398
394
399
391
396
397
NM1
84
85
83
123
121
135
86
82
78
116
173
163
177
178
169
115
166
172
225
Town of Lynn Lake
81
68
67
69
66
105
79

Stantec

Study Area
- Project Development Area at Mine
- Noise and Vibration Local Assessment Area (LAA)
- Noise and Vibration Regional Assessment Area (RAA)

Locations
- Noise Monitoring Location
- Receptor Location
- Future Worker Camp
- Temporary Worker Camp

Noise Level (dBA)
- >45 dBA
- >40 dBA
- >35 dBA
- >30 dBA
- >25 dBA

Landbase
- Highway
- Watercourse
- Waterbody

N

0 1.5 3 Kilometres
(At original document size of 11x17)
1:80,000

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 2025-02-24
Technical Review by YMa on 2025-02-24

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473076

Map No.
4

Title
Operation Phase Noise Contours - MacLellan Site

G:_GIS_Project_Folder\111473076_LGGP_EA\figures\Chs_Atmospheric_Environment\TkR Report Noise\2024_updates\Maps4_NOISE_OperationPhase_MacLellan_20250224.mxd Revised: 2025-02-24 By: ACampigotto

Appendix E Groundwater MacLellan Site – Groundwater Model Report

MacLellan Site – Groundwater Model Report

Lynn Lake Gold Project

December 4, 2024

Prepared for:
Alamos Gold Inc.

Prepared by:
Stantec Consulting Ltd.

Project Number:
111473076

Stantec

Limitations and Sign-off

The conclusions in the Report titled MacLellan Site – Groundwater Model Report are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

Stantec has assumed all information received from Alamos Gold Inc. (the "Client") and third parties in the preparation of the Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

This Report is intended solely for use by the Client in accordance with Stantec's contract with the Client. While the Report may be provided to applicable authorities having jurisdiction and others for whom the Client is responsible, Stantec does not warrant the services to any third party. The report may not be relied upon by any other party without the express written consent of Stantec, which may be withheld at Stantec's discretion.

Prepared by: Greaser, Kelly — Digitally signed by Greaser, Kelly Date: 2025.04.07 08:56:04 -06'00'
Signature

Kelly Greaser, Ph.D.
Printed Name

Reviewed by: Okeson, Seth — Digitally signed by Okeson, Seth Date: 2025.04.07 09:38:59 -06'00'
Signature

Seth Okeson, M.E.
Printed Name

Approved by: PROVINCE OF MANITOBA — M.J. FRASER — Member 38498G — REGISTERED PROFESSIONAL GEOSCIENTIST — Digitally signed by Fraser, Michelle Date: 2025.04.07 06:06:48 -04'00'
Signature

Michelle Fraser, M.Sc., P.Geo
Printed Name

Table of Contents

Limitations and Sign-off ..... **i**
Acronyms / Abbreviations ..... **v**
1 Introduction **1**
2 Site Setting **2**
2.1 Historical Mining Operations 2
2.2 Climate 2
2.3 Physiography and Topography 3
2.4 Surface Water Features 3
2.5 Regional Geology 4
2.5.1 Overburden Geology 4
2.5.2 Bedrock Geology 5
2.6 Hydrostratigraphy 5
2.6.1 Historical Mine Rock 6
2.6.2 Organics and Fill 6
2.6.3 Glaciolacustrine 6
2.6.4 Sand Diamicton 7
2.6.5 Bedrock 7
2.6.6 Ground Water Flow and Water Levels 10
3 Description of Numerical Model **12**
3.1 Model Code 12
3.2 Model Domain and Grid Discretization 13
3.3 Boundary Conditions 15
3.3.1 No Flow Boundaries 15
3.3.2 Stream Flow Routing 15
3.3.3 General Head Boundary 17
3.3.4 River Boundary 17
3.3.5 Recharge 18
3.4 Hydrogeologic Properties 18
3.4.1 Hydraulic Conductivity 18
3.4.2 Specific Storage and Specific Yield 18
4 Model Calibration **19**
4.1 Steady-State Model Calibration 19
4.1.1 Steady-State Model Observation Targets 19
4.1.2 Statistical Methods to Evaluate the Steady-State Model Calibration 21
4.1.3 Results of Steady-State Calibration 23
4.1.4 Calibrated Hydrogeologic Properties 26
4.1.5 Calibrated Recharge 27
4.1.6 Calibrated Hydraulic Conductivity for Boundary Conditions 27
4.2 Transient Model Calibration 28
4.2.1 Transient Model from 2015 through 2022 28
4.3 Assessment of Model Calibration 28
4.4 Calibrated Model Sensitivity Analysis 29
4.4.1 Hydraulic Conductivity of Hydrostratigraphic Units 29
4.4.2 Hydraulic Conductivity of Lakebed, Riverbed, and Streambed Material 31

4.4.3 Recharge 32
5 Model Applications 35
5.1 Baseline conditions 35
5.1.1 Model Setup: Baseline 35
5.1.2 Model Results: Baseline 35
5.2 Construction 37
5.2.1 Model Setup: Construction 38
5.2.2 Model Results: Construction 39
5.3 Operations 43
5.3.1 Model Setup: Operations 43
5.3.2 Model Results: Operations 45
5.4 Closure 49
5.4.1 Model Setup: Closure 49
5.4.2 Model Results: Closure 51
5.5 Predictive Sensitivity Analyses 56
5.5.1 Hydraulic Conductivity of Hydrostratigraphic Units 56
5.5.2 Hydraulic Conductivity of Lakebed, Riverbed, And Streambed Material 59
5.5.3 Recharge 61
5.5.4 Specific Yield and Specific Storage 63
5.6 Comparison of Model Results to the EIS 67
6 Prediction Confidence 70
7 Conclusions 71
8 References 72

List of Tables

Table 2.1 Climate Normal (1981 to 2010) Statistics at Lynn Lake Airport 3
Table 4.1 Steady State Model Hydraulic Head Calibration Targets and Residuals 19
Table 4.2 Steady State Calibration Statistics 25
Table 4.3 Baseflow at Keewatin River and Lynn River for the Steady State Calibrated Model 25
Table 4.4 Calibrated Hydrogeologic Properties 26
Table 4.5 Calibration Statistics for the Sensitivity Analyses for Hydraulic Conductivity of Hydrostratigraphic Units 31
Table 4.6 Calibration Statistics for the Sensitivity Analyses for Hydraulic Conductivity of Lakebed, Riverbed, and Streambed Materials 32
Table 4.7 Calibration Statistics for the Sensitivity Analyses for Recharge 34
Table 5.1 Predicted Groundwater Discharge to Lakes and Baseflow in Rivers under Baseline Conditions 36
Table 5.2 Predicted Seepage from Historical Mine Rock Storage Areas, Baseline Conditions 37
Table 5.3 Predicted Groundwater Discharge to Lakes and Baseflow in Rivers at End of Construction 41
Table 5.4 Predicted Discharge Rates and Travel Time from Mine Infrastructure to Receiving Environment at the End of Construction 43
Table 5.5 Predicted Groundwater Discharge to Lakes and Baseflow in Rivers at End of Operations 46

Table 5.6 Predicted Discharge Rates and Travel Time from Mine Infrastructure to Receiving Environment at the End of Operations 48
Table 5.7 Predicted Groundwater Discharge to Lakes and Baseflow in Rivers at End of Closure 53
Table 5.8 Predicted Discharge Rates and Travel Time from Mine Infrastructure to Receiving Environment at Closure 55
Table 5.9 Sensitivity Analysis Summary: Varying Hydraulic Conductivity (K) of Hydrostratigraphic Units 57
Table 5.10 Sensitivity Analysis Summary: Varying Riverbed, Lakebed, and Streambed Hydraulic Conductivity 60
Table 5.11 Sensitivity Analysis Summary: Varying Recharge 62
Table 5.12 Sensitivity Analysis Summary: Varying Specific Yield (Sy) and Specific Storage (S) 64
Table 5.13 MacLellan Site Feature Footprint Layout Changes 67

List of Figures

Figure 2-1 Hydraulic Conductivity and RQD Distribution in Bedrock with Depth 9
Figure 3-1 Model Layers and Hydrostratigraphy 14
Figure 4-1 Steady State Calibration Targets and Weighted Residuals 24
Figure 4-2 Calibrated Model Sensitivity Analysis - Hydraulic Conductivity of Hydrostratigraphic Units 30
Figure 4-3 Calibrated Model Sensitivity Analyses – Recharge 33
Figure 5-1 Predicted Groundwater Inflow to Open Pit and Satellite Pit During Construction and Operation 40
Figure 5-2 Predicted Net Predicted Open Pit and Satellite Pit Groundwater Inflow and Stage in Closure 52
Figure 5-3 Sensitivity of Predicted Open Pit and Satellite Pit Groundwater Inflow and Stage to Specific Storage and Specific Yield – End of Closure 66

List of Appendices

Appendix A Maps
Map 1 Location of the Proposed MacLellan and Gordon Mine Sites in Northwestern Manitoba
Map 2 Historical Project Infrastructure
Map 3 Site Plan
Map 4 Topography of Study Area and Monitoring Well Locations
Map 5 Reaches of Waterbodies and Watercourses
Map 6 Surficial Geology
Map 7 Bedrock Geology
Map 8 Cross-Section A-A'
Map 9 Cross-Section B-B'
Map 10 Cross-Section C-C'
Map 11 Model Domain and Boundary Conditions
Map 12 Location of Water Level and Baseflow Calibration Targets
Map 13 Spatial Distribution of Weighted Residual Errors in the Model
Map 14 Simulated Baseline Water Table Elevation Contours

Map 15 Simulated Baseline Particle Tracks
Map 16 Predicted Water Table Elevation Contours at End of Construction
Map 17 Predicted Water Table Drawdown at End of Construction
Map 18 Predicted Particle Traces from MRSA and TMF to the Receiving Environment at End of Construction
Map 19 Predicted Water Table Elevation Contours at End of Operation
Map 20 Predicted Water Table Drawdown at End of Operation
Map 21 Predicted Particle Traces from MRSA, TMF, and OSA to the Receiving Environment at End of Operation
Map 22 Predicted Water Table Elevation Contours at End of Closure
Map 23 Predicted Water Table Drawdown at End of Closure
Map 24 Predicted Particle Traces from MRSA and TMF to the Receiving Environment at End of Closure

Appendix B Monitoring Well Construction Details and Hydrographs

Appendix C Transient Calibration Hydrographs

Acronyms / Abbreviations

Alamos	Alamos Gold Inc.
amsl	above mean sea level
bgs	below ground surface
EIS	environmental impact statement
EPM	equivalent porous media
GHB	General head boundary
GMR	Groundwater Model Report
IAAC	Impact Assessment Agency of Canada
LAK3	Lake boundary
MAE	mean absolute error
MRSA	mine rock storage area
NSZ fault	North Shear Zone fault
OSA	future ore storage area
RMS	root mean squared
RQD	rock quality designation
SFR	Stream Flow Routing
TMF	tailings management facility
the Project	Lynn Lake Gold Project

1 Introduction

As part of the Lynn Lake Gold Project (the Project), Alamos Gold Inc. (Alamos) plans to operate the MacLellan Gold Mine (hereinafter referred to as the 'MacLellan site') 8 km northeast of the Town of Lynn Lake in northern Manitoba (Map 1). Alamos is seeking approval to proceed with alterations to the MacLellan site as approved under *Environment Act* License No. 3390 and the conditions stipulated therein (March 6, 2023) and a Decision Statement issued under the *Canadian Environmental Assessment Act, 2012* as documented by the Impact Assessment Agency of Canada (IAAC), dated March 5, 2023. The proposed alterations to the MacLellan site include modifications to the sumps, collection pond, mine rock storage area (MRSA), non-acid generating stockpile, tailings management facility (TMF) pond, overburden storage area, topsoil stockpile, camp, OEM platform, sewage treatment plant, temporary crushing area, future long term ore storage area (OSA), explosives mixing plant, process plant, and open pit. The proposed alterations also include the addition of a satellite pit, construction laydown areas, and detailed freshwater intake lines and effluent locations. The proposed mine plan is documented in the Feasibility Study Update (Alamos 2023).

This updated Groundwater Modeling Report (GMR) for the MacLellan site has been prepared to assess the potential effects of the construction, operation, and closure phases of the Project on groundwater resources and the consequent indirect effects on surface water resources at the MacLellan site. The GMR considers the MacLellan site components of the Project, baseline data collected for the Project since 2015, and comments received from agencies, Indigenous Nations, and other stakeholders.

To evaluate the effects of the Project (including proposed alterations to the MacLellan site) on groundwater quality and quantity, a three-dimensional groundwater flow model has been developed for the MacLellan site to provide estimates of:

- Changes in groundwater levels (drawdown), including changes to water table elevation and groundwater flow directions, due to dewatering of the open pit and satellite pit.
- The groundwater inflow rate to the open pit and satellite pit over time for use as an input to the water balance modelling conducted for the Project.
- Baseflow in, and/or groundwater discharge to, rivers, creeks and lakes during baseline, operation, and closure.
- Groundwater recharge and flow pathways from historical mine rock piles, ore storage area, tailings management facility (TMF), and mine rock storage area (MRSA) developed for the Project during operation and closure.

The groundwater flow model encompasses the groundwater Local Assessment Area and Regional Assessment Area as defined in the Environmental Impact Statement (EIS) for the Project (2020) (Stantec 2020a), referred to herein as the study area.

This GMR forms part of the supporting documentation for the MacLellan Mine Plan Amendment Notice of Alteration / Notice of Change completed for the Project.

2 Site Setting

This section provides an overview of the existing conditions that were used as background for the MacLellan site hydrogeology model development. More detailed information is presented in the following reports:

- Hydrogeology Baseline Technical Data Report (Stantec 2017c)
- Hydrology Baseline Technical Data Report (Stantec 2017b)
- Hydrogeology Technical Data Report: Validation Report (Stantec 2020b)
- Hydrology Baseline Technical Data Report: Validation Report (Stantec 2020c)

2.1 Historical Mining Operations

Historical mining operations in the study area consisted of the development of an underground mine to a depth of 448 meters (m) with five operating levels (Map 2) and an MRSA. The following is a summary of the historical mining operations described by Tetra Tech (2013).

The underground mine was active between 1986 and 1989 and produced 144,000 oz of gold and 432,000 oz of silver with a production rate of approximately 900 to 1,200 tons per day (tpd). The shaft was first sunk in 1969 and extended to a depth of 149 m, which was then deepened to 259 m between 1980 and 1985. In 1986, the shaft was deepened to 448 m and production commenced. Ramp access from surface extends to 420 m.

The mine operated under a license that allowed for the discharge of mine water and sewage-plant effluent into polishing ponds and a marshy area adjacent to the Keewatin River. Mining continued to 1989 when production ceased due to high operating costs and falling gold prices. From 1989 to 2000, additional drilling, trenching over crown pillar, geological mapping, and channel sampling was completed. In 2000, the mine was allowed to flood. The site has been in a state of ‘care and maintenance’ since 1989 with very little reclamation. Existing historical mine infrastructure includes the head frame, hoist house, maintenance building, core shack, and a historical MRSA. The historical MRSA shown on Map 2 contains surplus mine rock from historical mining operations at the MacLellan site. The proposed open pit and satellite pit will be located in the area of the majority of the historical mining operations (Map 3).

2.2 Climate

The climate and meteorology of the MacLellan site are detailed in the Climate and Meteorology Baseline Technical Data Report (Stantec 2017a). The Lynn Lake area has a climate typical of Northern Manitoba. The nearest permanent weather monitoring stations are Environment and Climate Change Canada stations 5061645 and 5061649, located at the Lynn Lake Airport. The climate normal (1981 to 2010) average temperature, precipitation, total rainfall, and total snowfall statistics for the Lynn Lake Airport are summarized in Table 2.1. The climate normals for the period 1991 to 2020 are similar to the values presented in Table 2.1.

Table 2.1 Climate Normal (1981 to 2010) Statistics at Lynn Lake Airport

Month	Average Temperature (°C)	Average Total Precipitation (mm)	Average Total Rainfall (mm)	Average Total Snowfall (cm)
January	-24	20	0.2	28
February	-20	16	0.1	24
March	-13	20	1.4	25
April	-3.1	24	4.5	24
May	5.6	37	27	10
June	13	62	61	1.3
July	16	85	85	0.1
August	15	69	69	0.1
September	7.7	61	57	3.5
October	-0.6	38	12	31
November	-13	27	0.8	36
December	-21	19	0.1	26
Annual	-3.2	478	318	208

The average monthly temperature is normally above freezing from May to September. The annual total precipitation for the region is 478 mm using the 1981 to 2010 climate normal, with 34% occurring as snow and 66% as rain. July typically receives the most monthly precipitation and February the least.

2.3 Physiography and Topography

The MacLellan site is surrounded by vegetated land, forest cover, scattered lakes, watercourses, and wetlands and is located within areas of discontinuous permafrost cover.

Regional topography around the MacLellan site slopes from a high of 375 m above mean sea level (amsl) in the west and northwest to a low of 325 m amsl in the southeast (Map 4). The ground surface is characterized as hummocky with steeply sloping rocky ridges that may extend 30 m to 60 m above lakes and peat-filled depressions. Surface water features and peat deposits generally occupy the topographic lows.

2.4 Surface Water Features

The MacLellan site is located within the Granville Lake River Watershed. The Lower Keewatin River, Lower Lynn River, and Cockeram Lake sub watersheds control drainage in the site. The Keewatin River, Lynn River, Goldsand Lake, and Cockeram Lake are some of the largest waterbodies in the Lower Keewatin River, Lower Lynn River, and Cockeram Lake sub watersheds. Drainage within the site is generally to the south into the Keewatin River and southeast through Cockeram Lake and Sickle Lake before discharging

into Granville Lake on the Churchill River, upstream of Southern Indian Lake. The sub watershed on the west side of the site flows towards the Keewatin River which ultimately converges with the Lynn River before entering Cockeram Lake. The Keewatin River and Lynn River are characterized by fast flows in some reaches and ponded flows in other reaches via a system of irregular bedrock-controlled stream systems. The site is also dominated by lakes, rivers, and peat deposits. The lakes range in size from less than 42,000 m^2 to greater than 630,000 m^2. Rivers range in length from less than 120 m to greater than 4 km, and in width between 2 m and 10 m. Most of the rivers connect to lakes. Wetlands are predominant east of the Town of Lynn Lake.

Five lakes surround the proposed TMF at the site. These include Payne Lake (which drains into the Keewatin River), Lobster Lake, Minton Lake, and two unnamed lakes (which drain into an unnamed river that ultimately discharges to Cockeram Lake in the south). The Keewatin River flows southeast from Cockeram Lake, through Sickle Lake before discharging into Granville Lake on the Churchill River, upstream of Southern Indian Lake (Worley 2023). On the western part of the Keewatin River is Dot Lake which is in the vicinity of the proposed open pit.

The surface area of Payne Lake is approximately 599,793 m^2 with an average lake elevation of approximately 348.5 m amsl. The surface area of Dot Lake is approximately 982,487 m^2 with an average lake elevation of approximately 331.6 m amsl. The surface area of Minton Lake is approximately 1,670,211 m^2 with an average lake elevation of approximately 329.6 m amsl.

Due to numerous unnamed lakes and rivers near the site, the naming convention used in Stantec's previous aquatic studies near the site was used for the groundwater model. The reach numbers associated with the lakes and rivers are presented in Map 5.

2.5 Regional Geology

A summary of the regional geology is provided below. Additional information on the regional and local geology is provided in the Hydrogeology Baseline Technical Data Report (Stantec 2017c) and subsequent validation report (Stantec 2020b).

2.5.1 Overburden Geology

The regional surficial geology has been mapped by the Geological Survey of Canada as shown on Map 6 (Kaszycki et al. 2008). During the Late Wisconsin period, the advance of the Keewatin ice centre (part of the Laurentide Ice Sheet) deposited glacial diamicton (diamicton) derived from the crystalline bedrock of the Canadian Shield. Meltwaters, resulting from the retreat of glacial ice, eroded, and cut through the various glacial deposits and resulted in deposition of glaciofluvial sediments that are typically stratified and sorted to varying degrees. As the ice retreated, glacial Lake Agassiz was formed and resulted in the deposition of glaciolacustrine laminated silt and clay. In the study area, overburden thickness was generally 2 to 4 m thick except where bedrock valleys are observed and overburden thickness was an order of magnitude greater.

2.5.2 Bedrock Geology

The bedrock geology of the area has been described in detail by the Manitoba Geological Survey. The MacLellan and Gordon sites are located within part of the Lynn Lake greenstone belt, which is located in the Churchill Structural Province of the Canadian Shield. Map 6 presents the regional bedrock geology. The Lynn Lake greenstone belt is comprised of metamorphosed volcanic rocks of the Wasekwan Group, metamorphosed sedimentary rocks of the Sickle Group, and plutonic intrusions. The Lynn Lake greenstone belt trends west to east and extends 130 km from the La Ronge greenstone belt in Saskatchewan (MEM 1986). Structural processes altered the Lynn Lake greenstone belt into two belts (north belt and south belt), that are separated by felsic intrusions (Beaumont-Smith and Böhm 2003). The north and south belts differ by stratigraphic sequences, chemistry, and structure (MEM 1986).

The MacLellan and Gordon sites are located within the north belt, which is characterized as a north-dipping homocline comprised of rhyolite, overlain by andesite and sedimentary rocks, and an upper unit of basaltic rocks (MEM 1986). The north belt includes the unique stratigraphic sequence known as the Agassiz Metallotect (also termed “Rainbow Trend”; Map 7), which consists of picritic flows, iron formation, and felsic volcanic rocks. The metallotect hosts the gold deposits of the MacLellan and Gordon sites. South of the sites lies the south belt, which consists of volcanic and sedimentary rocks and the east-west trending structural feature identified as the Johnson Shear Zone (Map 7). In some areas, these weathered shear zones may have been preferentially eroded because of the orientation of the shear zone relative to the direction of ice movement and the competence of the weathered bedrock in the shear zone relative to the surrounding bedrock units (Machibroda Engineering 1988).

The MacLellan site has three mineralized deposits, the Rainbow-Dot Deposit, the MacLellan Deposit, and the Nisku Deposit. The three deposits are located south of a major east-west trending North Shear Zone (NSZ) fault, which strikes southeast (065°) and dips 75° to 85° to the north (Map 7 and Map 4).

2.6 Hydrostratigraphy

The following hydrostratigraphic units are interpreted within the MacLellan site and are incorporated into the conceptual model.

- Historical Mine Rock
- Organics and Fill
- Glaciolacustrine
- Diamicton
- Bedrock

Cross-sections depicting the geologic interpretation of the hydrostratigraphic units across the site are shown on Map 8, Map 9, and Map 10. The cross-section locations are presented on Map 4. Additional description of the hydrostratigraphic units is presented below, including references to monitoring well locations where appropriate.

2.6.1 Historical Mine Rock

A historical MRSA, identified on Map 2, contains surplus mine rock from historical mining operations at the MacLellan site. This historical MRSA was not capped or covered following the closure of historical mining activities. Hydraulic testing of the historical mine rock was not completed due to the expected high hydraulic conductivity and limited extent below the water table. Typical testing methods are challenging to perform under these conditions. Based on the grain size and material descriptions, hydraulic conductivity values for historical mine rock were assumed to vary between 1×10^{-3} and 1×10^{-2} meters per second (m/s) (Fetter 2000).

2.6.2 Organics and Fill

Organic deposits in the form of fibric peat and topsoil were observed at ground surface throughout the study area. Fibric peat is the least decomposed type of peat and generally consists of greater than 30% organic material or greater than 17% organic carbon. Topsoil was observed in upland portions of the landscape and was characterized as mineral soil with minor enrichment of organic material. Typical thicknesses were less than 1 m, but accumulations of up to 3.6 m were observed in low lying areas such as at monitoring well GBHM-22. Organic deposits were found underlying surficial fill in boreholes completed along the access road.

Hydraulic testing of the organic deposits was not completed due to the shallow nature and thickness. Hydraulic conductivity values from literature cover a wide range and are dependent on the texture of the sediments composing the organic deposit. Based on the geology and material descriptions, hydraulic conductivity values for organic deposits were assumed to vary between 1×10^{-8} and 1×10^{-5} m/s (Fetter 2000).

2.6.3 Glaciolacustrine

Glaciolacustrine deposits were observed across the study area at either ground surface or underlying organic deposits. The glaciolacustrine deposits are discontinuous (Map 9 and Map 10). The glaciolacustrine deposits consist of nearshore coarse-grained deposits and offshore fine-grained deposits. Nearshore and offshore deposits were generally observed to grade laterally between the two units; however, in some areas the units were interlayered. Therefore, these units were conceptualized to be one hydrostratigraphic unit. Hydraulic conductivity estimates from three slug tests conducted in the glaciolacustrine offshore deposits range from 2.2×10^{-5} m/s to 2.4×10^{-5} m/s. Nearshore glaciolacustrine deposits of silty sand were observed in monitoring wells MWM-02B, MWM-11S, GBHM-03B, GBHM-22B, GBHM-16-04S, and GBHM-17-05S ranging in thickness from 0.9 m to 4.02 m. Hydraulic conductivity estimates from hydraulic response tests conducted in the glaciolacustrine nearshore deposits range from 1×10^{-7} to 5.7×10^{-5} m/s.

2.6.4 Sand Diamicton

Discontinuous deposits of sand diamicton were observed throughout the MacLellan site (Map 8, Map 9, and Map 10), consistent with the interpretation that the unit has been eroded by meltwaters associated with the retreat of glacial ice. When present, sand diamicton overlaid bedrock and was overlain by glaciolacustrine or organic deposits. Sand diamicton was observed in areas primarily to the northeast of the proposed open pit. The thickness of the sand diamicton generally ranges from less than 1 m to greater than 28 m (at monitoring well GBHM-14, Map 4). The sand diamicton was generally observed to occupy bedrock lows such as at monitoring wells GBHM-01, GBHM-07, and GBHM-14 (Map 4), where the thickness of the unit was observed to be greatest. Generally, the sand diamicton overlaid bedrock except in the northeast, where it overlaid glaciofluvial deposits. Hydraulic conductivity estimates from hydraulic response tests conducted in the sand diamicton deposits range from 4.2×10^{-7} to 6.2×10^{-5} m/s.

2.6.5 Bedrock

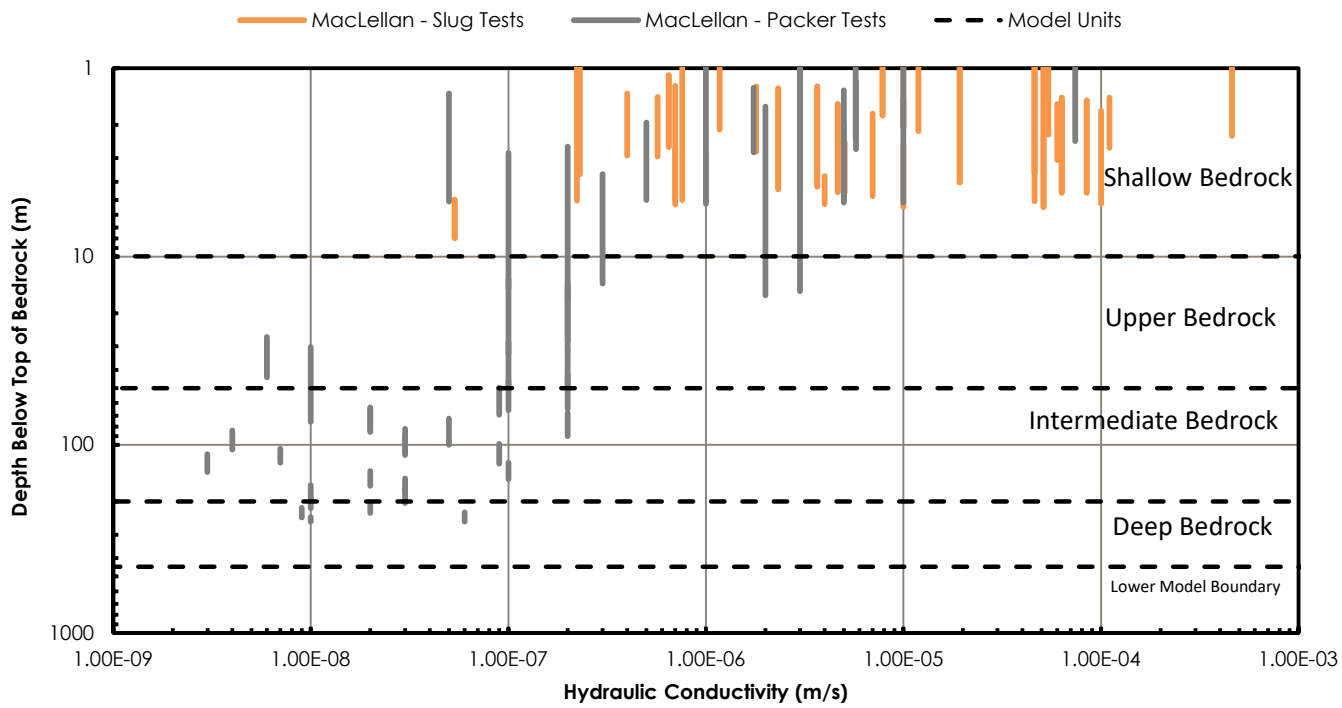
Bedrock was defined as a continuous unit throughout the MacLellan site and the top of bedrock surface described in Stantec (2017c) was interpreted from the boreholes and test pits installed at the site, including boreholes drilled for exploration and condemnation purposes. The bedrock topography was interpreted to follow a similar trend to ground surface topography. The top of bedrock was irregular with a series of highs and lows, which corresponded to the east-west striking, north-dipping beds. Bedrock is described as mafic extrusive igneous rock to schist (foliated metamorphic rock). Bedrock was observed near surface in areas associated with topographic highs and at depths up to 10 m below ground surface (bgs) associated with topographic lows, except in areas where bedrock depressions or valleys were observed.

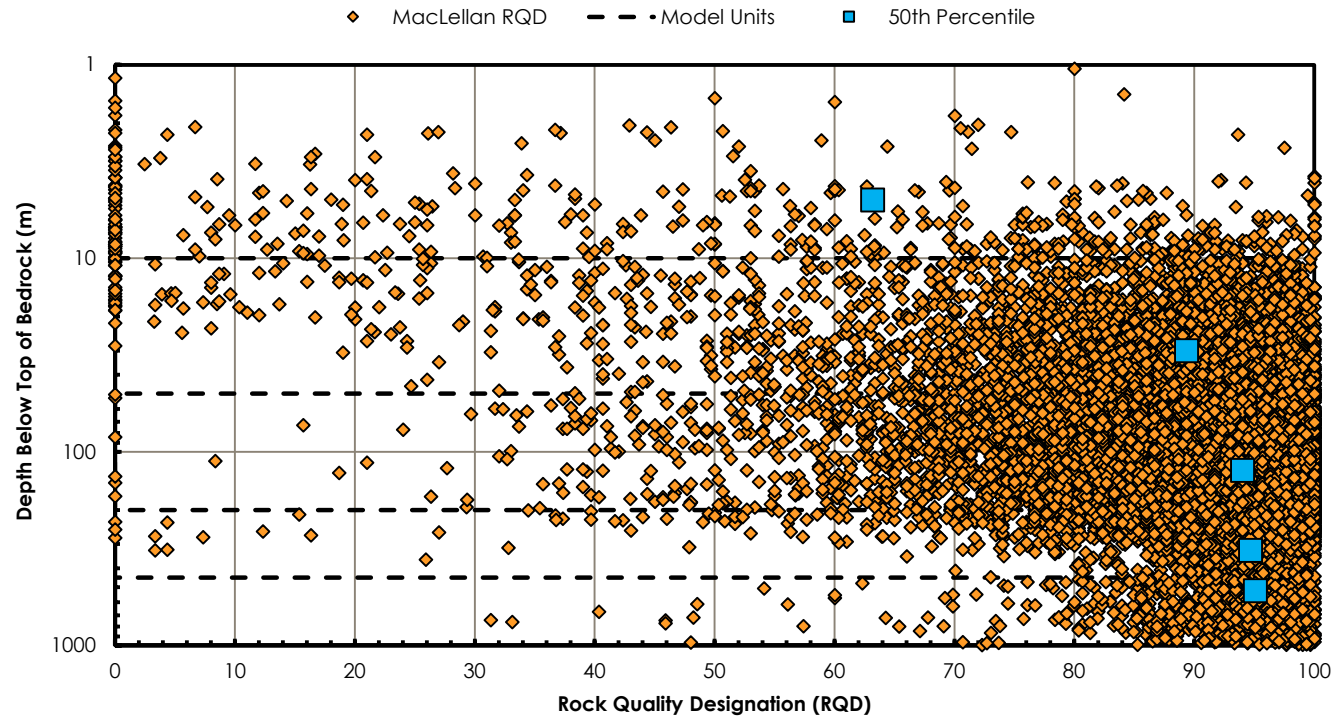
A bedrock depression or valley was observed at GBHM-01 (Map 4) located on the eastern edge of the proposed open pit and GBHM-05 located between the proposed open pit and Keewatin River in the area of the NSZ fault. Bedrock was encountered at 17.5 m bgs (317.5 m amsl) at monitoring well GBHM-01 and at 15.8 m bgs (317.5 m amsl) at monitoring well MWM-05. A localized bedrock depression was observed at MWM-12, located south of Payne Lake where bedrock was encountered at 11.7 m BGS (337.5 m amsl). MWM-12 is located at the base of a bedrock ridge with 15 m relief. The extensive glaciofluvial deposit at MWM-12 (approximately 9 m thick) suggests potential erosion of the bedrock by a former meltwater channel.

The deepest bedrock valley is located along the northern edge of Minton Lake where boreholes GBHM-14 and MWM-03 were terminated at depths of 28.9 m and 16.8 m, respectively, prior to encountering bedrock (Map 4). The orientation and extent of this bedrock valley is unknown but appears to be filled with sand diamicton that has been eroded and replaced by extensive glaciofluvial deposits. It is likely the valley was formed by erosion of the bedrock by glacial scouring as indicated by the thick sand diamicton, which was then eroded by a high-energy meltwater channel that deposited glaciofluvial sediment. The bedrock valley located in the area of Minton Lake is not interpreted to be connected with the bedrock valley associated with the NSZ fault in the area of the proposed open pit.

The hydraulic conductivity of the bedrock decreases with depth, with the upper portions being the most transmissive due to increased weathering and/or fracturing. Since Stantec (2017c) and Stantec (2020b), additional packer testing was completed in 2022 (WSP Golder 2022). The results of the 2022 hydraulic testing are incorporated into this description of bedrock hydrostratigraphy. The additional hydraulic conductivity estimates confirm the trend of decreasing hydraulic conductivity with depth below top of bedrock.

The bedrock was subdivided into four hydrostratigraphic units based on transmissivity data collected from hydraulic testing conducted in the study area (Stantec 2017c). These units include the Shallow Bedrock, Upper Bedrock, Intermediate Bedrock, and Deep Bedrock Units. A comparison of the measured hydraulic conductivity in the bedrock for each of the hydrostratigraphic units is presented in Figure 2-1. The hydraulic conductivity was observed to be variable across each hydrostratigraphic unit, as described below.





Notes:

Pumping test represent fractured interval of borehole

Client/Project

ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
MACLELLAN SITE

Figure No.

2-1

Title **Hydraulic Conductivity and RQD Distribution in Bedrock with Depth**

Stantec

https://stantec.sharepoint.com/teams/160999003/BC1609/Projects/111473012_Alamos/MacLellan Model Rebuild/Report/Figures to Insert into Word Document/Figure 2-1 Hydraulic Conductivity Distribution in Bedrock with Depth.xlsx

2.6.5.1 Shallow Bedrock

The shallow bedrock unit consists of a zone of weathered and fractured bedrock that exists below the overburden deposits or at ground surface where bedrock is exposed. The shallow bedrock is estimated to be approximately 10 m thick, with hydraulic conductivity estimates ranging from 5×10^{-8} to 5×10^{-4} m/s (Figure 2-1). A mapped fault (NSZ Fault, Map 4) occurs in the area of the open pit. Hydraulic conductivity estimates are not available for the fault but are assumed to have the same properties as the host rock.

The hydraulic conductivity data with depth were consistent with the rock quality designation (RQD) data, which suggests the upper 10 m of bedrock had a lower RQD (i.e., less competent rock) and higher hydraulic conductivity than the RQD of bedrock greater than 10 m depth (Figure 2-1).

2.6.5.2 Upper Bedrock

The upper bedrock unit underlies the shallow bedrock unit and is estimated to be 40 m thick. The hydraulic conductivity for the upper bedrock is estimated to range from 6×10^{-9} to 3×10^{-6} m/s (Figure 2-1).

2.6.5.3 Intermediate Bedrock

The intermediate bedrock unit underlies the upper bedrock and is estimated to be 150 m thick. The hydraulic conductivity for the intermediate bedrock is estimated to range from 3×10^{-9} to 2×10^{-7} m/s (Figure 2-1).

2.6.5.4 Deep Bedrock

The deep bedrock unit is the deepest bedrock unit and is considered to be relatively impermeable, although discrete fractures may occur that increase the hydraulic conductivity locally. Figure 2-1 presents RQD with depth below top of bedrock and indicates that RQD increases with depth in the bedrock. RQD and hydraulic conductivity are generally correlated because competent rock with few fractures (i.e., a high RQD) is commonly associated with a lower hydraulic conductivity. The measured hydraulic conductivity of this unit is estimated to be less than 7×10^{-9} m/s.

2.6.6 Ground Water Flow and Water Levels

Groundwater level data across the site and used for this GMR were measured from August 2015 to October 2022. This section presents a summary and interpretation of the data. Hydrographs and construction details for the monitoring wells are presented in Appendix B.

A reasonable spatial and temporal distribution of groundwater level data are available from late 2015 until late 2022. Generally, water levels peak in the summer or fall and decrease in the winter and spring. The magnitude of fluctuation varies by location and ranges from 0.7 to 4 m. Temporal data are limited at some locations. In general, most monitoring wells exhibit similar trends with rapid increases in groundwater levels following precipitation events and/or snowmelt followed by a gradual decrease during subsequent dry periods and/or freezing conditions (snowpack accumulation). The static water level in the area ranges from 310 m to 365 m amsl with generally lower water levels at lower elevations and higher water levels at higher elevations. The groundwater level in the vicinity of the pits and the MRSA ranges from 330 m to 365 m amsl. Groundwater generally flows from topographic highs and discharges to streams and lakes at lower elevations.

3 Description of Numerical Model

The numerical model code, domain, grid discretization, model boundaries, and simulation of hydrogeologic features are presented in this section.

An equivalent porous media (EPM) approach was selected to simulate the flow within the overburden and underlying bedrock. The EPM approach assumes that groundwater flow through fractured bedrock can be approximated by a porous medium with equivalent hydrogeologic properties of the bulk of the rock. The water level data within the shallow bedrock monitoring wells indicates a similar hydraulic response to the overburden system, indicating a high degree of connectivity. Cook (2003) demonstrates regional connectivity occurs within the shallow bedrock zone and decreases with depth due to a decrease in fracture frequency and permeability. Groundwater flow in the bedrock is therefore expected to occur dominantly through the upper portions of this shallow bedrock unit.

As shown in Section 2.6.5, the permeability and RQD of the bedrock decreases with increasing depth, due to more discrete fracturing of the bedrock. At the regional scale, the EPM approach remains appropriate for predicting the effective groundwater discharge rates from the deeper bedrock into the open pit but reduces the reliability of predicted travel times through discrete fractures (Wels et al. 2012). Travel times through the discrete fractures using the EPM approach could be under-predicted (due to lower effective fracture porosities in the bedrock) or over-predicted, if there is poor connectivity of fractures at depth. This is appropriate based on the regional scale of the modelling and considering that, based on measured hydraulic conductivity and RQD, flow was predicted to occur primarily through the shallow weathered bedrock.

3.1 Model Code

The groundwater models were developed using the three-dimensional finite difference groundwater flow computer code MODFLOW (Harbaugh 2005), MODFLOW-NWT, and MODFLOW-SURFACT in Groundwater Vistas Version 8 (Rumbaugh and Rumbaugh 2020). Groundwater Vistas is a pre-and post-processing software and was used to create standard format MODFLOW, MODFLOW-NWT, and MODFLOW-SURFACT files from graphical input data. Groundwater Vistas software supports MODFLOW, MODFLOW-NWT, and MODFLOW-SURFACT packages that are used to simulate the conceptual model scheme. The steady state and transient models used MODFLOW-NWT. The predictive models used MODFLOW for the dewatering model including the construction and operations period and MODFLOW-NWT for closure. The variation between MODFLOW and MODFLOW-NWT for the predictive models was due to stability of the solvers. The dewatering model was also simulated using MODFLOW-SURFACT to include freezing of the pit walls. The packages used in the models include Stream Flow Routing (SFR1), General Head Boundary (GHB), River; Recharge, Drain, Lake (LAK3); Adaptive Time-Stepping and Output Control, and Time-Varying Material Property.

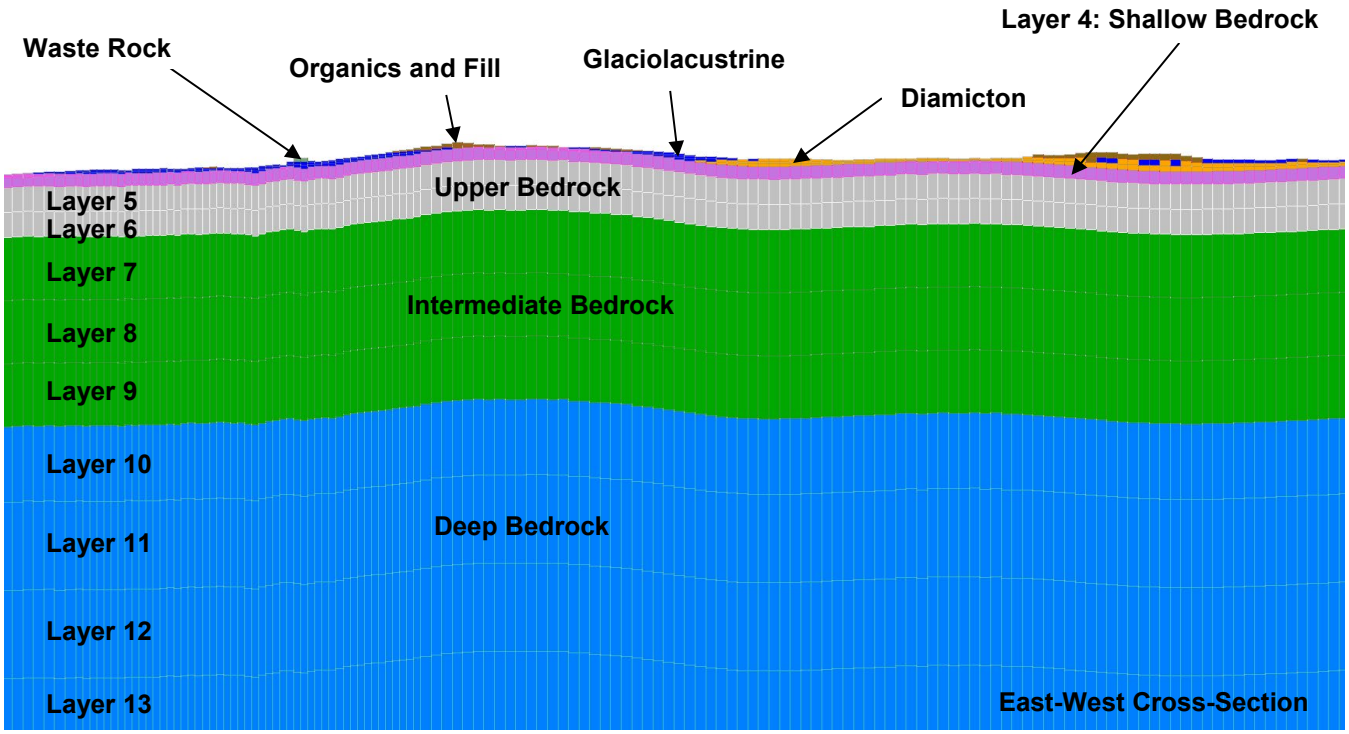
Model output was evaluated using Groundwater Vistas®, ArcMap® 10.6.1(ESRI), and Microsoft Office programs.

3.2 Model Domain and Grid Discretization

The same model domain used in the previous model (Stantec 2020e) was used in the current model to correspond to natural hydrogeologic boundaries and was extended to beyond the area where potential effects from the model predictions may impact model boundaries. The model domain is approximately 145.56 km^2 (Map 11). The model was discretized into 13 model layers based on hydrostratigraphic units (Figure 3-1). Figure 3-1 presents the average thickness of each layer. The maximum elevation in the model is 360 m amsl while the bottom of the model was assigned as -110 m amsl. As will be described in Section 5.3, the bottom of the pit is expected to reach -60 m amsl. The majority of the pit is within layer 11 and layers above, while the deepest portion of the pit is in layer 12. Layer 13 is completely below the pit and ranges from 32 m to 52 m thick beneath the deepest portion of the pit.

The model grid is coarser around the limits of the domain and grades to finer cells in the vicinity of the surface water features and the area of the proposed open pit (Map 11). The baseline model grid is composed of a total of 951,860 active cells.

A geological model of hydrostratigraphic units described in Section 2.6 was constructed in Leapfrog Hydro® software and the conceptual geological model grid was then saved in MODFLOW software format for direct transfer to MODFLOW groundwater model. Where hydrostratigraphic units were observed to be discontinuous across the study area and “pinch out”, the model layer was assigned a minimum thickness of 1 m and the hydraulic properties of the underlying hydrostratigraphic unit were assigned.



1	Waste Rock	1.4
2	Organics and Fill	1.4
3	Glaciolacustrine Sand Diamicton	1.4
	Shallow Bedrock	
4	Shallow Bedrock	8.4
5	Upper Bedrock	20
6		20
7	Intermediate Bedrock	50
8		50
9		50
10	Deep Bedrock	60
11		70
12		70
13		46

Client/Project

ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
MACLELLAN SITE

Figure No.

3-1

Title

Model Layers and Hydrostratigraphy

Stantec

3.3 Boundary Conditions

The model limits were assigned based on local watershed boundaries but were extended into neighboring watersheds based on anticipated effects from the presence of the open pit. Where the model was extended, natural hydrologic/hydrogeologic boundaries were used including watershed boundaries (assumed to be coincident with groundwater flow divides) or surface water features (also assumed to be coincident with groundwater flow divides). Although in the south portion of the model, west of Cockeram Lake, the model was truncated to reduce the size of the domain given discharge in the region is dominantly toward Cockeram Lake. The southern boundary of the model is sufficiently distant from the Site and should not influence results or predictions. The model domain and boundary conditions are presented in (Map 11).

3.3.1 No Flow Boundaries

No flow boundaries are used to simulate impermeable boundaries, groundwater divides, or streamlines. Along the model domain, no-flow boundaries occur by default when a boundary condition (e.g., a river or lake) is not defined.

3.3.2 Stream Flow Routing

The Stream Flow Routing (SFR1) Package is used to characterize the stream boundary condition when there is the need to accumulate stream flow along a water course (Niswonger and Prudic, 2005). The SFR1 characterizes streams by means of segments and reaches. Segments are sections of a stream with uniform or linearly changing properties (Prudic et al., 2004). Each segment consists of a group of reaches with upstream segments ordered from smaller numbers to larger numbers downstream (Prudic et al., 2004). With this segment configuration, flow in the stream is passed from lower reach numbers to higher reach numbers and from upstream segments to downstream segments. A stream water budget for each stream reach and leakage rate between a stream reach and corresponding model cell at the end of each iteration is computed independent of the groundwater model budget (Niswonger and Prudic, 2005).

The SFR1 package requires inputs for the start and end of each segment, flow entering segments, stream stage, streambed elevation, width of the stream, stream length, streambed thickness, hydraulic conductivity of the streambed, and slope of the stream channel to calculate streamflow/aquifer interaction.

The start of a stream segment indicates where flow in the stream is introduced in the model while the end indicates the destination of the flow in the stream in the model. The stream stage is assumed constant, with depth and width explicitly defined (ICALC=0). Stream stage is estimated as the sum of streambed elevation and the depth of water. SFR1 interpolates between input streambed elevations for the first reach and the last reach of each segment. Stream length, which is the sum of all stream reaches within a segment, is used to calculate average slope of the channel. Positive slopes represent flowing streams while zero slope represents ponded streams. Streambed thickness and hydraulic conductivity are also inputs.

The Keewatin River and Lynn River are simulated with the SFR1 package using a series of ordered segments and reaches (red cells) in Map 11. The Keewatin River flows in the north-south direction while the Lynn River flows west to east and joins the Keewatin River. Due to variation of stream depth along the length of the stream, stream cells are assigned to cells in different layers in the groundwater flow model according to the bottom of the streambed. The Keewatin River and Lynn River were divided into 38 segments and 707 reaches in GIS and stream properties were assigned to each segment.

Although flow has been measured at numerous stations within the study area beginning in 2015, the data were insufficient to estimate baseflow due to beaver activity, ice effects, and other challenges. Consequently, to estimate baseflow, the mean monthly flows at five monitoring stations (QM01, QM02, QM10, QM03, and QM06 along the Keewatin and QM05 on the Lynn River as shown on Map 5) was estimated using the drainage area and flow data from the Water Survey Canada (WSC) station Footprint River above Footprint Lake (Station ID: 05TF002) in the Nelson River Basin. This station was the most preferred of the numerous surrounding national hydrometric stations because the size of the drainage area is the closest in magnitude to the drainage areas of the site. The station is also naturally regulated with similar flow characteristics as the Keewatin River and Lynn River and has a continuous flow record for the past 48 years. Mean monthly flows were calculated for the WSC station Footprint River above Footprint Lake (05TF002) based on the period of record (1977 – 2020). The drainage-area ratio method was then used to estimate mean monthly flows at QM01, QM02, QM10, QM03, QM06, and QM05 based on the mean monthly flows from 05TF002. The drainage-area ratio method is a technique that statistically transfers streamflow information from one location to another based on the drainage areas of the two locations (Asquith et al. 2006). The drainage-area ratio method assumes that stream discharge and drainage area scale linearly for catchments with similar hydrologic characteristics. The method uses the formula

$$Q_u = Q_g \, (A_u/A_g)^m$$

where Q is streamflow (ungauged and gauged basin), A is catchment area (gauged and ungauged), and m is a calibration factor to account for non-linearities. The exponent m is typically assumed to have a value of 1 where there is a lack of validation data (IJC. 2014).

Using the drainage-area ratio method, the estimated mean monthly flow along the Keewatin River ranges between 3.17 m^3/s and 14.2 m^3/s while the estimated mean monthly flow along the Lynn River ranges between 1.14 m^3/s and 4.95 m^3/s. The average of the mean monthly flows from December through March was assumed to represent baseflow assuming flow in the rivers is dominantly from groundwater discharge rather than surface water. However, rain during these months or snow melt would over-estimate true baseflow. Estimated baseflow to the Keewatin River ranges from 4.06 m^3/s at QM01 to 4.16 m^3/s at QM06 while estimated baseflow to the Lynn River is approximately 1.45 m^3/s at QM05.

In the SFR1 package, baseflow entering the upstream segment of the Keewatin River was input as 4.06 m^3/s based on surface water measurements at QM01 while baseflow entering the Lynn River was input as 1.41 m^3/s. Stream stages were obtained from available field bathymetry data and aerial imagery in GIS. Stream depths were obtained from available field bathymetry data and discharge-depth relationship curves developed for monitoring stations where bathymetry data was unavailable. Stream depth data were used to estimate streambed elevation from stream stage data. The width of stream

segments was estimated from aerial imagery of the Keewatin and Lynn Rivers and measured cross sections where available. The width of the Keewatin River ranges from 10 m to approximately 300 m while the width of the Lynn River ranges from 10 m to approximately 100 m. From the aerial imagery of the Keewatin and Lynn Rivers, stream length was estimated based on changes in stream segments. A streambed thickness of 0.2 m was assumed for narrow segments with fast flows while a streambed thickness of 0.6 m was assumed for ponded segments. A higher streambed thickness was used for ponded segments assuming increased sedimentation in ponded areas compared to fast flowing areas. Streambed slope was based on the topography for the water courses. A review of sediment analyses from lakes and watercourses showed that the sediments are generally fine-grained (Stantec 2017b), and the initial conductance term was assigned to the model based on an assumed hydraulic conductivity of 1.2×10^{-8} m/s. The hydraulic conductivity of the streambed materials were included as calibration parameters. Ultimately, the hydraulic conductivity of the streambed was assigned based on the hydrostratigraphic unit in which the stream segment is located. Stream segments were located in organics and fill, glaciolacustrine, diamicton, and shallow bedrock.

3.3.3 General Head Boundary

A general head boundary (GHB) is a generic form of the head-dependent boundary condition (Rumbaugh and Rumbaugh 2020). Lakes were simulated as GHBs in the model. This type of boundary condition calculates the flow rate between the boundary condition and the aquifer based on the head assigned to the boundary condition. The vertical extent of the lakes was estimated using available bathymetric data collected at the lakes, and the reference head for each lake was estimated from the digital elevation model and measured water levels where available. The interaction between the surface water in the lakes and the groundwater in the underlying aquifers is defined by a “conductance” term. This term represents the presence of a layer of sediment on the lakebed that can affect the rate of water transferred between the lake and the underlying model layer. A review of sediment analyses from lakes and watercourses showed that the sediments are generally fine-grained (Stantec 2017b), and the initial conductance term was assigned to the model based on an assumed hydraulic conductivity of 1.2×10^{-8} m/s. The hydraulic conductivity of lakebed materials was used as a calibration parameter.

3.3.4 River Boundary

Watercourses other than the Keewatin and Lynn Rivers are simulated as river boundaries. The river boundary is a head-dependent boundary condition which allows water to enter or exit the model cell based on the hydraulic head of the aquifer compared to the river stage (water level in the river). The river package requires inputs for the length, width, stage, and bottom of the river as well as the thickness and hydraulic conductivity of the riverbed to calculate the interaction between groundwater and surface water in the rivers. River widths were estimated to range from 2 m to 10 m based on aerial imagery. Generally, rivers are wider in the lowlands and smaller widths were estimated in the upper parts of the basins. River depths are based on field observations of stream depths during average summer conditions. The initial hydraulic conductivity of the riverbed material was assigned similar to lakebed material and was used as a calibration parameter. River stage was assigned based on water levels in the lakes to maintain water

flow in the correct direction while river depths were estimated from field measurements. The rivers were divided into reaches based on river width, stage, and depth.

3.3.5 Recharge

Precipitation is the primary source for groundwater recharge. Publicly available precipitation data from Environment and Climate Change Canada weather monitoring stations 5061645 and 5061649, located at the Lynn Lake Airport were used to assign recharge. A uniform recharge rate was applied to the uppermost active layer of the model domain in the steady state model. For the baseline transient model, a portion of the monthly average precipitation was applied. The groundwater recharge rate was adjusted during the model calibration process.

3.4 Hydrogeologic Properties

Hydrogeologic properties were assigned in the model based on the hydrostratigraphic units as described in Section 2.6. This section describes the simulated aquifer properties including hydraulic conductivity, specific yield, and specific storage.

3.4.1 Hydraulic Conductivity

The initial hydraulic conductivity values assigned in the model were the geometric means from aquifer testing performed at the site (Stantec 2017c and WSP Golder 2022) or standard values based on hydrostratigraphic unit as discussed in Section 2.6. The initial hydraulic conductivity values were adjusted during the calibration process for both steady-state and transient conditions (Section 4).

The final horizontal hydraulic conductivity values are presented in Table 4.4 for each hydrostratigraphic unit. Anisotropy assigned for each hydrostratigraphic unit (based on literature values) is also presented in Table 4.4; anisotropy is presented as the ratio of horizontal hydraulic conductivity to vertical hydraulic conductivity.

3.4.2 Specific Storage and Specific Yield

Initial estimated specific yield for lithologic units ranged from 0.01 to 0.3 (dimensionless) for overburden units and 0.0001 to 0.001 for bedrock while specific storage for lithologic units in the study area ranged from $5x10^{-8}$ to $1x10^{-4}$ 1/m (Table 4.3). The specific storage and specific yield values initially assigned to the model were adjusted during the transient model calibration process (Section 4.2). The final storage values are presented in Table 4.4 for each hydrostratigraphic unit.

4 Model Calibration

The main objective of model calibration is to simulate observed hydrogeologic and hydrologic conditions. The process of calibration involves adjusting aquifer properties and boundary conditions to improve simulation of observed conditions and reduce model error (difference between observed and simulated conditions). Model calibration was completed using an iterative approach for steady-state and transient conditions. This involved a process where a flow simulation was completed, the resulting groundwater levels and baseflow rates to watercourses were compared to measured values, and the model input parameters were adjusted to achieve better agreement with observed (field measured) conditions. A hybrid calibration approach was used that combined automated parameter estimation, facilitated using the Model-Independent Parameter Estimation and Uncertainty Analysis software PEST (Doherty 2004) together with professional judgement and interpretation of the calibration results. Parameters were adjusted across typically observed ranges.

The calibrated model parameters, a description of the steady-state and transient model calibration, as well as sensitivity of the model calibration is presented in the following sections. The calibrated hydraulic conductivity and storage for the various hydrostratigraphic units are within the ranges expected for the materials based on measured and literature values (Fetter 2000; Schwartz and Zhang 2002), as the range was generally used to set upper and lower bounds as part of the calibration process.

4.1 Steady-State Model Calibration

Based on minimal changes to the hydrogeologic and hydrologic systems in the past, current conditions within the study area were assumed to generally represent steady-state conditions or at a minimum pre-mining conditions for the Project.

4.1.1 Steady-State Model Observation Targets

Groundwater elevation data measured at 38 observation wells were used together with baseflow data from 6 surface water monitoring locations as calibration targets for groundwater levels/pressure heads. Map 12 presents the location of calibration targets for the steady-state model.

The average annual water level at each location was calculated as well as the average monthly water level for the period from August 2015 through October 2022. Table 4.1 presents the average annual water level for each target as well as the simulated water level for the final calibrated model for steady state conditions.

Table 4.1 Steady State Model Hydraulic Head Calibration Targets and Residuals

Monitoring Location	Weighting Factor	Observed Head (m amsl)	Simulated Head (m amsl)	Weighted Residual (m)
MWM-10B	0.95	325.76	326.13	-0.35
MWM-02B	1	348.94	349.03	-0.09
MWM-06B	1	331.01	331.33	-0.32

Monitoring Location	Weighting Factor	Observed Head (m amsl)	Simulated Head (m amsl)	Weighted Residual (m)
MWM-09B	1	339.71	334.76	4.95
GBHM-03B	1	336.31	334.01	2.30
MWM-13B	0.9	347.32	356.86	-8.59
MWM-03	0.85	331.03	329.88	0.98
GBHM-22B	1	337.73	338.53	-0.80
GBHM-13B	1	342.90	339.48	3.41
GBHM-07	1	343.80	347.26	-3.46
MWM-05B	1	332.14	332.76	-0.62
GBHM-01B	1	332.61	333.01	-0.40
GBHM-05B	1	330.65	331.07	-0.42
GBHM-10B	1	338.12	334.97	3.15
MWM-02A	0.95	349.46	349.29	0.16
MWM-04	1	349.21	342.67	6.53
MWM-06A	0.8	331.05	331.34	-0.23
MWM-09A	1	339.14	334.72	4.42
GBHM-03A	0.9	336.45	334.00	2.21
GBHM-05A	1	330.56	331.12	-0.57
GBHM-06A	1	341.69	334.66	7.03
GBHM-08	1	348.18	350.25	-2.07
GBHM-09A	1	345.38	341.95	3.43
GBHM-10A	1	337.53	335.09	2.44
GBHM-12	1	339.64	345.35	-5.71
GBHM-13A	1	343.04	339.47	3.56
GBHM-15	1	338.34	339.28	-0.94
GBHM-16-01R	0.95	330.14	330.42	-0.27
BH18-02	0.85	355.02	355.73	-0.60
BH18-03	0.85	357.60	355.64	1.66
BH18-06	0.85	354.86	356.77	-1.62
BH18-07	0.85	363.27	359.98	2.80
MWM-01A	1	343.67	343.59	0.08
MWM-05A	1	332.31	332.87	-0.56
MWM-10A	1	326.27	326.27	0.00
GBHM-01A	1	325.25	333.08	-7.83
GBHM-18	1	339.98	346.39	-6.41
GBHM-22A	1	337.78	338.53	-0.75

Weights were assigned based on the period of record at each location. The period of record at most monitoring locations for the study area is 7 to 8 years. Assigned weights range from 0.8 to 1 and are listed in Table 4.1.

The water level calibration targets were assigned a weight of 1 except the following:

- The groundwater level target at MWM-06A was assigned a weight of 0.8 because the period of record was approximately 15 months.
- The groundwater level targets at MWM-03, BH18-02, BH18-03, BH18-06, and BH18-07 were assigned a weight of 0.85 because the periods of record were between 27 and 37 months.
- The groundwater level targets at MWM-13B and GBHM-03A were assigned a weight of 0.9 because the periods of record were between 40 and 47 months.
- The groundwater level targets at MWM-10B, MWM-02A, and GBHM-16-01R were assigned a weight of 0.95 because the periods of record were less than 5 years.

The steady-state model calibration included baseflow targets for surface water monitoring locations at QM02, QM10, QM03, and QM06 along the Keewatin River and at QM05 at the outlet of the Lynn River (near the confluence of the two rivers; Map 12). Baseflow was estimated as described in Section 3.3.2. The baseflow estimate at QM01 at the outlet of Burge Lake was input as inflow to the Keewatin River as described in Section 3.3.2. This inflow is listed in subsequent tables as a point of reference for simulated baseflow at the downstream gauging stations.

Baseflow to surface water features is provided primarily by groundwater discharge. However, a portion of the baseflow can also be attributed to the delayed drainage of precipitation storage in lakes and wetlands. This delayed release of surface water storage can be difficult to distinguish from groundwater contributions to baseflow. Therefore, the baseflow targets estimated from surface water hydrographs include both components. For calibration, baseflow to the Keewatin River and the Lynn River was estimated to range from 4.06 to 4.16 m^3/s. Baseflow at the Lynn River is estimated at 1.45 m^3/s and was the target for model calibration.

4.1.2 Statistical Methods to Evaluate the Steady-State Model Calibration

The purpose of the steady-state model is to establish baseline hydrogeologic conditions within the study area with an emphasis near the mine infrastructure. Parameter values such as recharge, lakebed, riverbed, and streambed conductance, and hydraulic conductivity were adjusted to improve model calibration. The steady-state model was calibrated using a combination of manual and automated calibration methods. Automated calibration methods utilized the software PEST, which adjusts model parameters using a weighted least square method (Doherty 2004). PEST utilizes the Gauss Levenberg Marquardt algorithm which optimizes the model parameters to improve the fit to observed targets and objectives (Doherty 2004).

$$\Phi = \sum_{i}^{m} (w_i r_i)^2$$

Where w_i is a weighting term applied to the measurement and r_i is the difference (residual) between the observation target and the model simulated outcome (Doherty 2004).

As a measure of calibration, plotting observed heads versus simulated heads provides a visual assessment of how closely the model simulated observed conditions. Each point on a graph represents the observed head and the simulated (calculated) head at the same location. If there was no difference between observed heads and simulated heads, each point would align along a line with a 1:1 slope. The further away a point is from the line, the greater the residual at that location. Plotting observed groundwater levels versus the residual head is another visual method for understanding the behavior of the model. If there is no difference between observed and simulated water levels, the points would plot along the zero line. Points above the zero line indicate simulated heads were less than observed, while points below the zero line indicate simulated heads were greater than observed heads. In addition to these graphs, statistical methods of evaluating observed versus computed hydraulic heads were used to evaluate the quality of calibration. These analyses included mean error (ME), mean absolute error (MAE), and root mean square error (RMS). The ME was calculated as follows:

$$ME = \frac{1}{n}\sum_{i=1}^{n} w_i(h_m - h_s)_i$$

Where n equals the number of targets, h_m is the measured (observed) head, and h_s is the simulated head. The mean error calculation provides a comparison of measured and simulated heads by computing the difference. A limitation of this method is caused by sign cancellation. An example of sign cancellation would be when the difference between the simulated value is a positive 30 m at one location and negative 30 m at another location. The average difference between these two wells is zero, which would be misleading, as there appears to be no error in the simulated heads.

The MAE calculation eliminates the problem of sign cancellation by using the average of the absolute value of the differences in heads:

$$MAE = \frac{\sum_{i=1}^{n} w_i|h_m - h_s|_i}{n}$$

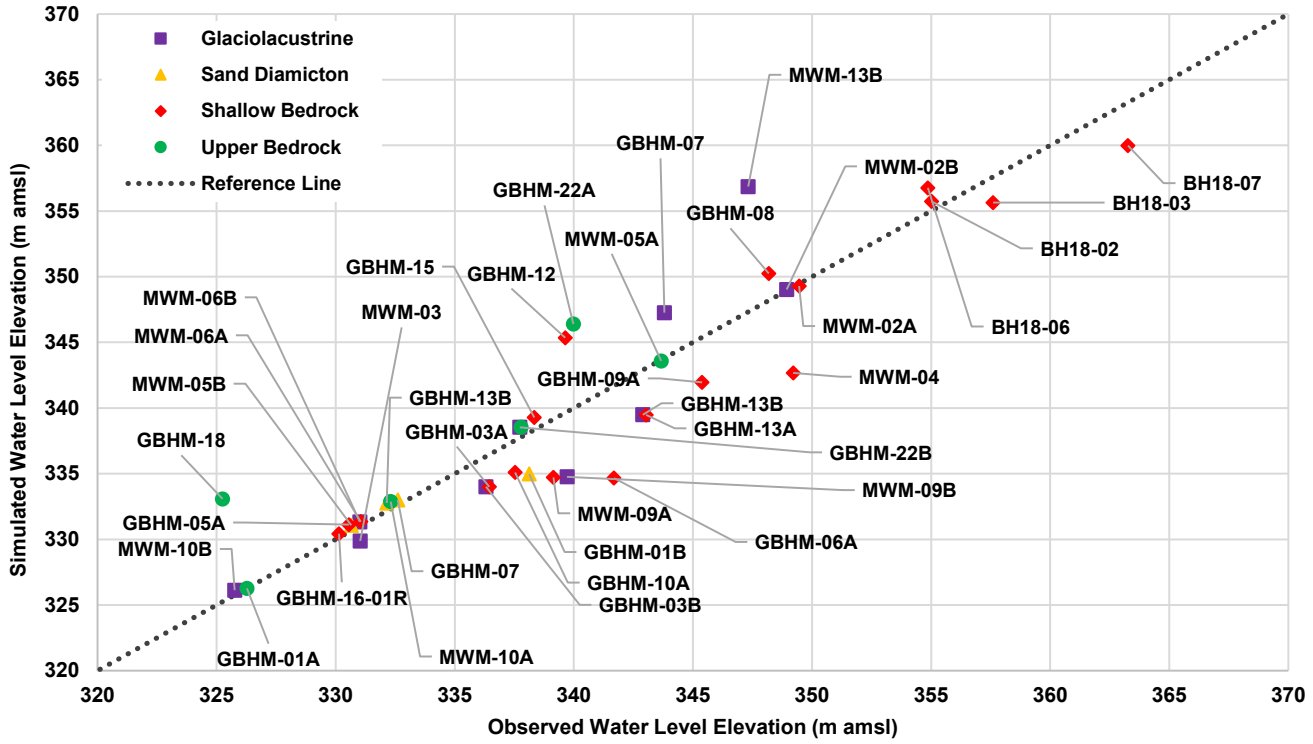
The RMS error, or the standard deviation, is the average of the squared differences in heads:

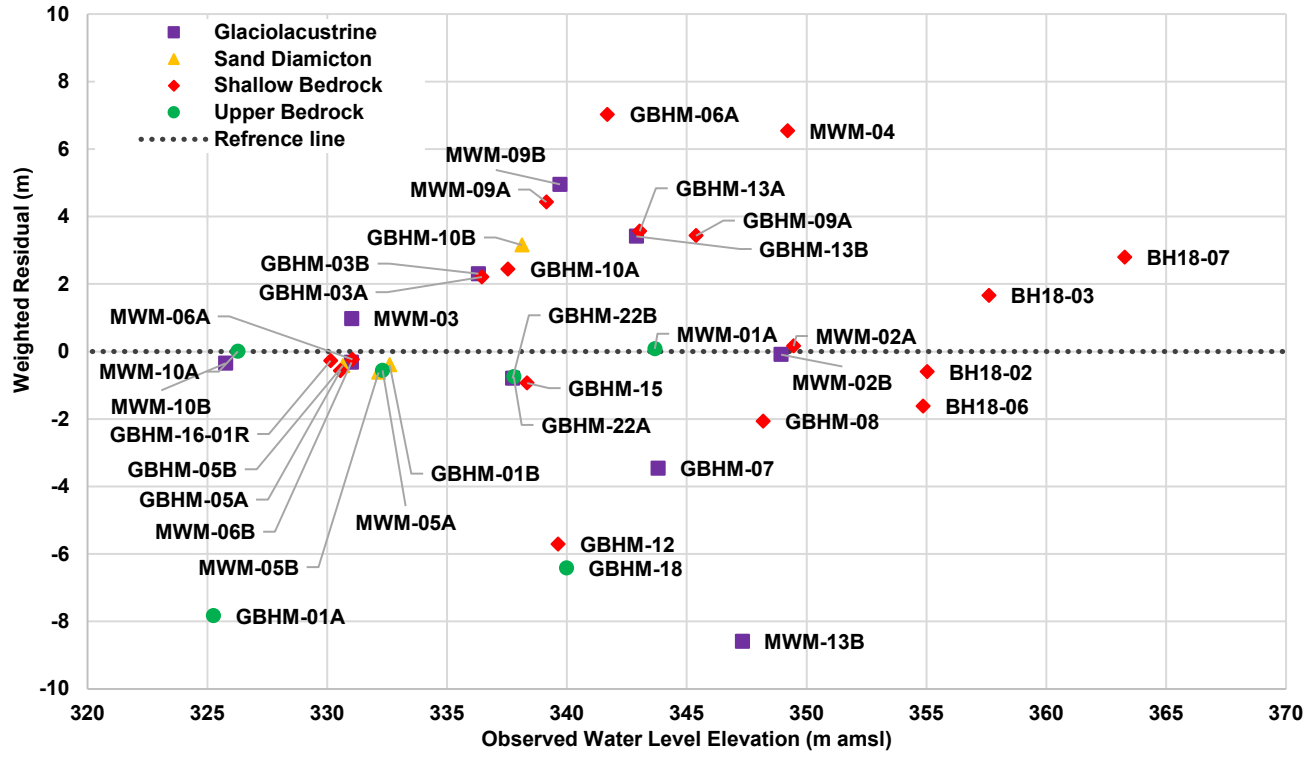
$$RMS = \sqrt{\frac{1}{n}\sum_{i=1}^{n} \lfloor w_i(h_m - h_s)_i \rfloor^2}$$

The RMS error tends to heavily weight the outlying points in the calculation. This occurs because of the squaring of the differences. When most of the differences are small, with few large differences, the error emphasizes the few rather than the many.

4.1.3 Results of Steady-State Calibration

The plot of observed head versus simulated head for the study area is presented in Figure 4-1. Residual errors between observed and simulated groundwater levels are graphically presented on Figure 4-1. The spatial distribution of residual error within the model is presented on Map 13.





Client/Project

ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
GORDON SITE

Figure No.

4-1

Title

Steady State Calibration Targets and Weighted Residuals

Stantec

The calibration statistics for the steady-state model are presented in Table 4.2. The steady-state model simulated an acceptable fit to observed heads with a scaled MAE of 6.4%and scaled RMS of 9%.

Table 4.2 Steady State Calibration Statistics

Statistic	Result
Number of Targets	38
Mean Error (m)	0.17
Mean Absolute Error (m)	2.41
Root Mean Square Error (m)	3.41
Scaled MAE (-)	0.064
Scaled RMS (-)	0.09

In evaluating the fit between the observed and the simulated water levels, the RMS error is usually regarded as the best measure (Anderson and Woessner 1991). If the ratio of the RMS error to the total water level differential (i.e., the scaled RMS error) over the model area is small (e.g., less than 10%; Wels et al. 2012 and Spitz and Moreno 1996), then the errors are only a small part of the overall hydraulic response of the model. The British Columbia Ministry of Environment guidance for groundwater modelling (Wels et al. 2012) states, “Generally, NRMSE (aka scaled RMS error) under 10% is good in many models, and under 5% is very good in terms of average residual fit.” In this simulation, the ratio of the RMS error to the total water level differential (9%) is less than the recommended 10% threshold. No systematic bias was observed in the residuals considering hydrostratigraphic units or proximity to boundary conditions.

Map 14 presents the simulated water table from the calibrated steady state model. The model provides a good representation of groundwater flow conditions at the site and mimics the ground surface contours (Map 4).

The model simulated average annual baseflow to the Keewatin and Lynn Rivers is summarized in Table 4.3. Simulated average annual baseflow to the Keewatin River matched the estimated baseflow at QM01 and QM02 and exceeded the estimated baseflow at QM10, QM03, and QM06 by 0.24% to 0.48%. The simulated average annual baseflow to the Lynn River matched the estimated baseflow at QM05. This is considered a reasonable estimate of baseflow for this watershed, and therefore, the calibration to baseflow is considered acceptable.

Table 4.3 Baseflow at Keewatin River and Lynn River for the Steady State Calibrated Model

Stream	Monitoring Location	Estimated Average Annual Baseflow (m^3/s)	Simulated Average Annual Baseflow (m^3/s)
Keewatin River	QM01	4.06	4.06
Keewatin River	QM02	4.10	4.10
Keewatin River	QM10	4.12	4.13

Stream	Monitoring Location	Estimated Average Annual Baseflow (m^3/s)	Simulated Average Annual Baseflow (m^3/s)
Keewatin River	QM03	4.13	4.14
Keewatin River	QM06	4.16	4.18
Lynn River	QM05	1.45	1.45

4.1.4 Calibrated Hydrogeologic Properties

The calibrated horizontal hydraulic conductivity and anisotropy values are presented in Table 4.4 for each hydrostratigraphic unit; anisotropy is presented as the ratio of horizontal hydraulic conductivity to vertical hydraulic conductivity. The calibrated specific yield and specific storage for each hydrostratigraphic unit is also presented in Table 4.4; the transient calibration is discussed in Section 4.2. Due to the limited extent of the mine rock within the project area, the hydraulic conductivity of the mine rock generally does not influence simulated water levels or groundwater/surface water interactions. Consequently, the horizontal and vertical hydraulic conductivities assigned to the mine rock are relatively high but not so high to contribute to model instability.

Table 4.4 Calibrated Hydrogeologic Properties

Hydrostratigraphic Unit	Horizontal Hydraulic Conductivity (m/s)	Anisotropy (-)	Specific Yield (-)	Specific Storage (1/m)	Streambed Hydraulic Conductivity[2] (m/s)
Mine rock					
Calibrated Value	1×10^{-3}	1	0.16	NA	NA
Expected Range	1×10^{-3} to 1×10^{-2}	1 to 5	0.01 to 0.3		
Organics and Fill					
Calibrated Value	1×10^{-5}	10	0.19	NA	1×10^{-5}
Expected Range	1×10^{-8} to 1×10^{-5}	1 to 100	0.01 to 0.3		1×10^{-8} to 1×10^{-5}
Glaciolacustrine					
Calibrated Value	5.8×10^{-5}	10	0.16	NA	2.1×10^{-6}
Expected Range	1×10^{-7} to 6×10^{-5}	1 to 100	0.01 to 0.3		1×10^{-8} to 6×10^{-5}
Sand Diamicton					
Calibrated Value	6.4×10^{-5}	10	0.2	NA	9.5×10^{-6}
Expected Range	4×10^{-7} to 6×10^{-5}	1 to 50	0.01 to 0.3		1×10^{-8} to 6×10^{-5}
Shallow Bedrock					
Calibrated Value	2.2×10^{-6}	10	0.06	1×10^{-5}	4.5×10^{-6}
Expected Range	5×10^{-8} to 5×10^{-4}	1 to 100	0.0001 to 0.3	1×10^{-6} to 1×10^{-4}	1×10^{-8} to 5×10^{-4}
Upper Bedrock					
Calibrated Value	3.7×10^{-7}	10	0.0001	1×10^{-5}	NA
Expected Range	6×10^{-9} to 3×10^{-5}	1 to 100	0.0001 to 0.001	3×10^{-7} to 3×10^{-5}	

Hydrostratigraphic Unit	Horizontal Hydraulic Conductivity (m/s)	Anisotropy (-)	Specific Yield (-)	Specific Storage (1/m)	Streambed Hydraulic Conductivity[2] (m/s)
Intermediate Bedrock					
Calibrated Value	2×10^{-7}	10	0.0001	1×10^{-5}	NA
Expected Range	3×10^{-9} to 2×10^{-7}	1 to 100	0.0001 to 0.001	7×10^{-8} to 7×10^{-6}	
Deep Bedrock					
Calibrated Value	1×10^{-7}	10	0.0001	1×10^{-5}	NA
Expected Range	7×10^{-9} to 1×10^{-7}	1 to 100	0.0001 to 0.001	5×10^{-8} to 5×10^{-6}	
Lakebed[1]					
Calibrated Value	4.1×10^{-6}	NA			
Expected Value	1×10^{-8}				
Riverbed[1]					
Calibrated Value	4.6×10^{-6}	NA			
Expected Value	1×10^{-8}				

Notes:

1 Hydraulic conductivity assigned for the conductance term in the river and lake boundary conditions

2 Used in the SFR1 package

Table 4.4 demonstrates the calibrated hydraulic conductivity for the majority of lithologic units in the model is near or above the upper bound of the field-tested or conceptual ranges. The only hydrostratigraphic units for which this is not the case is the shallow bedrock and upper bedrock. The calibrated hydraulic conductivity for the shallow bedrock is similar to the geometric mean from field testing while the calibrated hydraulic conductivity of the intermediate bedrock is nearly an order of magnitude above the geometric mean from field testing. Using relatively high hydraulic conductivities is conservative to assess effects of the Project on groundwater and surface water resources.

4.1.5 Calibrated Recharge

A uniform recharge rate of 72.3 mm/yr or 15%of the annual average precipitation (478 mm/yr) was applied to the uppermost active layer of the model domain in the steady state model. For the transient model, 15%of the monthly average precipitation was applied.

4.1.6 Calibrated Hydraulic Conductivity for Boundary Conditions

The calibrated streambed hydraulic conductivity for segments in organics and fill, glaciolacustrine, diamicton, and shallow bedrock are 1.0×10^{-5} m/s, 2.1×10^{-6} m/s, 9.5×10^{-6} m/s, and 4.5×10^{-6} m/s respectively. The calibrated lakebed hydraulic conductivity is 4.1×10^{-6} m/s. The calibrated riverbed hydraulic conductivity is 4.6×10^{-6} m/s. These calibrated hydraulic conductivities are presented in Table 4.4 for comparison to the lithologic units. The hydraulic conductivity of the streambed, lakebed, and riverbed materials are all two orders of magnitude or greater than the expected value based on sediment analyses from lakes and water courses in the study area (Stantec 2017b). As demonstrated in Table 4.4, the hydraulic conductivity of the streambed, lakebed, and riverbed materials are within the range of expected

hydraulic conductivity of lithologic materials. Considering sediments in lakes and watercourses are expected to be finer grained compared to surrounding soils, this is conservative to assess effects from the Project.

4.2 Transient Model Calibration

The purpose of transient calibration is to assess groundwater contribution to/from lakes, rivers, and streams and pumping from the open pit over time. Transient calibration was conducted using observed water level hydrographs in the study area. The transient models were calibrated by varying the hydraulic conductivity, specific storage, specific yield, and lakebed, riverbed, and streambed hydraulic conductivity until a close visual match between the observed and simulated water levels was achieved.

4.2.1 Transient Model from 2015 through 2022

A transient model was constructed with monthly time steps from August 2015 through October 2022. The simulated head from the steady-state model was used as the initial head for the transient model. The hydraulic conductivity, specific yield, specific storage, lakebed, riverbed, and streambed hydraulic conductivity were adjusted to match average monthly observed heads during the transient calibration period. For the transient model, recharge was set to 15%of the monthly average precipitation.

Hydrographs of the observed vs. simulated water levels for the period form August 2015 through October 2022 are presented in Appendix C. The trends of the simulated heads match the trends of the observed heads for the model period although the magnitude of annual change in observed heads is under-predicted. The seasonal variation in measured heads ranges from 0.7 m to 4 m while the simulated range is generally less than 0.8 m. The range in measured water levels is likely due to changing water levels in lakes and rivers. The water level data for rivers and lakes are heavily influenced by beaver activity and therefore insufficient to simulate monthly or seasonal variation in river and lake water levels for the model. Consequently, the variation in water levels could not be simulated with changes in hydraulic properties. Transient calibration was therefore not effective. Given transient calibration is used to calibrate storage parameters, the values of storage assigned in the model (Table 4-4) are conservative to assess the effects of the Project on receivers.

4.3 Assessment of Model Calibration

For the steady state model, the error of the model was acceptable with a scaled MAE of 6.4% and scaled RMS error of 9%. No systematic bias was observed in the residuals considering hydrostratigraphic units or proximity to boundary conditions. Simulated baseflow along the Keewatin River exceeded estimated baseflow by 0.48% or less. The scaled RMS for the steady state model was below the 10% threshold for model calibration as defined in Spits and Moreno (1996) and Wells et al. (2012). The calibrated model is suitable for the purpose of assessing potential impacts from mining operations in the study area.

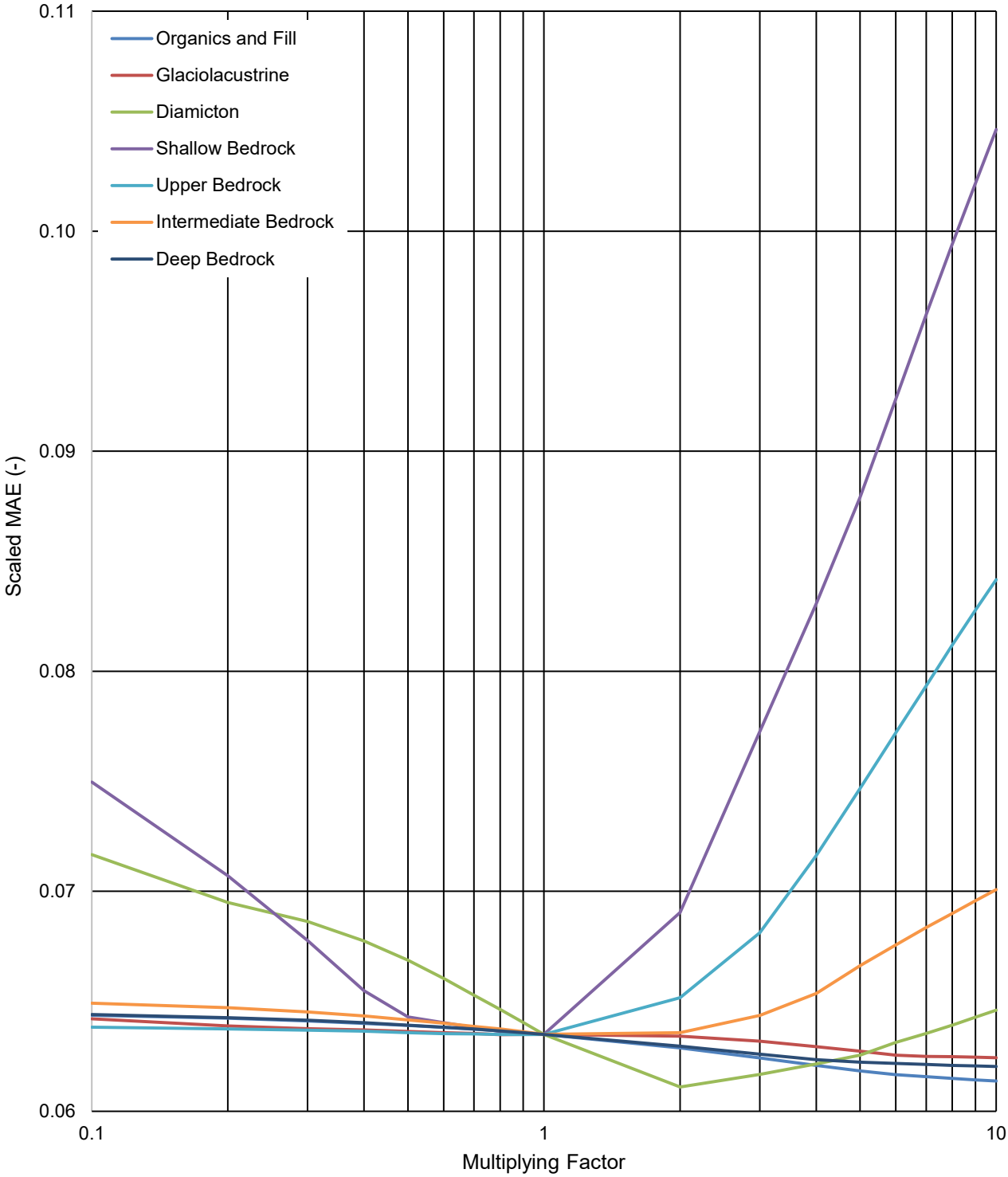
4.4 Calibrated Model Sensitivity Analysis

A sensitivity analysis was performed to assess the uncertainty in estimated parameters, hydraulic stresses, and boundary conditions used to develop the calibrated steady state groundwater flow model, consistent with the approach described in Anderson and Woessner (1991). For this sensitivity analysis, iterative changes were applied to the hydraulic conductivity of the hydrostratigraphic units, the hydraulic conductivity of lakebed, riverbed, and streambed materials, and recharge. Modelled changes for each of these parameters were constrained to reasonable and foreseeable values for each parameter/condition; tests were not performed for parameters outside of expected ranges as described below.

4.4.1 Hydraulic Conductivity of Hydrostratigraphic Units

Multiple sensitivity analyses were performed for the hydraulic conductivity of hydrostratigraphic units. The hydraulic conductivity of each hydrostratigraphic unit (except mine rock) was adjusted individually using factors between 0.1 and 10 to assess the sensitivity of the calibration to the hydraulic conductivity of each hydrostratigraphic unit.

The scaled MAE for each sensitivity simulation is presented in Figure 4-2 which indicates the calibrated model is most sensitive to increases in hydraulic conductivity of the shallow bedrock and upper bedrock. The calibrated model is less sensitive to increases in hydraulic conductivity of the organics and fill, glaciolacustrine, and diamicton units because the calibrated hydraulic conductivities are near or exceed the upper bound of field-tested ranges at the site. This is conservative when assessing impacts from mining operations. As the hydraulic conductivity of the hydrostratigraphic units decrease, the calibration is most sensitive to the hydraulic conductivity of the shallow bedrock and the diamicton units. The calibrated model is fairly insensitive to increases or decreases in the hydraulic conductivity of the intermediate bedrock and deep bedrock. The sensitivity simulation with the lowest scaled MAE was the 2-fold increase in hydraulic conductivity of the diamicton unit with a scaled MAE of 0.061 compared to 0.064 for the calibrated model, which is a small improvement. The results of the sensitivity analysis demonstrate the calibrated hydraulic conductivities simulate the measured water levels well and alternate values are not indicated.



Client/Project

ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
GORDON SITE

Figure No.

4-2

Title **Calibrated Model Sensitivity Analysis - Hydraulic Conductivity of Hydrostratigraphic Units**

Stantec

https://stantec.sharepoint.com/teams/160999003/BC1609/Projects/111473012_Alamos/MacLellan Model Rebuild/Report/Figures to Insert into Word Document/Figure 4-2 Calibrated Model Sensitivity Analysis - Hydraulic Conductivity.xlsx

The hydraulic conductivity of the hydrostratigraphic units were also adjusted simultaneously. Except for the mine rock, each hydrostratigraphic unit was adjusted by an order of magnitude decrease and increase (factor of 10) from the calibrated baseline values. Table 4.5 presents the calibration statistics for the sensitivity scenarios and the baseline model for comparison.

Table 4.5 Calibration Statistics for the Sensitivity Analyses for Hydraulic Conductivity of Hydrostratigraphic Units

Statistic	Baseline	K x 0.1	K x 10
Mean Error (m)	0.17	-32.9	4.63
Mean Absolute Error (m)	2.41	32.9	5.09
Root Mean Square Error (m)	3.41	51.3	7.23
Scaled MAE (-)	0.064	0.87	0.13
Scaled RMS (-)	0.09	1.35	0.19

Decreasing the hydraulic conductivity of the hydrostratigraphic units by an order of magnitude increases the error of the model significantly. The scaled RMS of 135% indicates the RMS error is greater than the range of measured water levels and the model is clearly inconsistent with measured data. The simulated water levels at every monitoring location are higher than measured, hence the magnitude of the ME and MAE are the same except opposite sign. This should be considered when evaluating results of this sensitivity simulation. Increasing the hydraulic conductivity of the hydrostratigraphic units by an order of magnitude also increases the error of the model although to a lesser degree. The scaled RMS of 19% is above the generally accepted value of 10% for a good calibration. The lower sensitivity of the model to an increase in hydraulic conductivity is likely because the majority of calibrated hydraulic conductivities are relatively high and increasing the values higher is less influential compared to a decrease in hydraulic conductivity.

The effect of simultaneously varying the hydraulic conductivity for the hydrostratigraphic units on predicted baseflow to the rivers, lakes, and streams is discussed in Section 5.5.1.

4.4.2 Hydraulic Conductivity of Lakebed, Riverbed, and Streambed Material

Two sensitivity simulations were performed whereby the hydraulic conductivity of riverbed material (as represented in the River boundary condition), lakebed material (as represented in the GHB), and streambed material (as represented in the SFR) was varied to evaluate model responsiveness. The hydraulic conductivity for each boundary condition was increased and decreased by a factor of ten. Table 4.6 presents the calibration statistics for the sensitivity scenarios and the baseline model.

Table 4.6 Calibration Statistics for the Sensitivity Analyses for Hydraulic Conductivity of Lakebed, Riverbed, and Streambed Materials

Statistic	Baseline	K x 0.1	K x 10
Mean Error (m)	0.17	-0.44	0.24
Mean Absolute Error (m)	2.41	2.71	2.38
Root Mean Square Error (m)	3.41	3.73	3.39
Scaled MAE (-)	0.064	0.07	0.06
Scaled RMS (-)	0.09	0.10	0.09

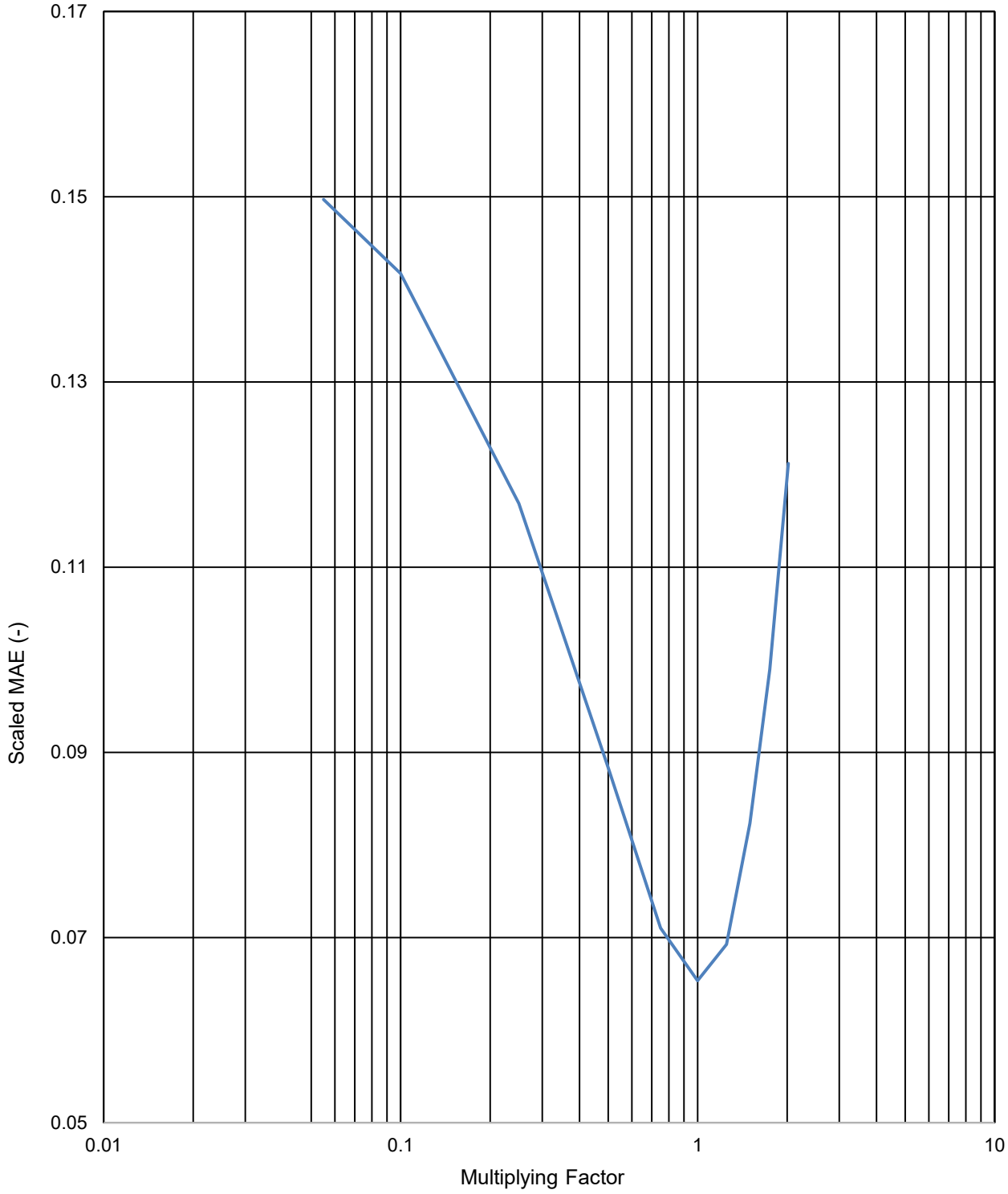
Decreasing riverbed and lakebed hydraulic conductivity increases the error of the model as indicated by the scaled RMS error of 10%. Increasing the riverbed and lakebed hydraulic conductivity has minimal effect on the error of the model as indicated by the scaled RMS error of 9%. This indicates the calibrated values for hydraulic conductivity of the riverbed and lakebed materials simulate high hydraulic connection between surface water and groundwater and further increasing the hydraulic conductivity does not increase the hydraulic connection. This is conservative to assess impacts.

The effect of varying riverbed, lakebed, and streambed hydraulic conductivity on predicted baseflow to the rivers, lakes, and streams is discussed in Section 5.5.2.

4.4.3 Recharge

Multiple sensitivity simulations were performed by adjusting the recharge rate using factors between 0.055 and 2 to assess the conceptual range of recharge, which is assumed to be 4 to 146 mm/yr. The range in recharge rate used in this sensitivity scenario is considered conservative as climate change forecasts for Lynn Lake, Manitoba are in the range of 11% to 15% increase in precipitation for the next 20 to 50 years, respectively, under a high emissions scenario (ClimateData.ca 2024).

Figure 4-3 indicates the calibration is sensitive to both a decrease and increase from the calibrated baseline recharge, but most sensitive to a decrease in recharge. The results of the sensitivity analysis demonstrate water levels are highly sensitive to recharge rate. The calibrated recharge rate simulates the measured water levels well, and an alternate value is not indicated.



Client/Project

ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
GORDON SITE

Figure No.

4-3

Title **Calibrated Model Sensitivity Analysis - Recharge**

Stantec

Table 4.7 presents the calibration statistics for the sensitivity scenarios and the baseline model for comparison in which recharge was increased and decreased by 50%.

Table 4.7 Calibration Statistics for the Sensitivity Analyses for Recharge

Statistic	Baseline	Recharge x 0.5	Recharge x 1.5
Mean Error (m)	0.17	2.32	-1.63
Mean Absolute Error (m)	2.41	3.20	3.00
Root Mean Square Error (m)	3.41	4.61	4.49
Scaled MAE (-)	0.064	0.08	0.08
Scaled RMS (-)	0.09	0.12	0.12

Decreasing and increasing recharge by 50% increases the error of the model as indicated by the scaled RMS error of 12%. The scaled RMS error for both recharge sensitivity scenarios is greater than the 10% threshold described in Section 4.1.3.

The effect of varying recharge on predicted baseflow to the rivers, lakes, and streams is discussed in Section 5.5.3.

5 Model Applications

The calibrated groundwater flow model was used to quantify baseline groundwater levels, flow, and groundwater discharge to the receiving environment under baseline conditions. The baseline model results were then used to compare to model predictions during construction, operation, and closure phases of the Project. Model modifications completed to allow simulation of the following phases:

- Construction (Mine Years -2 to 0) – initial dewatering of the open pit and satellite pit and seepage collection associated with the TMF and new MRSA.
- Operation (Mine Years 1 to 11) – dewatering of the open pit and satellite pit, and seepage collection associated with the TMF and new MRSA.
- Active reclamation/closure (after Mine Year 11) – filling of the open pit and satellite pit and seepage associated with the TMF and new MRSA.

5.1 Baseline conditions

5.1.1 Model Setup: Baseline

The calibrated groundwater flow model discussed in Section 4 was used to estimate the water table elevation (i.e., the top of the saturated water column) and groundwater flow under baseline conditions.

Recharge through the historical MRSA has the potential to affect groundwater quality and as a result the model was used to estimate the discharge location and flux of water recharging the groundwater flow system from beneath the MRSA. A forward particle tracking approach was used, where a particle was released from each model node within the footprint of the historical MRSA. The travel paths of the particles were simulated through the model domain until they arrived at a receptor, such as a lake or watercourse.

The groundwater flux associated with each particle track was then used to estimate the total discharge rate (Q) for the historical MRSA to the environment. The groundwater discharge to a surface water feature that is contributed by the cell in the historical MRSA is conservatively assumed to be equal to the average annual recharge rate into that cell (e.g., $Q_{in} = Q_{out}$). It was assumed the groundwater recharge that enters the historical MRSA will ultimately discharge to receptors. As a result, the groundwater flow model may over-estimate groundwater discharge rates, as local seepage to intermittent surface water features or ditches that may be present in the area of the historical MRSA are not accounted for in the model.

The historical MRSA receives an average recharge rate of 72.3 mm/yr under baseline conditions

5.1.2 Model Results: Baseline

The calibrated groundwater flow model was used to estimate the water table elevation, groundwater flow, and groundwater discharge to surface water under baseline conditions.

5.1.2.1 Groundwater Elevation

Map 14 shows the simulated average annual water table elevation contours under baseline conditions. The model provides a good representation of groundwater flow conditions in the area of the open pit and mimics the ground surface contours, with groundwater flowing regionally to the southeast. Groundwater flow converges locally to Cockeram Lake in the southeast portion of the model domain.

5.1.2.2 Groundwater Discharge to Surface Water

Simulated baseflow to the watercourses, primary lakes, and streams located within the model domain is presented in Table 5.1. The locations of surface water features are presented in Map 5. The baseflow rates were used to quantify changes to baseflow during the construction, operation, and closure phases, as presented in subsequent sections.

In Table 5.1, a positive number for the net groundwater to receiver indicates groundwater discharge to the surface water feature (gaining river, lake, or stream) and a negative value indicates that the surface water feature is recharging the groundwater flow system (losing river, lake, or stream). Baseflow values presented in the table represent the groundwater contributions to the features, and do not include contributions from surface water storage.

Table 5.1 Predicted Groundwater Discharge to Lakes and Baseflow in Rivers under Baseline Conditions

Receiver	Discharge or Baseflow (m^3/s)[1]
Predicted Groundwater Discharge to Lakes and Tributaries	
Dot Lake	0.0278
Minton Lake	0.0373
Payne Lake	0.0150
Lake 2	0.0051
Lake 3	0.0124
Tributary of Keewatin River (KEE3-A1)	0.0011
Tributary of Keewatin River (KEE3-B1 and KEE3-B1-2)	0.0117
Watercourse from East Pond to Tributary of Keewatin River (KEE3-B2-A1)	-0.0001
Watercourse connecting Payne Lake and Keewatin River (KEE3-PAY1)	0.0090
Predicted Baseflow in Rivers	
Keewatin River Gauging Station QM01	4.06
Keewatin River Gauging Station QM02 Including Contribution from Payne Lake and Payne Lake Rivers (KEE3-PAY1 and KEE3-PAY2)	4.10

Receiver	Discharge or Baseflow (m^3/s)[1]
Keewatin River Gauging Station QM10 Including Contribution from Dot Lake and Dot Lake Rivers (KEE3-DOT1 and KEE3-DOT3)	4.13
Keewatin River Gauging Station QM03	4.14
Keewatin River Gauging Station QM06 Including Contribution Keewatin River Tributaries (KEE3-B2, KEE3-B2-3, KEE3-B2-A1, KEE3-B1-2, KEE3-B1, KEE3-A1)	4.18
Lynn River Gauging Station QM05 Including Contributions from Lake LYN-B2 and River LYN2-A1	1.45

Note:
1 – Positive value represents flow from groundwater to receiver

5.1.2.3 Seepage From Historical MRSA

The particle tracks from the historical MRSA under baseline conditions are presented on Map 15, and the estimated discharge rates and travel time statistics to the receiving environment is presented in Table 5.2. As shown on Map 15 and Table 5.2, seepage originating from the historical MRSA discharges to KEE3-B2-A1, a tributary from East Pond. The flow paths are long as they flow into the bedrock unit, with average estimated travel time from the water table to the KEE3-B2-A1 of approximately 19 years.

Table 5.2 Predicted Seepage from Historical Mine Rock Storage Areas, Baseline Conditions

Source	Receptor	Discharge (m^3/s)	Travel Time (years)		
			Minimum	Mean	Maximum
Historical MRSA	East Pond Tributary (KEE3-B2-A1)	6.1E-05	15	19	31

5.2 Construction

The primary activities that are anticipated to potentially influence groundwater levels and flow during construction include the initial dewatering of the open pit and the satellite pit and construction of the new MRSA and TMF. While these activities will continue into the initial operating years, predicted results are presented to document the potential changes to groundwater levels and flow in the early phases of Project development.

5.2.1 Model Setup: Construction

Starting with the calibrated baseline groundwater flow model, the following modifications were completed to represent the dewatering of the open pit and the satellite pit, and the fate of groundwater originating from the TMF and MRSA. The historical MRSA was not simulated as the mine rock it contains will be relocated to the new MRSA during construction. The modifications are discussed below for each Project component. The model was simulated using four 6-month stress periods to simulate the 2-year construction phase.

5.2.1.1 Dewatering Open and Satellite Pits

To evaluate the effects of groundwater inflows to the open pit, the baseline groundwater flow model was modified to include the extent and depth of the open pit and satellite pit. By the end of construction, the open pit will be excavated to an elevation of approximately 270 m amsl.

The pits were simulated as drain boundary conditions to remove water from the model. The drain boundary is a head-dependent boundary condition that allows water to exit the model cell based on the hydraulic head of the aquifer compared to the head in the drain boundary. The drain boundary does not function if the computed head in the model cell (aquifer) is less than the head in the drain boundary. The drain boundary requires inputs for length, width, thickness, hydraulic conductivity, and head in the drain to calculate the amount of groundwater removed from the aquifer. The length, width, thickness, and hydraulic conductivity of the drain is used to calculate the conductance of the drain. The conductance of the drains was assigned a sufficiently high value to facilitate drainage within the pit but low enough to avoid model instability. Heads in the pit drain cells were defined as the layer bottom in each model layer in which the drains intersect or the pit bottom for the drains at the bottom of the pit. Drain cells were assigned from the water table to the deepest portion of the open pit in layer 7.

5.2.1.2 MRSA and TMF

The MRSA was represented in the model by adjusting the groundwater recharge within the footprint of the MRSA. This footprint increases over time in the model to reflect the expansion of the MRSA over the construction phase. The groundwater recharge within the footprint of the MRSA was estimated using a MACRO model (Stantec 2020d). The average recharge rate to the groundwater flow system under the MRSA during the operations phase is predicted to be 8.4 mm/yr from the top surface and 39 mm/yr from the side slopes of the MRSA. The footprint of the MRSA was added in the first model stress period and modified in subsequent stress periods to represent the expansion of the MRSA over time.

The TMF was simulated as a transient GHB condition. The head of the TMF was assigned based on TMF head specifications at various years during construction according to the Mine Plan. The conductance was assigned based on the length, width, thickness, and the hydraulic conductivity of tailings.

The extent of each facility at the end of the construction period was added in the first model stress period and modified in subsequent stress periods to represent the expansion of the facility over time. In each stress period where a model cell first fell within the footprint of the expanding facility, a particle was added to the cell. The travel paths of the particles were evaluated for the 2-year construction period where they

discharged to a receptor, such as a lake or watercourse, or the seepage collection system (which was represented by drain cells assigned 1 m bgs in cells where the collection ditch is present), or remained in groundwater.

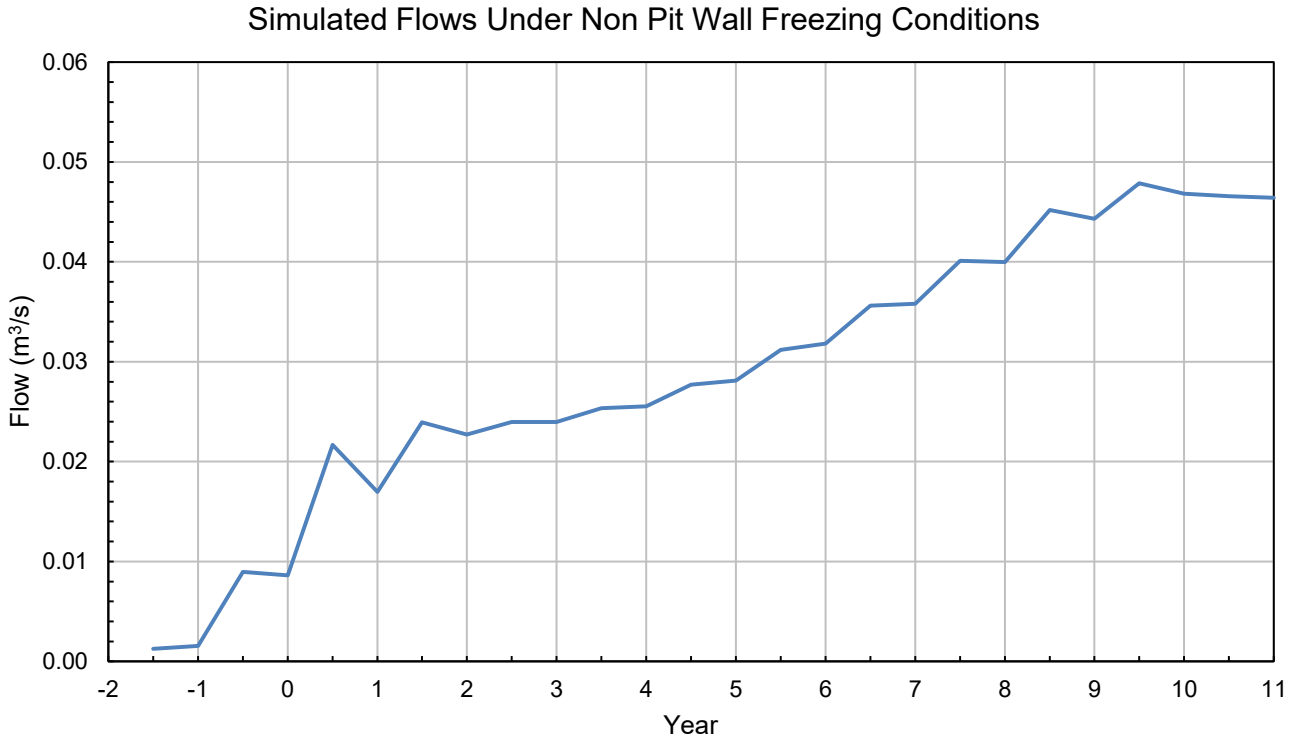
The groundwater flux associated with each particle track was then used to estimate the total discharge rate (Q) for the MRSA and TMF to the environment using the method described in Section 5.1.1. The estimated groundwater flux represents the total discharge rate to the environment at the end of construction following two years of flow of the particles.

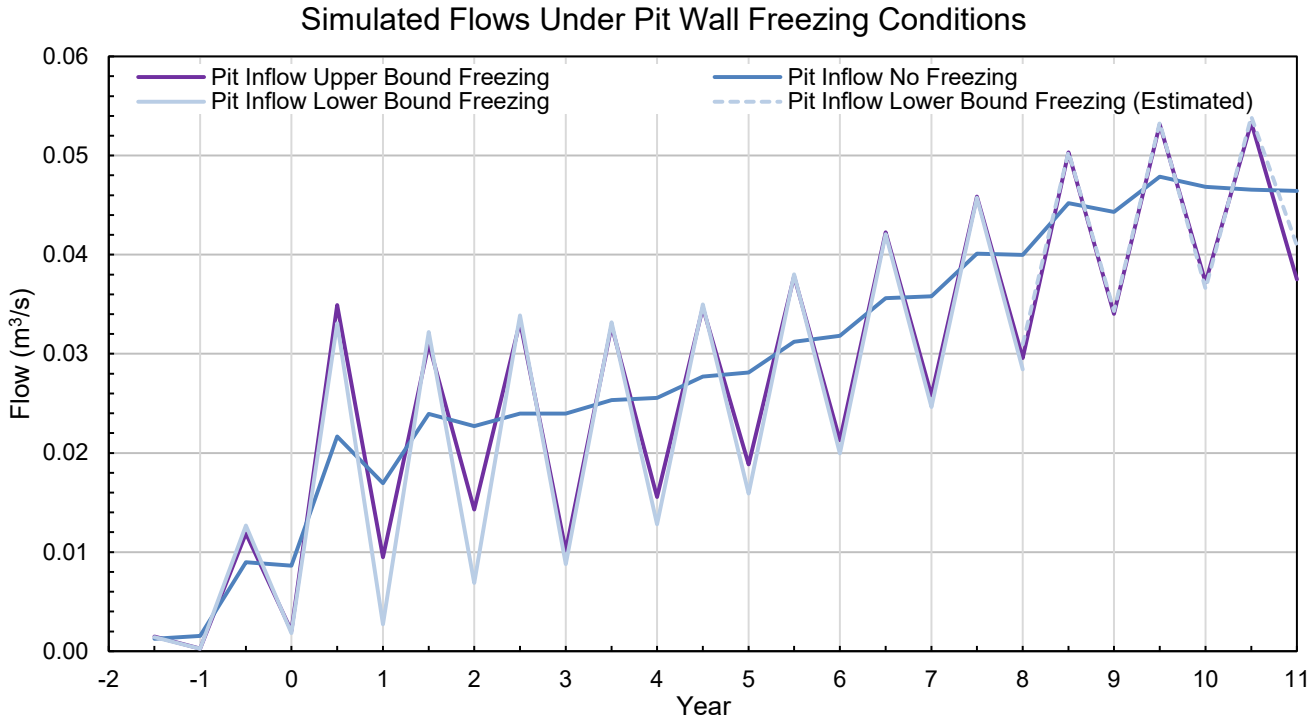
5.2.2 Model Results: Construction

5.2.2.1 Dewatering Volumes

The predicted groundwater inflow rate to the open pit and satellite pit is presented in Figure 5-1. The predicted groundwater inflow rate includes short-term increases which represent the progression of the pits. In the model, the in-pit drains begin operation immediately at the bottom elevation of the pit for each 6-month stress period in the model. This leads to high flow rates immediately following initiation of the new drains. In reality, the progression of the pits will be gradual, consequently flow rates are not likely to include short-term increases as shown in Figure 5-1.

At the end of the construction period, the groundwater flow into the open pit and satellite pit is predicted to be approximately 0.009 m^3/s.





Client/Project

ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
GORDON SITE

Figure No.

5-1

Title

Predicted Groundwater Inflow to Open Pit and Satellite Pit During Construction and Operation

Stantec

https://stantec.sharepoint.com/teams/160999003/BC1609/Projects/111473012_Alamos/MacLellan Model Rebuild/Report/Figures to Insert into Word Document/Figure 5-1 Predicted Groundwater Inflow During Construction and Operation.xlsx

5.2.2.2 Groundwater Drawdown and Discharge

The predicted groundwater elevation and drawdown contours at the end of the construction period are presented in Map 16 and Map 17. The 1 m drawdown contour is predicted to extend approximately 500 m to the east of the MRSA and 300 m to the south. Drawdown near the MRSA is due to the intersection of the seepage collection ditch with the water table and reduced recharge compared to baseline during the construction period. Drawdown associated with the seepage collection ditch is constrained by Minton Lake. Near the pits, the 1 m drawdown contour is predicted to extend approximately 500 m north and 400 m south of the pits, increasing to a maximum of 62 m of drawdown within the open pits. The drawdown extent is limited to the east and west due to recharge to groundwater from the Keewatin River and a tributary to the Keewatin (KEE3-B1-2). Mounding due to the TMF is generally limited to within the footprint of the TMF and reaches a maximum of 12 m.

Table 5.3 presents the comparison of baseline groundwater discharge and baseflow rates with the end of the construction period. As shown in Table 5.3, the response of the groundwater flow system to the dewatering of the pits at the end of the construction period are relatively small (less than 0.001 m^3/s). The directions of groundwater flow into (discharge) or out of (recharge) each lake are predicted to remain consistent between baseline and construction except for East Pond which is dewatered. Groundwater discharge to Payne Lake is predicted to increase at the end of construction due to mounding of the water table in association with the TMF

The changes to groundwater discharge to tributaries at the end of the construction period is relatively small (less than 0.002 m^3/s). The directions of groundwater flow into (discharge) or out of (recharge) each tributary are predicted to remain consistent between baseline and construction.

The changes to baseflow rates for the Keewatin River (generally less than 0.1 m^3/s) and the Lynn River (less than 0.01 m^3/s) are very small (less than 2% change) in comparison with the anticipated baseflow in these streams under baseline conditions.

Table 5.3 Predicted Groundwater Discharge to Lakes and Baseflow in Rivers at End of Construction

Resource	Baseline	End of Construction[1]	Change from Baseline[2]
Predicted Groundwater Discharge to Lakes and Tributaries (m^3/s)			
Dot Lake	0.0278	0.0275	-0.0002
Minton Lake	0.0373	0.0366	-0.0007
Payne Lake	0.0150	0.0153	0.0002
Lake 2	0.0051	0.0051	negligible
Lake 3	0.0124	0.0124	negligible
Tributary of Keewatin River (KEE3-A1)	0.0011	0.0011	negligible
Tributary of Keewatin River (KEE3-B1 and KEE3-B1-2)	0.0117	0.0101	-0.0017

Resource	Baseline	End of Construction[1]	Change from Baseline[2]
Watercourse from East Pond to Tributary of Keewatin River (KEE3-B2-A1)	-0.0001	-0.0021	-0.0020
Watercourse connecting Payne Lake and Keewatin River (KEE3-PAY1)	0.0090	0.0089	-0.0001
Predicted Baseflow in Rivers (m^3/s)			
Keewatin River Gauging Station QM01	4.06	4.06	N/A
Keewatin River Gauging Station QM02 Including Contribution from Payne Lake and Payne Lake Rivers (KEE3-PAY1 and KEE3-PAY2)	4.10	4.07	-0.03
Keewatin River Gauging Station QM10 Including Contribution from Dot Lake and Dot Lake Rivers (KEE3-DOT1 and KEE3-DOT3)	4.13	4.07	-0.06
Keewatin River Gauging Station QM03	4.14	4.08	-0.06
Keewatin River Gauging Station QM06 Including Contribution Keewatin River Tributaries (KEE3-B2, KEE3-B2-3, KEE3-B2-A1, KEE3-B1-2, KEE3-B1, KEE3-A1)	4.18	4.09	-0.09
Lynn River Gauging Station QM05 Including Contributions from Lake LYN-B2 and River LYN2-A1	1.45	1.44	-0.01

Notes:

1 – Positive value represents flow from groundwater to receiver

2 – Change presented is predicted flow in the Mining Period minus flow simulated in Baseline

N/A – Baseflow at gauging station is an input parameter and does not change from baseline during model simulations

5.2.2.3 Seepage from Mine Infrastructure

The particle traces at the end of the construction period are presented in Map 18, and the estimated discharge rates and travel time statistics to the receiving environment are presented in Table 5.4. A portion of the particles originating from the MRSA and TMF are predicted to be captured by the seepage collection ditch with mean advective travel time of 1.5 and 2 years, respectively. At the end of construction, seepage discharged from the new MRSA and TMF is not predicted to reach natural surface water features such as rivers, creeks, and lakes. Seepage from both facilities not captured by the seepage collection ditch remains in groundwater.

The results of the particle tracking analyses performed for the construction phase presented in Table 5.4 are conservative and overestimate discharge because seepage is assumed to discharge at the beginning of each year over the footprint for each facility at the end of the year. The discharge is expected to be smaller than estimated.

Table 5.4 Predicted Discharge Rates and Travel Time from Mine Infrastructure to Receiving Environment at the End of Construction

Source	Receptor	Discharge Arriving by End of Construction (m^3/s)	Travel Time (years)		
			Minimum	Mean	Maximum
MRSA	Seepage Collection Ditch	4.2E-05	<1	1.5	2
TMF	Seepage Collection Ditch	3.5E-06	2	2	>2

5.3 Operations

The groundwater model was subsequently modified from the construction phase to simulate the effects of the Project during operation on groundwater levels and flow and the fate of groundwater originating from the MRSA, TMF, and OSA during operation. As part of these simulations, the model was used to predict groundwater inflows to the open pit and to evaluate the flow paths and groundwater discharge rates to receptors for recharge that originates from the MRSA, OSA, and TMF.

5.3.1 Model Setup: Operations

The transient groundwater flow model used for the prediction of effects in construction described in Section 5.2.1 was simulated for a further 11 years (22 6-month stress periods) with the following modifications to model the predicted effects of the operations phase.

5.3.1.1 Dewatering Open and Satellite Pits

The number of drain cells used to represent the open and satellite pits was increased to represent progression of the pits over time. The ultimate footprint of the open pit has an area of 713,800 m^2 and an ultimate depth of approximately 400 m which corresponds to approximately -60 m amsl. Drain cells were assigned from layer 1 in the pits to the deepest portion of the pit in layer 12. The ultimate footprint of the satellite pit has an area of 45,800 m^2 and an ultimate depth of approximately 67 m, which corresponds to approximately 270 m amsl.

Three models were constructed to predict potential impacts from mining activities during the construction and operation phases:

1. In-pit drains, no freezing: This model incorporates drains within the open pit and satellite pit for dewatering assuming no freezing.
2. In-pit drains with partial freezing, upper bound: This model reduces the hydraulic conductivity of the open pit and satellite pit by two orders of magnitude from October 15 to April 15 for each hydrostratigraphic unit within the pits.

3. In-pit drains with partial freezing, lower bound: This model reduces the hydraulic conductivity of the open pit and satellite pit by three orders of magnitude from October 15 to April 15 for each hydrostratigraphic unit within the pits.

To assess the influence of freezing the pit walls in the winter, the hydraulic conductivity of the cells within the pit was adjusted from October 15 to April 15 to simulate reduced hydraulic conductivity. The period during which the hydraulic conductivity was reduced was based on previous modeling completed in FEFLOW (Stantec 2020e). Within models which represent partial freezing, the hydraulic conductivity was linearly reduced from the calibrated value for each hydrostratigraphic unit within the pit to the reduced value from October 15 to November 1 of each year. From November 1 to March 31, the hydraulic conductivity remained at the reduced value. From March 31 to April 15, the hydraulic conductivity was linearly increased from the reduced value to the calibrated value for each hydrostratigraphic unit. Given the uncertainty of the extent of freezing in the winter, the relative change in hydraulic conductivity was assigned based on two factors: the calibrated hydraulic conductivity of each hydrostratigraphic unit in the pit was reduced by either two orders of magnitude or three orders of magnitude. Simulations which included freezing were completed using MODFLOW-SURFACT version 4. The time-varying material properties were simulated using the TMP1 package.

5.3.1.2 MRSA, TMF, and OSA

The MRSA footprint will become larger throughout operations. The average recharge rate to the groundwater flow system under the MRSA is consistent with the construction phase recharge which is 8.4 mm/yr on the top of the MRSA and 39 mm/yr on the side slopes.

As with the construction phase, the GHB cells representing the TMF were assigned based on TMF head specifications at various years during operations according to the Mine Plan. The conductance of the GHB cells varied in time to represent the increasing thickness of the tailings as the facility is constructed.

Ore will be temporarily stockpiled in the OSA as mining progresses. Therefore, the OSA extent and height will vary over time as material is removed for processing. Thus, it is not considered an enhanced recharge feature, and the average recharge rate of 72.3 mm/yr used in the baseline model was retained within the OSA footprint.

The forward particle tracking approach presented in Section 5.1.1 was used to predict the fate of recharge from the MRSA, TMF, and OSA, where a particle was released from each model cell within the footprint of each facility. The resulting predicted discharge rates to the environment from the MRSA, TMF, and OSA represent the end of operations when particles have been tracked for up to 13 years (2 years of construction plus 11 years of operation).

5.3.2 Model Results: Operations

5.3.2.1 Dewatering Volumes

The predicted groundwater inflow rates to the open pit and satellite pit are presented in Figure 5-1. The predicted groundwater inflow rate includes short-term increases which represent the progression of the pits. In the model, the in-pit drains begin operation immediately at the bottom elevation of the pit for each 6-month time step in the model. This leads to high flow rates immediately following initiation of the new drains. In reality, the progression of the pits will be gradual, consequently flow rates are not likely to include short-term increases as shown in Figure 5-1. Inflow rate in the pits without freezing reaches nearly 0.05 m^3/s at 9.5 years of operations.

The predicted groundwater inflow rates to the open pit and satellite pit with and without freezing are also presented in Figure 5-1. Predicted groundwater inflow to the open pit and satellite pit may decrease significantly during the winter months followed by increases in the spring and summer. The extent of freezing is uncertain, consequently, a lower and upper bound are presented. While the majority of the pit walls may freeze in the winter, some inflow is expected to occur through fractures and faults. The minimum predicted inflow rate is generally less than 0.01 m^3/s in the first year of operation in the winter and gradually increases later in operations to approximately 0.04 m^3/s. In the spring and summer, the predicted inflow rates increase compared to the winter and are generally 0.01 m^3/s higher than the predicted inflow rate without freezing. The maximum predicted inflow rate in the spring and summer months ranges from approximately 0.03 m^3/s to more than 0.05 m^3/s. The range of flow throughout the year may be up to 0.03 m^3/s or more.

5.3.2.1 Groundwater Drawdown and Discharge to Surface Water

The predicted groundwater elevation and drawdown contours at the end of the operation period are presented in Map 19 and Map 20. The 1 m drawdown contour is predicted to extend slightly more than 500 m to the east of the MRSA. Drawdown near the MRSA is due to the seepage collection ditch intercepting the water table and reduced recharge compared to baseline during the construction period. Near the pits, the 1 m drawdown contour is predicted to extend approximately 1 km north, 1 km east, 2 km south, and 2 km west of the pits. The maximum drawdown in the deepest portion of the pit is nearly 400 m. Mounding due to the TMF extends approximately 1 km west of the TMF and reaches a maximum of 26 m.

Table 5.5 presents the comparison of groundwater discharge and baseflow at the end of the operation period to baseline. The decrease in groundwater discharge to lakes are small (less than 0.001 m^3/s) to negligible except for Dot Lake. The groundwater discharge to Dot Lake is predicted to decrease by 0.004 m^3/s at the end of operation compared to baseline conditions which represents a 15% decrease. The directions of groundwater flow into (discharge) or out of (recharge) each lake are predicted to remain consistent between baseline and end of operations. Groundwater discharge to Payne Lake is predicted to increase by 0.002 m^3/s (13% increase) due to mounding of the water table associated with the TMF.

The changes to groundwater discharge to tributaries at the end of the construction period is also relatively small (decrease than less 0.001 m^3/s) except for the tributary associated with Keewatin River (KEE3-B1 and KEE3-B1-2). The groundwater discharge to the tributary associated with the Keewatin River (KEE3-B1 and KEE3-B1-2) is predicted to decrease by 0.0086 m^3/s (73% decrease in groundwater discharge). The tributary of the Keewatin River is located close to the open pit where drawdown due to dewatering is predicted to be greater. The directions of groundwater flow into (discharge) or out of (recharge) each lake are predicted to remain consistent between baseline and end of operations.

Changes to baseflow rates for the Keewatin River (generally less than 0.1 m^3/s) and the Lynn River (less than 0.01 m^3/s) are very small (2% or less) in comparison with the anticipated baseflow in these streams for baseline conditions.

Table 5.5 Predicted Groundwater Discharge to Lakes and Baseflow in Rivers at End of Operations

Resource	Baseline[1]	End of Operations[1]	Change from Baseline[2]
Predicted Groundwater Discharge to Lakes and Tributaries (m^3/s)			
Dot Lake	0.0278	0.0237	-0.0041
Minton Lake	0.0373	0.0363	-0.0010
Payne Lake	0.0150	0.0170	0.0020
Lake 2	0.0051	0.0051	negligible
Lake 3	0.0124	0.0124	negligible
Tributary of Keewatin River (KEE3-A1)	0.0011	0.0008	-0.0003
Tributary of Keewatin River (KEE3-B1 and KEE3-B1-2)	0.0117	0.0031	-0.0086
Watercourse from East Pond to Tributary of Keewatin River (KEE3-B2-A1)	-0.0001	-0.0036	-0.0035
Watercourse connecting Payne Lake and Keewatin River (KEE3-PAY1)	0.0090	0.0098	0.0008
Predicted Baseflow in Rivers (m^3/s)			
Keewatin River Gauging Station QM01	4.06	4.06	N/A
Keewatin River Gauging Station QM02 Including Contribution from Payne Lake and Payne Lake Rivers (KEE3-PAY1 and KEE3-PAY2)	4.10	4.07	-0.03
Keewatin River Gauging Station QM10 Including Contribution from Dot Lake and Dot Lake Rivers (KEE3-DOT1 and KEE3-DOT3)	4.13	4.07	-0.07
Keewatin River Gauging Station QM03	4.14	4.07	-0.07

Resource	Baseline[1]	End of Operations[1]	Change from Baseline[2]
Keewatin River Gauging Station QM06 Including Contribution Keewatin River Tributaries (KEE3-B2, KEE3-B2-3, KEE3-B2-A1, KEE3-B1-2, KEE3-B1, KEE3-A1)	4.18	4.08	-0.10
Lynn River Gauging Station QM05 Including Contributions from Lake LYN-B2 and River LYN2-A1	1.45	1.44	-0.01

Notes:

1 – Positive value represents flow from groundwater to receiver

2 – Change presented is predicted flow in the Mining Period minus flow simulated in Baseline

N/A – Baseflow at gauging station is an input parameter and does not change from baseline during model simulations

5.3.2.2 Seepage From Mine Infrastructure

The fate of seepage that recharges beneath mine infrastructure at the end of operations was estimated by conducting forward particle tracking. The particle traces at the end of the operation period are presented in Map 21. The particle traces were used to quantify the discharge rates and travel times to the receiving environment are summarized in Table 5.6. The results of the particle tracking analyses performed for the operation phase presented in Table 5.6 are conservative and overestimate discharge because seepage is assumed to discharge at the beginning of each year over the footprint for each facility at the end of the year. The discharge is expected to be smaller than estimated. Approximately 10% of seepage from the MRSA discharges to the open pit or satellite pit with a mean advective travel time of 3 years. Approximately 59% of seepage from the MRSA discharges to the seepage collection ditch with a mean advective travel time of 2 years while approximately 9% of seepage from the MRSA discharges to tributaries of the Keewatin River. Approximately 10% of seepage from the MRSA discharges to Minton Lake with a mean advective travel time of 13 years. Discharge to remaining receptors is small in magnitude (much less than 0.001 m^3/s) and less than 1% of the total seepage from the MRSA. Approximately 10% of seepage from the MRSA remains in groundwater at the end of the operations period.

For seepage discharged from the TMF, approximately 34% discharges to the open pit or satellite pit with a mean travel time of 9 years. Approximately 8% of seepage from the TMF discharges to Payne Lake with a mean travel time of 13 years while approximately 23% is captured by the seepage collection ditch with a mean travel time of 12 years. Approximately 9% of seepage from the TMF discharges to Minton Lake with a mean travel time of 13 years. Discharge to remaining receptors is small in magnitude (less than 0.001 m^3/s) and less than 5% of the total seepage from the TMF. Approximately 18% of seepage from the TMF remains in groundwater at the end of operations.

At the end of operations, nearly 100% of seepage from the OSA discharges to the open pit with a mean travel time of 2 years.

Table 5.6 Predicted Discharge Rates and Travel Time from Mine Infrastructure to Receiving Environment at the End of Operations

Source	Receptor	Discharge Arriving by End of Operations (m^3/s)	Travel Time (years)		
			Minimum	Mean	Maximum
OSA	Open Pit	2.5E-04	2	2	3
MRSA	Open Pit	2.0E-04	<1	3	10
	Payne Lake	1.5E-05	<1	13	>13
	Seepage Collection Ditch	1.1E-03	1	2	12
	Tributaries of the Keewatin River (KEE3-B2, KEE3-B2-3, KEE3-B2-A1, KEE3-B1-2, and KEE3-B1)	1.7E-04	<1	4	12
	Minton Lake	1.9E-04	<1	13	>13
TMF	Open Pit	1.3E-03	2	9	>13
	Payne Lake	3.0E-04	13	13	>13
	Seepage Collection Ditch	8.7E-04	2	12	>13
	Tributaries of the Keewatin River (KEE3-B2, KEE3-B2-3, KEE3-B2-A1, KEE3-B1-2, and KEE3-B1)	5.3E-05	4	12	>13
	Tributaries of Minton Lake(COC2-LOB2MIN5-5, COC2LOB2MIN5-2, COC2LOB2MIN5-3, COC2LOB2-MIN5-4, COC2LOB2-MIN5-5, COC2LOB2-MIN3)	2.2E-05	13	13	>13
	Tributaries of Payne Lake Rivers (KEE3-PAY1 and KEE3-PAY2)	1.9E-04	4	9	>13
	Minton Lake	3.3E-04	13	13	>13
	Keewatin River	8.4E-05	6	11	>13

5.4 Closure

The groundwater model was subsequently modified from the operation phase to simulate the effects of the Project on groundwater levels and flow and the fate of groundwater originating from the TMF, MRSA, and OSA during closure. As part of these simulations the model was used to predict groundwater inflows to the open pit and satellite pit as the pits fill and to evaluate the flow paths and groundwater discharge rates to receptors for recharge that originates from mine infrastructure.

5.4.1 Model Setup: Closure

Starting with the calibrated groundwater flow model and modifications completed at the end of operation, the following additional modifications were completed: removal of the seepage collection ditch, filling of the open pit (in-pit drains were removed), the TMF was allowed to drain (the GHB for the TMF was removed and recharge rate changed), change in recharge for the MRSA. The closure model was simulated for a period of 200 years with 38 stress periods.

5.4.1.1 Open Pit and Satellite Pit Filling

In closure, the open pit and satellite pit will be allowed to fill through precipitation and groundwater inflow. The filling of the pits during closure was simulated by removing the drain boundary conditions (GHBs) and replacing them with the lake module (LAK3; Merritt and Konikow 2000)). The stage (water level) of the pit lakes is calculated using the dynamic pit lake water balance as follows:

$$h_l^n = h_l^{n-1} + t\frac{(P_{inflow} + R_{inflow} - W_{out} - Evap_{out} - SP - Q_s)}{A_s}$$

Variables:

- h_l^n = Stage of the pit lake, current time step; previous time step is n-1 (ft or m)
- t = time step length (days)
- P_{inflow} = Precipitation on the lake (user input; ft^3/day or m^3/day)
- R_{inflow} = Surface water runoff to the lake (user input; ft^3/day or m^3/day)
- W_{out} = Water withdrawal from the pit lake (user input; ft^3/day or m^3/day)
- $Evap_{out}$ = Evaporation from the pit lake surface (user input; ft^3/day or m^3/day)
- SP = Net seepage between the lake and the aquifer (ft^3/day or m^3/day)
- Q_s = Net inflow and outflow from streams (ft^3/day or m^3/day)
- A_s = Surface area of the pit lake (ft^2 or m^2)

P_{inflow}, R_{inflow}, W_{out}, $Evap_{out}$, and Q_s were all set to zero. The only inflow to the pit lakes in the groundwater model is groundwater seepage and there will be no outlet for the pit lake. The initial stages of the lakes were assigned based on the final heads in the pits from the operations model. The minimum and maximum stages of the open pit are -60 m and 332 m amsl respectively while the minimum and maximum

stages of the satellite pit are 230 m and 336 m amsl, respectively. A lakebed hydraulic conductivity of 5.8×10^{-6} m/s (0.5 m/day) and thickness of 1 m were assumed for both lakes. The hydraulic conductivity of the pit walls and pit bottom was assigned similar to the surrounding overburden and bedrock units or up to an order of magnitude higher to allow full hydraulic connection between the pit lake and the aquifer. Precipitation to the pit surface was set to zero because the pit filling rate will be estimated as a part of surface water modeling which will include precipitation. The groundwater inflow rate predicted using the groundwater flow model will be used as input for the surface water model.

5.4.1.2 MRSA, TMF, and OSA

The new MRSA as represented during the operation phase of mine development was maintained in the full extent throughout the closure model. Progressive rehabilitation of the MRSA is proposed by application of a cover. The MACRO model that was used to estimate recharge from the MRSA in operation was also used to estimate recharge from the MRSA once the MRSA has been covered, revegetated, and the storage capacity of the rock has been filled (the rock has fully wetted up; Stantec 2020d). The time for the storage capacity to be filled is the time to reach a steady-state saturation condition in the MRSA, where the volume of water infiltrating into the MRSA from precipitation will result in an equal amount of recharge from the base of the MRSA. The MRSA is predicted to wet up 25 years after the start of closure. Therefore, the recharge from the MRSA was increased in closure compared to operation. The average recharge rate to the groundwater flow system under the MRSA during the closure phase is predicted to be 35 mm/yr at the base of the MRSA and 39 mm/yr at the base of the side slopes of the MRSA. Applying these recharge rates for the full closure simulation is conservative as there are 25 years in closure where the recharge from the MRSA will be less than the wetted up recharge rates. These recharge rates account for a soil cover over the MRSA in closure.

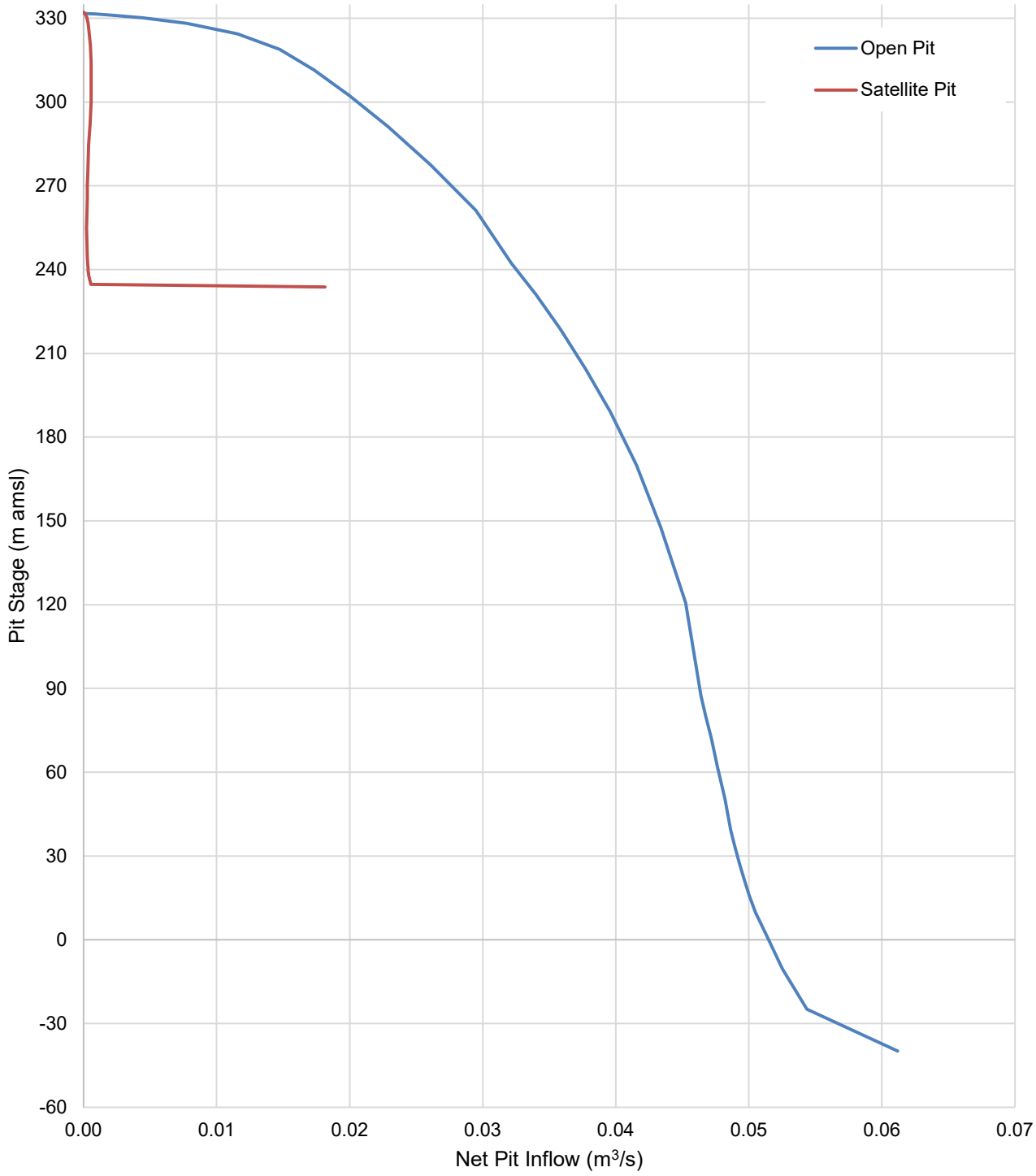
An extra layer was added above the top layer of the operations model to simulate the TMF. The final elevation of the TMF at the end of the operation phase was assumed as the top elevation of the TMF in the closure model and used to assign layer thickness of the new top layer within the TMF. Outside the TMF, a layer thickness of 1 m was assigned, and the cells are assigned as no-flow. Recharge of 36.15 mm/yr is applied to the TMF which is half of the calibrated recharge of 72.3 mm/yr. The reduced recharge is assumed because it is anticipated that a cover will be installed on the TMF at closure and the fine texture of the tailings will reduce seepage. The seepage collection ditch was removed for the closure model.

Ore will be stockpiled in the OSA for the initial 6 years of closure. The OSA is not considered an enhanced recharge feature, and the average recharge rate of 72.3 mm/yr used in the baseline model was retained within the OSA footprint.

5.4.2 Model Results: Closure

5.4.2.1 Open Pit and Satellite Pit Filling

The rate of groundwater inflow and the estimated pit stages are presented in Figure 5-2. The water level in the open pit increases from approximately -60 m amsl to approximately -40 m amsl in the first stress period in the model. The initial net groundwater inflow rate to the open pit is approximately 0.061 m^3/s. The initial net groundwater inflow rate to the satellite pit is less than 0.02 m^3/s and decreases significantly due to groundwater outflow nearly equal to inflow until the water level in the open pit approximates the water level in the satellite pit. The net groundwater inflow rate to the open pit decreases to less than 0.001 m^3/s at a final pit lake level of 332 m amsl. For the satellite pit, the net groundwater inflow rate also decreases below 0.001 m^3/s inflow at a final pit lake level of 332 m amsl. Both the open pit and satellite pits become “through-flow” lakes in which groundwater flows into and out of the pits, although the net inflow (in-out) is much lower than 0.001 m^3/s at the end of closure.



Notes:
Net Pit Inflow = Inflow - Outflow

Client/Project

ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
GORDON SITE

Figure No.

5-2

Title

Predicted Net Predicted Open Pit and Satellite Pit Groundwater Inflow and Stage in Closure

Stantec

5.4.2.2 Groundwater Drawdown and Discharge to Surface Water Features

The predicted groundwater elevation and drawdown contours at the end of closure are presented in Map 22 and Map 23. At the end of closure, the water table is anticipated to return to near baseline conditions except in the vicinity of mine infrastructure. A comparison between the baseline water table (Map 14) and the water table at closure (Map 22) generally agree quite well and indicates groundwater elevations at closure are near baseline conditions except the area within the pits, the TMF, and the MRSA. Areas of drawdown are predicted within the pits compared to baseline because recharge was removed from the pits. This is conservative to assess effects and was conducted to predict the groundwater inflow rate to the pit without the influence of precipitation to support the surface water modeling. Drawdown in the vicinity of the TMF and MRSA are due to reduced recharge compared to baseline. The footprint of East Pond is assumed to be filled by groundwater at closure.

Table 5.7 presents a comparison of baseline baseflow rates with effects of the pit lakes on the surface water flows at closure (i.e., after the pit lake is full) without seepage collection ditches around the TMF and MRSA. Groundwater discharge to surface water is predicted to return to near baseline once the pit is full. The predicted changes in groundwater discharge to lakes and tributaries is relatively small (less than 0.001 m^3/s) except for Minton Lake and the tributary of Keewatin River (KEE3-B1 and KEE3-B1-2). Groundwater discharge to Minton Lake is predicted to decrease by 0.0017 m^3/s at the end of closure compared to baseline condition which represents a 4% decrease. Surface from the tributary of the Keewatin River (KEE3-B1 and KEE3-B1-2) that recharges groundwater is predicted to increase by 0.0019 m^3/s compared to baseline conditions, which represents a 16% increase. The directions of groundwater flow into (discharge) or out of (recharge) each lake and tributary are predicted to remain consistent between baseline and closure.

Predicted changes to baseflow for the Keewatin River in closure compared to baseline is less than 0.1 m^3/s. The predicted changes in baseflow to the Lynn River at closure as compared to baseline is less than 0.01 m^3/s. These changes in baseflow represent 2% or less change in comparison to baseline conditions for the Keewatin River and Lynn River.

Table 5.7 Predicted Groundwater Discharge to Lakes and Baseflow in Rivers at End of Closure

Resource	Baseline	End of Closure[1]	Change from Baseline[2]
Predicted Groundwater Discharge to Lakes and Tributaries (m^3/s)			
Dot Lake	0.0278	0.0277	-0.0001
Minton Lake	0.0373	0.0356	-0.0017
Payne Lake	0.0150	0.0145	-0.0005
Lake 2	0.0051	0.0051	negligible
Lake 3	0.0124	0.0123	negligible
Tributary of Keewatin River (KEE3-A1)	0.0011	0.0010	-0.0001

Resource	Baseline	End of Closure[1]	Change from Baseline[2]
Tributary of Keewatin River (KEE3-B1 and KEE3-B1-2)	0.0117	0.0098	-0.0019
Watercourse from East Pond to Tributary of Keewatin River (KEE3-B2-A1)	-0.0001	-0.0016	-0.0015
Watercourse connecting Payne Lake and Keewatin River (KEE3-PAY1)	0.0090	0.0085	-0.0005
Predicted Baseflow in Rivers (m^3/s)			
Keewatin River Gauging Station QM01	4.06	4.06	NA
Keewatin River Gauging Station QM02 Including Contribution from Payne Lake and Payne Lake Rivers (KEE3-PAY1 and KEE3-PAY2)	4.10	4.07	-0.03
Keewatin River Gauging Station QM10 Including Contribution from Dot Lake and Dot Lake Rivers (KEE3-DOT1 and KEE3-DOT3)	4.13	4.07	-0.06
Keewatin River Gauging Station QM03	4.14	4.08	-0.06
Keewatin River Gauging Station QM06 Including Contribution Keewatin River Tributaries (KEE3-B2, KEE3-B2-3, KEE3-B2-A1, KEE3-B1-2, KEE3-B1, KEE3-A1)	4.18	4.09	-0.09
Lynn River Gauging Station QM05 Including Contributions from Lake LYN-B2 and River LYN2-A1	1.45	1.44	-0.01

Notes:

1 – Positive value represents flow from groundwater to receiver

2 – Change presented is predicted flow in the Mining Period minus flow simulated in Baseline

N/A – Baseflow at gauging station is an input parameter and does not change from baseline during model simulations

5.4.2.3 Seepage from Mine Infrastructure

The fate of seepage that recharges beneath mine infrastructure at closure was estimated by conducting forward particle tracking. The particle traces at closure are presented on Map 24. The particle traces were used to quantify the discharge rates and travel times to the receiving environment from mine infrastructure and summarized in Table 5.8.

Table 5.8 Predicted Discharge Rates and Travel Time from Mine Infrastructure to Receiving Environment at Closure

Source	Receptor	Discharge Arriving by End of Closure (m^3/s)	Travel Time (years)		
			Minimum	Mean	Maximum
OSA	Open Pit	2.5E-04	<1	<1	<1
MRSA	Open Pit	1.0E-03	1	1	18
	Tributaries of the Keewatin River (KEE3-B2, KEE3-B2-3, KEE3-B2-A1, KEE3-B1-2, and KEE3-B1)	2.0E-04	<1	7	35
	Minton Lake	9.8E-04	1	2	16
	Minton Lake Rivers (COC2-LOB2MIN5-5, COC2LOB2MIN5-2, COC2LOB2MIN5-3, COC2LOB2-MIN5-4, COC2LOB2-MIN5-5, COC2LOB2-MIN3)	8.7E-04	<1	8	25
TMF	Open Pit	9.7E-04	6	56	122
	Tributaries of the Keewatin River (KEE3-B2, KEE3-B2-3, KEE3-B2-A1, KEE3-B1-2, and KEE3-B1)	9.3E-05	23	112	193
	Minton Lake	6.8E-04	13	104	>200
	Tributaries of Minton Lake (COC2-LOB2MIN5-5, COC2LOB2MIN5-2, COC2LOB2MIN5-3, COC2LOB2-MIN5-4, COC2LOB2-MIN5-5, COC2LOB2-MIN3)	3.8E-04	19	90	>200
	Payne Lake	2.6E-04	5	61	110
	Tributaries of Payne Lake (KEE3-PAY1 and KEE3-PAY2)	5.3E-05	28	51	143
	Cockeram Lake	2.4E-05	133	153	197

At the end of closure, seepage from the MRSA is primarily discharged to Minton Lake and tributaries of Minton Lake as well as the open pit or satellite pit. Seepage discharged to the open pit or satellite pit is approximately 27% of total seepage from the MRSA with a mean advective travel time of 1 year. Approximately 26% of seepage discharges to Minton Lake with a mean advective travel time of 2 years. Seepage discharged to the tributaries of Minton Lake is approximately 23% of the total seepage from the MRSA with a mean advective travel time of 8 years. Discharge to remaining receptors is small in magnitude (much less than 0.001 m^3/s) and less than 5% of the total seepage from the MRSA. Approximately 18% of seepage from the MRSA remains in groundwater.

At the end of closure, seepage from the TMF is primarily discharged to the open pit or satellite pit and Minton Lake and its tributaries. Seepage discharged to the open pit or satellite pit is approximately 39% of the total seepage from the TMF with a mean advective travel time of 56 years. Approximately 27% of seepage from the TMF discharges to Minton Lake with a mean advective travel time of 104 years. Seepage discharged to the tributaries of Minton Lake is approximately 15% of total seepage from the TMF with a mean advective travel time of 90 years. Approximately 11% of seepage from the TMF discharges to Payne Lake with a mean travel time of 61 years. Discharge to remaining receptors is small in magnitude (much less than 0.001 m^3/s) and less than 4% of the total seepage from the TMF. Less than 1% of seepage from the TMF remain in groundwater.

At the end of closure, more than 99% of seepage from the OSA discharges to the open pit with a mean travel time of less than 1 year. Less than 1% of seepage from the OSA remains in groundwater.

5.5 Predictive Sensitivity Analyses

Sensitivity analyses were completed for several parameters: hydraulic conductivity of the hydrostratigraphic units; hydraulic conductivity of the lakebed, riverbed, and streambed materials; recharge; and storage. Parameter values were adjusted manually to higher and lower values in a symmetrical fashion (e.g., increased and decreased by a factor of ten) with exceptions described below. The factor by which the parameters varied was based on the nature of the parameter (there is more uncertainty in hydraulic conductivity values than recharge values) and previous experience.

Sensitivities were evaluated by comparing discharge rates from groundwater to key receptors in the calibrated model to the discharge rates after varying the key parameters up and down.

5.5.1 Hydraulic Conductivity of Hydrostratigraphic Units

To evaluate model response to decreased hydraulic conductivity, all hydraulic conductivities for subsurface layers were decreased and increased by a factor of ten except for the mine rock. The change in net groundwater discharge to receivers compared to the base case for baseline, end of construction, end of operations, and end of closure is presented in Table 5.9. Effects on the predicted baseflow in the Keewatin River are summarized using flow station QM06 which accounts for the contribution to the Keewatin River from Payne Lake, Payne Lake Rivers (KEE3-PAY1 and KEE3-PAY1), Dot Lake, Dot Lake Rivers (KEE3-DOT1 and KEE3-DOT3), East Pond, East Pond Rivers (KEE3-B2, KEE3-B2-3, KEE3-B2-A1, KEE3-B1-2, and KEE3-B1), and Keewatin River Tributary KEE3-A1.

Table 5.9 Sensitivity Analysis Summary: Varying Hydraulic Conductivity (K) of Hydrostratigraphic Units

Receiver	Net Groundwater Discharge or Baseflow (m^3/s)[1]											
	Baseline			End of Construction			End of Operations			End of Closure		
	Base Case	Reduced K	Increased K	Base Case	Reduced K	Increased K	Base Case	Reduced K	Increased K	Base Case	Reduced K	Increased K
Predicted Groundwater Discharge to Lakes												
Dot Lake	0.0278	0.0262	0.0363	0.0275	0.0263	0.0324	0.0237	0.0137	-0.0167	0.0277	0.0258	0.0333
Minton Lake	0.0373	0.0384	0.0383	0.0366	0.0353	0.0359	0.0363	0.0159	0.0097	0.0356	0.0364	0.0349
Payne Lake	0.0150	0.0166	0.0032	0.0153	0.0147	0.0053	0.0170	0.0091	0.0008	0.0145	0.0163	0.0050
Lake 2	0.0051	0.0054	0.0022	0.0051	0.0054	0.0027	0.0051	0.0033	0.0025	0.0051	0.0054	0.0026
Lake 3	0.0124	0.0127	0.0098	0.0124	0.0127	0.0097	0.0124	0.0095	0.0094	0.0123	0.0127	0.0097
Predicted Baseflow in Rivers												
Keewatin River Gauging Station QM06	4.18	4.18	4.18	4.09	4.09	4.09	4.08	4.06	3.94	4.09	4.09	4.10
Lynn River Gauging Station QM05	1.45	1.45	1.44	1.44	1.44	1.44	1.44	1.41	1.43	1.44	1.44	1.44
Water Management Features												
Seepage Collection Ditch	N/A			0.0109	0.0169	0.0049	0.0227	0.0004	0.0016	N/A		
Open Pit				0.0086	0.0032	0.0432	0.0464	0.0092	0.3208			

Receiver	Change in Net Groundwater Discharge or Baseflow Compared to Base Case (m^3/s)[2]							
	Baseline		End of Construction		End of Operations		End of Closure	
	Reduced K	Increased K	Reduced K	Increased K	Reduced K	Increased K	Reduced K	Increased K
Predicted Groundwater Discharge to Lakes								
Dot Lake	-0.0015	0.0085	-0.0013	0.0049	-0.0100	-0.0404	-0.0019	0.0056
Minton Lake	0.0011	0.0010	-0.0014	-0.0007	-0.0205	-0.0266	0.0009	-0.0007
Payne Lake	0.0015	-0.0118	-0.0006	-0.0100	-0.0079	-0.0162	0.0017	-0.0095
Lake 2	0.0003	-0.0029	0.0003	-0.0024	-0.0018	-0.0026	0.0003	-0.0025
Lake 3	0.0003	-0.0025	0.0003	-0.0026	-0.0029	-0.0030	0.0003	-0.0027
Predicted Baseflow in Rivers								
Keewatin River Gauging Station QM06	-0.0015	0.0023	-0.0027	-0.0032	-0.0176	-0.1409	-0.0050	0.0139
Lynn River Gauging Station QM05	0.0009	-0.0108	0.0001	-0.0019	-0.0263	-0.0060	0.0000	-0.0012
Water Management Features								
Seepage Collection Ditch	N/A		0.0059	-0.0060	-0.0223	-0.0211	N/A	
Open Pit			-0.0054	0.0346	-0.0372	0.2744		

Notes:
1 – Positive value represents flow from groundwater to receiver
2 –Change presented is predicted flow in the Mining Period minus flow simulated in Baseline
N/A – not applicable – feature not present in the modelled timeframe or at the end of the period indicated

Of the lakes assessed, net groundwater discharge to Dot, Minton, and Payne Lakes is most sensitive to an increase in hydraulic conductivity of hydrostratigraphic units. An increase in hydraulic conductivity of the hydrostratigraphic units likely results in deeper flow of applied recharge and generally lower gradient within the basins. Consequently, water levels decrease in upland areas and increase in lowland areas. Therefore, groundwater discharge in upland areas is generally lower while groundwater discharge in lowland areas is higher. This trend is generally confirmed by the results in Table 5.9: an increase in hydraulic conductivity results in decreased groundwater discharge to Payne Lake, Lake 2 and Lake 3 and increased groundwater discharge to Dot Lake. Similarly, groundwater discharge increases to the Keewatin River[1] and Cockeram Lake, the two dominant surface features in the model. The opposite pattern is demonstrated following a decrease in hydraulic conductivity of the hydrostratigraphic units: hydraulic gradients increase, water levels in the uplands increase while water levels in the lowlands decrease which leads to higher groundwater discharge in the uplands and lower groundwater discharge in the lowlands. The cause of an increase in groundwater discharge at Minton Lake for both sensitivity simulations is unclear. Further, an increase in hydraulic conductivity of hydrostratigraphic units at the end of operations likely increases the influence of drawdown from the pits, because Dot Lake is predicted to change from a gaining lake to a losing lake.

Overall, baseflow in the Keewatin and Lynn Rivers is not sensitive to changes in the hydraulic conductivity of the hydrostratigraphic units with changes in baseflow of less than 0.03 m^3/s. One notable exception is that increasing hydraulic conductivity of the hydrostratigraphic units in operations results in a 3% decrease in the predicted baseflow in the Keewatin River at the end of operations. Most of this decrease is predicted to be measurable at the QM03 gauging station which is closer to the open pit than gauging station QM06. The larger decrease in groundwater discharge following an increase of hydraulic conductivity of the hydrostratigraphic units may increase the influence of drawdown from the pits. It is important to recognize the scaled RMS error of the baseline model following a decrease in hydraulic conductivity of the hydrostratigraphic units is 135% while the scaled RMS error is 19% following an increase in hydraulic conductivity. Consequently, the magnitude of the changes to net groundwater discharge and baseflow with an increase in hydraulic conductivity of the hydrostratigraphic units may be more realistic than the magnitude of changes with a decrease in hydraulic conductivity (Section 4.4.1).

At the end of the construction period, flow to the seepage collection ditch is predicted to increase following a decrease in hydraulic conductivity of the hydrostratigraphic units and flow is predicted to decrease following an increase in hydraulic conductivity. This is likely because with a decrease in hydraulic conductivity, recharge from the TMF and MRSA is more readily captured in the seepage collection ditch because the lower hydraulic conductivity of the subgrade beneath each facility leads to more lateral flow compared to the base case. The opposite is true for an increase in hydraulic conductivity of the subgrade, recharge may flow vertically rather than laterally and less is captured in the seepage collection ditch. At the end of operations, following an increase in hydraulic conductivity, drawdown from the pits is better developed due to the higher hydraulic conductivity compared to the base case. The

[1] Leakage to the Keewatin River as calculated using the SFR package increases following an increase in hydraulic conductivity although the total baseflow contribution presented in Table 5.9 decreases due to the influence of tributary lakes and rivers.

drawdown from the pits induces more vertical flow beneath the TMF and MRSA compared to lateral flow, consequently, the seepage collection ditch less effective for both a decrease and increase in hydraulic conductivity.

Net groundwater discharge to the open pit and satellite pit is less sensitive to decreases in hydraulic conductivity of the hydrostratigraphic units than increases. As hydraulic conductivity is directly proportional to groundwater flow rate, decreases in hydraulic conductivity of the hydrostratigraphic units results in decreases in flow to the open pits while increases in hydraulic conductivity of the hydrostratigraphic units results in increases in flow to the open pits.

5.5.2 Hydraulic Conductivity of Lakebed, Riverbed, And Streambed Material

To evaluate model response to changes in the hydraulic conductivity of the lakebed, riverbed, and streambed materials, the hydraulic conductivity of riverbed material (as represented in the River boundary condition), lakebed material (as represented in the General Head Boundary), and streambed material (as represented in the Streamflow Routing Package) was increased and decreased by a factor of ten. Increasing the hydraulic conductivity of the lakebed, riverbed, and streambed materials by a factor of ten and five resulted in model instabilities in the closure model. Consequently, hydraulic conductivity was increased by a factor of two for the closure model only. The change in net groundwater discharge to receivers compared to the base case for baseline, end of construction, end of operations, and end of closure is presented in Table 5.10. Effects on the predicted baseflow in the Keewatin River are summarized using flow station QM06 which accounts for the contribution to the Keewatin River from Payne Lake, Payne Lake Rivers (KEE3-PAY1 and KEE3-PAY1), Dot Lake, Dot Lake Rivers (KEE3-DOT1 and KEE3-DOT3), East Pond, East Pond Rivers (KEE3-B2, KEE3-B2-3, KEE3-B2-A1, KEE3-B1-2, and KEE3-B1), and Keewatin River Tributary KEE3-A1.

Table 5.10 Sensitivity Analysis Summary: Varying Riverbed, Lakebed, and Streambed Hydraulic Conductivity

Receiver	Net Groundwater Discharge or Baseflow (m^3/s)[1]											
	Baseline			End of Construction			End of Operations			End of Closure		
	Base Case	Reduced K	Increased K	Base Case	Reduced K	Increased K	Base Case	Reduced K	Increased K	Base Case	Reduced K	Increased K
Predicted Groundwater Discharge to Lakes												
Dot Lake	0.0278	0.0282	0.0277	0.0275	0.0279	0.0277	0.0237	0.0239	0.0237	0.0277	0.0281	0.0277
Minton Lake	0.0373	0.0386	0.0385	0.0366	0.0375	0.0372	0.0363	0.0363	0.0357	0.0356	0.0363	0.0353
Payne Lake	0.0150	0.0157	0.0153	0.0153	0.0158	0.0154	0.0170	0.0171	-0.0107	0.0145	0.0155	0.0149
Lake 2	0.0051	0.0053	0.0051	0.0051	0.0052	0.0050	0.0051	0.0052	0.0050	0.0051	0.0053	0.0051
Lake 3	0.0124	0.0130	0.0095	0.0124	0.0130	0.0097	0.0124	0.0129	0.0097	0.0123	0.0130	0.0120
Predicted Baseflow in Rivers												
Keewatin River Gauging Station QM06	4.18	4.18	4.18	4.09	4.09	4.09	4.08	4.08	4.08	4.09	4.09	4.09
Lynn River Gauging Station QM05	1.45	1.45	1.45	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
Water Management Features												
Seepage Collection Ditch	N/A			0.0109	0.0142	0.0110	0.0227	0.0171	0.0022	N/A		
Open Pit				0.0086	0.0088	0.0087	0.0464	0.0457	0.0528			

Receiver	Change in Net Groundwater Discharge or Baseflow Compared to Base Case (m^3/s)[2]							
	Baseline		End of Construction		End of Operations		End of Closure	
	Reduced K	Increased K	Reduced K	Increased K	Reduced K	Increased K	Reduced K	Increased K
Predicted Groundwater Discharge to Lakes								
Dot Lake	0.0004	0.0000	0.0003	0.0001	0.0002	0.0000	0.0004	0.0000
Minton Lake	0.0014	0.0012	0.0009	0.0006	0.0000	-0.0006	0.0008	-0.0003
Payne Lake	0.0006	0.0003	0.0005	0.0001	0.0001	-0.0277	0.0009	0.0003
Lake 2	0.0002	0.0000	0.0002	-0.0001	0.0001	-0.0001	0.0002	0.0000
Lake 3	0.0006	-0.0029	0.0006	-0.0027	0.0006	-0.0027	0.0006	-0.0003
Predicted Baseflow in Rivers								
Keewatin River Gauging Station QM06	-0.0015	-0.0014	0.0019	-0.0005	0.0012	-0.0015	0.0022	0.0001
Lynn River Gauging Station QM05	0.0002	-0.0002	0.0007	-0.0003	0.0006	-0.0002	0.0007	-0.0001
Water Management Features								
Seepage Collection Ditch	N/A		0.0033	0.0000	-0.0056	-0.0205	N/A	
Open Pit			0.0002	0.0001	-0.0008	0.0064		

Notes:
1 – Positive value represents flow from groundwater to receiver
2 – Change presented is predicted flow in the Mining Period minus flow simulated in Baseline
N/A – not applicable – feature not present in the modelled timeframe or at the end of the period indicated

Of the lakes assessed, net groundwater discharge to Lake 3 is most sensitive to changes in hydraulic conductivity of the lakebed sediments with an increase of hydraulic conductivity resulting in increases in net groundwater discharge to Lake 3 of approximately 20% in baseline conditions, end of construction, and end of operations. Generally, reducing the hydraulic conductivity of the lakebed, riverbed, and streambed sediments results in increasing groundwater levels in the model overall as demonstrated in Table 4.6. The higher water levels lead to higher groundwater discharge to most surface water features. In contrast, an increase in the hydraulic conductivity of the lakebed, riverbed, and streambed sediments results in decreasing groundwater levels in the model which leads to lower groundwater discharge to most surface water features. However, local changes in water levels and surface water/groundwater interactions lead to exceptions to this general pattern. Regardless, changes in groundwater discharge to most surface water features is generally insignificant given high hydraulic connection in the baseline model. Baseflow in the Keewatin and Lynn Rivers is not sensitive to changes in streambed and riverbed hydraulic conductivity, with all changes to predicted baseflow being less than 0.002 m^3/s.

Flow to the seepage collection ditch and the open pits is relatively insensitive to changes in the hydraulic conductivity of the riverbed, lakebed, and streambed sediments with most changes in discharge and baseflow being less than 0.004 m^3/s. One notable exception is flow to the seepage collection ditch at the end of operations when the hydraulic conductivity of the riverbed, lakebed, and streambed sediments is increased by a factor of ten resulting in a decrease in groundwater discharge to the seepage collection system of 90%. Increasing the hydraulic conductivity allows increases in the net groundwater discharge to those features leaving less groundwater available for discharge to the seepage collection system.

Confidence in the sensitivity analyses for increased and decreased hydraulic conductivity of the riverbed, lakebed, and streambed sediments is similar as the calibration statistics for the models are generally similar (Section 4.4.2).

5.5.3 Recharge

To evaluate model response to changes in recharge, the recharge rate was increased and decreased by 50%. This is a smaller increase and decrease than other parameters (such as hydraulic conductivity) as recharge is relatively well constrained by average yearly precipitation, which is known. When recharge was increased by 50%, the model was found to be unstable. Consequently, recharge was increased by 15% for the construction and operations model and 25% for the closure model. The range in recharge rate used in this sensitivity scenario is considered conservative as climate change forecasts for Lynn Lake, Manitoba are in the range of 11% to 15% increase in precipitation for the next 20 to 50 years, respectively, under a high emissions scenario (ClimateData.ca 2024).

The change in net groundwater discharge to receivers compared to the base case for baseline, end of construction, end of operations, and end of closure is presented in Table 5.11. Effects on the predicted baseflow in the Keewatin River are summarized using flow station QM06 which accounts for the contribution to the Keewatin River from Payne Lake, Payne Lake Rivers (KEE3-PAY1 and KEE3-PAY1), Dot Lake, Dot Lake Rivers (KEE3-DOT1 and KEE3-DOT3), East Pond, East Pond Rivers (KEE3-B2, KEE3-B2-3, KEE3-B2-A1, KEE3-B1-2, and KEE3-B1), and Keewatin River Tributary KEE3-A1.

Table 5.11 Sensitivity Analysis Summary: Varying Recharge

Receiver	Net Groundwater Discharge or Baseflow (m^3/s)[1]											
	Baseline			End of Construction			End of Operations			End of Closure		
	Base Case	Decreased Recharge	Increased Recharge	Base Case	Decreased Recharge	Increased Recharge	Base Case	Decreased Recharge	Increased Recharge	Base Case	Decreased Recharge	Increased Recharge
Predicted Groundwater Discharge to Lakes												
Dot Lake	0.0278	0.0216	0.0336	0.0275	0.0214	0.0293	0.0237	0.0176	0.0253	0.0277	0.0216	0.0306
Minton Lake	0.0373	0.0312	0.0443	0.0366	0.0310	0.0384	0.0363	0.0300	0.0377	0.0356	0.0302	0.0380
Payne Lake	0.0150	0.0115	0.0189	0.0153	0.0115	0.0163	0.0170	0.0117	0.0178	0.0145	0.0115	0.0167
Lake 2	0.0051	0.0040	0.0062	0.0051	0.0040	0.0054	0.0051	0.0040	0.0054	0.0051	0.0040	0.0056
Lake 3	0.0124	0.0106	0.0141	0.0124	0.0106	0.0129	0.0124	0.0106	0.0129	0.0123	0.0106	0.0132
Predicted Baseflow in Rivers												
Keewatin River Gauging Station QM06	4.18	4.13	4.23	4.09	4.08	4.09	4.08	4.06	4.08	4.09	4.08	4.10
Lynn River Gauging Station QM05	1.45	1.43	1.46	1.44	1.42	1.44	1.44	1.42	1.44	1.44	1.42	1.44
Water Management Features												
Seepage Collection Ditch	N/A			0.0109	0.0042	0.0142	0.0227	0.0024	0.0243	N/A		
Open Pit				0.0086	0.0076	0.0091	0.0464	0.0429	0.0470			

Receiver	Change in Net Groundwater Discharge or Baseflow Compared to Base Case (m^3/s)[2]							
	Baseline		End of Construction		End of Operations		End of Closure	
	Decreased Recharge	Increased Recharge	Decreased Recharge	Increased Recharge	Decreased Recharge	Increased Recharge	Decreased Recharge	Increased Recharge
Predicted Groundwater Discharge to Lakes								
Dot Lake	-0.0061	0.0058	-0.0061	0.0018	-0.0061	0.0016	-0.0061	0.0029
Minton Lake	-0.0061	0.0070	-0.0056	0.0018	-0.0063	0.0013	-0.0054	0.0024
Payne Lake	-0.0036	0.0038	-0.0038	0.0010	-0.0053	0.0008	-0.0031	0.0021
Lake 2	-0.0011	0.0011	-0.0011	0.0003	-0.0011	0.0003	-0.0011	0.0005
Lake 3	-0.0017	0.0018	-0.0017	0.0005	-0.0017	0.0005	-0.0017	0.0009
Predicted Baseflow in Rivers								
Keewatin River Gauging Station QM06	-0.0471	0.0464	-0.0142	0.0043	-0.0139	0.0037	-0.0138	0.0071
Lynn River Gauging Station QM05	-0.0182	0.0179	-0.0138	0.0042	-0.0138	0.0042	-0.0138	0.0069
Water Management Features								
Seepage Collection Ditch	N/A		-0.0067	0.0033	-0.0203	0.0015	N/A	
Open Pit			-0.0010	0.0004	-0.0035	0.0006		

Notes:
1 – Positive value represents flow from groundwater to receiver
2 – Change presented is predicted flow in the Mining Period minus flow simulated in Baseline
N/A – not applicable – feature not present in the modelled timeframe or at the end of the period indicated

Of the lakes assessed, net groundwater discharge to Dot Lake, Payne Lake, and Lake 2 are the most sensitive to changes in recharge. For each lake in each model/period, reducing recharge reduces the discharge from groundwater to receivers while increasing recharge increases the discharge to receivers or, for Dot Lake, increases the recharge from the receiver. This result is expected. Baseflow in the Keewatin and Lynn Rivers is not particularly sensitive to changes in recharge, with changes to predicted baseflow being less than 0.05 m^3/s.

Net groundwater discharge to the seepage collection system and open pit follow the pattern expected: inflow is lower for reduced recharge and higher for increased recharge.

Confidence in the sensitivity analyses for increased and decreased recharge is similar as the calibration statistics for the baseline model with increased and decreased recharge are similar, yet still higher than the baseline model (Section 4.4.3).

5.5.4 Specific Yield and Specific Storage

To evaluate model response to changes storage parameters, the specific storage and the specific yield of each hydrostratigraphic unit were decreased and increased from the calibrated values by factors of ten and two, respectively The change in net groundwater discharge to receivers compared to the base case for baseline, end of construction, end of operations, and end of closure is presented in Table 5.12. Effects on the predicted baseflow in the Keewatin River are summarized using flow station QM06 which accounts for the contribution to the Keewatin River from Payne Lake, Payne Lake Rivers (KEE3-PAY1 and KEE3-PAY1), Dot Lake, Dot Lake Rivers (KEE3-DOT1 and KEE3-DOT3), East Pond, East Pond Rivers (KEE3-B2, KEE3-B2-3, KEE3-B2-A1, KEE3-B1-2, and KEE3-B1), and Keewatin River Tributary KEE3-A1.

Table 5.12 Sensitivity Analysis Summary: Varying Specific Yield (Sy) and Specific Storage (S)

Receiver	Net Groundwater Discharge to Receiver (m^3/s)[1]								
	End of Construction			End of Operations			End of Closure		
	Base Case	Decreased Sy/S	Increased Sy/S	Base Case	Decreased Sy/S	Increased Sy/S	Base Case	Decreased Sy/S	Increased Sy/S
Predicted Groundwater Discharge to Lakes									
Dot Lake	0.0275	0.0276	0.0276	0.0237	0.0230	0.0073	0.0277	0.0277	0.0277
Minton Lake	0.0366	0.0362	0.0371	0.0363	0.0362	0.0353	0.0356	0.0352	0.0354
Payne Lake	0.0153	0.0155	0.0151	0.0170	0.0171	0.0096	0.0145	0.0149	0.0150
Lake 2	0.0051	0.0051	0.0051	0.0051	0.0051	0.0051	0.0051	0.0051	0.0051
Lake 3	0.0124	0.0124	0.0123	0.0124	0.0124	0.0124	0.0123	0.0123	0.0123
Predicted Baseflow in Rivers									
Keewatin River Gauging Station QM06	4.09	4.09	4.09	4.08	4.08	4.05	4.09	4.09	4.09
Lynn River Gauging Station QM05	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
Water Management Features									
Seepage Collection Ditch	0.0109	0.0118	0.0118	0.0227	0.0227	0.0051	N/A		
Open Pit	0.0086	0.0081	0.0098	0.0464	0.0458	0.0593			

Receiver	Change in Net Groundwater Discharge to Receiver Compared to Base Case (m^3/s)[2]					
	End of Construction		End of Operations		End of Closure	
	Decreased Sy/S	Increased Sy/S	Decreased Sy/S	Increased Sy/S	Decreased Sy/S	Increased Sy/S
Predicted Groundwater Discharge to Lakes						
Dot Lake	negligible	0.0001	-0.0007	-0.0164	negligible	negligible
Minton Lake	-0.0004	0.0004	-0.0001	-0.0010	-0.0003	-0.0002
Payne Lake	0.0002	-0.0002	negligible	-0.0075	0.0004	0.0004
Lake 2	negligible	negligible	negligible	negligible	negligible	negligible
Lake 3	negligible	negligible	negligible	negligible	negligible	negligible
Predicted Baseflow in Rivers						
Keewatin River Gauging Station QM06	-0.0007	0.0008	-0.0014	-0.0292	0.0001	0.0002
Lynn River Gauging Station QM05	0.0001	-0.0002	-0.0002	-0.0022	negligible	negligible
Water Management Features						
Seepage Collection Ditch	0.0009	0.0009	0.0000	-0.0177	N/A	
Open Pit	-0.0005	0.0011	-0.0007	0.0128		

Notes:
1 – Positive value represents flow from groundwater to receiver
2 – Change presented is predicted flow in the Mining Period minus flow simulated in Baseline
N/A – not applicable – feature not present in the modelled timeframe or at the end of the period indicated

For the lakes assessed, net groundwater discharge is generally insensitive to changes in specific storage and specific yield with most changes below 0.0005 m^3/s. However, at the end of operations, increases to specific storage and specific yield result in decreases in net groundwater discharge of up to approximately 0.0075 m^3/s. At the end of operations, drawdown from the pits is well developed and more influential with higher storage which decreases groundwater discharge to receivers near the pits.

Groundwater discharge to the pits follows the pattern expected: flow decreases following a decrease in storage and increases following an increase in storage. Flow to the seepage collection ditch is generally insensitive to changes in storage. However, at the end of operations following an increase in storage, drawdown from the pits is better developed due to the higher storage compared to the base case. This leads to more vertical flow beneath the TMF and MRSA compared to lateral flow, consequently the seepage collection ditch is less effective, therefore flow to the ditch decreases compared to the base case.

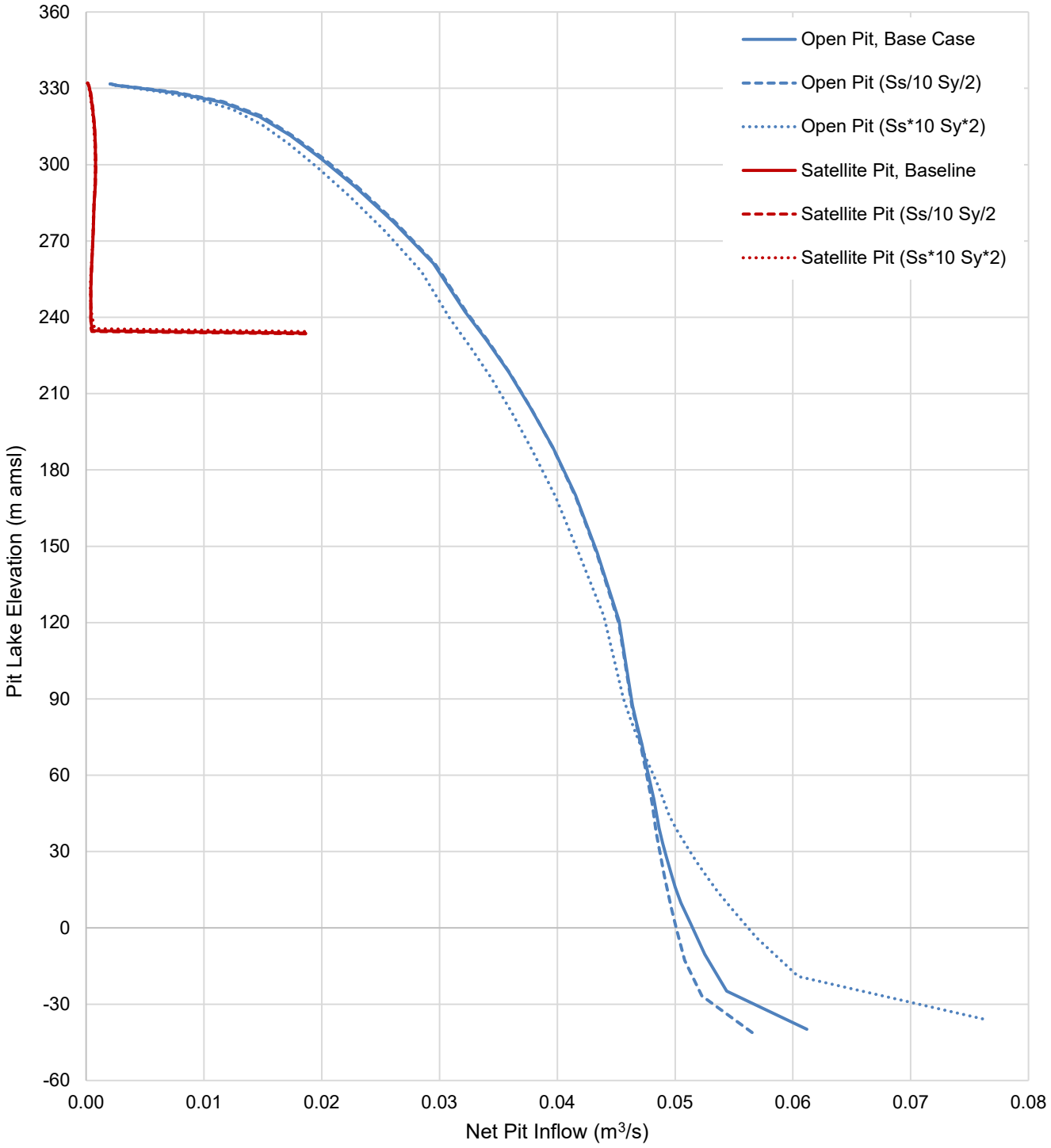
Predicted baseflow to the lakes, rivers, and streams following both increases and decreases in specific storage and specific yield are similar to baseline conditions at the end of closure. Given the closure model is 200 years long, this is expected.

Figure 5-3 presents the sensitivity of predicted open pit and satellite pit lake filling rates to specific storage and specific yield during closure. Two scenarios of decreased and increased specific storage and specific yield are presented and compared with the base case model.

Net inflow[2] to the open pit following a decrease in specific storage and specific yield decreases from 0.061 m^3/s at a pit lake elevation of approximately -40 m amsl in the base case model to a pit filling rate of 0.057 m^3/s at the same pit lake elevation. Similar to the base case model, the model with decreased specific storage and specific yield also shows continuous decreasing net inflow to the open pit until the final pit lake elevation is attained at the end of closure. Net inflow to the open pit following an increase in specific storage and specific yield increases from 0.061 m^3/s at a pit lake elevation of approximately -40 m amsl in the base case model to a pit filling rate of 0.076 m^3/s at approximately -36 m amsl. Net inflow to the open pit decreases in a similar trend to the base case model until the final pit lake elevation is attained at the end of closure. Although the pit fills at a faster rate at lower stages compared to the base case and slower at higher stages. Net inflow to the satellite pit is relatively insensitive to changes in specific storage and specific yield.

The results of the sensitivity analyses indicate that net inflow to the open pit is sensitive to both an increase and decrease in specific storage and specific yield while net inflow to the satellite pit is insensitive to changes in storage.

[2] Net inflow is groundwater inflow minus groundwater outflow. A positive value indicates inflow exceeds outflow.



Client/Project

ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
GORDON SITE

Figure No.

5-3

Title

Sensitivity of Predicted Open Pit and Satellite Pit Groundwater Inflow and Stage to Specific Storage and Specific Yield – End of Closure

Stantec

https://stantec.sharepoint.com/teams/160999003/BC1609/Projects/111473012_Alamos/MacLellan Model Rebuild/Report/Figures to Insert into Word Document/Figure 5-3 Sensitivity of Predicted Open Pit and Satellite Pit inflow to Storage in Closure.xlsx

5.6 Comparison of Model Results to the EIS

The results of the model predictions for the current mine plan presented herein were compared with the predicted effects from the EIS (Stantec 2020e). A comparison of the current modelled mine plan, based on the Feasibility Study Update (Alamos 2023), with the EIS mine plan (Stantec 2020a) is presented in Table 5.13 for those mine features that have the potential to effect groundwater quantity or quality.

Table 5.13 MacLellan Site Feature Footprint Layout Changes

Feature	Proposed Footprint Layout Area (ha)	EIS Footprint Layout Area (ha)
Open Pit	71.38	66.05
Satellite Pit	4.58	n/a
Mine Rock Storage Area	279.41	339.44
Ore Storage Areas	9.05	8.67
Tailings Management Facility	221.80	53.69
Tailings Management Facility Pond	26.88	183.22

The predicted groundwater inflow rate to the open pit at the end of operations is similar (within about 20%) to that predicted for the EIS (0.05 m^3/s versus 0.04 m^3/s, respectively).

The drawdown due to open pit dewatering is larger than presented in the EIS. The drawdown cone extends an additional 1 km to the east and an additional 2 km to the south and west. The larger drawdown cone than the EIS is the result of a higher dewatering rate, a higher calibrated hydraulic conductivity of the hydrostratigraphic layers, and lower calibrated recharge rate. The assessment of drawdown within this updated model is more conservative than the EIS.

Groundwater discharge to lakes at the end of operation was similar to that presented in the EIS except for Dot and Minton lakes. A negligible effect to groundwater discharge to Dot Lake was presented in the EIS whereas in this model update a 15% decrease in groundwater discharge (about 0.004 m^3/s change) compared to baseline conditions is predicted. The decrease in groundwater discharge at the end of operations in this model iteration is the result of a larger drawdown cone (due to greater calibrated hydraulic conductivity of the hydrostratigraphic units). For Minton Lake, an increase in groundwater discharge was predicted at the end of operation in the EIS compared to baseline conditions. The increase in groundwater discharge was associated with a smaller drawdown cone and mounding of the water table associated with the MRSA during the operation period. In this model iteration, the drawdown cone extends closer to Minton Lake and, based on refined modelling of the “wetting up” of the MRSA, increased recharge of the MRSA was predicted to occur in closure, not operations. Therefore, in this model iteration, a 2% decrease in groundwater discharge to Minton Lake is predicted at the end of operation compared to baseline conditions. In the EIS closure scenario, the groundwater discharge to Minton Lake, Payne Lake, Lake 2, and Lake 3 were predicted to increase compared to baseline with negligible effect to Dot Lake. In this model iteration, the change in groundwater discharge in closure

compared to baseline is negligible for lakes except for Minton and Payne lakes which are predicted to have up to 4% decrease in closure compared to baseline conditions.

The predicted groundwater discharge to tributaries and rivers are predicted to be similar between the EIS and this iteration of the model except for:

- KEE3-A1: Groundwater discharge in closure for the EIS was predicted to increase whereas a negligible change in closure is predicted in this iteration of the modelling compared to baseline conditions.
- KEE3-B1: The change in groundwater discharge in operations and closure for the EIS was predicted as negligible whereas this model iteration, a decrease in groundwater discharge in operations (73%) and closure (4%) compared to baseline conditions is predicted.
- KEE3-PAY1: The groundwater discharge was predicted to decrease in operations in the EIS whereas in this model iteration an increase in groundwater discharge is predicted compared to baseline conditions. The increase in groundwater discharge in operations is the result of mounding of the water table associated with the TMF resulting in an increased horizontal hydraulic gradient toward the creek.

Overall, the changes in groundwater discharge to surface water are small, generally less than 0.01 m^3/s compared to the overall flow in the features for both the EIS and this model iteration.

Receptors of groundwater seepage from mine infrastructure remained consistent with the EIS except for the Keewatin River and Payne Lake. In the EIS, a small portion of seepage from the MRSA was predicted to discharge to the Keewatin River which is not predicted in this model iteration. In this model iteration, a small portion of seepage from the MRSA was predicted to discharge to Payne Lake, which was not predicted in the EIS. Overall, the effectiveness of the seepage collection ditches was slightly better in this model iteration than the EIS resulting in slightly less seepage from the MRSA to Minton Lake and tributaries of the Keewatin River, and slightly less seepage from the TMF to all receivers in this model iteration compared to the EIS.

Predictions of travel time of seepage from mine infrastructure also changed relative to the EIS. The porosity of the shallow, upper, intermediate, and deep bedrock in the EIS groundwater flow model was 0.0001. In this model update, the porosity of the shallow bedrock was set to 0.06 while the porosity for the upper, intermediate, and deep bedrock layers was set to 0.0001. These porosity values reflect discussions and sensitivity analysis completed through the Information Requests subsequent to the submission of the EIS (IR-IAAC-83, IR-IAAC-R2-72). In addition, subsequent to the EIS, the travel times for MacLellan were presented as years and subsequent to the EIS it was discovered the travel times were actually days, which means travel times in the EIS should have been presented as tens of years instead of thousands of years. The porosity does not affect the flux, or specific discharge, of groundwater through the rock, the porosity only affects the predicted timing of seepage from the mine infrastructure discharging to the receiver. As a result, the predicted travel times of seepage from mine infrastructure decreases from tens to thousands of years in the EIS to a few years to tens of years in this model update. The predictions of seepage rates and travel times from mine infrastructure is conservative in that processes along the groundwater flow path such as dispersion and geochemical reactions were not simulated and would

serve to increase groundwater flow travel times and decrease concentrations along the groundwater flow path.

Compared with the results of the EIS (Stantec 2020e), the effects of the Project on groundwater remained similar, except for the extent of the drawdown cone which was larger in this model iteration. For the few differences in prediction of groundwater discharge to surface water, the overall differences were less than 0.01 m^3/s which is minor compared to the overall flow in the receiver. In conclusion, the results of the updated groundwater assessment do not change the characterization of residual effects, or the significance ratings summarized for groundwater as presented in the EIS (Stantec 2020a).

6 Prediction Confidence

The assessment of baseline conditions and the inferred conceptualization of groundwater processes are based on applying industry standards and practices under quality assurance and quality control programs.

The three-dimensional groundwater flow modelling was conducted using a model calibrated to within an acceptable range of error for groundwater levels and baseflow to establish baseline conditions. Predictions made using the three-dimensional groundwater flow model are based on several conservatively protective assumptions to reduce the influence of uncertainty in the predictions. Therefore, the confidence in the predictions made using the three-dimensional groundwater flow model is considered high.

Groundwater drawdown is conservatively overpredicted in closure. To predict the groundwater inflow rate into the pit independently of other variables, no precipitation was accounted for over the pit lake, which reduced predicted groundwater levels in closure in the vicinity of the pit lake. Underprediction of groundwater levels results in overpredicted of reduction in baseflow in the Keewatin River, which is also conservative for the assessment of effects.

Groundwater recharge rates of the MRSA to the receiving environment is conservatively over predicted in closure. The recharge rate in closure is assumed to be the fully saturated recharge rate whereas the MRSA is predicted to take an additional 25 years in closure to reach a fully saturated recharge rate. Therefore, the recharge rate of the MRSA in closure is overestimated for 25 years of the closure simulation. As a result, the groundwater travel times from the MRSA to the receiving environment is predicted faster than likely to occur. In addition, the travel times of particles from the MRSA, the OSA, and the TMF to the receiving environments do not account for dispersion or geochemical reactions which will increase the travel times.

7 Conclusions

Hydrogeological modelling was conducted to identify changes to groundwater levels and flow pathways to inform the assessment of potential effects of the LLGP on groundwater and surface water resources in the study area. The modelling was conducted using MODFLOW, MODFLOW-NWT, and MODFLOW-SURFACT in Groundwater Vistas Version 8 (a pre-and post-processing software) and was calibrated to baseline conditions within acceptable industry standards.

The construction and operation of the open pit and satellite pit will require dewatering. A final dewatering head of approximately -60 m amsl will result in the drawdown of the water table by up to 1 m over an area extending approximately 1 km north, 1 km east, 2 km south, and 2 km west of the pits. The maximum drawdown in the deepest portion of the pit is nearly 400 m. Drawdown from the MRSA extends approximately 500 m east of the MRSA. Mounding due to the TMF extends approximately 1 km west and reaches a maximum greater than 26 m.

As dewatering progresses, the groundwater inflow rate in the pits increases from 0.009 m^3/s at the end of construction to nearly 0.05 m^3/s at the end of operations.

Dewatering of the pits and mounding in the vicinity of the TMF will also result in changes in groundwater discharge from baseline conditions in lakes, watercourses, and streams (Keewatin River and Lynn River). Groundwater discharge to primary lakes (Dot Lake and Minton Lake) will decrease from baseline because of pit dewatering while groundwater discharge to Payne Lake will increase from baseline as a result of mounding of the water table in the vicinity of the TMF which increases the hydraulic gradient toward the lake. East Pond will be dewatered during construction and operations. Groundwater discharge to the Keewatin and Lynn River will also decrease from baseline during construction and operations but is predicted to be 2% or less change from baseline conditions. This is expected due to the induced hydraulic gradient between the pits and the streams considering the proximity of the streams to the pits.

Groundwater discharge to surface water features associated with Project facilities represents a minor component of the overall surface water flow systems. The installation of a seepage collection system around the TMF and new MRSA is predicted to capture up to 23% and 59% of seepage from these features, respectively. The modelling results will be considered in the assessment of potential effects on the receiving environment.

Compared with the results of the EIS (Stantec 2020e), the effects of the Project on groundwater remained similar, except for the extent of the drawdown cone which was larger in this model iteration. For the few differences in prediction of groundwater discharge to surface water, the overall differences were less than 0.01 m^3/s which is minor compared to the overall flow in the receiver. In conclusion, the results of the updated groundwater assessment do not change the characterization of residual effects, or the significance ratings summarized for groundwater as presented in the EIS (Stantec 2020a).

8 References

Alamos Gold Inc. (Alamos). 2023. Feasibility Study Update, NI-43-101 Technical Report for the Lynn Lake Project. Issue date: August 22, 2023.

Anderson, M.P., and W.W. Woessner. 1991. Applied Groundwater Modeling. Academic Press, 381 pp.

Asquith, W.H., Roussel, M.C., and Vrabel, Joseph, 2006, Statewide analysis of the drainage-area ratio method for 34 streamflow percentile ranges in Texas: U.S. Geological Survey Scientific Investigations Report 2006–5286, 34 p., 1 appendix.

Beaumont-Smith, C.J. and C.O. Böhm. 2003. Tectonic evolution and gold metallogeny of the Lynn Lake greenstone belt; in Report of Activities 2003, Manitoba Industry, Trade and Mines, Manitoba Geological Survey, p. 39-49.

Cook, P.G. 2003. A Guide to Regional Groundwater Flow in Fractured Rock Aquifers. Glen Osmond, SA, Australia: CSIRO Land and Water.

Doherty, J. 2004. PEST Model-Independent Parameter Estimation. Watermark Numerical Computing, 5th Edition.

Fetter, C.W. 2000. Applied Hydrogeology, 4th Edition. University of Wisconsin-Oshkosh. Prentice Hall, New Jersey.

Harbaugh, A.W. 2005. MODFLOW-2005, The U.S. Geological Survey modular ground-water model—the Ground-Water Flow Process: U.S. Geological Survey Techniques and Methods 6-A16, variously p.

International Joint Commission (IJC). 2014. An Investigation of the Effects of the 2000 Rule Curve Change on the Rainy River Hydrologic and Hydraulic Regime.

Kaszycki, C.A., L.A. Dredge, and H. Groom. 2008. Surficial geology and glacial history, Lynn Lake – Leaf Rapids area, Manitoba. Geological Survey of Canada Open File 5873.

Machibroda Engineering Ltd. 1988. Geotechnical and Hydrogeological Investigation, Proposed Farley Lake Gold Project. Prepared for W.A. Meneley Consultants Ltd. July 5, 1988.

Manitoba Energy and Mines (MEM). 1986. Bedrock geology compilation map series. Grenville Lake, NTS 64C, 1:250,000.

Merritt, M. L. and L. Konikow. 2000. Documentation of a Computer Program to Simulate Lake-Aquifer Interaction using the MODFLOW Ground-Water Flow Model and the MOC3D Solute-Transport Model. US Geological Survey. Water-Resources Investigations Report 00-4167.

Niswonger, R.G., and Prudic, D.E. 2005. Documentation of the Streamflow-Routing (SFR2) Package to include unsaturated flow beneath streams—A modification to SFR1: U.S. Geological Survey Techniques and Methods 6-A13, 50 p.

Prudic, D. E., L.F. Konikow, and E. R., Banta. 2004. A New Streamflow-Routing (SFR1) Package to Simulate Stream-Aquifer Interaction with MODFLOW-2000. US Geological Survey. Open-File Report 2004-1042.

Rumbaugh, J.O., and D.B. Rumbaugh. 2020. Guide to Using Groundwater Vistas Version 8, www.groundwatermodels.com.

Schwartz, F.W. and H. Zhang. 2002. Fundamentals of Ground Water. John Wiley & Sons, Inc. New York, USA.

Spitz, K. and J. Moreno. 1996. A Practical Guide to Groundwater and Solute Transport Modeling. John Wiley & Sons Inc. New York.

Stantec Consulting Ltd. (Stantec). 2017a. Lynn Lake Gold Project (LLGP): Climate and Meteorology Baseline Technical Data Report. Prepared for Alamos Gold Inc. May 2017.

Stantec Consulting Ltd. (Stantec). 2017b. Lynn Lake Gold Project (LLGP): Hydrology Baseline Technical Data Report. Prepared for Alamos Gold Inc. July 2017.

Stantec Consulting Ltd. (Stantec). 2017c. Hydrogeology Baseline Technical Data Report. Prepared for Alamos Gold Inc. November 2017.

Stantec Consulting Ltd. (Stantec). 2020a. Environmental Impact Statement for the Lynn Lake Gold Project. Prepared for Alamos Gold Inc. Winnipeg, MB.

Stantec Consulting Ltd. (Stantec). 2020b. Lynn Lake Gold Project (LLGP) Hydrogeology Technical Data Report: Validation Report. Prepared for Alamos Gold Inc. April 2020.

Stantec Consulting Ltd. (Stantec). 2020c. Lynn Lake Gold Project (LLGP) Hydrology Technical Data Report: Validation Report. Prepared for Alamos Gold Inc.

Stantec Consulting Ltd. (Stantec). 2020d. Water Balance and Water Quality Model Technical Modelling Report: Gordon Site. Prepared for Alamos Gold Inc.

Stantec Consulting Ltd. (Stantec). 2020e. Lynn Lake Gold Project Hydrogeology Modelling Technical Data Report – MacLellan Site. Prepared for Alamos Gold Inc.

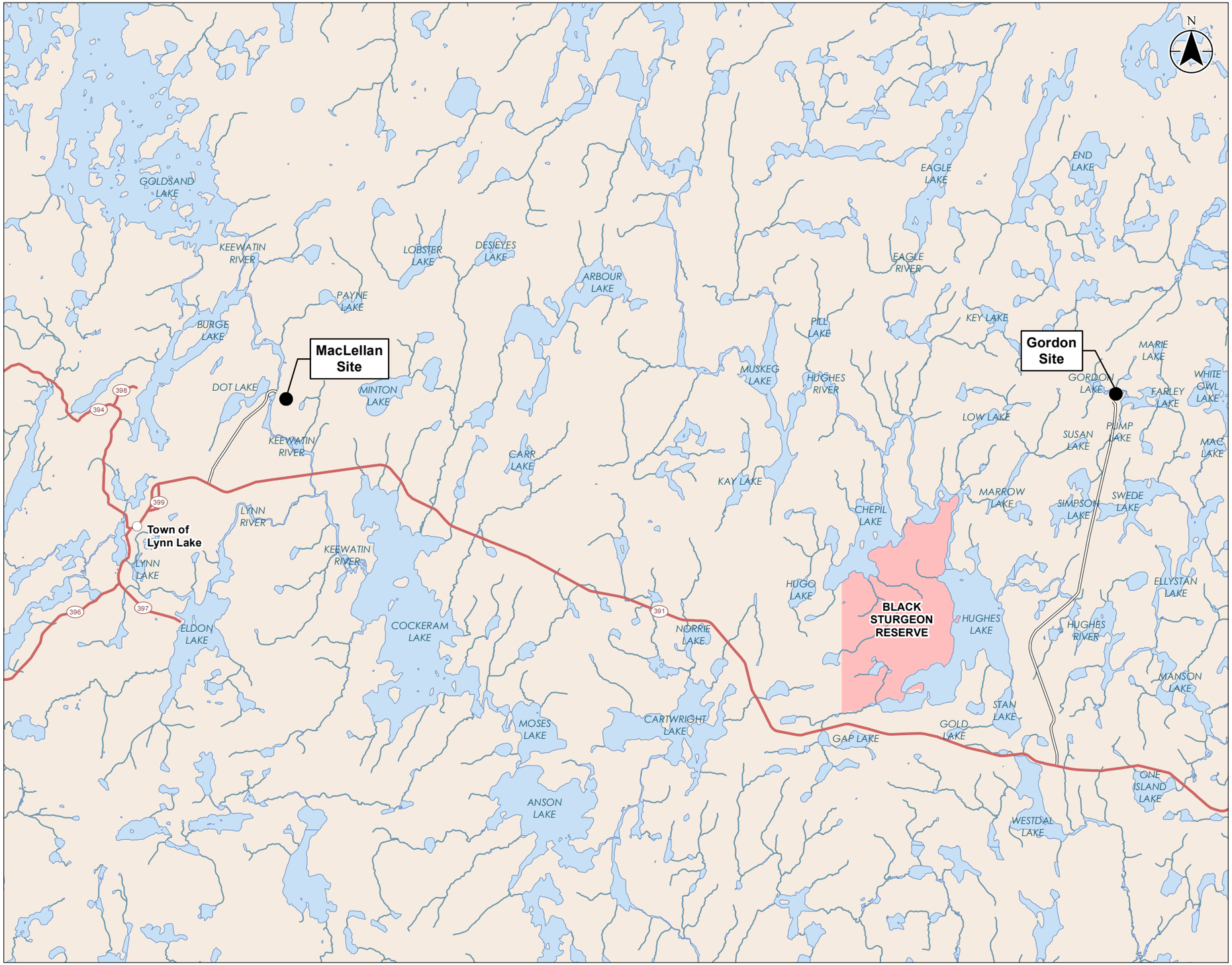
Tetra Tech. 2013. MacLellan Mine Project: Draft 2012 Environmental Baseline Study. Prepared for Carlisle Goldfields Ltd. March 2013.

Wels, C., D. Mackie, and J. Scibek. 2012. Guidelines for Groundwater Modelling to Assess Impacts of Proposed Natural Resource Development Activities. Prepared for the British Columbia Ministry of Environment, Water Protection & Sustainability Branch.

WSP Golder. 2022. Constant Head Tests. Alamos Golde – Lynn Lake. Lynn Lake, Manitoba. April 25, 2022.

Appendices

Appendix A Maps



Stantec

Landbase

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

0 4 8 Kilometres

1:150,000 (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 Site
Lynn Lake, Manitoba

111473003

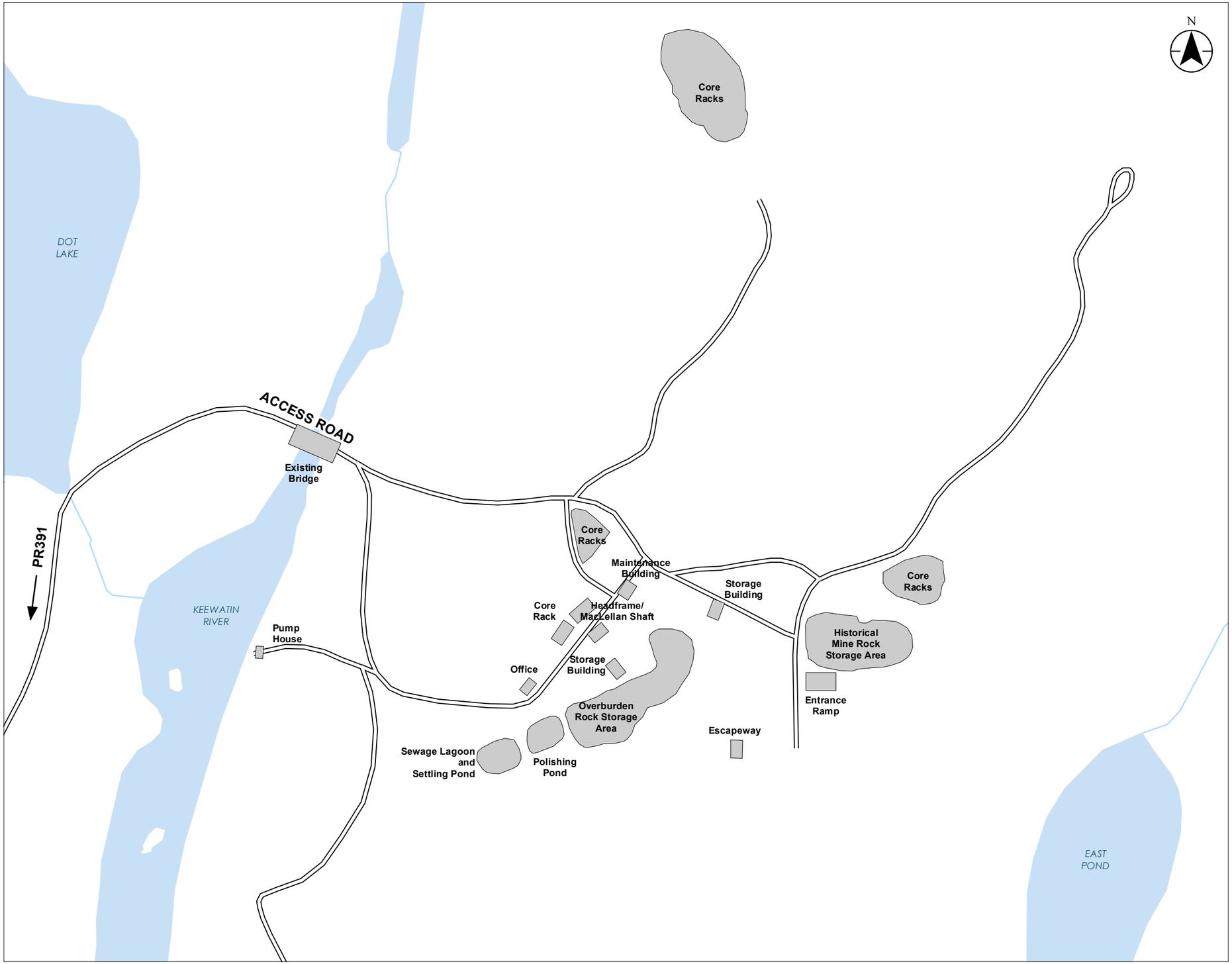
Prepared by AC on 2018-03-16
Technical Review by MF on 2018-03-19

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
1

Title
Location of the Proposed MacLellan and Gordon Mine Sites in Northwestern Manitoba

G:_GIS_Project_Folder\111440293_AurRico\Figures\Hydro-geology\EA\Fig.e1_Project-Location_20180316.mxd Revised: 2018-06-27 By: dcampagnolo



Stantec

Historical Mine Infrastructure

- Existing Infrastructure Associated with Historical Mine

Landbase

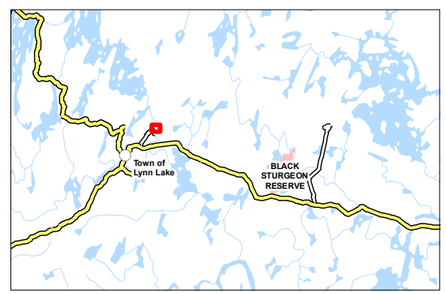
- Existing Access Road
- Watercourse
- Waterbody

0 100 200 Metres

1:5,000 (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 Site
Lynn Lake, Manitoba

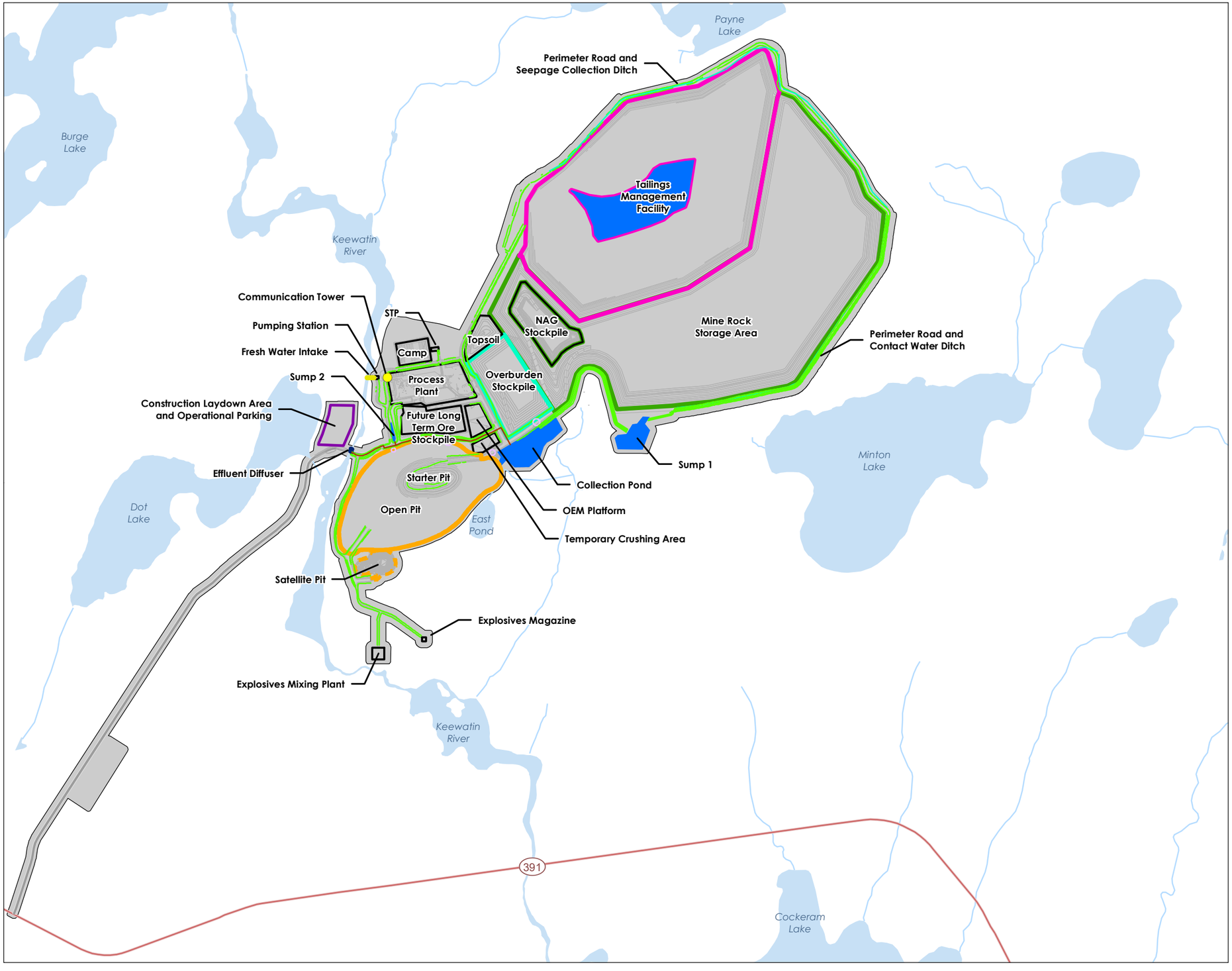
111473003
Prepared by AC on 2019-12-10
Technical Review by JK on 2019-12-10

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
2

Title
Historical Project Infrastructure

V:\60945\active\01\gis_GIS Project Folder\111440923 AuRico Figures Hydro design\2 Modelling\MXD 2020\Map2_Historical_MacLellan_20191210.mxd Revised: 2020-04-08 By: ACampagnolo



Stantec

Project Infrastructure (NOA)

- Communication Tower
- Culvert
- Ditching
- Corridor / Access Road
- Collection Pond Discharge
- Fresh Water Intake
- Effluent Diffuser
- Mine Rock Storage Area
- Overburden Stockpile
- Tailings Management Facility
- Open Pit
- Satellite Pit
- Collection Pond/Sumps
- Other Infrastructure
- Construction Laydown Area
- NOA Project Development Area (PDA)

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

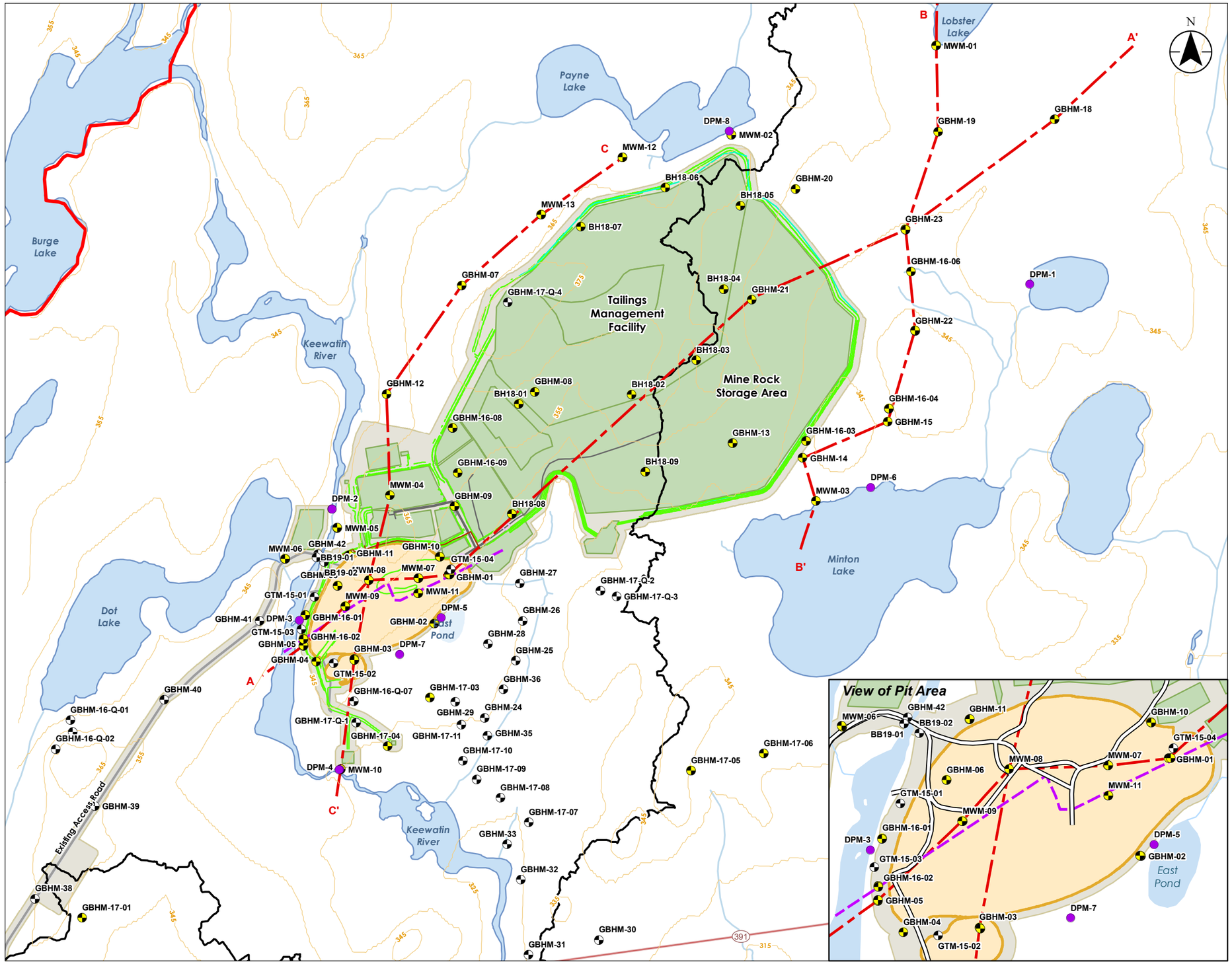
Prepared by ACampigotto on 2025-01-31
Technical Review by KMathers on 2025-01-31

Client/Project
111473084
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
3

Title
Site Plan

\Cca0046-pbsg01\vgis_GIS_Project_Folder\111482923_AurEco\Figures\Hydro-geology\Maclellan_IMR_2024 Feb 2025 NOA Updates\Map3_SitePlan_MacLellan_20250226.mxd Revised: 2025-02-26 By: ACampigotto



Stantec

Project Infrastructure
- Project Development Area
- Proposed Open Pit
- Proposed Infrastructure
- Existing Access Road
- Haul Road
- Culvert
- Ditching
- Corridor / Access Road

Study Area
- Study Area
- Subwatersheds

Survey Locations
- Borehole
- Drive-Point Piezometers
- Monitoring Well
- Cross Section Locations

Landbase
- Highway
- Existing Access Road
- Approximate Location of NSZ
- Elevation Contours (m)
- Waterbody

0 0.5 1 Kilometres
1:30,000 (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 Site
Lynn Lake, Manitoba

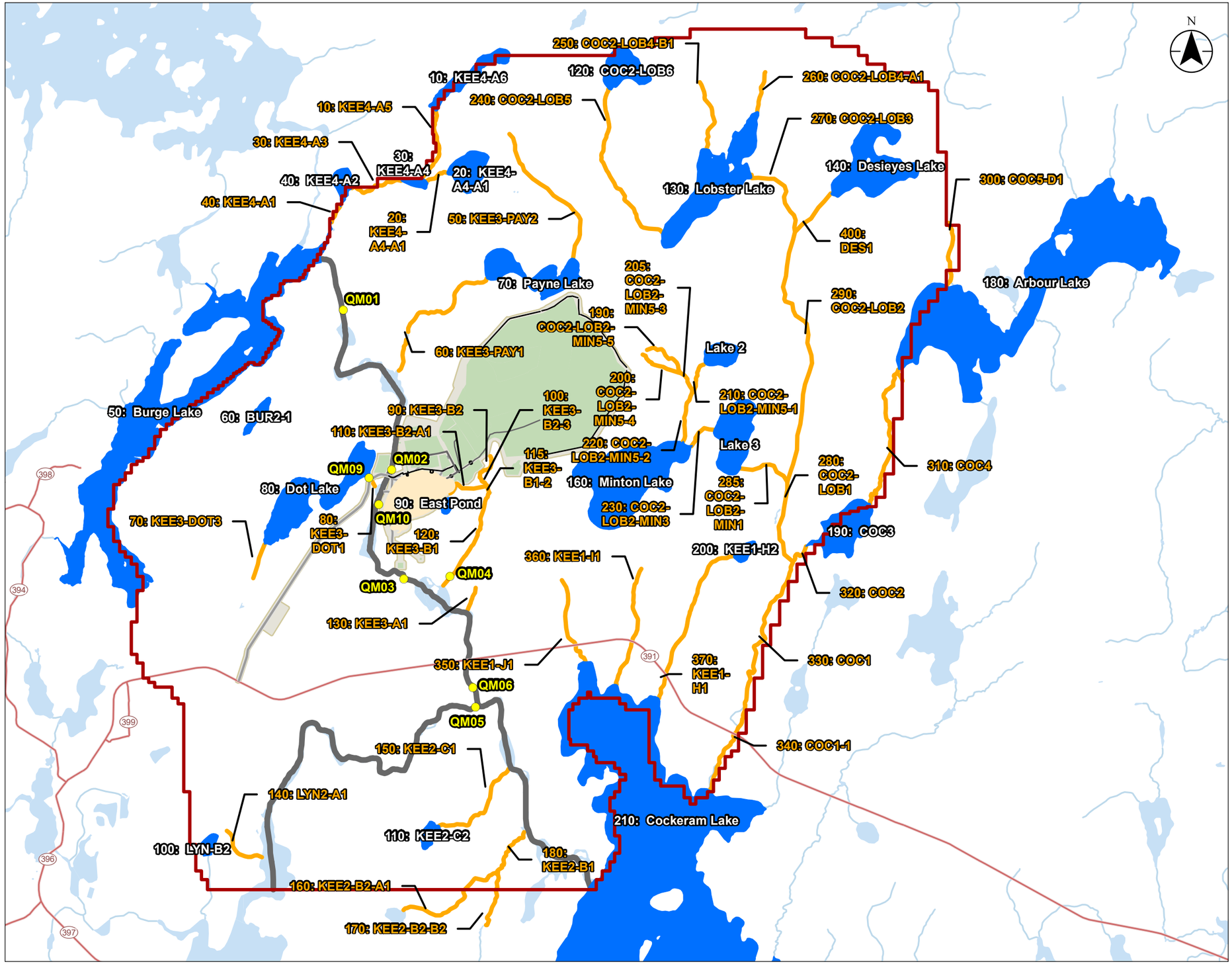
111473076
Prepared by AC on 2025-02-26
Technical Review by AD on 2025-02-26

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
4

Title
Topography of Study Area and Monitoring Locations - MacLellan

\Cca0046-p\ogi01\gis_GIS_Project_Folder\111440293_AuRecon\Figures\Hydro-geology\Maclellan_fig4_2024feb2025NOA_Updates\Map 4 Topography_Maclellan_20250226.mxd Revised: 2025-02-26 By: ACampagnaro



Stantec

Project Infrastructure
- Project Development Area
- Proposed Open Pit
- Proposed Infrastructure
- Drainage Ditch
- Existing Access Road
- Haul Road

Study Area
- Study Area
- Hydrology Monitoring Station
- Keewatin River and Lynn River Reaches
- Watercourses in Model Domain
- Waterbodies in Model Domain

Landbase
- Highway
- Existing Access Road
- Waterbody

0 1 2 Kilometres
1:67,437 (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 Site
Lynn Lake, Manitoba

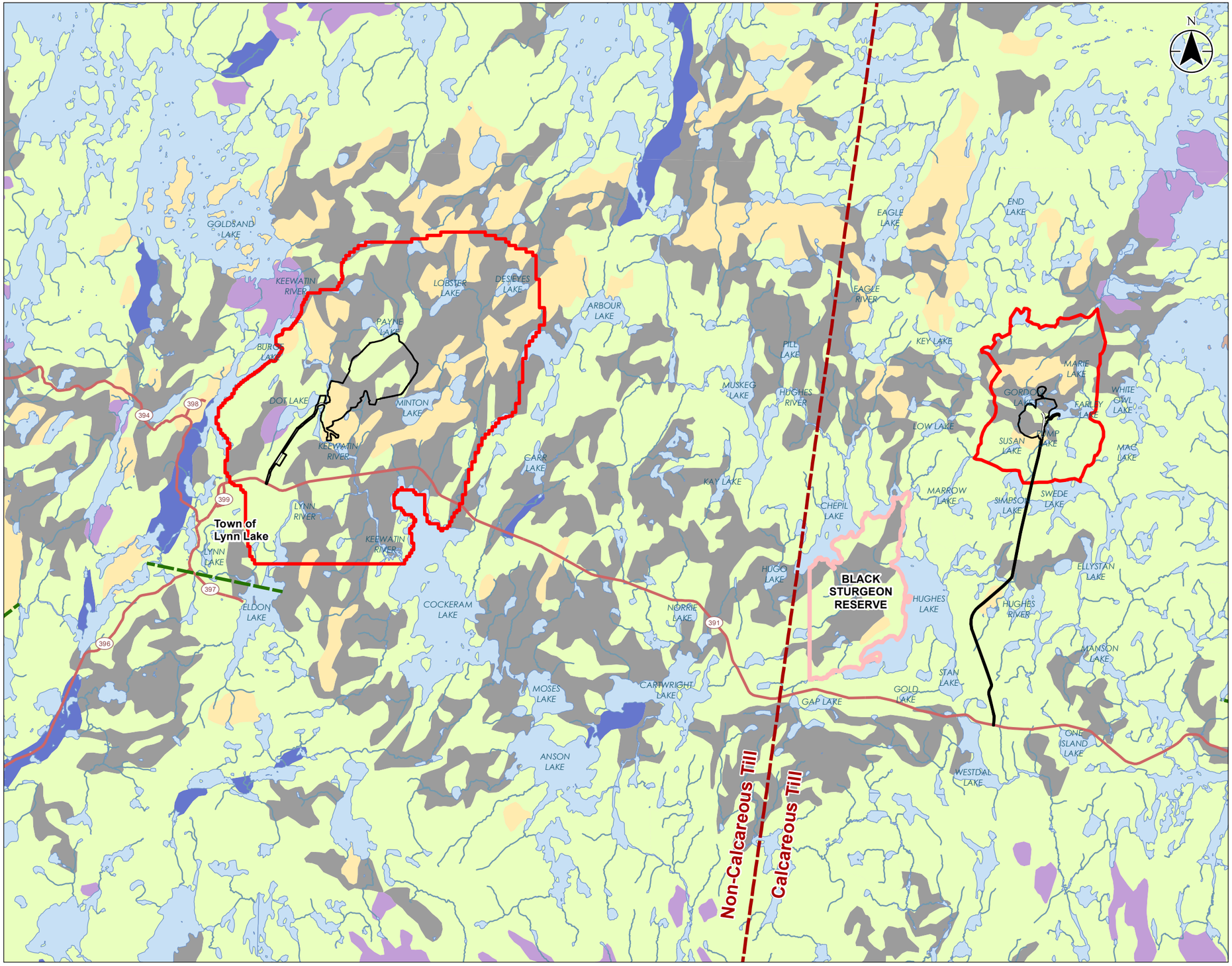
111473076
Prepared by AC on 2025-02-26
Technical Review by AD on 2025-02-26

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
5

Title
Reaches of Waterbodies and Watercourses - MacLellan

\\Cn0045-pbsgl01\gis_GIS_Project_Folders\111473076 Aalkcon\Figures\Hydro-geo\bgyx\Maclellan_hydr_2024\Feb 2025 NOA Updates\Maps\Reaches_MacLellan_20250226.mxd Revised: 2025-02-26 By: ACampagnolo



Stantec

Project Infrastructure
- Project Development Area

Study Area
- Local Study Area

Surficial Geology
- Organic Deposits
- Marginal Glaciolacustrine Sediments
- Offshore Glaciolacustrine Sediments
- Proximal Glaciofluvial Sediments
- Sand Diamicton
- Precambrian Terrane

Landbase
- Approximate Western Extent of Calcarious Till
- Approximate Locations of Eskers
- Existing Access Road
- Highway
- Watercourse
- Waterbody
- First Nation Reserve

0 5 10 Kilometres

1:175,000 (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 Site
Lynn Lake, Manitoba

111473076

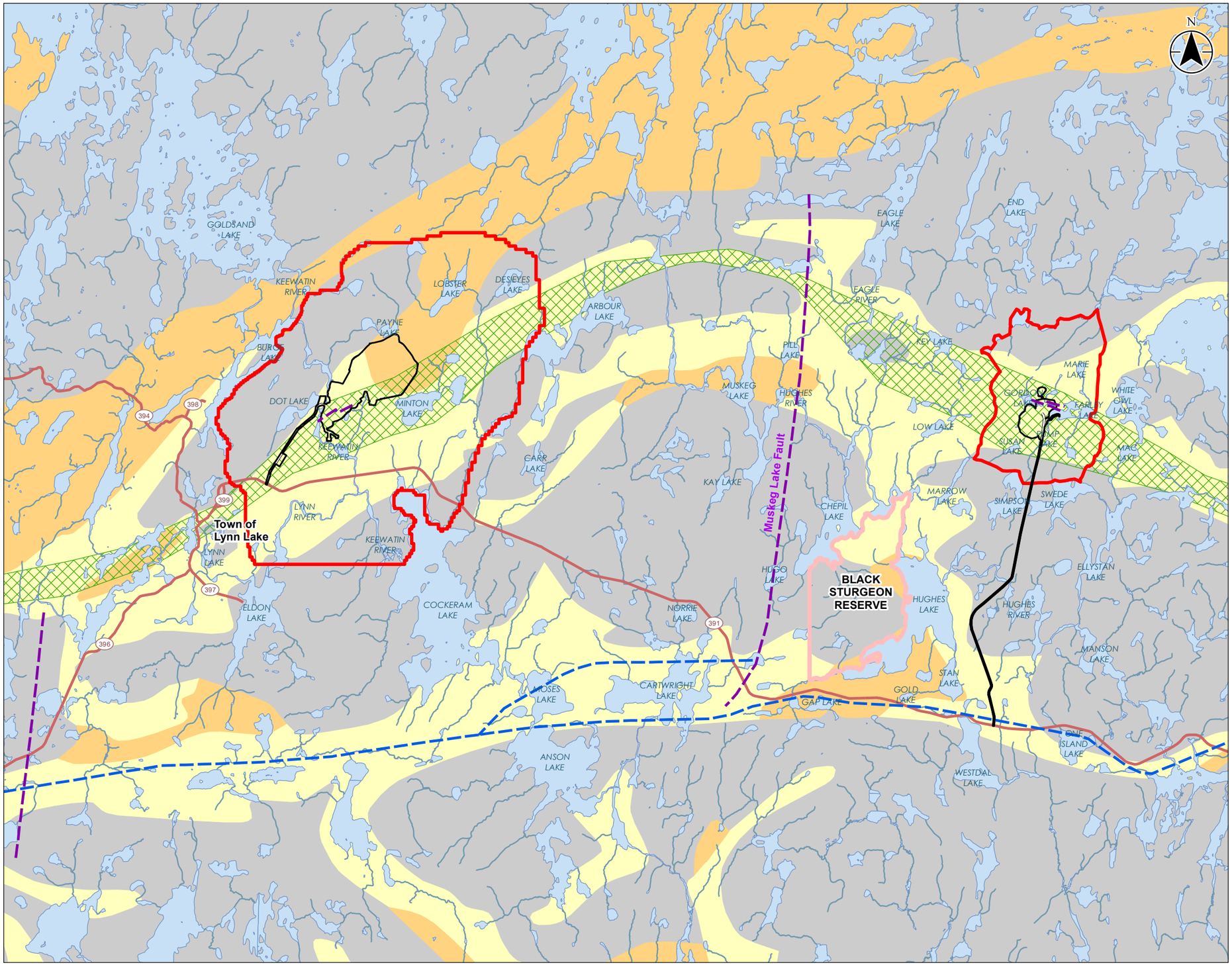
Prepared by ACampigotto on 2025-02-26
Technical Review by AD on 2025-02-26

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
6

Title
Surficial Geology

\\Cn0045-pbsgis01\gis_GIS_Project_Folder\111440293_AuRico\Figures\Hydrogeology\Mxd\Baseline_TMR_2024Feb2025 NOA Updates\Mxd\4_SurficialGeology_20250226.mxd Revised: 2025-02-26 By: ACampigotto



Stantec

Project Infrastructure
- Project Development Area

Study Area
- Study Area

Bedrock Geology
- Intrusive Rocks
- Metamorphic and Metasedimentary Rocks
- Metavolcanic Rocks (includes Amisk and Wasekwan Groups and Great Island volcanic rocks)

Landbase
- Approximate Location of Fault
- Approximate Location of Johnson Shear
- Existing Access Road
- Highway
- Watercourse
- Approximate Location of Agassiz Metallatect / Greenstone Belt
- Waterbody
- First Nation Reserve

0 5 10 Kilometres

1:175,000 (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 Site
Lynn Lake, Manitoba

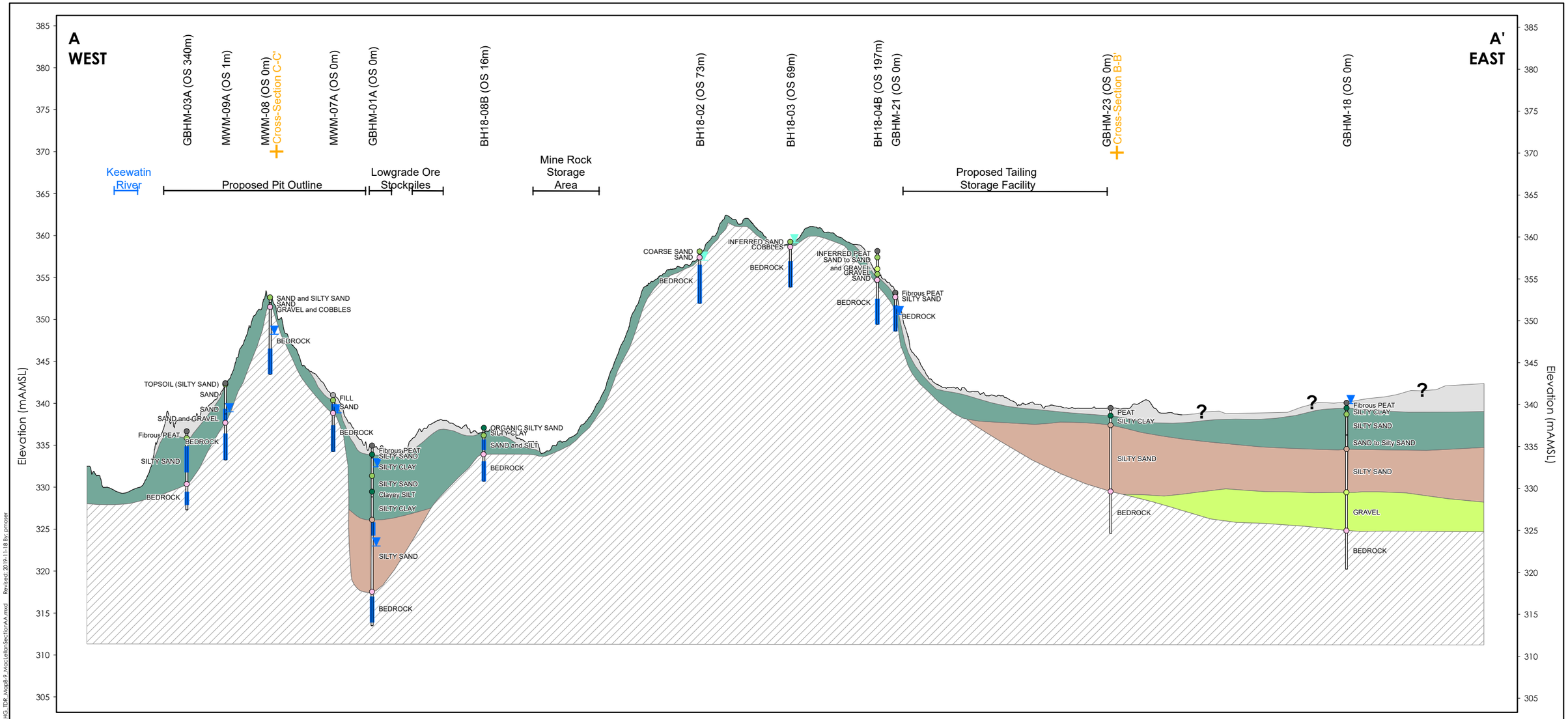
111473076
Prepared by AC on 2025-02-26
Technical Review by AD on 2025-02-26

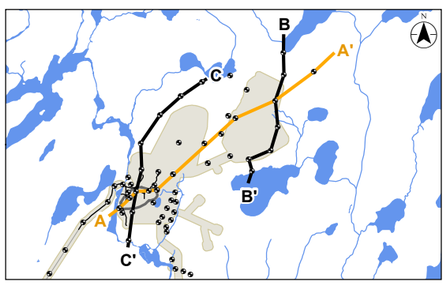
Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
7

Title
Bedrock Geology

\\Cn0045-ebog101.ugl\...GIS Project Folder\111440293 AuRico Figures\Hydrogeology\Mosketen TMR 2024\Feb 2025 NOA Updates\Vsop7 BedrockGeology_20250226.mxd Revised: 2025-02-26 by ACampagnolo





MW1-15 (OS m)

Well ID (Offset)

Sand

Stratigraphy

Water Level
(June 22-26, 2018)
(July 4-5, 2019)

Well Screen

- Fill
- Organics
- Glaciofluvial
- Glaciolacustrine Nearshore
- Glaciolacustrine Offshore
- Diamicton
- Bedrock

- Ground Surface
- Rock Dump
- Fill/Organics
- Glaciolacustrine
- Glaciofluvial
- Diamicton
- Bedrock

50x Vertical Exaggeration

0 500 1,000 metres

1:25,000 (At original document size of 11x17)

Notes
1. Manual water level measurements from September 25 to 29, 2015.

Stantec

Project Location
Lynn Lake,
Manitoba

111473008
Prepared by PRM on 2019-11-18
Technical Review by JM on 2019-11-18

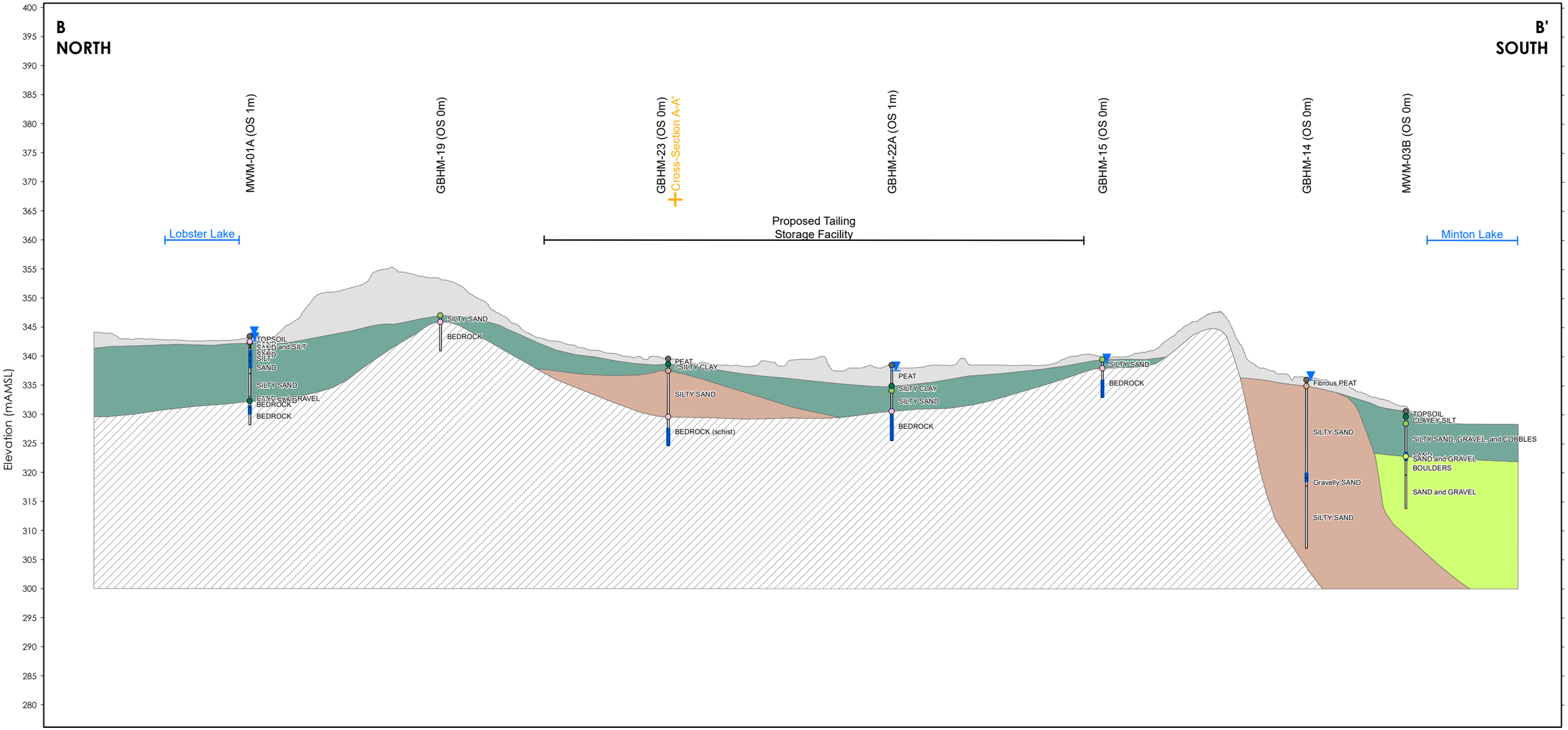
Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

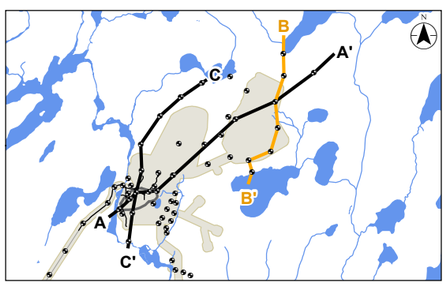
Map No.
8

Title
Cross-Section A-A'

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

\\cd1004401\work_group\01659\active\111440923_Alamos\MXD\Hydrogeology\TDR\111473008_HG_TDR_Map8-9_MacLellanSectionAA.mxd Revised: 2019-11-18 By: pmoser





MW1-15 (OS m)

Well ID (Offset)

Sand

Stratigraphy

Water Level
(June 22-26, 2018)

Well Screen

- Fill
- Organics
- Glaciofluvial
- Glaciolacustrine Nearshore
- Glaciolacustrine Offshore
- Diamicton
- Bedrock

- Ground Surface
- Rock Dump
- Fill/Organics
- Glaciolacustrine
- Glaciofluvial
- Diamicton
- Bedrock

20x Vertical Exaggeration

0 250 500 metres

1:15,000 (At original document size of 11x17)

Notes

1. Manual water level measurements from September 25 to 29, 2015.

Stantec

Project Location
Lynn Lake,
Manitoba

111473008
Prepared by PRM on 2019-11-18
Technical Review by JM on 2019-11-18

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
9

Title
Cross-Section B-B'

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

\\cd1004101\work_group\01409\active\111446093_Alamos\WD\Hydrogeology\TDR\111473008_HG_TDR_Map8-10_MacLellanSection88.mxd Revised: 2019-11-18 By: pmoser

C
NORTH

C'
SOUTH

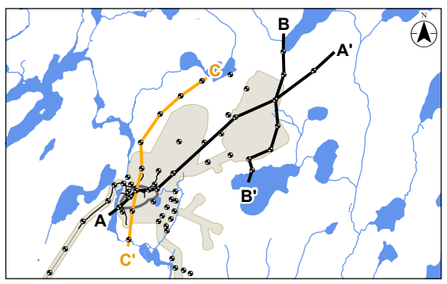
MWM-12D (OS m)
MWM-13D (OS m)
GBHM-07 (OS m)
GBHM-12 (OS m)
MWM-04A (OS m)
Cross-Section A-A'
MWM-09A (OS m)
GBHM-03A (OS m)
MWM-10A (OS m)
Keewatin River

Historical Overburden Rock Storage Area
Overburden Stockpile
Proposed Pit Outline

PEAT
COBBLES / BOULDERS
SAND and COBBLES
COBBLES / BOULDERS
BEDROCK
PEAT
TOPSOIL
SAND
SILTY CLAY
CLAY
BOULDERS and COBBLES
BEDROCK
Fibrous PEAT
SILTY SAND
CLAYEY SILT
SILTY SAND
SAND
SILTY SAND
?
?
?
FIBROUS PEAT
SILTY SAND
SAND and GRAVEL
BEDROCK
SAND
BEDROCK
BEDROCK
TOPSOIL (SILTY SAND)
SAND
SAND
SAND and GRAVEL
BEDROCK
Fibrous PEAT
SILTY SAND
BEDROCK
BOULDERS and ORGANICS
SAND
COBBLES and BOULDERS
BEDROCK

Elevation (mAMSL)

410 405 400 395 390 385 380 375 370 365 360 355 350 345 340 335 330 325 320 315 310 305 300 295 290 285 280 275 270



MW1-15 (OS m)
Sand
Well ID (Offset)
Stratigraphy
Water Level
(June 22-26, 2018)
(July 4-5, 2019)
Well Screen

- Fill
- Organics
- Glaciofluvial
- Glaciolacustrine Nearshore
- Glaciolacustrine Offshore
- Diamicton
- Bedrock

- Ground Surface
- Rock Dump
- Fill/Organics
- Glaciolacustrine
- Glaciofluvial
- Diamicton
- Bedrock

20x Vertical Exaggeration
0 250 500 metres
1:17,500 (At original document size of 11x17)

Notes
1. Manual water level measurements from September 25 to 29, 2015.

Stantec

Project Location
Lynn Lake,
Manitoba

111473000
Prepared by PRM on 2019-11-18
Technical Review by MF on 2020-03-13

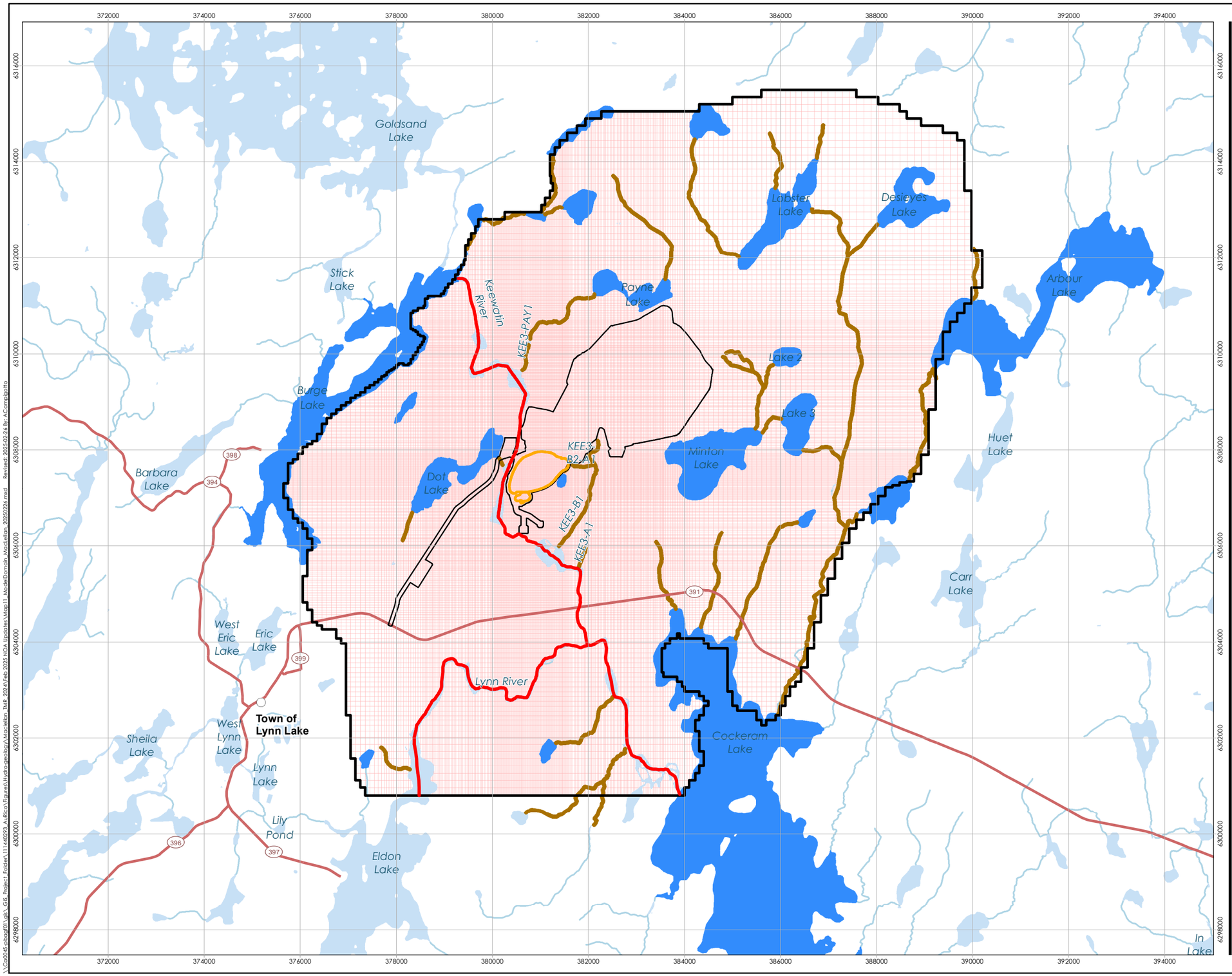
Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
10

Title
Cross-Section C-C'

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

\\cd1004-f01\work_group\01699\active\111442923_Alamos\WP\Hydrogeology\TDR\111473008_HG_TDR_Mod8-11_MacLellanSectionCC.mxd Revised: 2020-03-13 By: pmraser



Stantec

Project Infrastructure
- Proposed Open Pit
- Project Development Area

Study Area
- Study Area
- Stream Segments (SFR2)
- Watercourses (River Boundary)
- Waterbodies (General Head Boundary)
- Model Grid

Landbase
- Highway
- Watercourse
- Waterbody

N

0 1 2 Kilometres
(At original document size of 11x17)
1:80,000

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 AC on 2025-02-26
Technical Review by AD on 2025-02-26

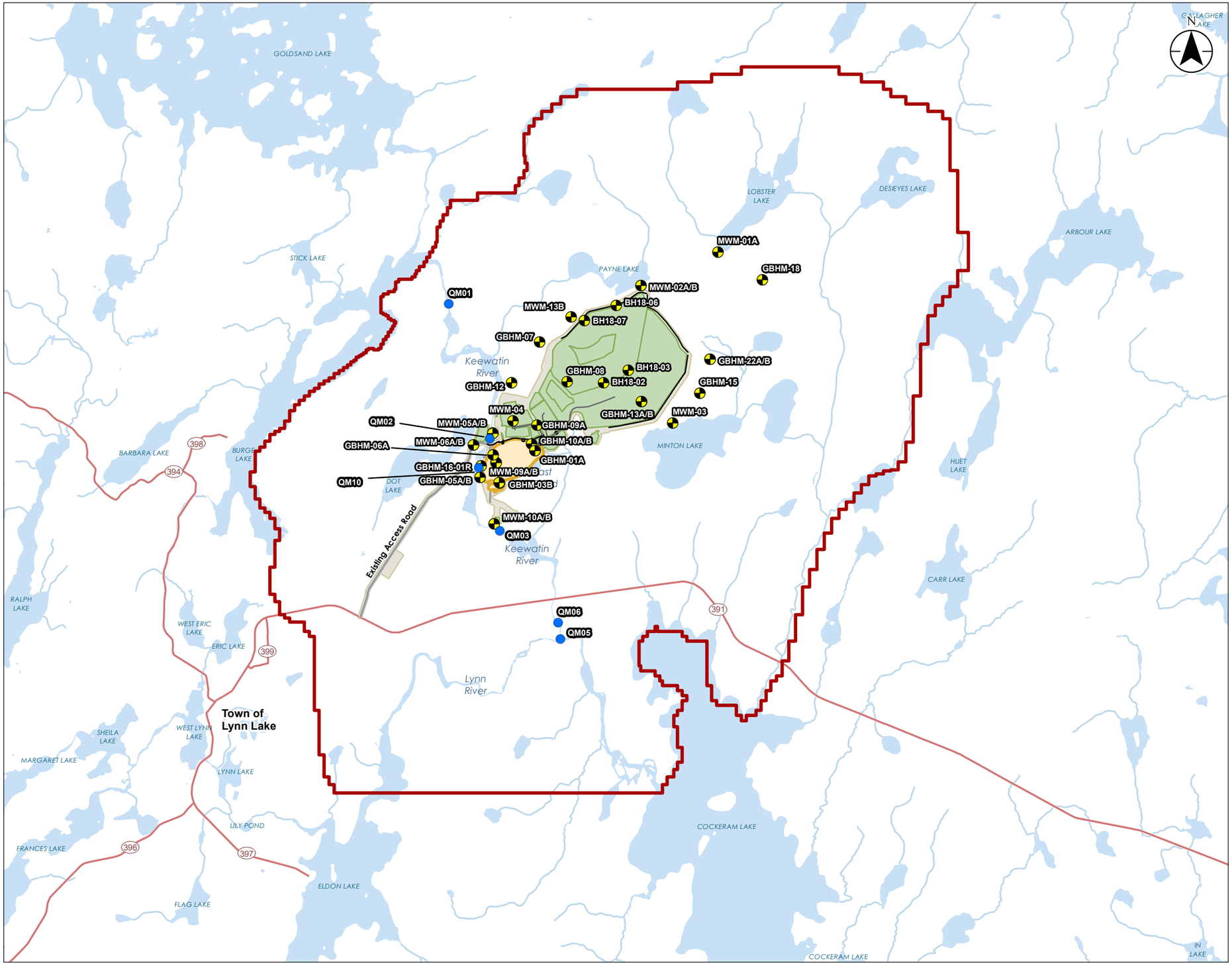
Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

111473076

Map No.
11

Title
Model Domain and Boundary Conditions - Baseline Model

\\Cd2045-pbsgfs01.\gis_GIS_Project Folder\111440293 AuRico\Figures\Hydro-geology\MacLellan_NWR_2024\Feb 2025 NOA Updates\Map11_ModelDomain_MacLellan_20250224.mxd Revised: 2025-02-26 By: ACompagnino



Project Infrastructure
- Project Development Area
- Proposed Open Pit
- Proposed Infrastructure
- Drainage Ditch
- Existing Access Road
- Haul Road

Study Area
- Groundwater Level target
- Surface Water Calibration Target
- Study Area

Landbase
- Highway
- Existing Access Road
- Waterbody

0 1 2 Kilometres
1:80,000 (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 Site
Lynn Lake, Manitoba

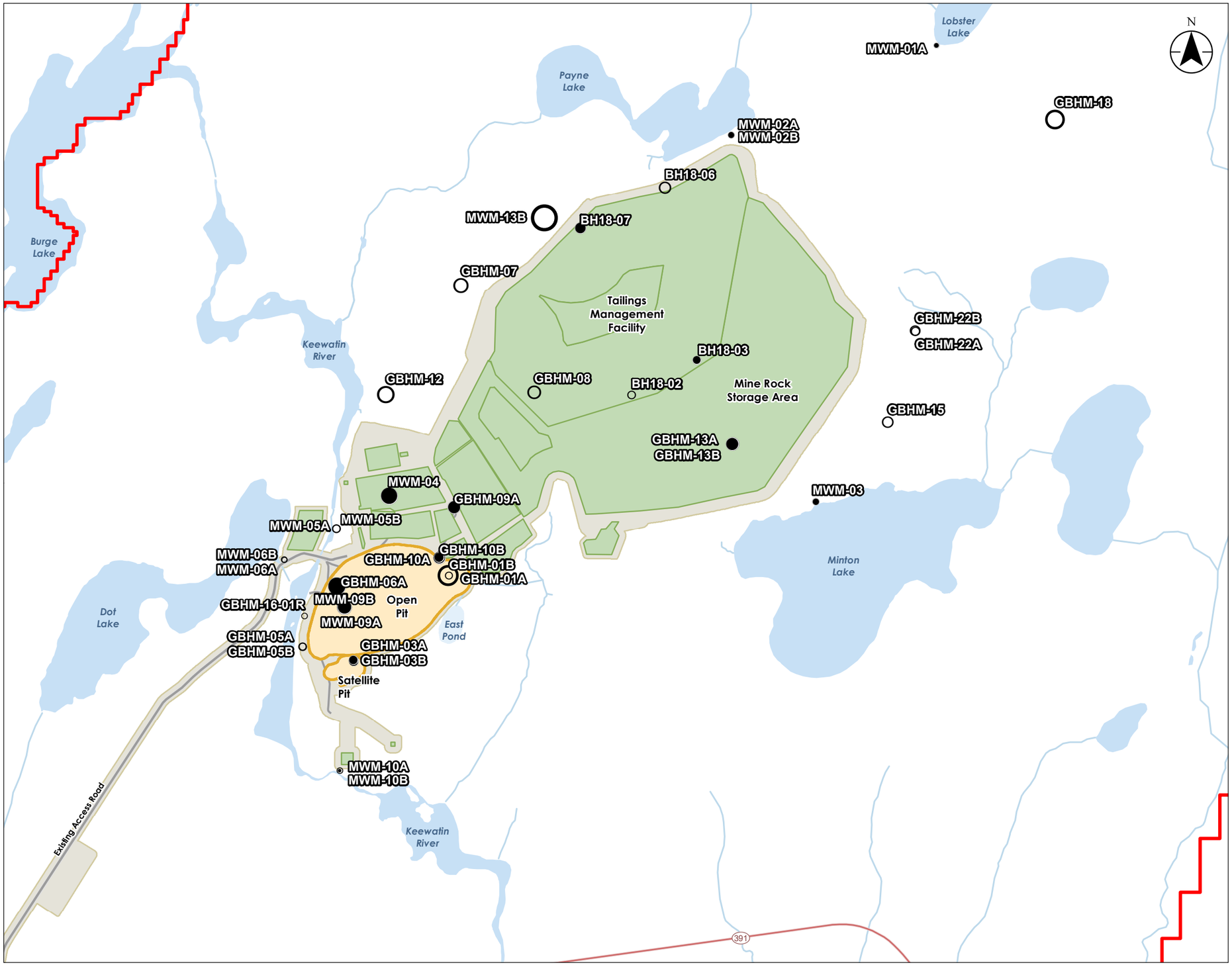
111473076
Prepared by AC on 2025-02-26
Technical Review by AD on 2025-02-26

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
12

Title
Location of Water Level and Baseflow Calibration Targets

\\Ca0045-pbsgis01.ugs\...\GIS Project Folder\111440293 AuRico Ulgaren\Hydrogeology\Mackellan_TMR_2024\Feb 2025 NOA Updates\Map 12 Waterlevel Baseflow_calibration_Mackellan_20250224.mxd Revised 2025-02-24 By: ACampagnolo



Stantec

Project Infrastructure
- Project Development Area
- Proposed Open Pit
- Proposed Infrastructure
- Existing Access Road

Study Area

Positive Weighted Residual Errors (m)
- 0 to 2
- 2 to 4
- > 4

Negative Weighted Residual Errors (m)
- 0 to -2
- -2 to -4
- > -4

- Study Area

Landbase
- Highway
- Existing Access Road
- Waterbody

0 0.5 1 Kilometres

1:30,000 (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 Site
Lynn Lake, Manitoba

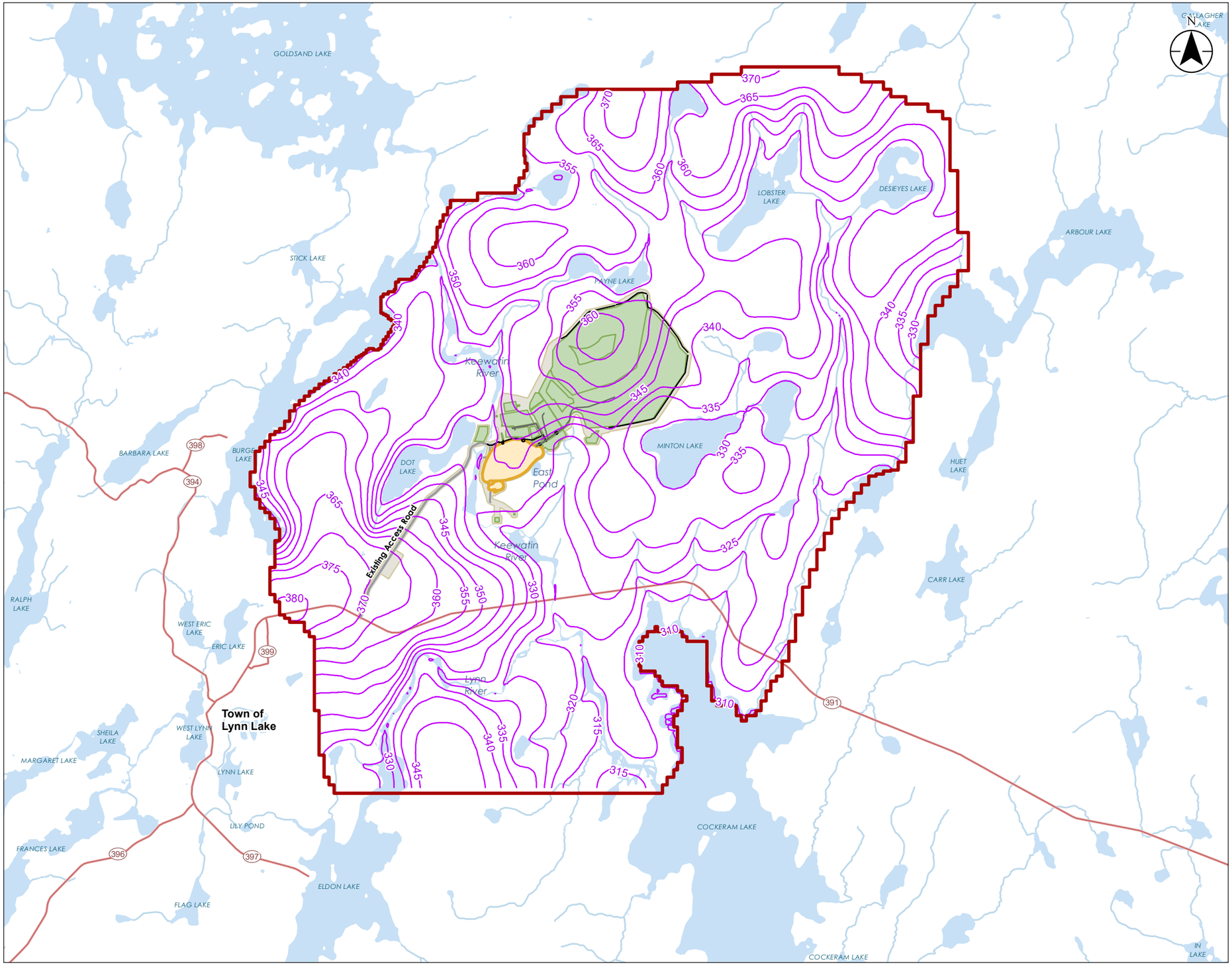
111473076
Prepared by AC on 2025-02-26
Technical Review by AD on 2025-02-26

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
13

Title
Spatial Distribution of Weighted Residual Errors in the Model

\\Cor0045-pbsgl01.ggh\...GIS Project Folder\111440293 AuRec\Figures\Hydrogeology\Mocleltan_TMF_2024\Feb 2025 NOA Updates\Map13_Spatial Distribution_residual_errors_Mac_20250226.mxd Revised: 2025-02-26 By: ACcampagnaro



Stantec

Project Infrastructure

- Project Development Area
- Proposed Open Pit
- Proposed Infrastructure
- Drainage Ditch
- Existing Access Road
- Haul Road

Study Area

- Predicted Water Table Elevation Contours
- Study Area

Landbase

- Highway
- Existing Access Road
- Waterbody

0 1 2 Kilometres

1:80,000 (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 Site
Lynn Lake, Manitoba

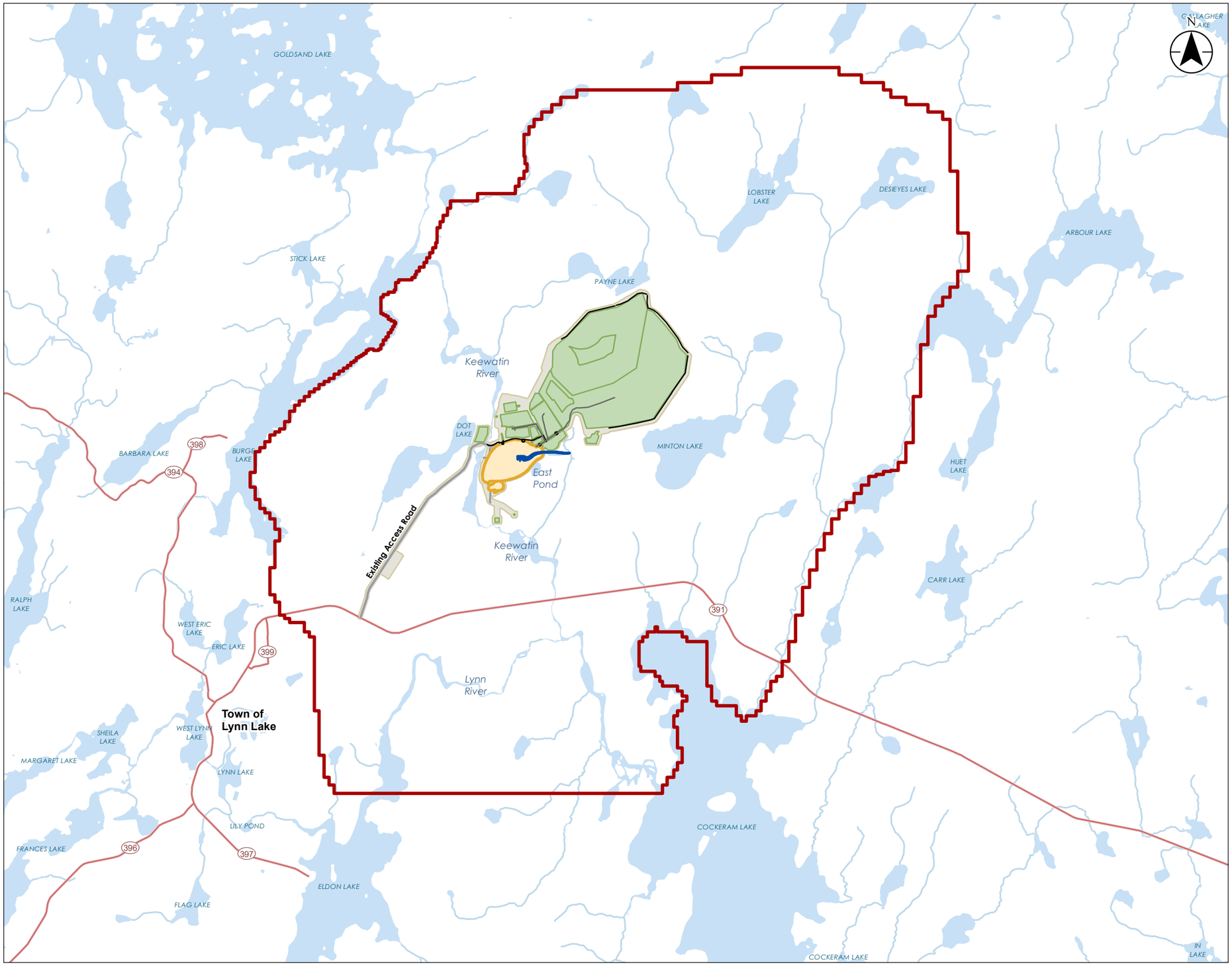
111473076
Prepared by AC on 2025-02-26
Technical Review by AD on 2025-02-26

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
14

Title
Simulated Baseline Water Table Elevation Contours

\Cal0046-p\acad\01 Vgis\ GIS Project Folder\111440293 AuRico\Figures\Hydro-geology\Maclellan TMR 2024\Feb 2025 NOA Updates\Map14 Baseline Water Table elevations_MacLellan_20250226.mxd Revised: 2025-02-26 By: ACampigotto



Stantec

Project Infrastructure
- Project Development Area
- Proposed Open Pit
- Proposed Infrastructure
- Drainage Ditch
- Existing Access Road
- Haul Road

Study Area
- Historical MRSA particle Tracks
- Study Area

Landbase
- Highway
- Existing Access Road
- Waterbody

0 1 2 Kilometres
1:80,000 (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 Site
Lynn Lake, Manitoba

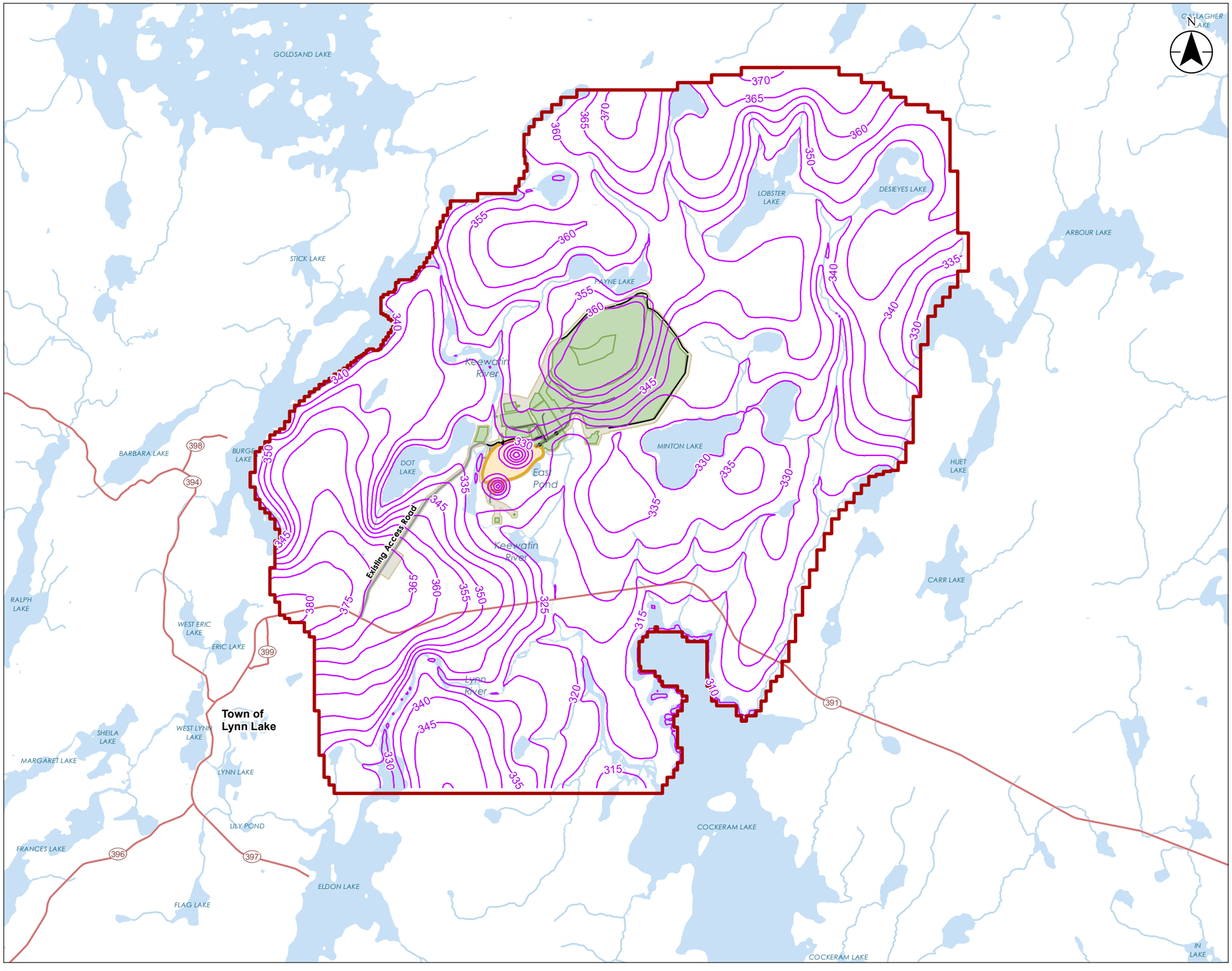
111473076
Prepared by AC on 2025-02-26
Technical Review by AD on 2025-02-26

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
15

Title
Simulated Baseline Particle Tracks

\\Cal0046-pbsgl01\gis_GIS_Project Folder\111440293 AuRico\Figures\Hydro-geology\Maclellan_IWR_2024 Feb 2025 MDA Updates\Map15_Baseline_Particle_Tracks_MacLellan_20250226.mxd Revised: 2025-02-26 By: ACampagnolo



Project Infrastructure
- Project Development Area
- Proposed Open Pit
- Proposed Infrastructure
- Drainage Ditch
- Existing Access Road
- Haul Road

Study Area
- Predicted Water Table Elevation Contours
- Study Area

Landbase
- Highway
- Existing Access Road
- Waterbody

0 1 2 Kilometres

1:80,000 (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 Site
Lynn Lake, Manitoba

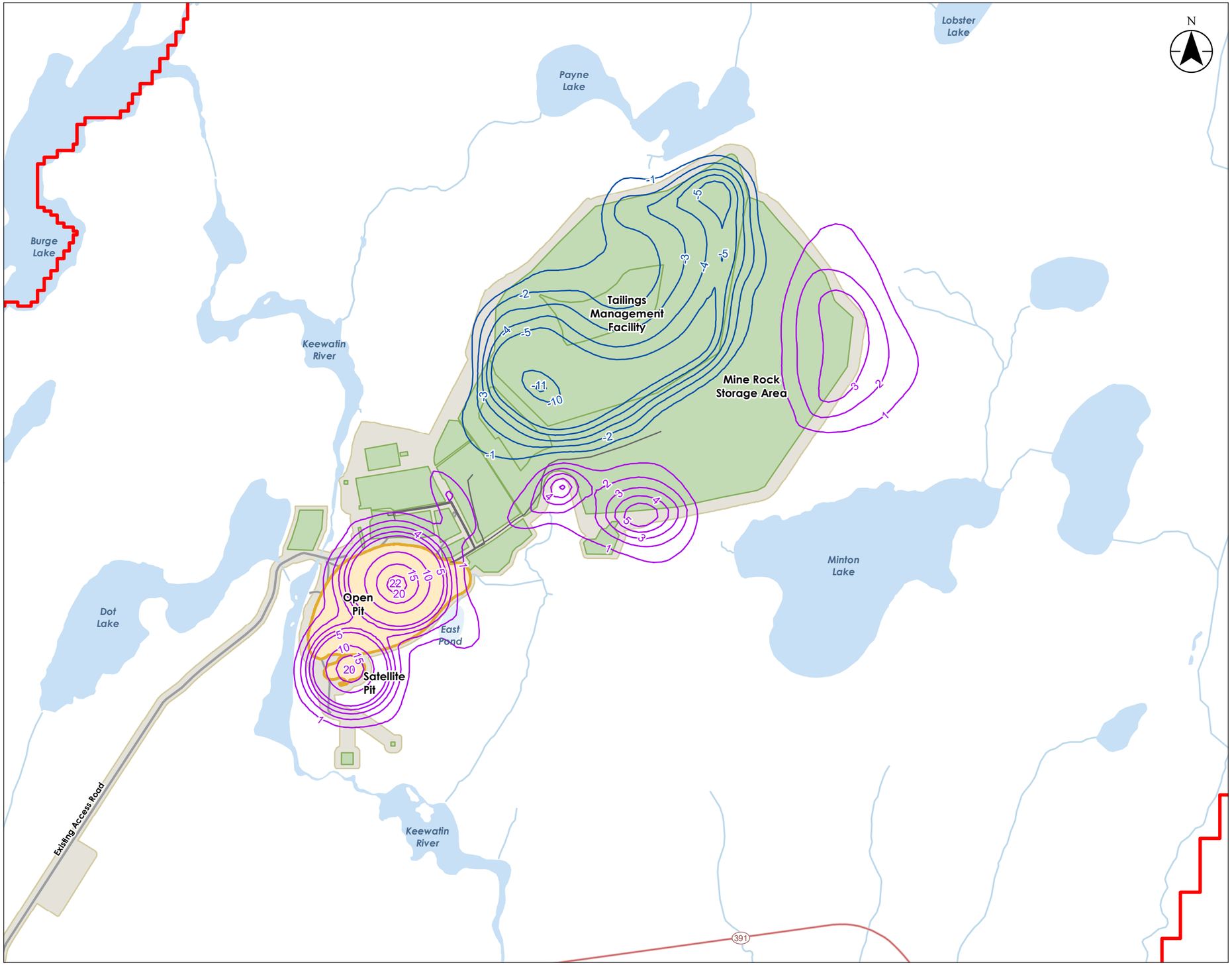
111473076
Prepared by AC on 2025-02-26
Technical Review by AD on 2025-02-26

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
16

Title
Predicted Water Table Elevation Contours at End of Construction

\Co0046-p\pog\01\vpa_GIS_Project_Folder\111440293_AuRecon\Figures\Hydro-geology\Maclellan_fWR_2024Feb2025NOA Updates\Map16_End_of_Construction_Water_Table_elevations_MacLellan_20250226.mxd Revised: 2025-02-26 By: ACampagnolo



Stantec

Project Infrastructure
- Project Development Area
- Proposed Open Pit
- Proposed Infrastructure
- Existing Access Road
- Haul Road

Study Area
- Predicted Water Table Drawdown Contours
- Predicted Water Table Mounding Contours
- Study Area

Landbase
- Highway
- Existing Access Road
- Elevation Contours (m)
- Waterbody

0 0.5 1 Kilometres

1:30,000 (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 Site
Lynn Lake, Manitoba

111473076

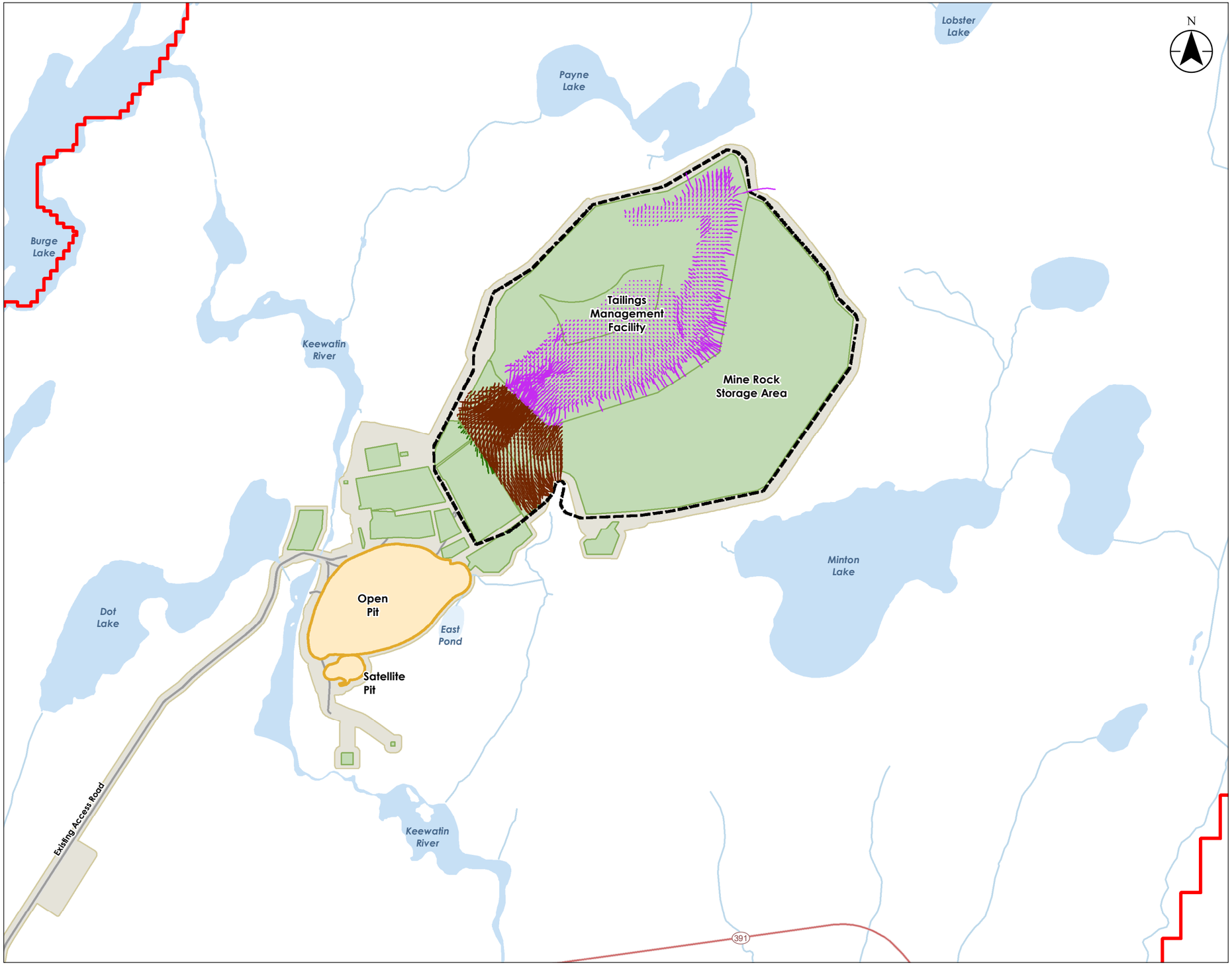
Prepared by AC on 2025-02-26
Technical Review by AD on 2025-02-26

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
17

Title
Predicted Water Table Drawdown at End of Construction

\\Cal0046-pbsgl01\gis_GIS_Project Folder\111440293 Aurico\Figures\Hydro-geology\Maclellan_TWR_2024 Feb 2025 HDA Updates\Map17_End_of_Construction_WaterTableDrawdown_Maclellan_20250226.mxd Revised: 2025-02-26 By: ACampagnolo



Stantec

Project Infrastructure
- Project Development Area
- Proposed Open Pit
- Proposed Infrastructure
- Existing Access Road

Study Area
- Seepage Collection Ditch
- Study Area

Particle Traces by Source
- Long Term Ore Stockpile
- Mine Rock Storage Area
- Tailings Management Facility

Landbase
- Highway
- Existing Access Road
- Elevation Contours (m)
- Waterbody

0 0.5 1 Kilometres

1:30,000 (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 Site
Lynn Lake, Manitoba

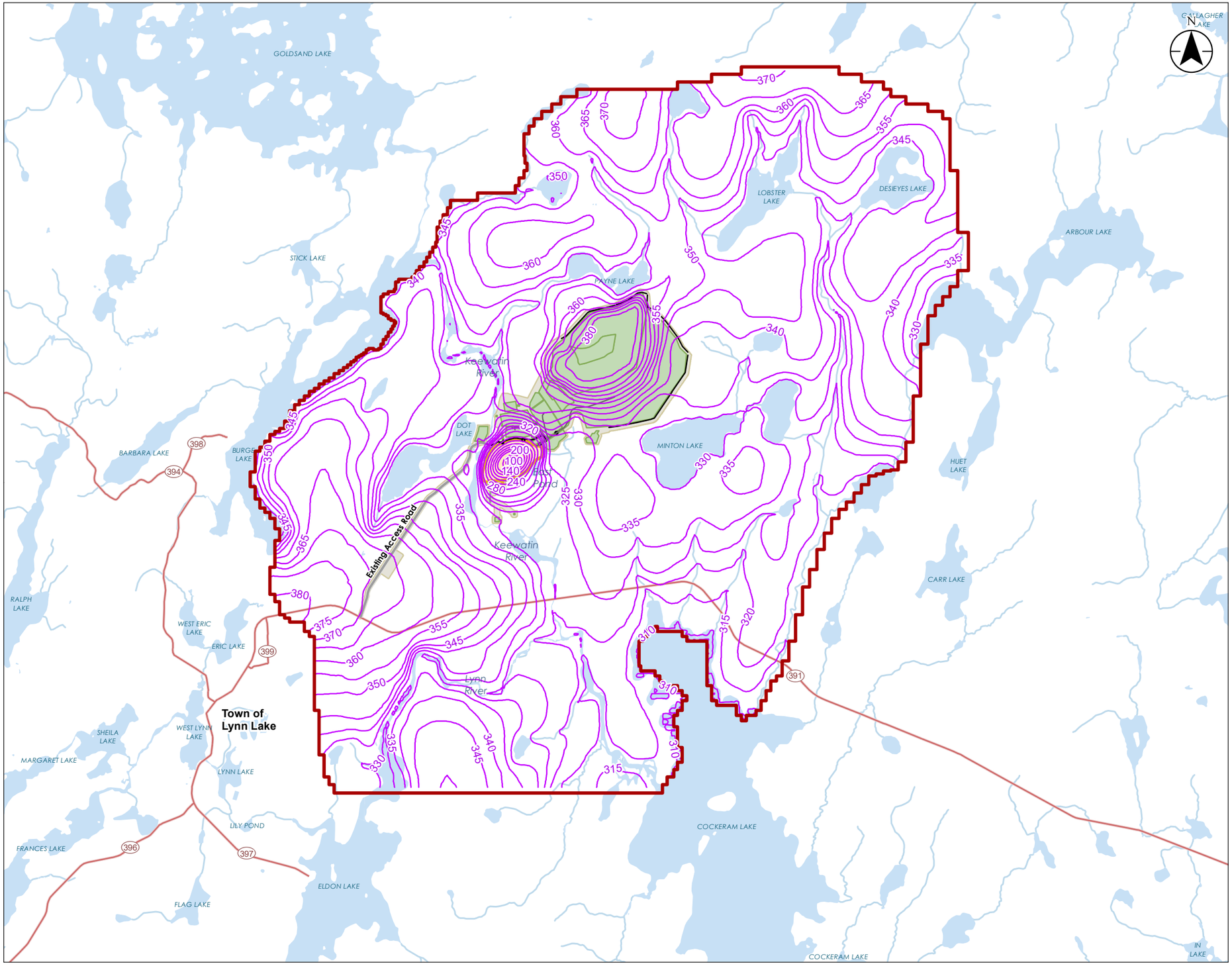
111473076
Prepared by AC on 2025-02-26
Technical Review by AD on 2025-02-26

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
18

Title
Predicted Particle Traces from MRSA and TMF to the Receiving Environment at End of Construction

\\Cc0045-p-bsg101.ga\...GIS Project Folder\111440293 AuRico Figures\Hydrogeology\Maclellan_TMF_MRSA_MacLellan_V4_20250224.mxd Revised: 2025-02-26 By: ACampigotto



Stantec

Project Infrastructure
- Project Development Area
- Proposed Open Pit
- Proposed Infrastructure
- Drainage Ditch
- Existing Access Road
- Haul Road

Study Area
- Predicted Water Table Elevation Contours
- Study Area

Landbase
- Highway
- Existing Access Road
- Waterbody

0 1 2 Kilometres

1:80,000 (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 Site
Lynn Lake, Manitoba

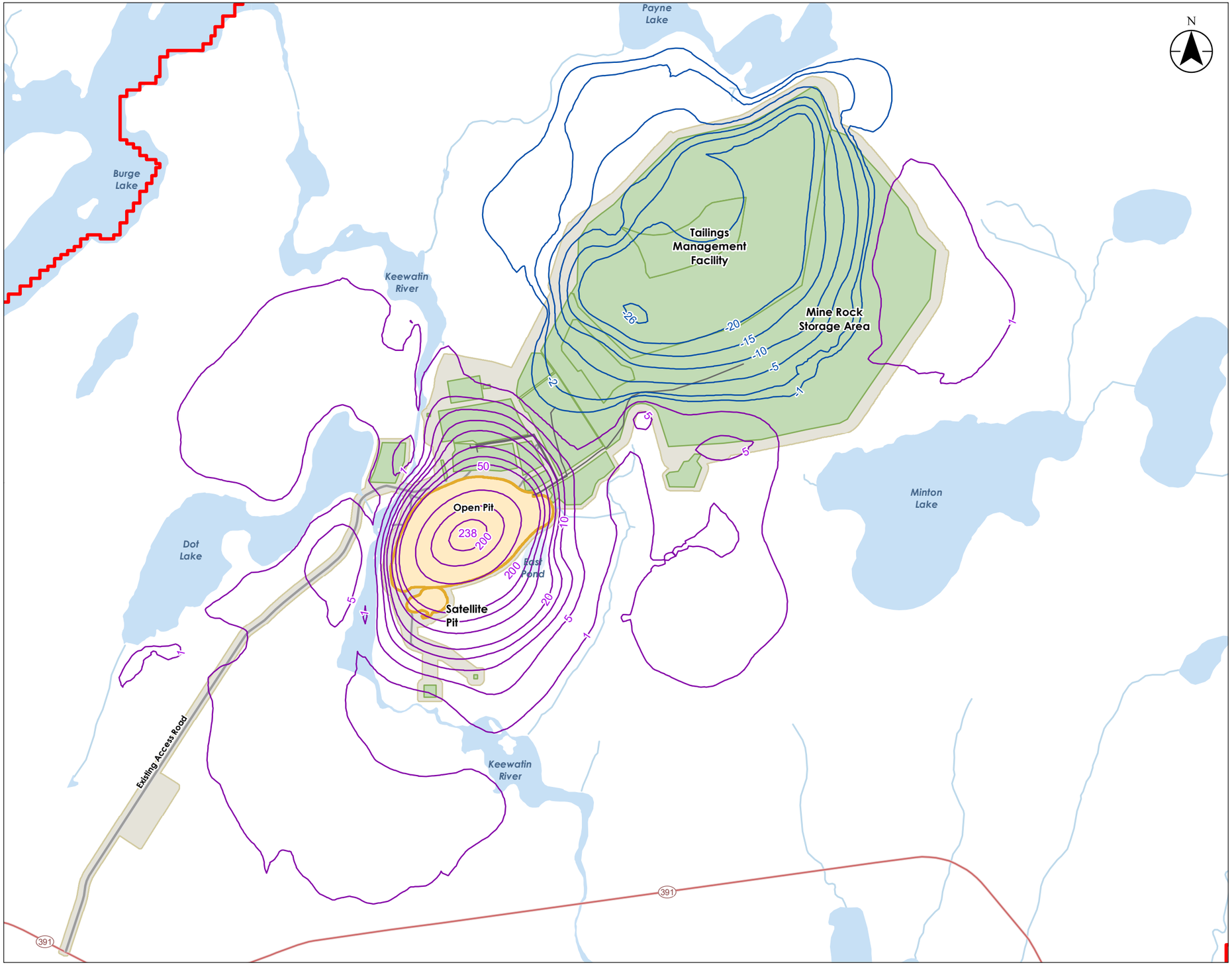
111473076
Prepared by AC on 2025-02-26
Technical Review by AD on 2025-02-26

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
19

Title
Predicted Water Table Elevation Contours at End of Operation

\\Ca0045-pbsgf01.ugl\...\GIS_Project_Folder\111440293_AuRico_Ungava\Hydrogeology\Maclellan_TMR_2024\Feb 2025 NOA Updates\Map 19_End_of_Operation_Water_Table_elevations_MacLellan_20250226.mxd Revised: 2025-02-26 By: ACampagnotto



Stantec

Project Infrastructure
- Project Development Area
- Proposed Open Pit
- Proposed Infrastructure
- Existing Access Road
- Haul Road

Study Area
- Predicted Water Table Drawdown Contours
- Predicted Water Table Mounding Contours
- Study Area

Landbase
- Highway
- Existing Access Road
- Elevation Contours (m)
- Waterbody

0 0.5 1 Kilometres

1:30,000 (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 Site
Lynn Lake, Manitoba

111473076

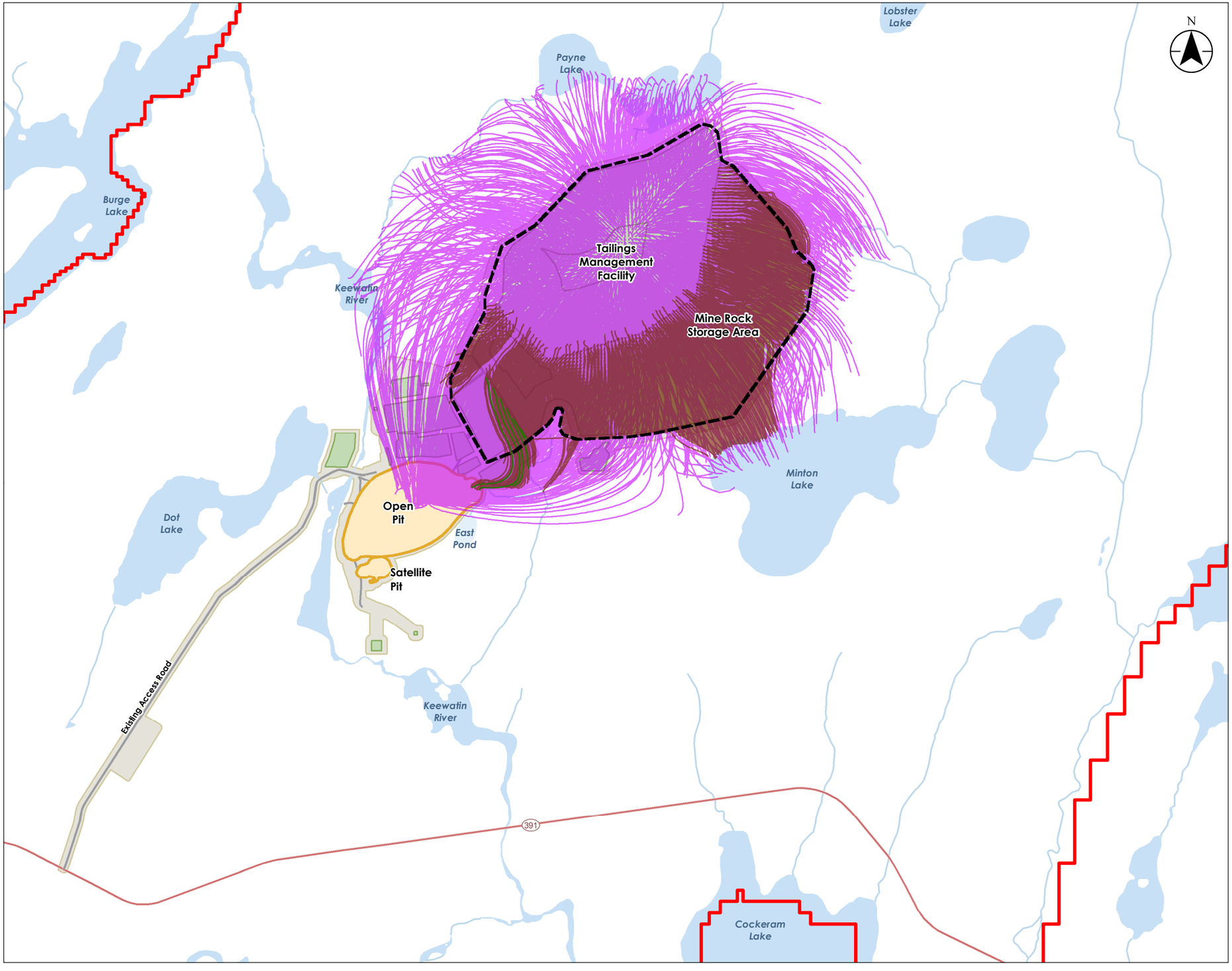
Prepared by AC on 2025-02-26
Technical Review by AD on 2025-02-26

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
20

Title
Predicted Water Table Drawdown at End of Operation

\Cal0046-pbsgfil1\gis_GIS_Project Folder\111440293 AuRico\Figures\Hydro-geology\Maclellan_IWR_2024 Feb 2025 HDA Updates\Map20_End_of_Operation_WaterTableDrawdown_MacLellan_20250226.mxd Revised: 2025-02-26 By: ACampagnolo



Stantec

Project Infrastructure
- Project Development Area
- Proposed Open Pit
- Proposed Infrastructure
- Existing Access Road

Study Area
- Study Area
- Seepage Collection Ditch

Particle Traces by Source
- Long Term Ore Stockpile
- MIne Rock Storage Area
- Tailings Management Facility

Landbase
- Highway
- Existing Access Road
- Elevation Contours (m)
- Waterbody

0 0.5 1 Kilometres
1:35,000 (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 Site
Lynn Lake, Manitoba

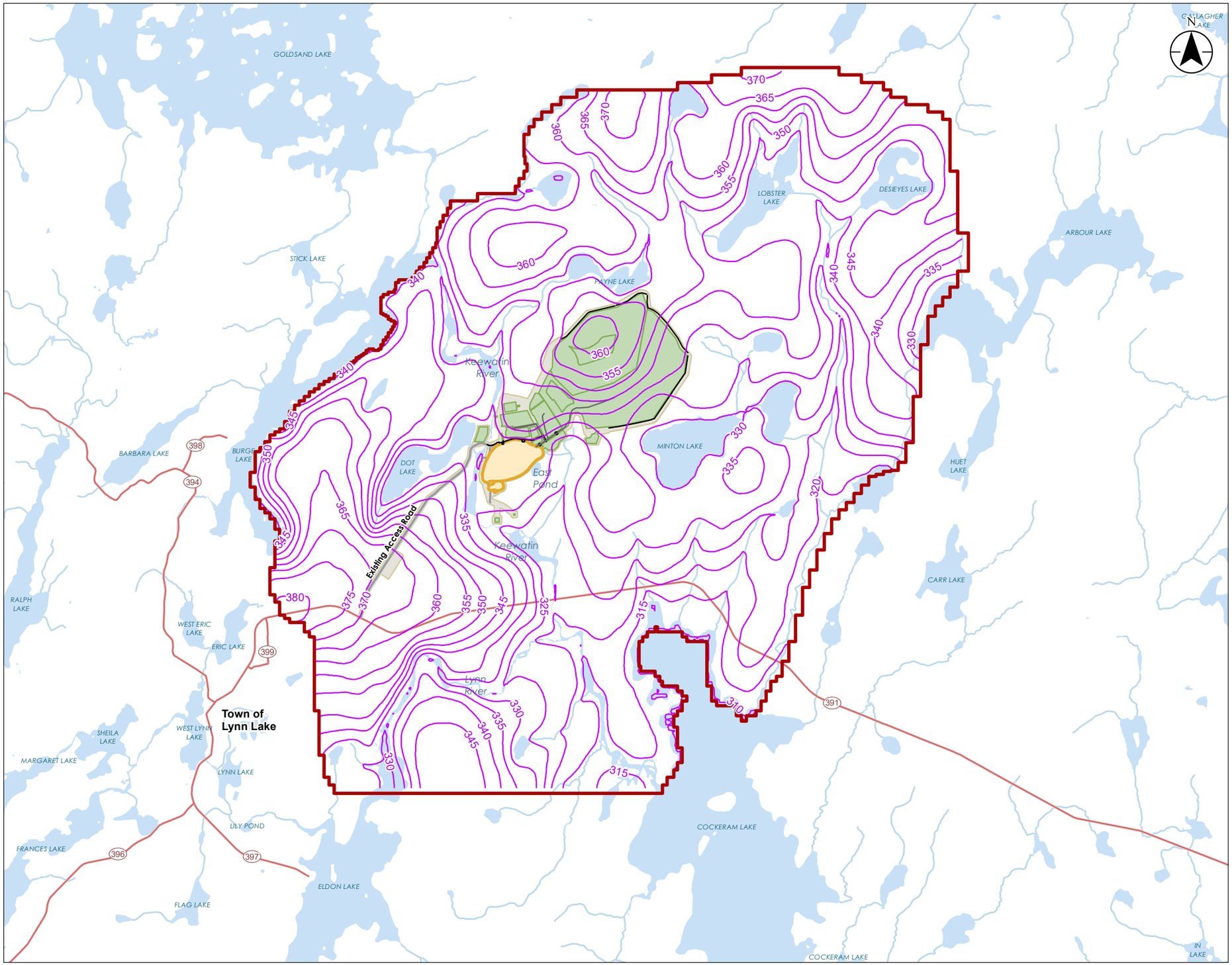
111473076
Prepared by AC on 2025-02-26
Technical Review by AD on 2025-02-26

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
21

Title
Predicted Particle Traces from MRSA, TMF, and OSA to Open Pit and Receiving Environment at End of Operation

\\Cn0045-pbsgf01\gis_GIS_Project_Folder\111440293_AuRico\Figures\Hydro-geology\Maclellan_NWR_2024\Feb 2025 NOA Updates\Map21_Year13_ParticleTracks_MacLellan_20250226.mxd Revised: 2025-02-26 By: ACampagnaro



Stantec

Project Infrastructure

- Project Development Area
- Proposed Open Pit
- Proposed Infrastructure
- Drainage Ditch
- Existing Access Road
- Haul Road

Study Area

- Predicted Water Table Elevation Contours
- Study Area

Landbase

- Highway
- Existing Access Road
- Waterbody

0 1 2 Kilometres

1:80,000 (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 Site
Lynn Lake, Manitoba

111473076

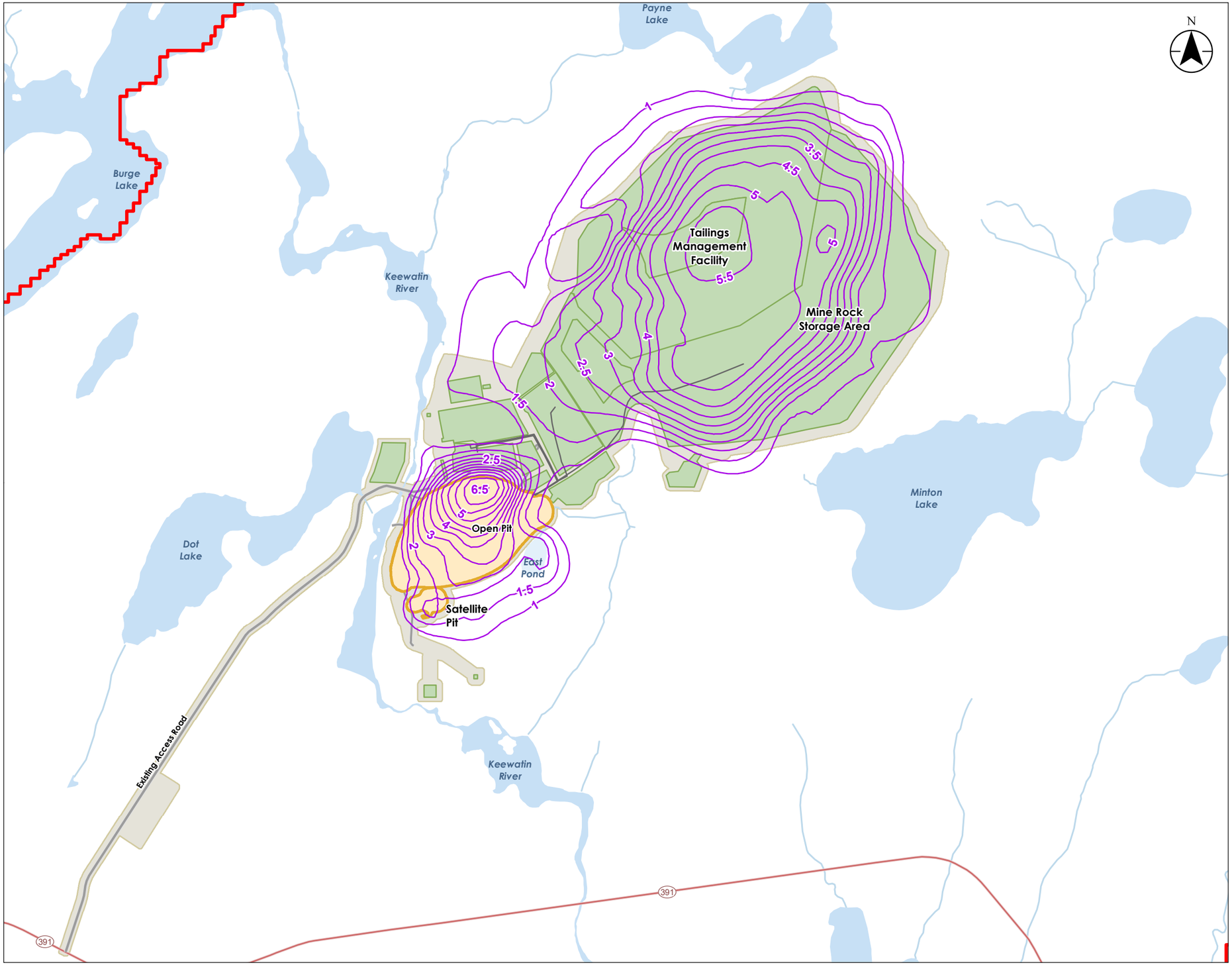
Prepared by AC on 2025-02-26
Technical Review by AD on 2025-02-26

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
22

Title
Predicted Water Table Elevation Contours at End of Closure

\Ca0046-p\proj\01\gis_GIS_Project_Folder\111440293_AuRico\Figures\Hydrogeology\Maclellan_TMR_2024\Feb 2025 NOA Updates\Map22_End_of_Closure_Water_Table_elevations_MacLellan_20250226.mxd Revised: 2025-02-26 By: ACampagnolo



Stantec

Project Infrastructure
- Project Development Area
- Proposed Open Pit
- Proposed Infrastructure
- Existing Access Road
- Haul Road

Study Area
- Predicted Water Table Drawdown Contours
- Study Area

Landbase
- Highway
- Existing Access Road
- Elevation Contours (m)
- Waterbody

0 0.5 1 Kilometres
1:30,000 (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 Site
Lynn Lake, Manitoba

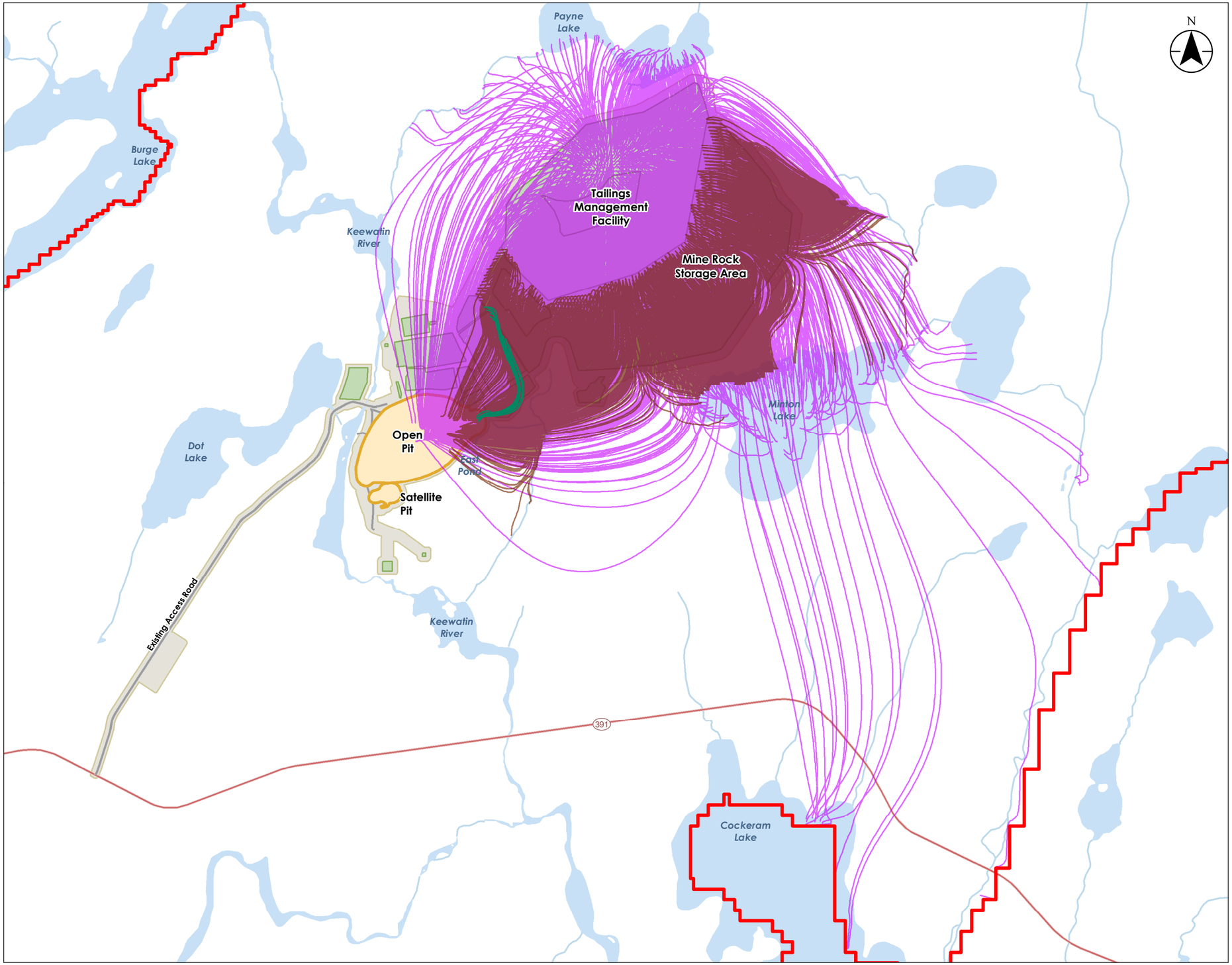
111473076
Prepared by AC on 2025-02-26
Technical Review by AD on 2025-02-26

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
23

Title
Predicted Water Table Drawdown at End of Closure

\\Cn0045-pbsgf01\gis_GIS_Project_Folder\111440293_AuRico\Figures\Hydrogeology\Maclellan_hydr_2024\Feb 2025 NOA Updates\Map23_Closure_WaterTableDrawdown_MacLellan_20250226.mxd Revised: 2025-02-26 By: ACampagnaro



Stantec

Project Infrastructure
- Project Development Area
- Proposed Open Pit
- Proposed Infrastructure
- Existing Access Road

Study Area
- Study Area

Particle Traces by Source
- Long Term Ore Stockpile
- Mine Rock Storage Area
- Tailings Management Facility

Landbase
- Highway
- Existing Access Road
- Elevation Contours (m)
- Waterbody

0 0.5 1 Kilometres
1:37,500 (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 Site
Lynn Lake, Manitoba

111473076
Prepared by AC on 2025-02-26
Technical Review by AD on 2025-02-26

Client/Project
Alamos Gold Inc.
Lynn Lake Gold Project
MacLellan Site

Map No.
24

Title
Predicted Particle Traces from MRSA and TMF to the Receiving Environment at End of Closure

\\Cor0045.ebagl01.vgk\...GIS Project Folder\111440293 AuRico Figures\Hydrogeology\Maclellan_TMF_2024\Feb 2025 NOA Updates\Map24_Closure_ParticleTracks_MacLellan_20250224.mxd Revised: 2025-02-26 By: ACamagiotis

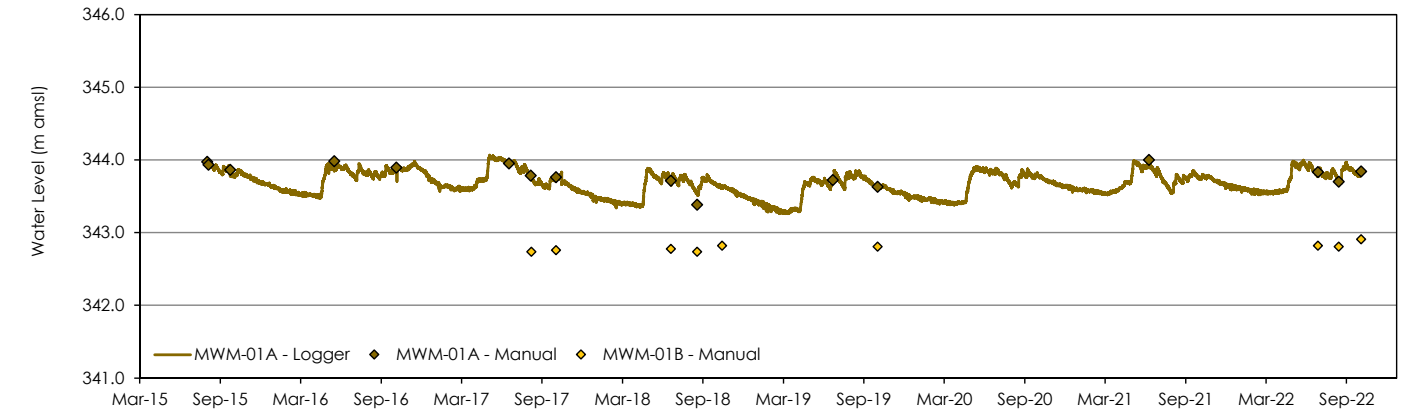
Appendix B Monitoring Well Construction Details and Hydrographs

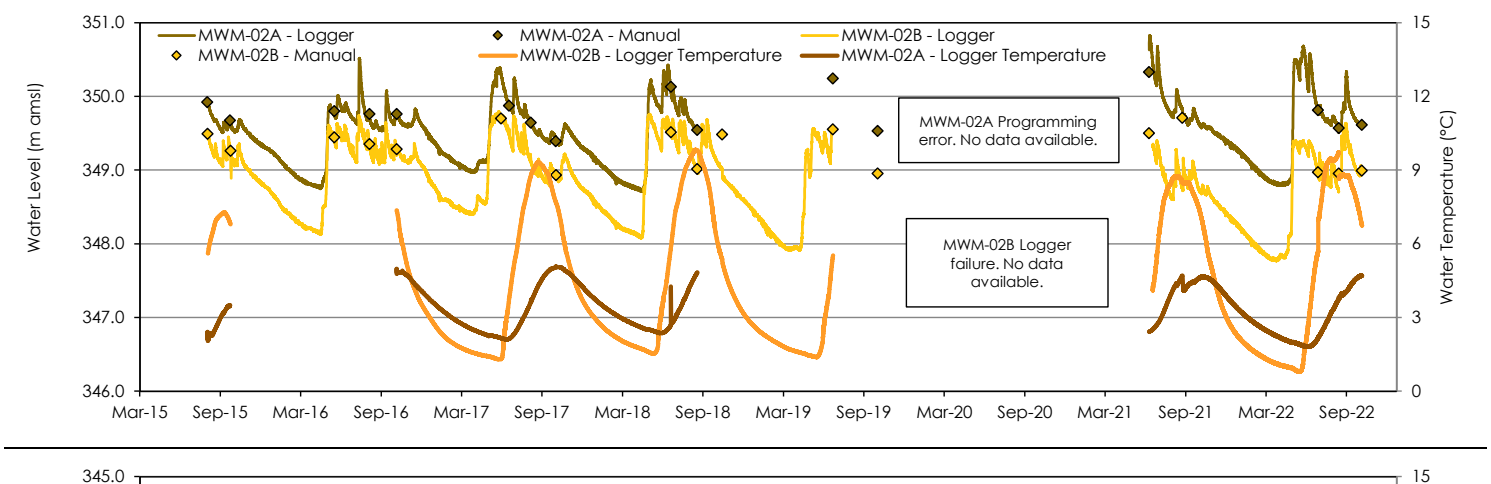
Table B1
MacLellan Site Well Construction Details
Lynn Lake Gold Project (LLGP)

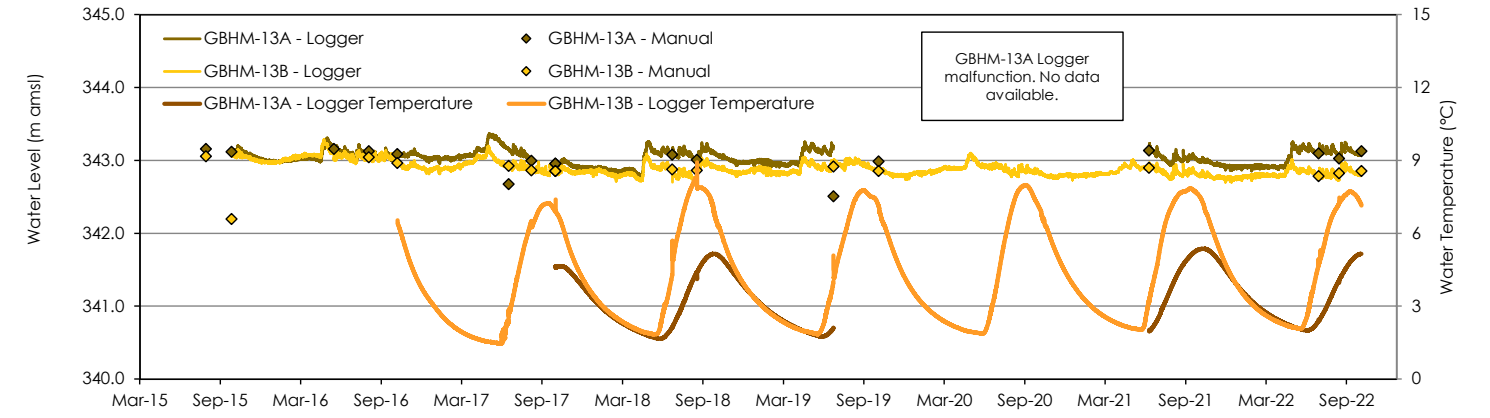
Well ID	Site	Installation Date	Coordinates		Elevation		Stick-up	Borehole Depth	Well Diameter	Screened Interval				Screened Material	Screened Unit
										Top of Well Screen		Bottom of Well Screen			
			Northing	Easting	Ground Surface	Top of Casing									
					m AMSL	m AMSL	(m AGS)	(m BGS)	(mm)	(m BGS)	(m AMSL)	(m BGS)	(m AMSL)		
Monitoring Wells															
MWM-10B	MacLellan	15-Jun-15	6306244	380597	326.49	327.65	1.16	6.7	51	5.00	321.49	6.60	319.89	Sand, Cobbles, and Boulders	Glaciolacustrine
MWM-02B	MacLellan	19-Jun-15	6311072	383569	349.87	350.71	0.84	2.1	51	1.20	348.67	2.10	347.77	Sand and Silty Sand	Glaciolacustrine
MWM-06B	MacLellan	13-Jun-15	6307848	380175	332.20	333.30	1.10	3.5	51	1.80	330.40	3.50	328.70	Sand	Glaciolacustrine
MWM-09B	MacLellan	14-Jun-15	6307487	380632	342.33	343.18	0.86	4.6	51	3.00	339.33	4.60	337.73	Sand and Gravel	Glaciolacustrine
GBHM-03B	MacLellan	29-Jun-15	6307076	380703	336.50	337.52	1.01	4.7	51	1.65	334.85	4.70	331.80	Silty Sand	Glaciolacustrine
MWM-13B	MacLellan	15-Feb-19	6310442	382150	347.36	348.25	0.90	5.5	51	3.96	343.40	5.49	341.87	Silty Clay and Clay	Glaciolacustrine
MWM-03	MacLellan	24-Jun-15	6308286	384213	330.57	331.73	1.16	16.8	51	7.00	323.57	8.50	322.07	Sand and Gravel and Boulders	Glaciolacustrine
GBHM-22B	MacLellan	15-Jul-15	6309584	384966	338.01	339.01	1.00	7.9	51	3.88	334.13	7.90	330.11	Silty Sand	Glaciolacustrine
GBHM-13B	MacLellan	10-Jul-15	6308725	383580	343.08	344.17	1.09	3.1	51	1.50	341.58	3.10	339.98	Silty Clay, Silty Sand, Clayey Sand	Glaciolacustrine
GBHM-07	MacLellan	19-Jul-15	6309928	381518	344.76	345.93	1.16	18.0	51	4.58	340.18	6.10	338.66	Clayey Silt and Silty Sand	Glaciolacustrine
MWM-05B	MacLellan	17-Jun-15	6308084	380569	333.31	334.17	0.86	14.5	51	11.00	322.31	14.00	319.31	Silty Sand to Sand	Sand Diamicton
GBHM-01B	MacLellan	30-Jun-15	6307726	381426	334.97	336.07	1.11	10.7	51	9.15	325.82	10.67	324.30	Silty Sand	Sand Diamicton
GBHM-05B	MacLellan	27-Jun-15	6307186	380313	332.25	333.13	0.88	5.4	51	2.34	329.91	5.38	326.87	Sand and Silt	Sand Diamicton
GBHM-10B	MacLellan	27-Jun-15	6307861	381353	339.49	340.51	1.02	3.4	51	0.92	338.57	3.35	336.14	Silty Sand	Sand Diamicton
MWM-02A	MacLellan	19-Jun-15	6311074	383570	349.70	350.64	0.94	6.7	51	4.60	345.10	6.70	343.00	Bedrock	Shallow Bedrock
MWM-04	MacLellan	20-Jun-15	6308330	380972	352.79	353.71	0.92	5.6	51	2.50	350.29	5.60	347.19	Bedrock	Shallow Bedrock
MWM-06A	MacLellan	13-Jun-15	6307845	380177	332.21	333.18	0.98	7.6	51	4.60	327.61	7.60	324.61	Bedrock	Shallow Bedrock
MWM-09A	MacLellan	14-Jun-15	6307487	380634	342.40	343.34	0.93	9.1	51	6.00	336.40	9.10	333.30	Bedrock	Shallow Bedrock
GBHM-03A	MacLellan	29-Jun-15	6307082	380699	336.67	337.81	1.14	9.4	51	7.22	329.45	8.74	327.93	Bedrock	Shallow Bedrock
GBHM-05A	MacLellan	27-Jun-15	6307184	380313	332.20	333.10	0.90	9.1	51	7.62	324.58	9.14	323.06	Bedrock	Shallow Bedrock
GBHM-06A	MacLellan	27-Jun-15	6307643	380575	343.02	343.90	0.87	4.7	51	2.82	340.20	4.34	338.68	Bedrock	Shallow Bedrock
GBHM-08	MacLellan	18-Jul-15	6309118	382073	348.52	349.56	1.04	4.5	51	3.05	345.47	4.52	344.00	Bedrock	Shallow Bedrock
GBHM-09A	MacLellan	18-Jul-15	6308247	381463	347.80	348.67	0.86	5.0	51	3.51	344.29	4.73	343.07	Bedrock	Shallow Bedrock
GBHM-10A	MacLellan	27-Jun-15	6307862	381351	339.46	340.45	0.99	7.9	51	4.57	334.89	7.62	331.84	Bedrock	Shallow Bedrock
GBHM-12	MacLellan	17-Jul-15	6309100	380946	339.92	340.95	1.04	7.6	51	4.57	335.35	7.62	332.30	Bedrock	Shallow Bedrock
GBHM-13A	MacLellan	10-Jul-15	6308726	383577	343.07	344.21	1.13	7.7	51	3.96	339.11	7.01	336.06	Bedrock	Shallow Bedrock
GBHM-15	MacLellan	13-Jul-15	6308891	384758	339.47	340.42	0.96	6.6	51	3.51	335.96	6.55	332.92	Bedrock	Shallow Bedrock
GBHM-16-01R	MacLellan	24-Jul-16	6307421	380329	330.90	332.10	1.20	7.7	51	5.18	325.72	6.71	324.19	Bedrock	Shallow Bedrock
BH18-02	MacLellan	7-Feb-19	6309098	382812	358.29	358.95	0.66	6.2	51	1.60	356.69	6.17	352.12	Bedrock	Shallow Bedrock
BH18-03	MacLellan	10-Feb-19	6309360	383308	359.39	360.32	0.93	5.4	51	2.36	357.03	5.40	353.99	Bedrock	Shallow Bedrock
BH18-06	MacLellan	18-Jan-19	6310674	383066	356.69	357.45	0.76	6.2	51	1.09	355.60	5.87	350.82	Bedrock	Shallow Bedrock
BH18-07	MacLellan	18-Jan-19	6310366	382425	366.27	367.31	1.04	6.3	51	1.22	365.05	5.79	360.48	Bedrock	Shallow Bedrock
MWM-01A	MacLellan	23-Jun-15	6311753	385129	343.40	344.08	0.68	15.2	51	11.90	331.50	13.40	330.00	Bedrock	Upper Bedrock
MWM-05A	MacLellan	17-Jun-15	6308081	380571	333.36	334.34	0.97	20.4	51	17.40	315.96	20.40	312.96	Bedrock	Upper Bedrock
MWM-10A	MacLellan	15-Jun-15	6306242	380596	326.45	327.34	0.89	12.2	51	9.10	317.35	12.20	314.25	Bedrock	Upper Bedrock
GBHM-01A	MacLellan	30-Jun-15	6307726	381419	334.98	336.08	1.09	21.5	51	18.00	316.98	21.05	313.93	Bedrock	Upper Bedrock
GBHM-18	MacLellan	27-Jun-15	6311189	386027	340.17	341.11	0.94	19.8	51	16.76	323.41	19.81	320.36	Bedrock	Upper Bedrock
GBHM-22A	MacLellan	15-Jul-15	6309582	384968	338.05	339.02	0.97	13.0	51	9.91	328.14	12.95	325.10	Bedrock	Upper Bedrock

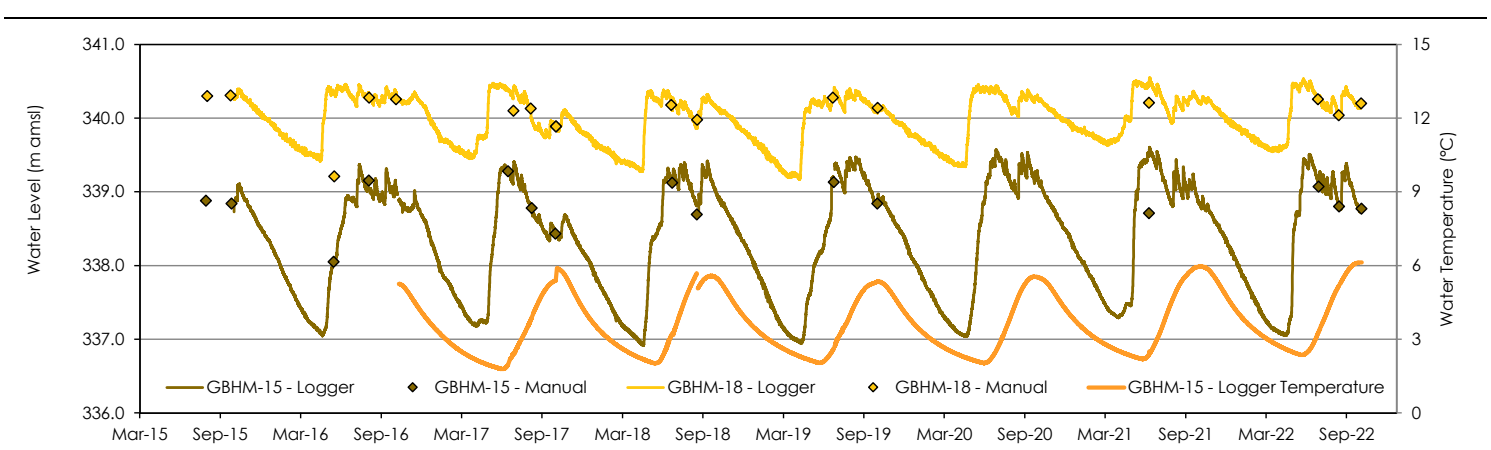
Notes:

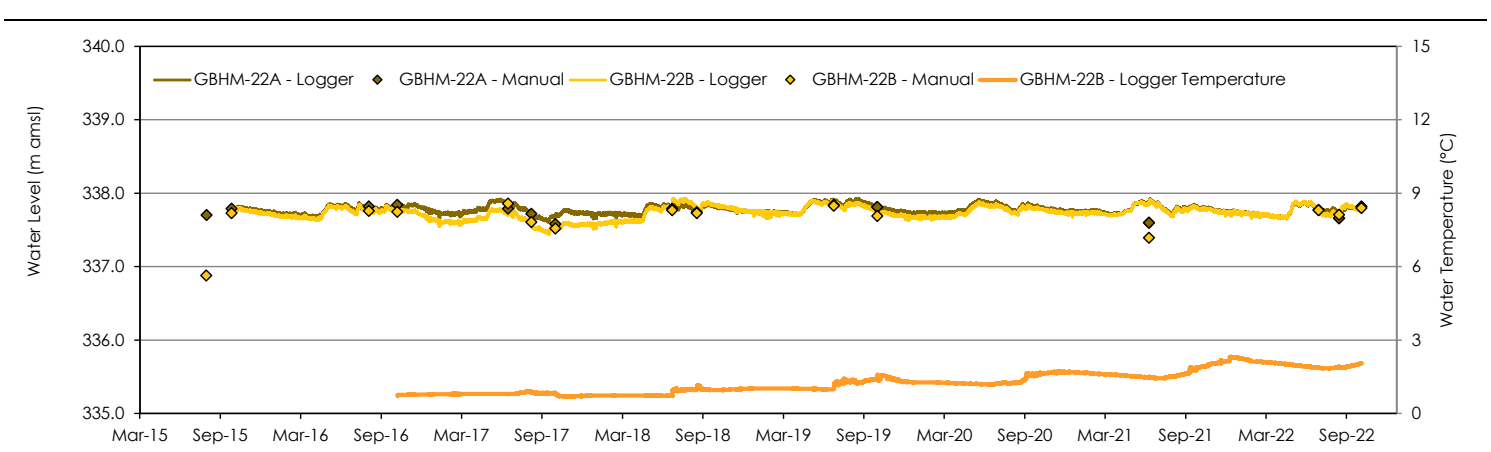
n/a:	not available
m AGS:	metres above ground surface
m BGS:	metres below ground surface
m AMSL:	metres above mean sea level
SW	surface water measured from staff gauge
*	Borehole inclinlation of 60° and azimuth of 110° at GTM-15-01, 030° at GTM-15-02, 165° at GTM-15-03, and 180° at GTM-15-04.
	GBHM-16, GBHM-17, and GBHM-34 were not installed due to poor access.
	Northing and Easting Coordinates presented as UTM NAD 83 Zone 14

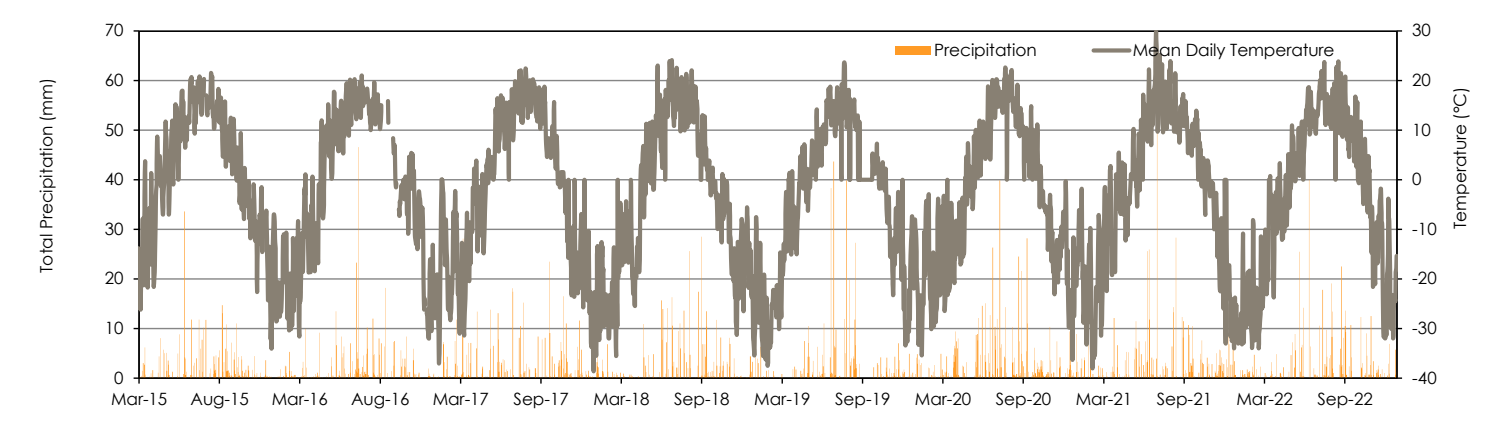












Notes:

1. MWM-01B frozen from summer 2015 until summer 2017 and periodically until spring 2019.
2. No MWM-02A pressure transducer data available from September 2018 to July 2019 due to a pressure transducer malfunction.

Client/Project

ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
MACLELLAN SITE

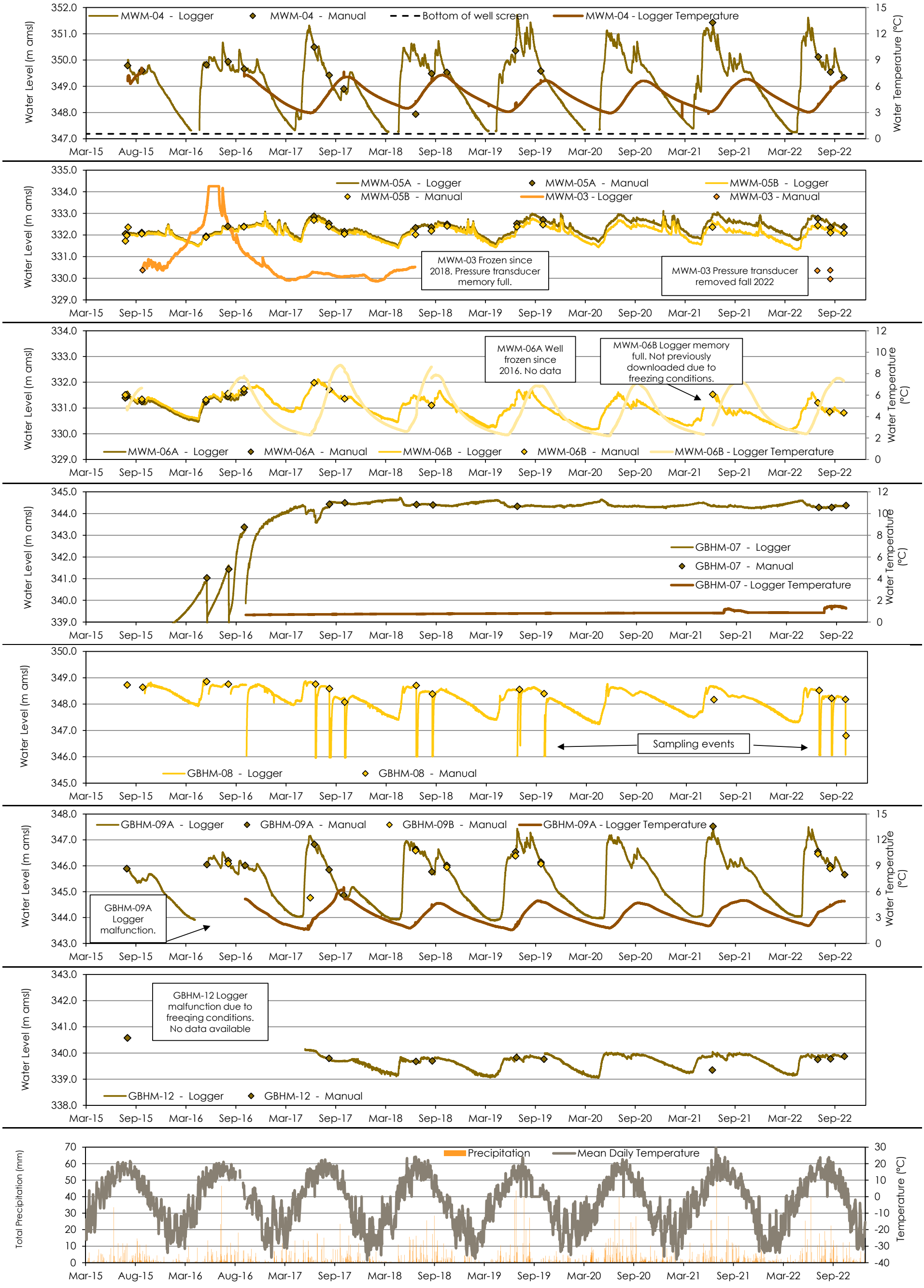
Figure No.

B-1

Title **Hydrograph - Northeastern Study Area**

Stantec

\\Ca0045-ppfss01\workgroup\1114\Active\111473076\03_disciplines\hydrogeology\reports\mac gw model report\Appendix B Well Construction and Hydrographs\Fig_04A_MacLellan_Hydrographs_20221005_RD.xlsm



Notes:

1. Water level in MWM-04 below pressure transducer in spring 2016, 2018 and 2019 (base of well screen 347.19 m AMSL)
2. MWM-06A frozen from 2017 to 2019. MWM-06B frozen in spring 2019.
3. Slow water level recovery between sampling events at GBHM-07 and GBHM-08.

Client/Project

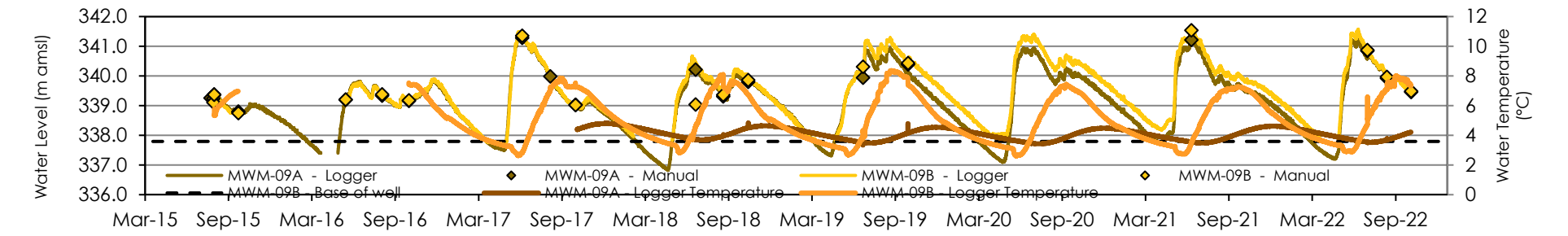
ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
MACLELLAN SITE

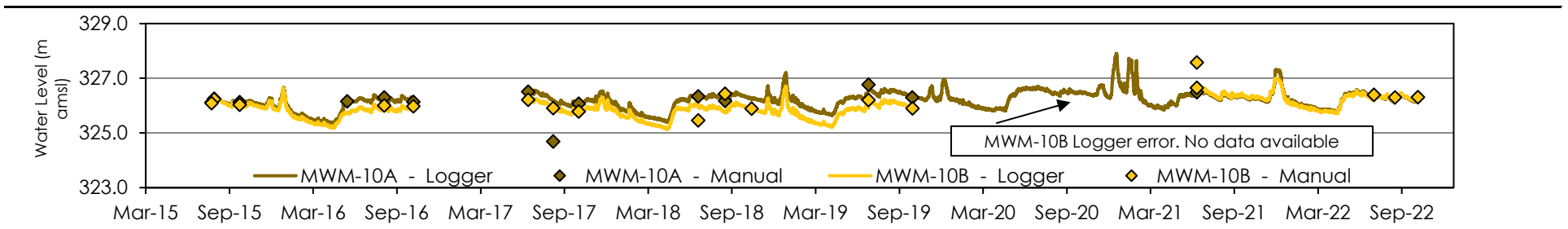
Figure No.

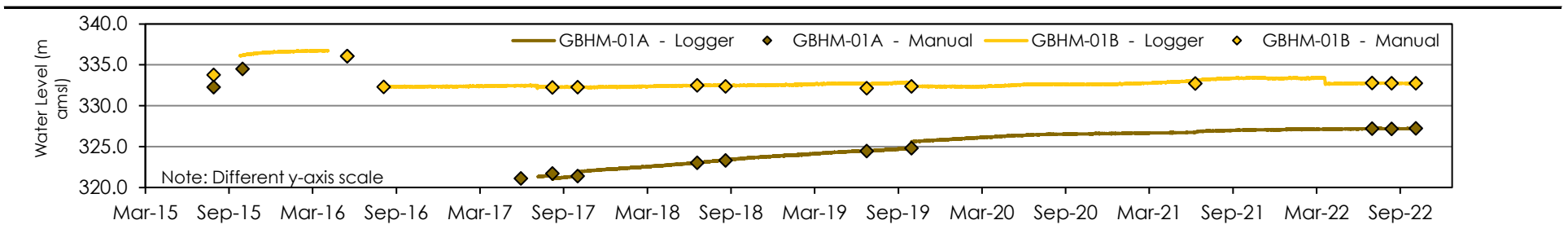
B-2

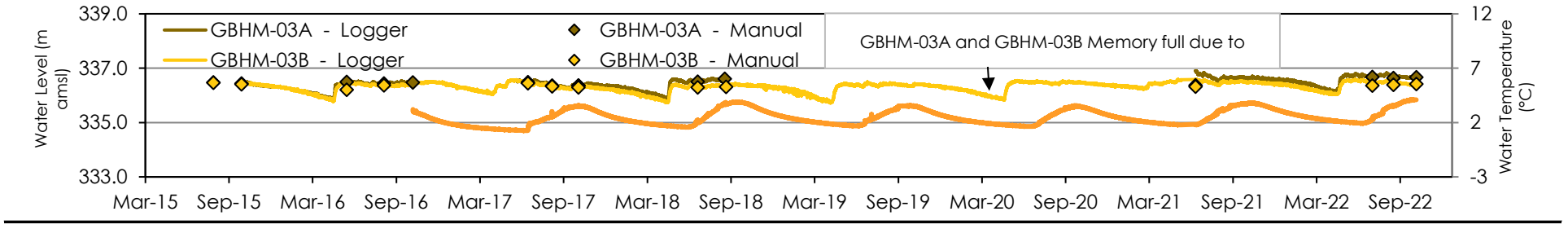
Title **Hydrograph - North of Proposed Open Pit**

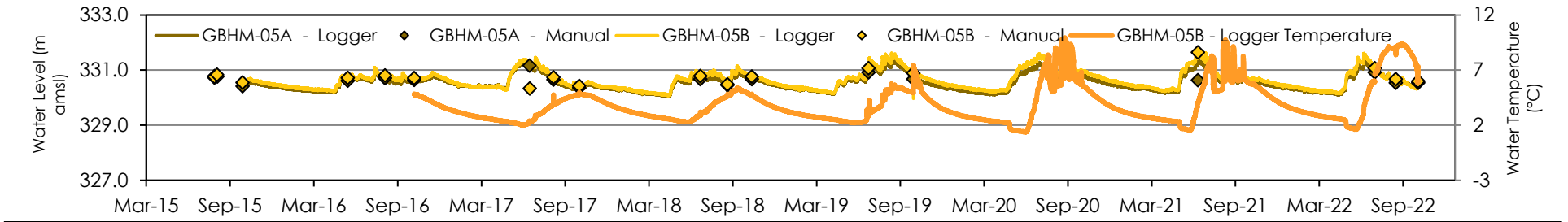
Stantec

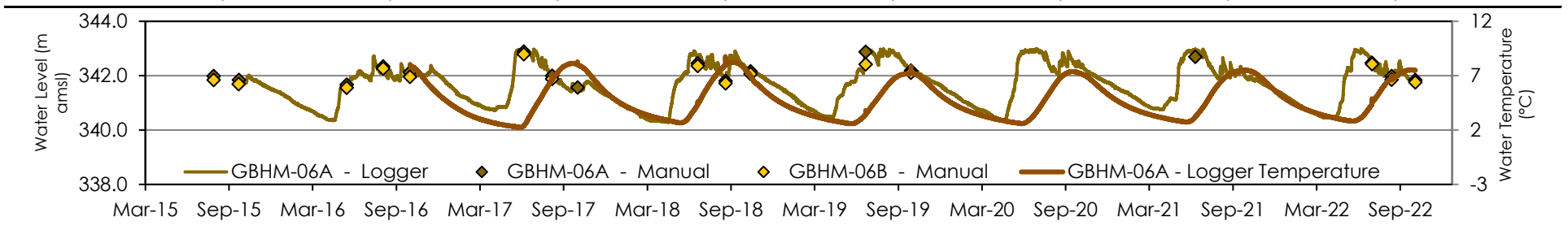


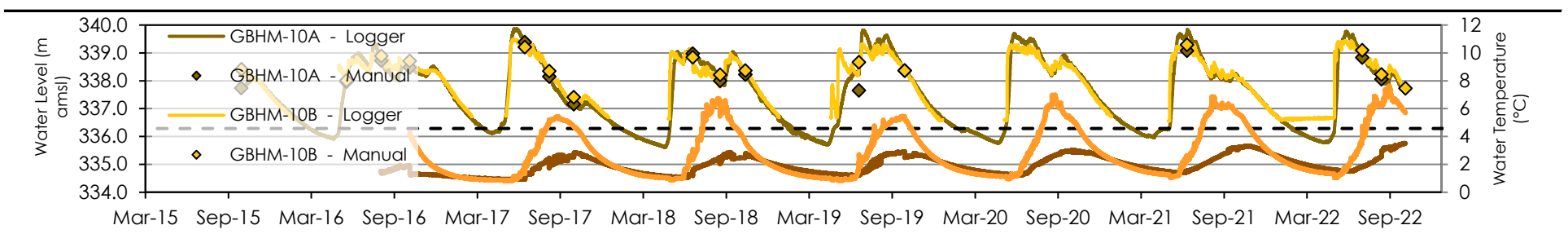


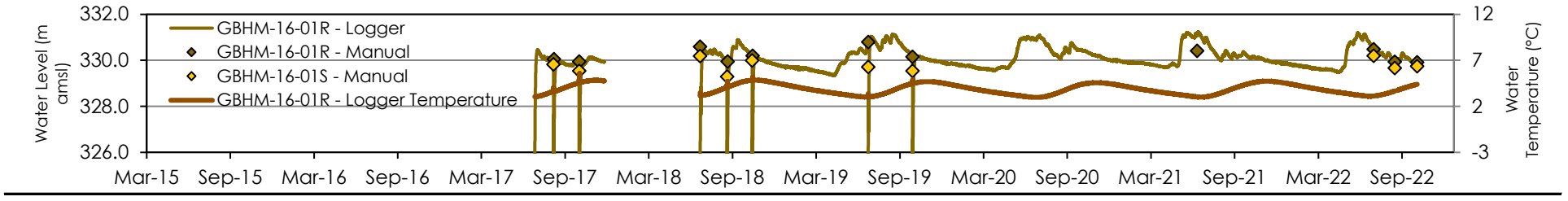


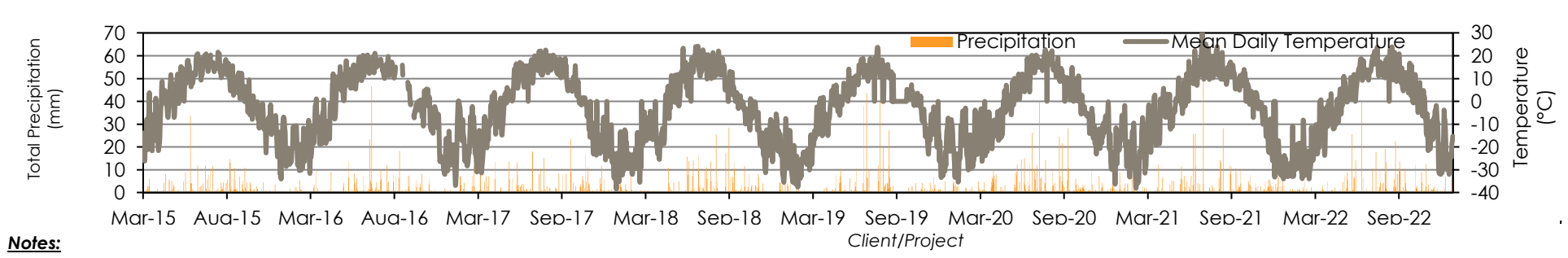












Notes:

1. MWM-09A water level periodically below pressure tranducer or bottom of well screen.
2. MWM-10A and MWM-10B pressure transducer programming error in fall 2016.
3. No data logger recording at MWM-09B between September 2015 and May 2016
4. GBHM-03A and GBHM-03B Frozen from summer 2018 until spring 2019.
5. Transducer in GBHM-10B malfunctioned between January 2015 and May 2016.
6. GBHM-16-01R transducer programming error in fall 2017.

Stantec

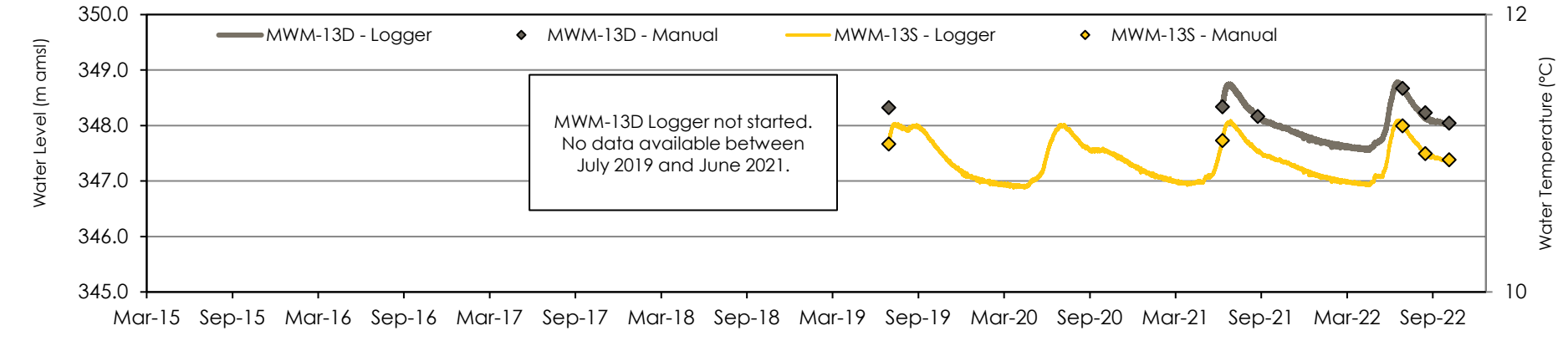
Client/Project

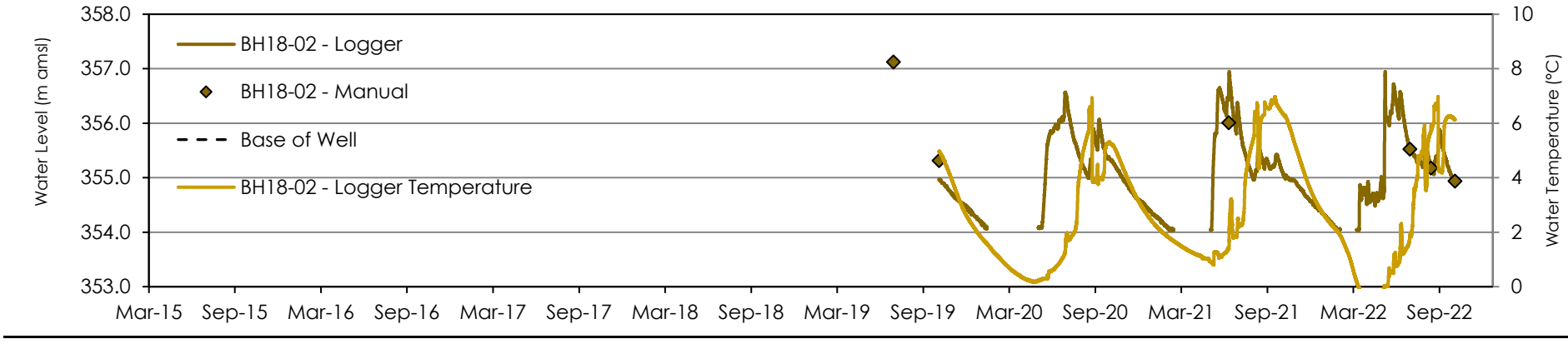
ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
MACLELLAN SITE

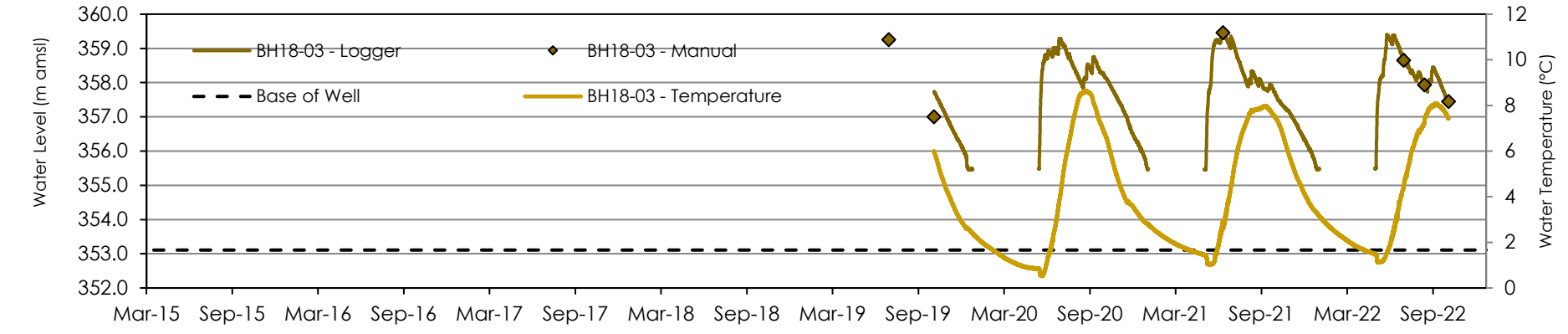
Figure No.

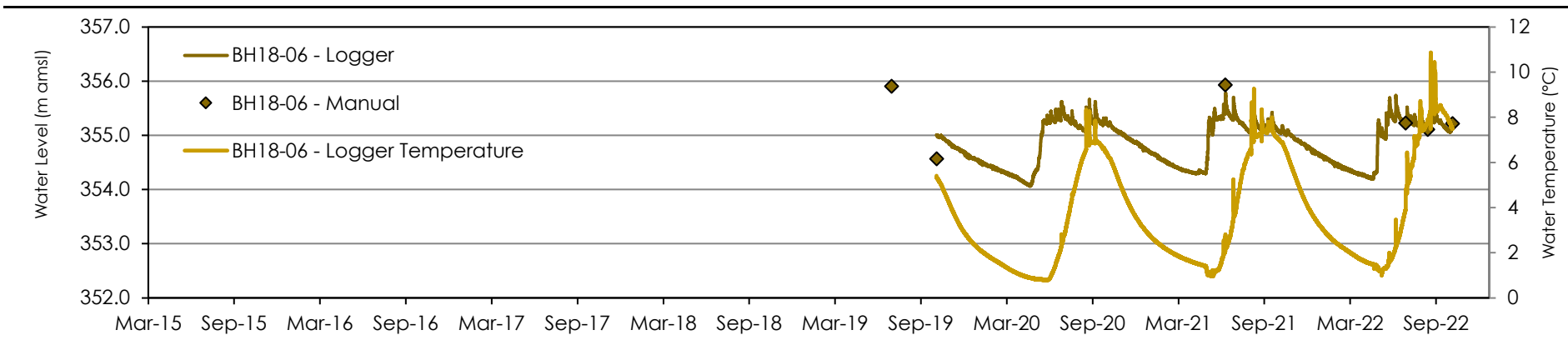
B-3

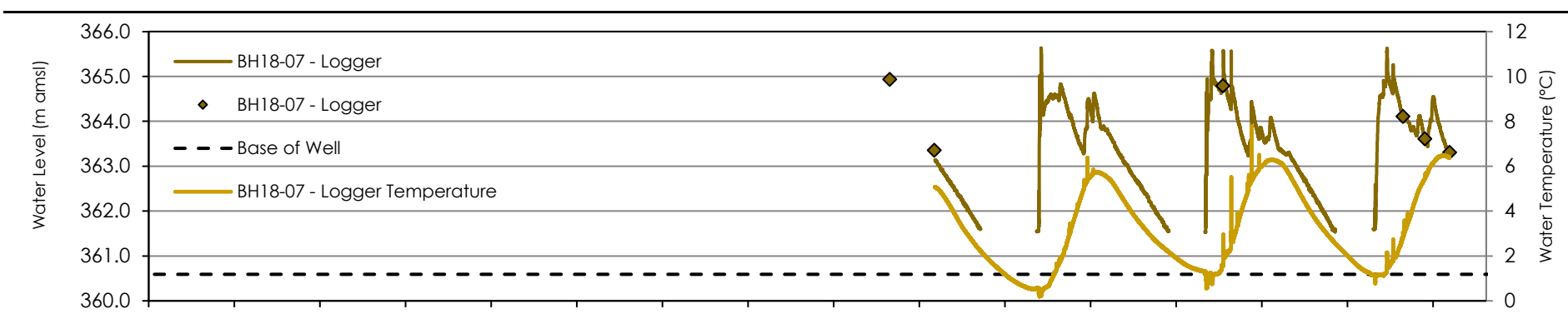
Title **Hydrograph - Proposed Open Pit**

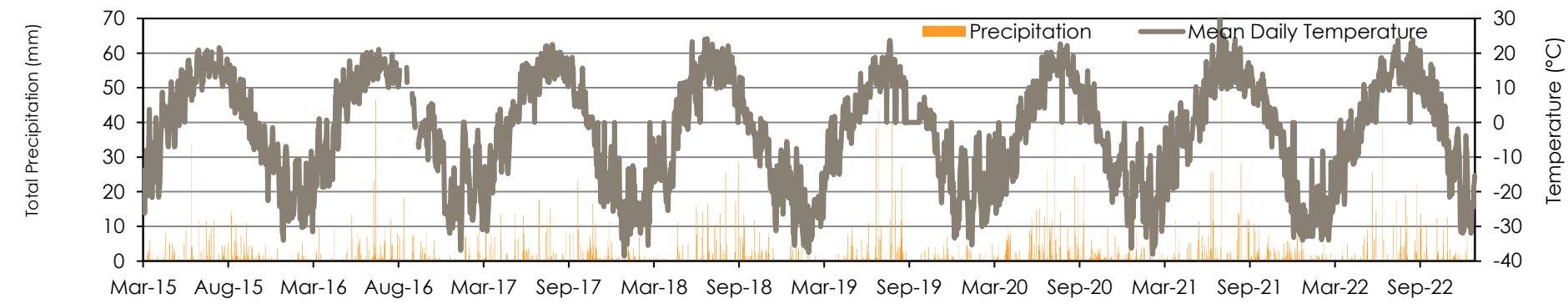












Notes:

Client/Project

ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
MACLELLAN SITE

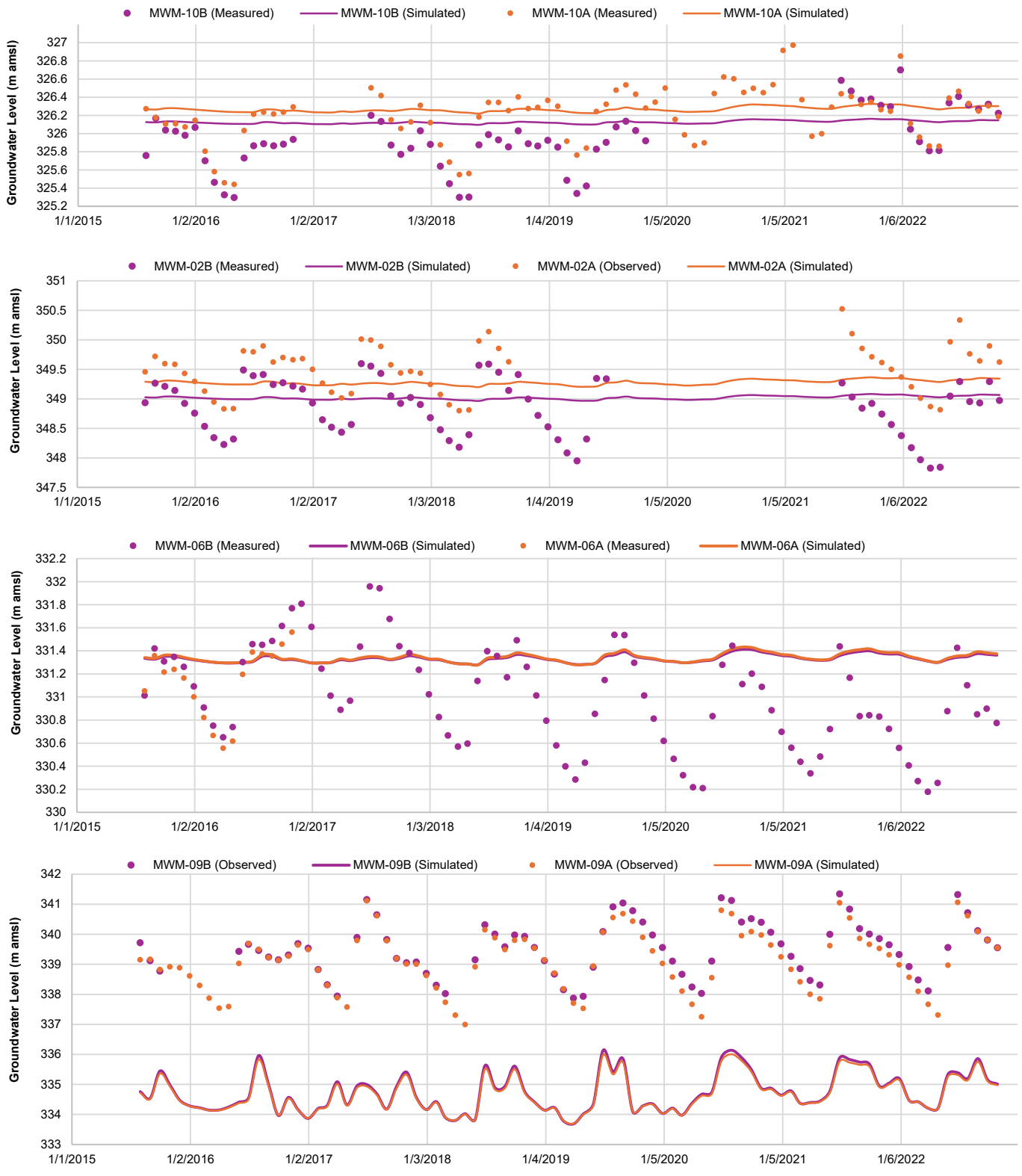
Figure No.

B-4

Title **Hydrographs - TMF Area**

Stantec

Appendix C Transient Calibration Hydrographs



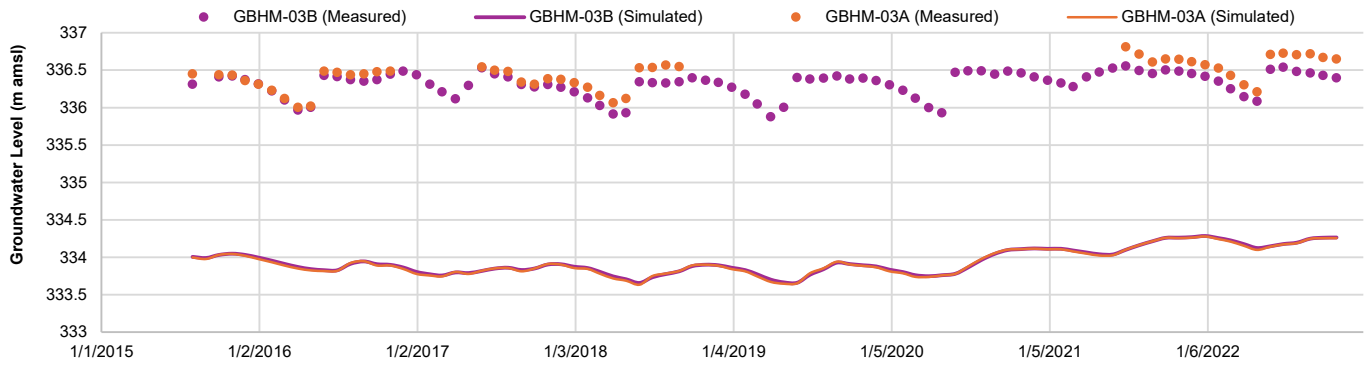
Client/Project

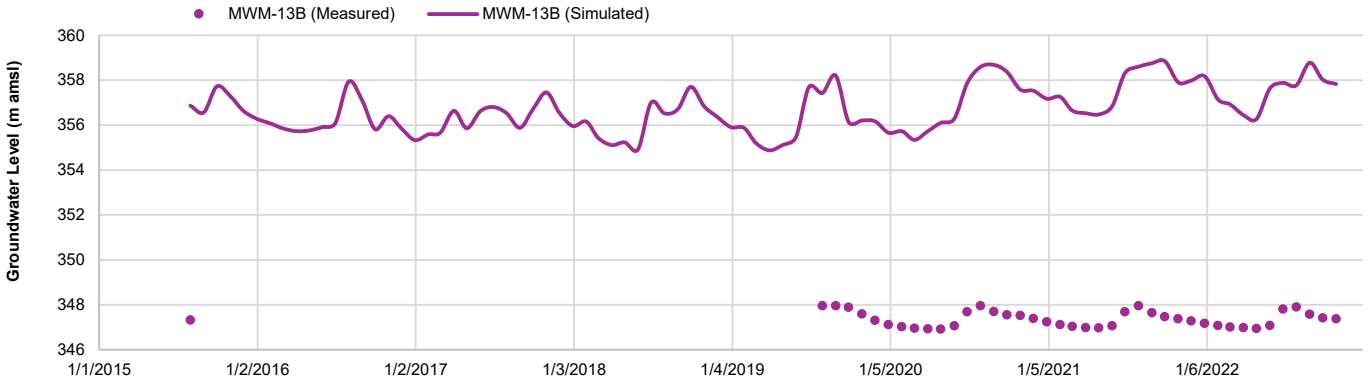
ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
MACLELLAN SITE

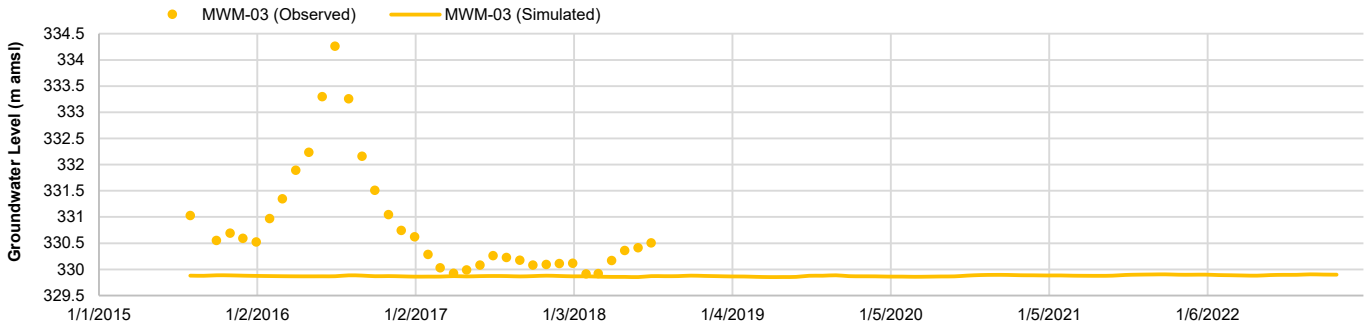
Figure No. **C-1**

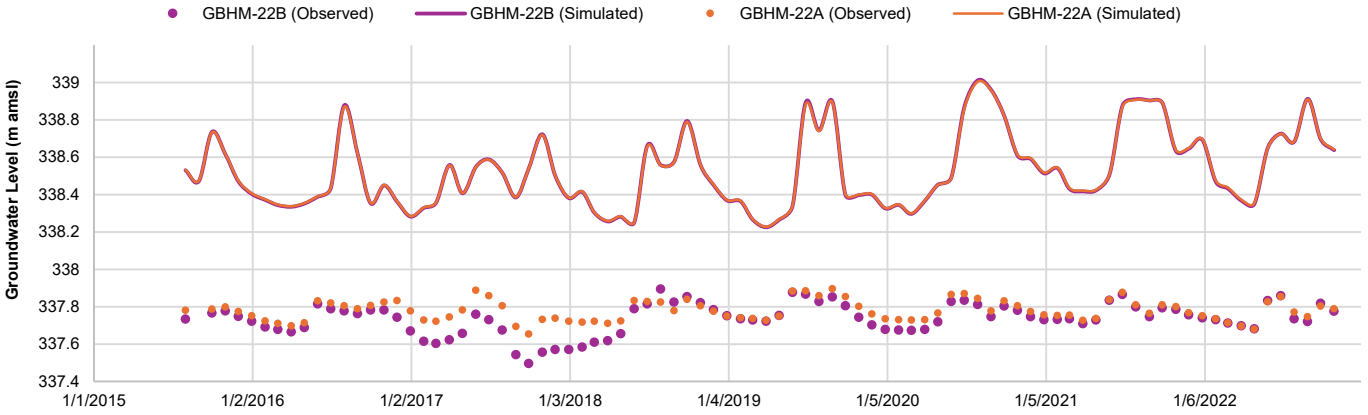
Title **Hydrographs of Measured and Simulated Water Levels**

Stantec









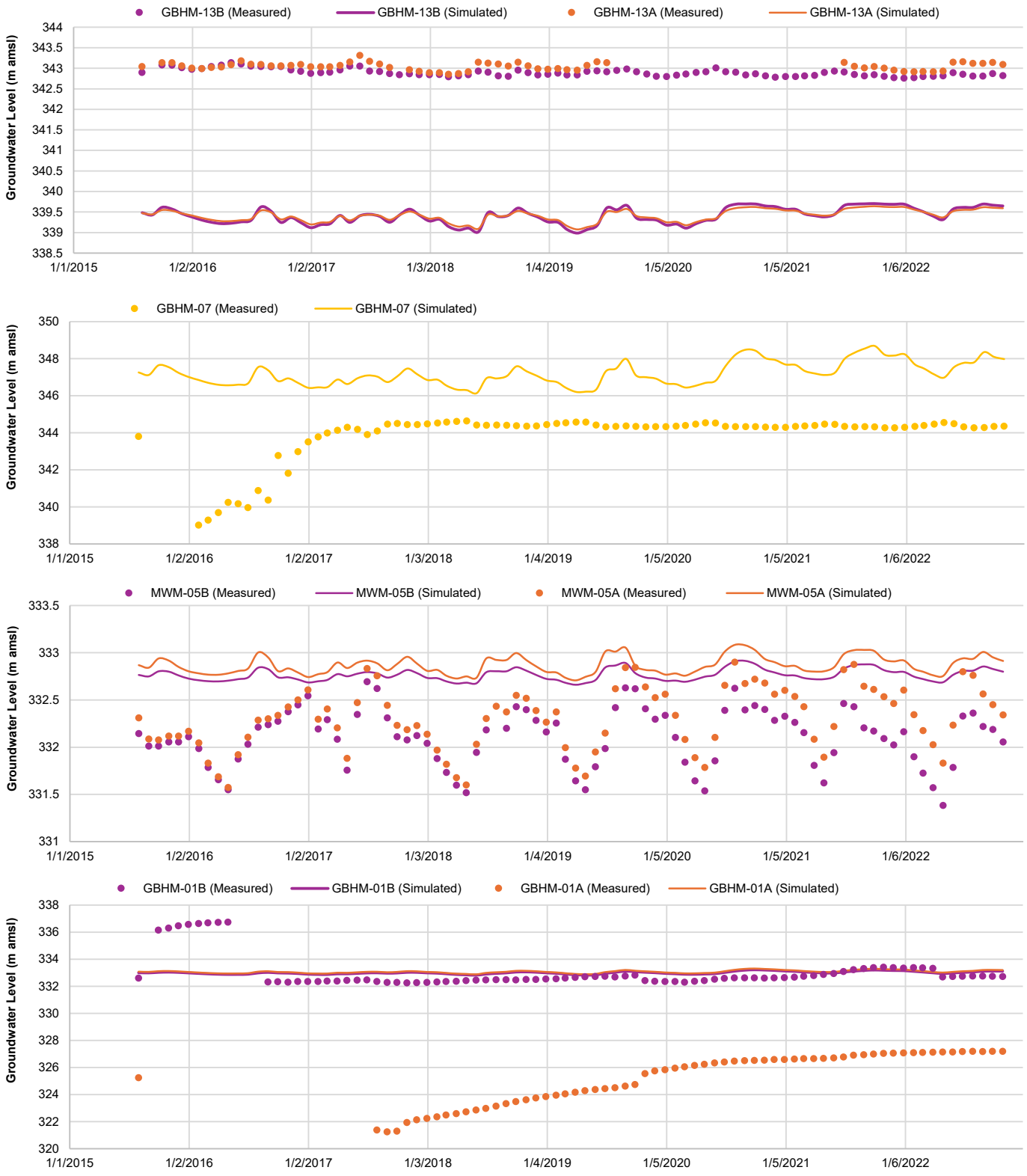
Client/Project

ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
MACLELLAN SITE

Figure No. **C-2**

Title **Hydrographs of Measured and Simulated Water Levels**

Stantec



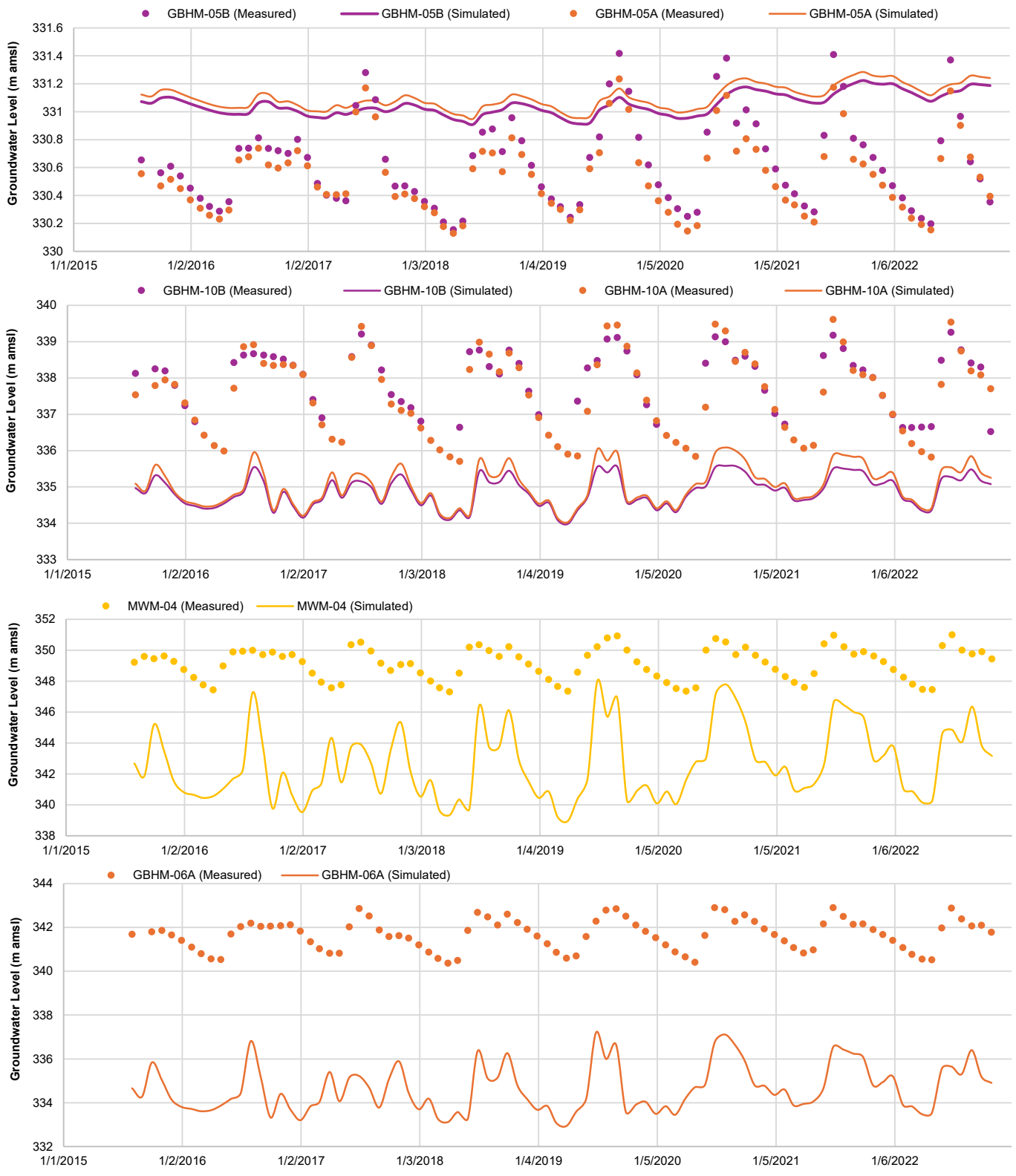
Client/Project

ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
MACLELLAN SITE

Figure No. **C-3**

Title **Hydrographs of Measured and Simulated Water Levels**

Stantec



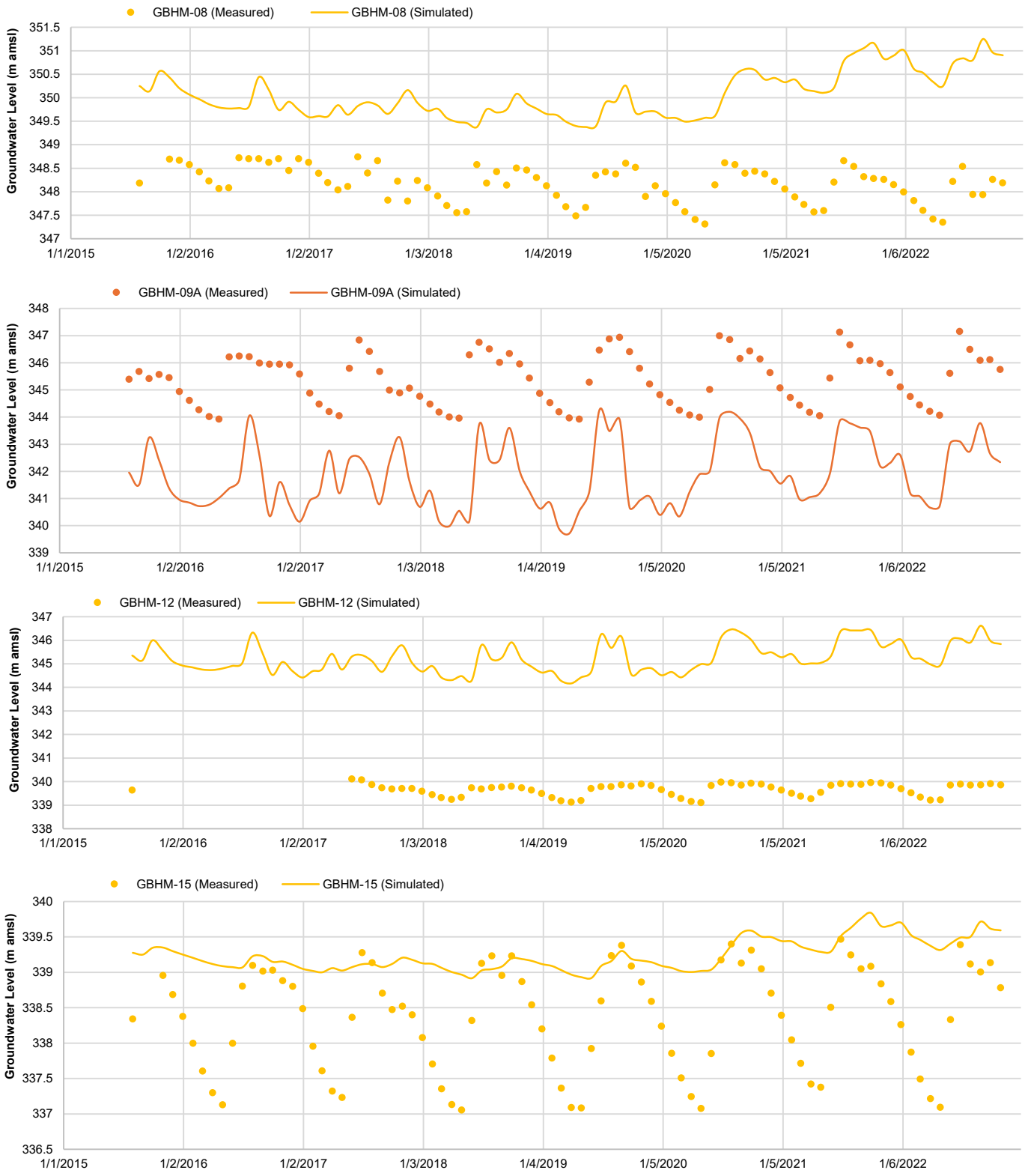
Client/Project

ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
MACLELLAN SITE

Figure No. **C-4**

Title **Hydrographs of Measured and Simulated Water Levels**

Stantec



Client/Project

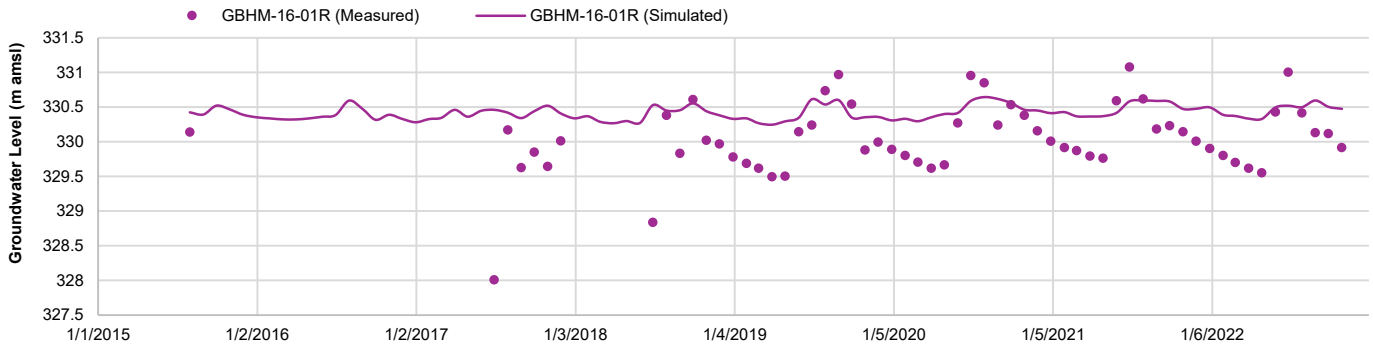
ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
MACLELLAN SITE

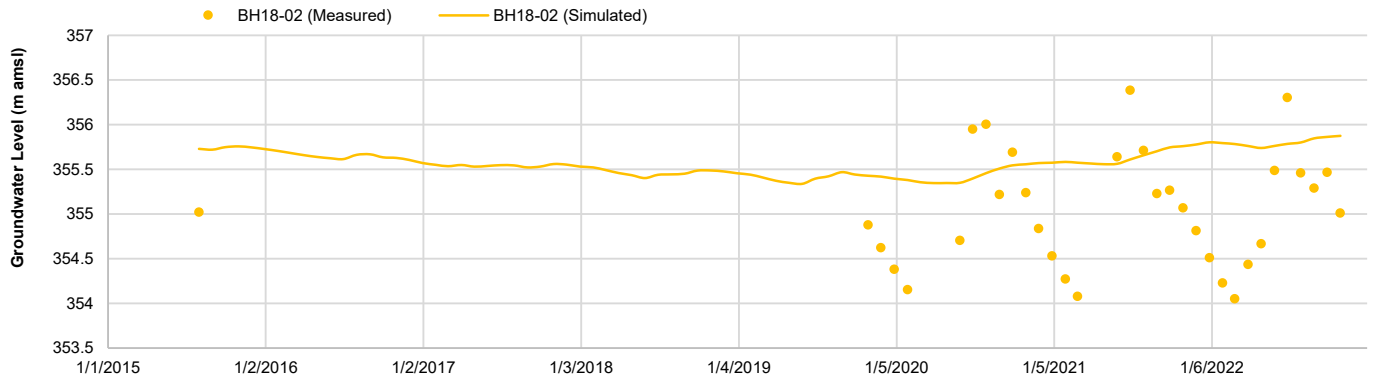
Figure No. **C-5**

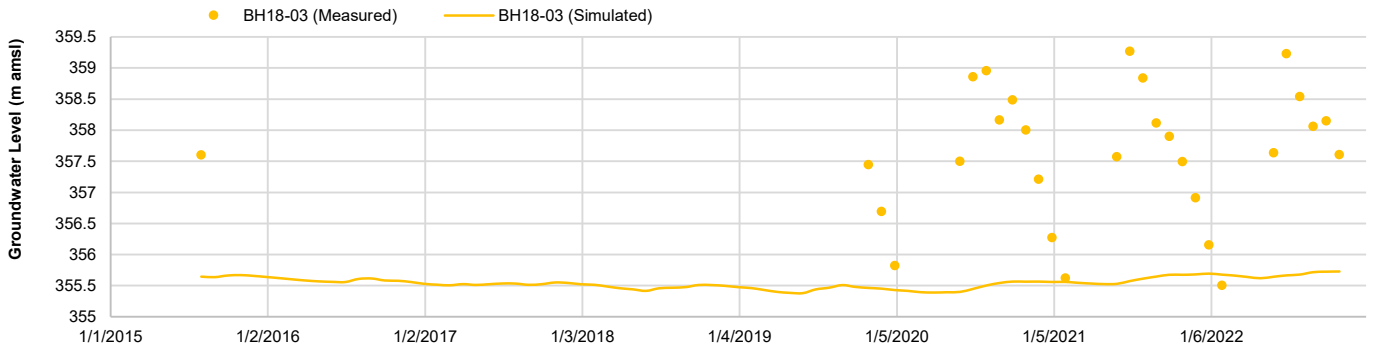
Title **Hydrographs of Measured and Simulated Water Levels**

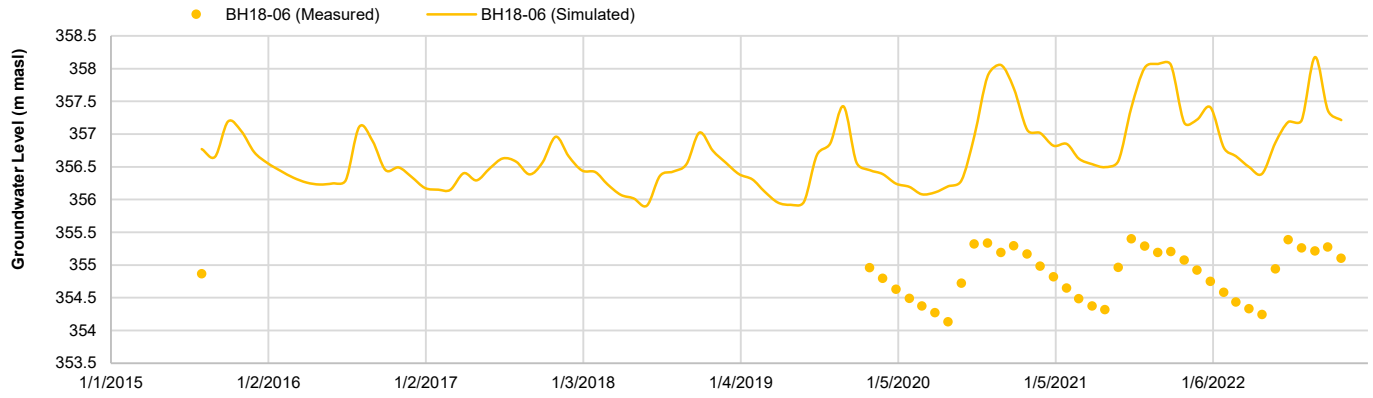
Stantec

https://stantec.sharepoint.com/teams/160999003/BC1609/Projects/111473012_Alamos/MacLellan Model Rebuild/Report/AppendixC_Sim_Hydrographs/AppendixC_Figure C-5.xlsx









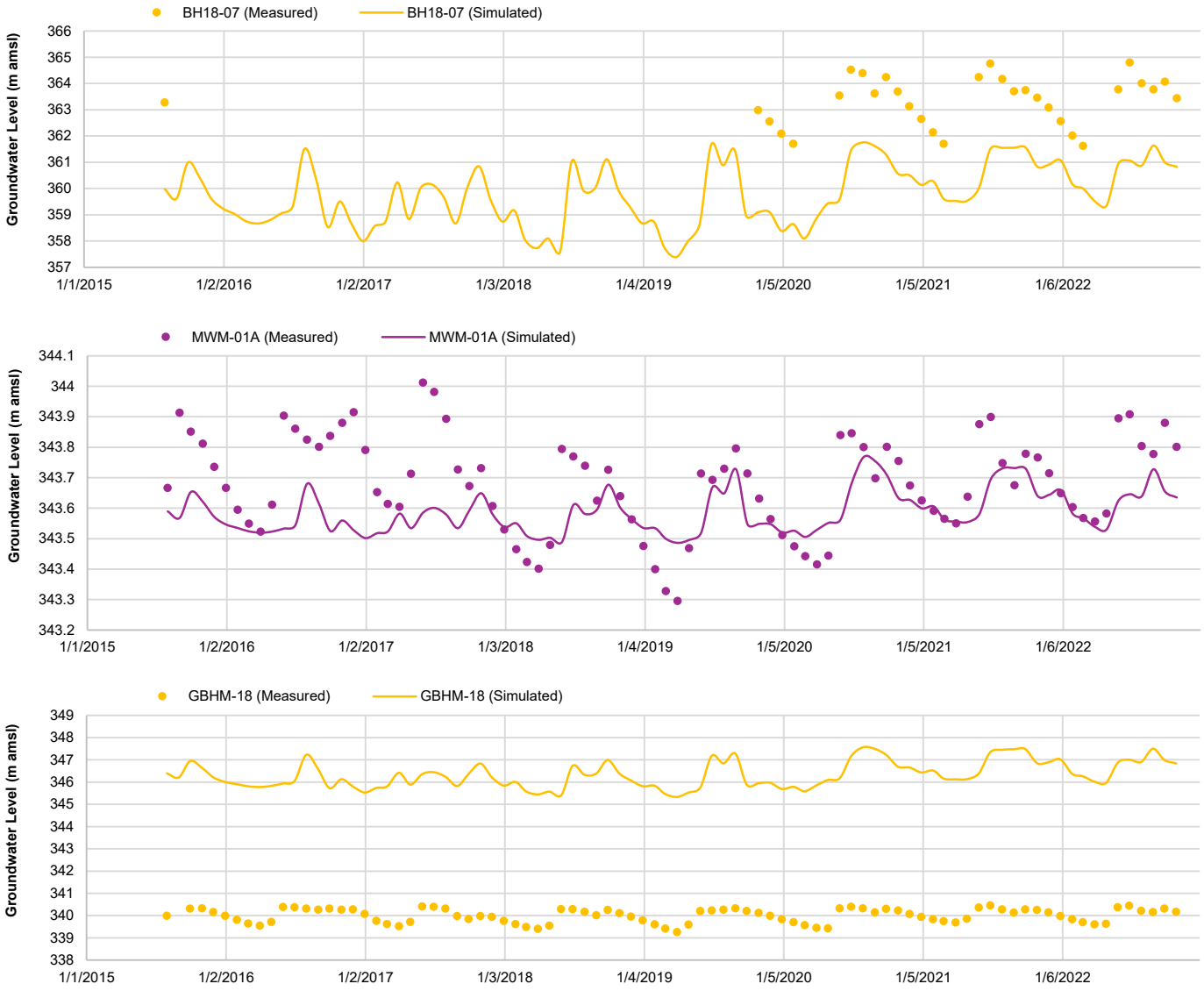
Client/Project

ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
MACLELLAN SITE

Figure No. **C-6**

Title **Hydrographs of Measured and Simulated Water Levels**

Stantec



Client/Project

ALAMOS GOLD INC.
LYNN LAKE GOLD PROJECT
MACLELLAN SITE

Figure No. **C-7**

Title **Hydrographs of Measured and Simulated Water Levels**

Stantec

Appendix F Lynn Lake Gold Project: MacLellan Water Balance and Water Quality Model Update for Notice of Alteration / Notice of Change

Lynn Lake Gold Project: MacLellan Water Balance and Water Quality Model Update for Notice of Alteration / Notice of Change

March 18, 2025

Prepared for:
Alamos Gold Inc.

Prepared by:
Stantec Consulting Ltd.

Project/File:
111473084

Stantec

Limitations and Sign-off

This document entitled Lynn Lake Gold Project: MacLellan Water Balance and Water Quality Model Update for Notice of Alteration / Notice of Change was prepared by Stantec Consulting Ltd. ("Stantec") for the account of Alamos Gold Inc. (the "Client") for regulatory submission. Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Water Balance Prepared by:

PROVINCE OF MANITOBA
A. NAGHIBI
Apr 8, 2025
Member 51197
REGISTERED PROFESSIONAL ENGINEER

Signature

Ali Naghibi, Ph.D., P.Eng.
Printed Name

Water Quality Prepared by:

Digitally signed by Phan, Thai
Date: 2025.04.08 17:25:41 -04'00'

Signature

Thai Phan, Ph.D.
Printed Name

Water Balance Reviewed by:

Digitally signed by Sinclair, Andrew (Markham)
Date: 2025.04.08 19:38:49 -04'00'

Signature

Andrew Sinclair, Ph.D.
Printed Name

Water Quality Reviewed by:

PROVINCE OF MANITOBA
B.L. BAILEY
April 8, 2025
Member 51011
REGISTERED PROFESSIONAL GEOSCIENTIST

Signature

Brenda Bailey, Ph.D., P.Geo.
Printed Name

Table of Contents

Limitations and Sign-off ..... **i**
Acronyms / Abbreviations ..... **iv**
1 Introduction **1**
1.1 Previous Reports and Supporting Studies 1
1.2 Objectives 1
2 Water Balance Model Updates **3**
2.1 Inputs 3
2.1.1 Project Components 3
2.1.2 Water Management 5
2.1.3 Pit Volume 10
2.1.4 Runoff Coefficients 10
2.1.5 Groundwater 11
2.1.6 Operations Data 11
2.2 Methods 12
2.2.1 Receiving Environment Streamflow 12
2.3 Results 14
2.4 Comparison with EIS Model Results 25
3 Water Quality Model Updates **28**
3.1 Inputs 28
3.1.1 Potential Development of Acidity 28
3.1.2 Mine Components Assumptions and Source Terms 28
3.2 Model Scenarios 31
3.3 Results 32
3.3.1 Updated Model Results 32
3.3.2 Comparison with EIS Model Results 32
4 Closing **34**
5 References **35**

List of Tables

Table 2.1 Footprint area of Project Components at MacLellan Site 3
Table 2.2 Runoff Coefficients for Site Runoff 10
Table 2.3 Ore Processing Tonnage 11
Table 2.4 Material Properties and Process Water Data 11
Table 2.5 Long-Term Estimates for Receiving Environment Runoff 13
Table 2.6 Simulated Average Monthly Streamflows at Model Node QM02 15
Table 2.7 Simulated Average Monthly Streamflows at Model Node QM03 16
Table 2.8 Simulated Average Monthly Streamflows at Model Node QM04 17
Table 2.9 Simulated Average Monthly Streamflows at Model Node QM06 18
Table 2.10 Simulated Average Monthly Streamflows at Model Node QM07 19

Table 2.11 Simulated Average Monthly Streamflows at Model Node QM08 20
Table 2.12 Simulated Average Monthly Streamflows at Model Node QM09 21
Table 2.13 Simulated Average Monthly Streamflows at Model Node QM11 22
Table 2.14 Simulated Average Monthly Water Levels at Minton Lake 23
Table 2.15 Simulated Average Monthly Water Levels at Cockeram Lake 24
Table 2.16 Comparison of Updated Water Balance Model Results with EIS Results – Streamflows 26
Table 2.17 Comparison of Updated Water Balance Model Results with EIS Results – Lake Levels 27
Table 3.1 Waste Rock and Ore Production Rates 29

List of Figures

Figure 1.1 Project Components and Catchment Areas at MacLellan Site 2
Figure 2.1 NOA Footprint Files - MacLellan site 4
Figure 2.2 Water Balance and Water Quality Model Nodes 5
Figure 2.3 Conceptual Water Management at the End of Construction 6
Figure 2.4 Conceptual Water Management during Operations 7
Figure 2.5 Conceptual Water Management during Closure (Pit Filling) 8
Figure 2.6 Conceptual Water Management at Post-closure (after Pit Filling) 9
Figure 2.7 Modelled and Observed Streamflows at QM08 during Concurrent Period of Record with Regional Hydrometric Station (WSC05TF002) 13
Figure 3.1 Scaling Factor for Progressive Closure for Expected Case and Upper Case Source Terms 30

List of Appendices

Appendix A Water Balance Results
Appendix B Water Quality Results For the Expected Case Scenario – Summary Statistics
Appendix C Water Quality Results For the Upper Case Scenario – Summary Statistics
Appendix D Comparison of the Water Quality Results Between the Updated Model and the EIS Model For the Average Case

Acronyms / Abbreviations

%	percent
<	less than
>	greater than
Alamos; ‘the proponent’	Alamos Gold Inc.
ARD	acid rock drainage
EIS	Environmental Impact Statement
Golder	Golder Associates Ltd.
IAAC	Impact Assessment Agency of Canada
km	kilometre
km^2	square kilometre
m	metre
m^3/hr	cubic metres per hour
m^3/s	cubic metres per second
MacLellan site	MacLellan Gold Mine
mg/L	milligrams per litre
mm	millimetre
Mm^3	cubic megametre
MRSA	mine rock stockpile area
Mt	metric tonne
NAG	Non-Acid Generating
NOA	Notice of Alteration
NOC	Notice of Change
NSE	Nash-Sutcliffe Efficiency
PAG	potentially acid generating
Stantec	Stantec Consulting Ltd.
STP	Sewage Treatment Plant
t/day	tonne per day
t/m^3	tonnes per cubic metre
t/yr	tonne per year

the Project	Lynn Lake Gold Project
TMF	tailings management facility
TSS	total suspended solids
WSC	Water Survey of Canada
WSP	WSP Inc. Canada

1 Introduction

As part of the Lynn Lake Gold Project (the Project) Alamos Gold Inc. (Alamos; 'the proponent') plans to operate the MacLellan Gold Mine, (hereinafter referred to as the 'MacLellan site') near the Town of Lynn Lake in northern Manitoba. Alamos is seeking approval to proceed with alterations to the MacLellan site as approved under *Environment Act* License No. 3390 and the conditions stipulated therein (March 6, 2023) and a Decision Statement issued under the *Canadian Environmental Assessment Act, 2012* as documented by the Impact Assessment Agency of Canada (IAAC), dated March 5, 2023. The proposed alterations include but are not limited to modifications to the mine rock stockpile area (MRSA), tailings management facility (TMF), overburden stockpile, topsoil stockpile, and process plant. The proposed alterations also include the addition of a satellite pit, construction laydown areas, and detailed design level freshwater intake lines and effluent discharge locations. The proposed mine plan is documented in the Feasibility Study Update (Alamos 2023).

This updated water balance and water quality model report for the MacLellan site has been prepared to incorporate the proposed alterations to the mine plan and assess the resulting potential effects of the construction, operation, and closure phases of the Project on surface water quantity and quality receiving environment. This updated water balance and water quality model report forms part of the supporting documentation for the MacLellan Mine Plan Amendment Notice of Alteration (NOA) / Notice of Change (NOC) completed for the Project.

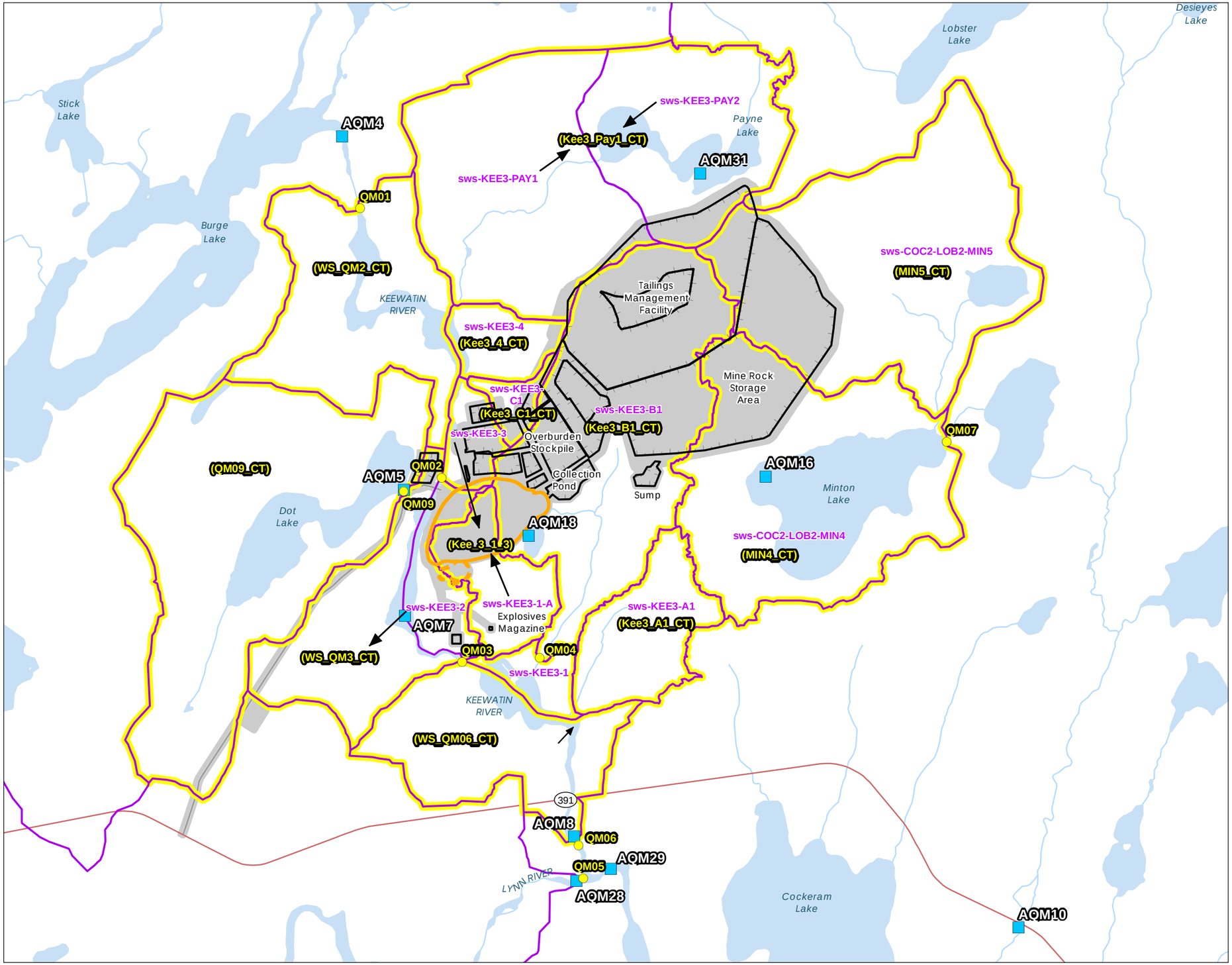
1.1 Previous Reports and Supporting Studies

Stantec (2020a) developed a site-wide and receiving environment water balance and water quality model to support the Environmental Impact Statement (EIS, Stantec 2020b). In a supplemental filing, Stantec (2021) further developed the water balance and water quality model to reflect Project refinements to the MRSA. The water balance and water quality model presented in Stantec (2020a) and further developed in Stantec (2021) is hereafter referred to as 'the EIS model'.

A TMF water balance was completed by Golder (2020). As part of the detailed design for the Project's TMF, WSP (2023) updated the assumptions and inputs to the TMF water balance.

1.2 Objectives

The objective of this water balance and water quality model update was to refine the EIS model with the proposed alterations in the Feasibility Study Update (Alamos 2023) and the TMF water balance update (WSP 2023) as described in the following sections. The model update was then used to predict the effects of the Project on the receiving surface water quantity and quality in Section 3.3 of MacLellan Mine Plan Amendment NOA / NOC. Model nodes (including hydrometric and water quality stations) and catchment areas are unchanged from the EIS model (Figure 1.1).



Stantec

Project Infrastructure
- Proposed Open Pit
- Proposed Satellite Pit
- Proposed Infrastructure
- Project Development Area (PDA)

Project Data
- Hydrology Model Subwatersheds (sws-FAR5)
- Water Quality Model Subcatchments (QF04_CT)
- Combined Subwatersheds
- Hydrology Monitoring Station
- Water Quality Station

Landbase
- Access Road
- Highway
- Watercourse
- Waterbody

N

0 0.45 0.9 Kilometres

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

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 2025-02-03
Technical Review by KMathers on 2025-02-03

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473084

Map No.
1.1

Title
Project Components and Catchment Areas at MacLellan Site

G:\GIS Project Folder\111473008-LGP-EA\IR\13\WQ_2024_Program\111473084 ProjectComponents and Catchments MacLellan 20250203.mxd Revised: 2025-02-03 By: ACampigotto

2 Water Balance Model Updates

2.1 Inputs

The following sections present updates to the EIS water balance model inputs resulting from the proposed alteration. All other water balance model inputs remain unchanged from the EIS model (e.g., the average, 1:25-year dry, and 1:25-year wet annual precipitation of 478 mm, 344 mm, and 655 mm, respectively).

2.1.1 Project Components

The proposed alteration involves adjusting the footprints of several of the Project components and adding several new components in comparison to the description of the MacLellan site originally included in the EIS model. The components included in the proposed alteration are presented in Figure 2.1, with footprint areas summarized in Table 2.2.

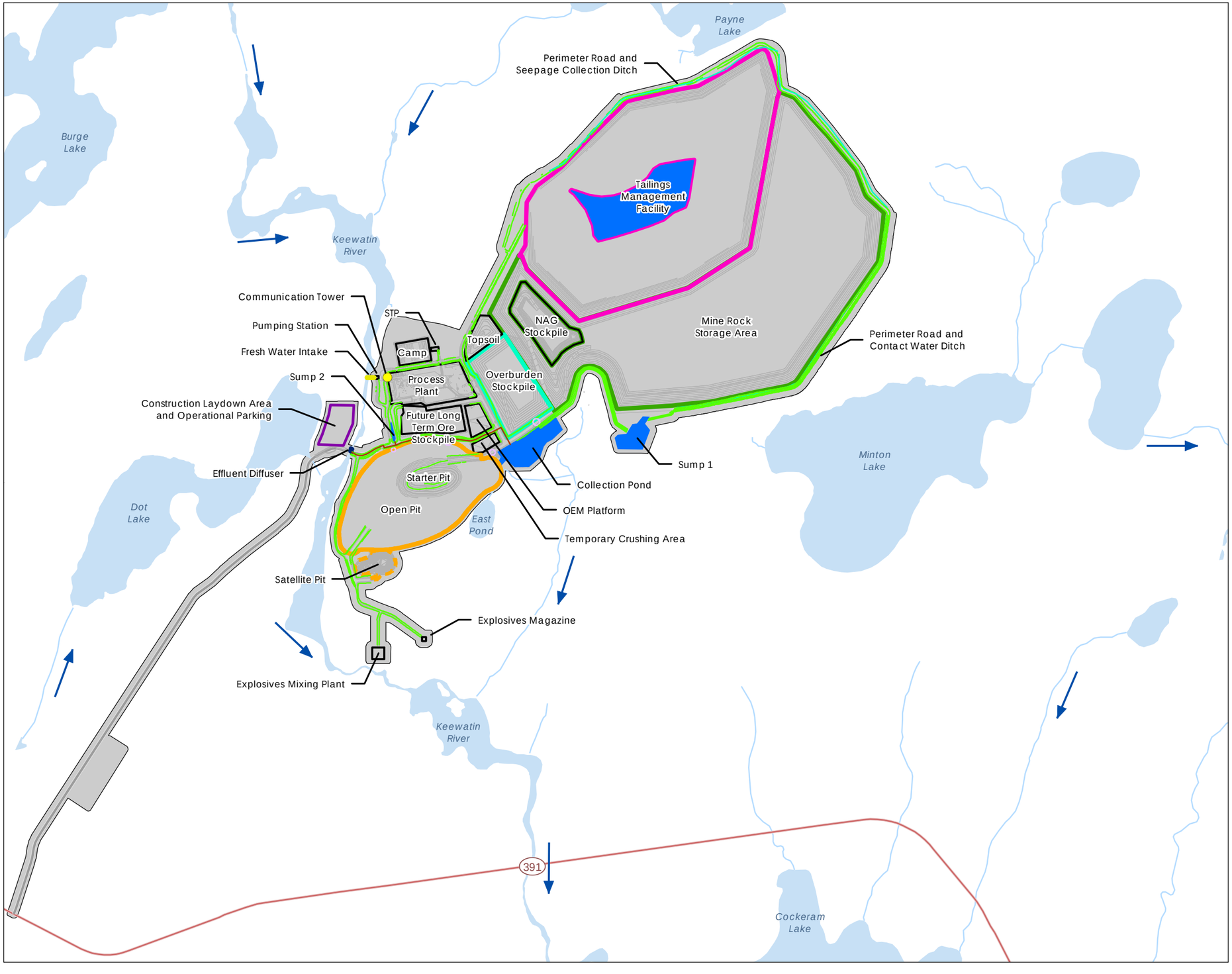
Table 2.1 Footprint area of Project Components at MacLellan Site

Project Component	**Area (ha)**	
	EIS Areas (Stantec 2020b)	**Updated Areas (this report)**
Open Pit	66.0	71.4
Satellite Pit	–[1]	4.6
Mine Rock Storage Area	339	313
Non-Acid Generating (NAG) Stockpile	–[1]	15.4
Overburden Stockpile	18.2	24.2
Topsoil Stockpile	5.0	4.5
Tailings Management Facility	53.7	224
Tailings Management Facility Pond	183	26.9
Collection Pond	1.8	9.0
Plant Site[2]	17	51

Notes:

1 Did not exist in the EIS model (Stantec 2020b)

2 includes the camp, OEM Platform, Temporary Crushing Area, Processing Plant, Sewage Treatment Plant (STP), and Construction Laydown Areas.



Stantec

Project Infrastructure (NOA)

- Communication Tower
- Culvert
- Ditching
- Corridor / Access Road
- Collection Pond Discharge
- Fresh Water Intake
- Effluent Diffuser
- Mine Rock Storage Area
- Overburden Stockpile
- Tailings Management Facility
- Open Pit
- Satellite Pit
- Collection Pond/Sumps
- Other Infrastructure
- Construction Laydown Area
- NOA Project Development Area (PDA)

Landbase

- Highway
- Existing Access Road
- Surface Water Flow Direction
- 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 2025-02-24
Technical Review by ANaghibi on 2025-02-24

Client/Project
ALAMOS GOLD INC.
Lynn Lake Gold Project

111473084

Map No.
2.1

Title
NOA Footprint Files - MacLellan site

G:_GIS Project Folder\111473008 LGP EA\Rpts\SWQ_2024 Program\111473084_NOA_Footprints_MacLellan_20250224.mxd Revised: 2025-02-24 By: ACampigotto

2.1.2 Water Management

In the EIS model, water intake for the mill freshwater needs, as well as effluent discharge from the collection pond, was assumed to be from/to the Keewatin River at model node QM03. Based on detailed engineering design for the proposed alteration, the freshwater intake and collection pond effluent is moved upstream, to model node QM02 (Figure 2.2). On-site mine water management, during different phases of the MacLellan site is illustrated in Figure 2.3 to Figure 2.6.

Figure 2.2 Water Balance and Water Quality Model Nodes

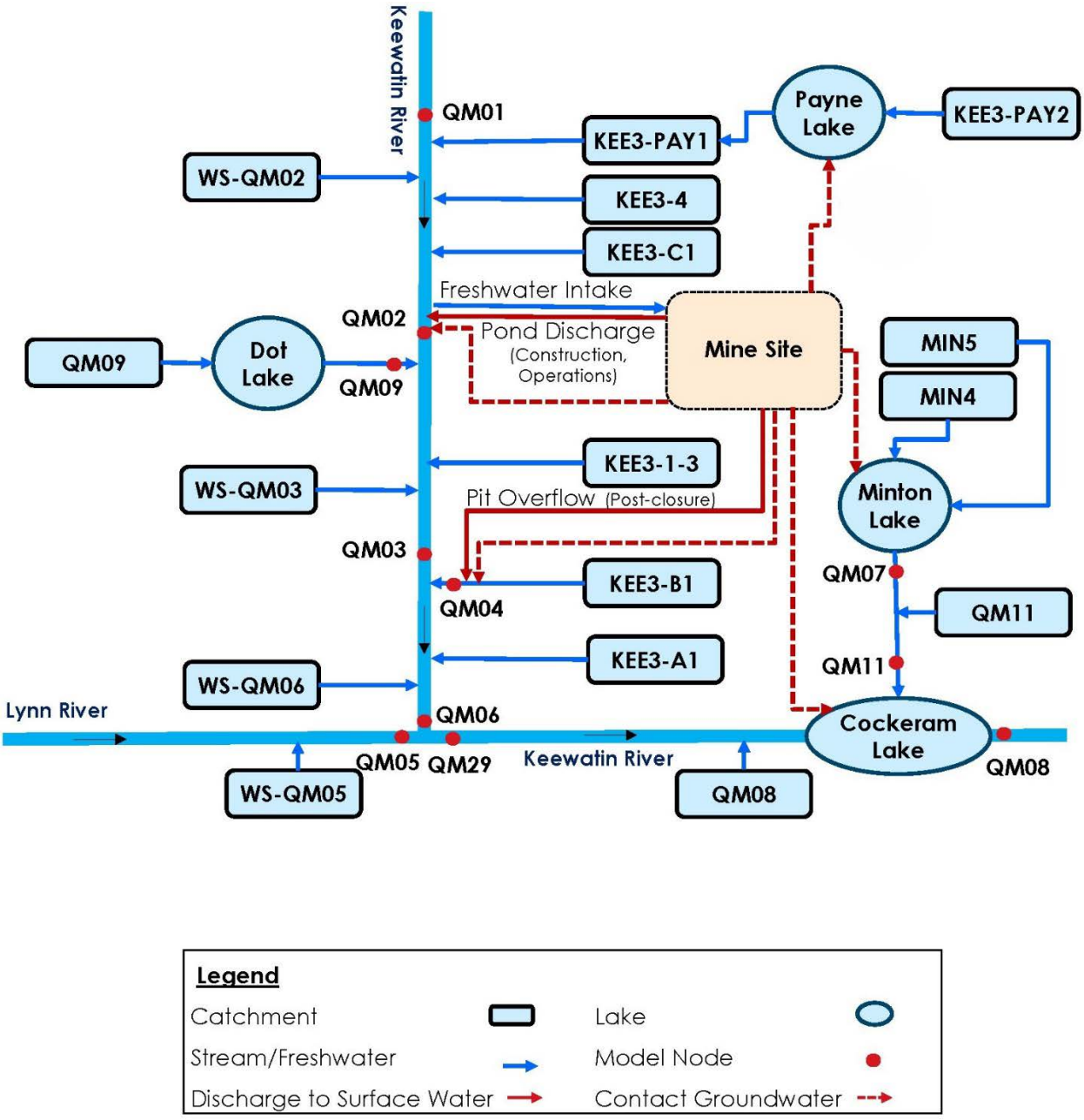


Figure 2.3 Conceptual Water Management at the End of Construction

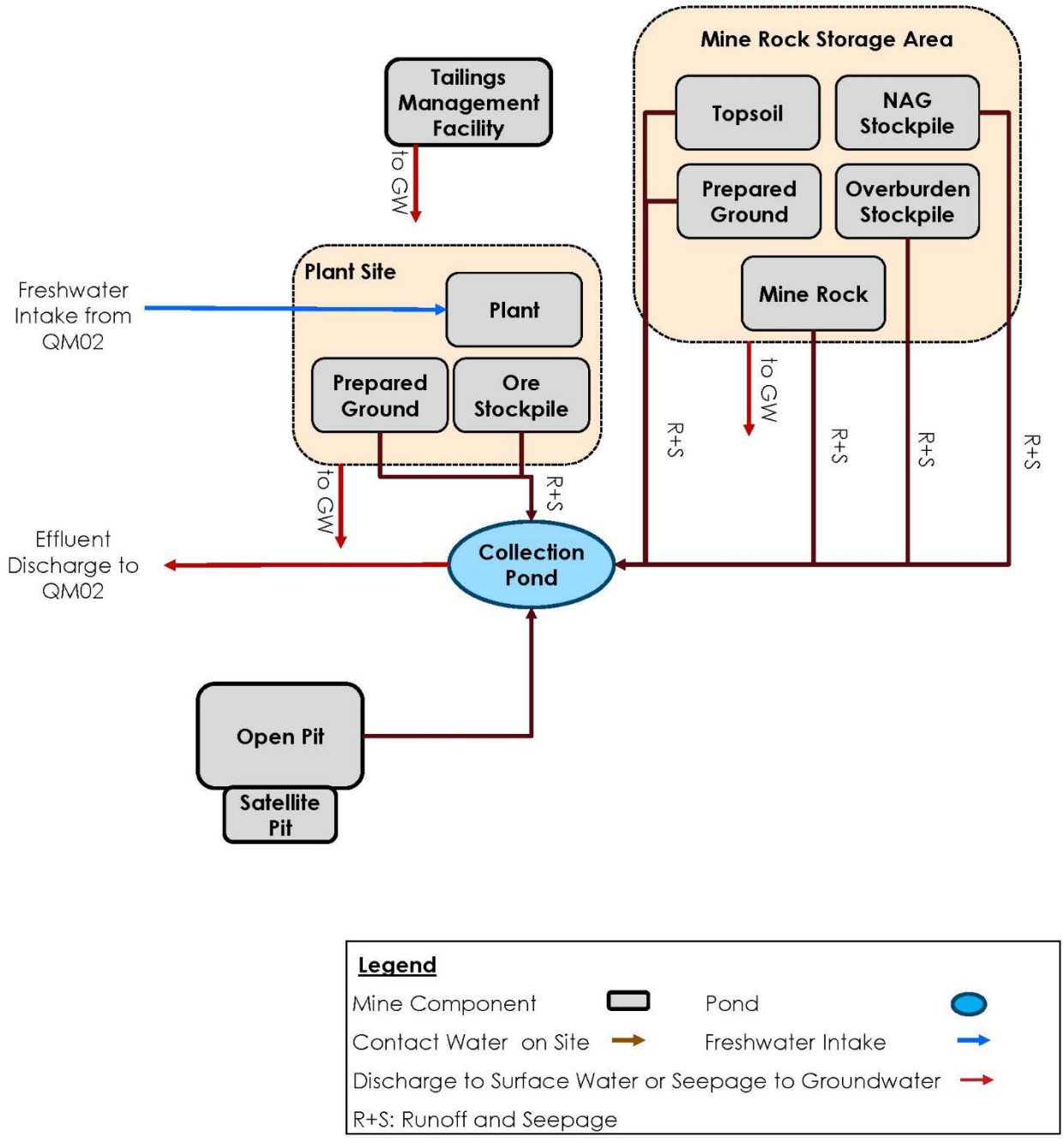


Figure 2.4 Conceptual Water Management during Operations

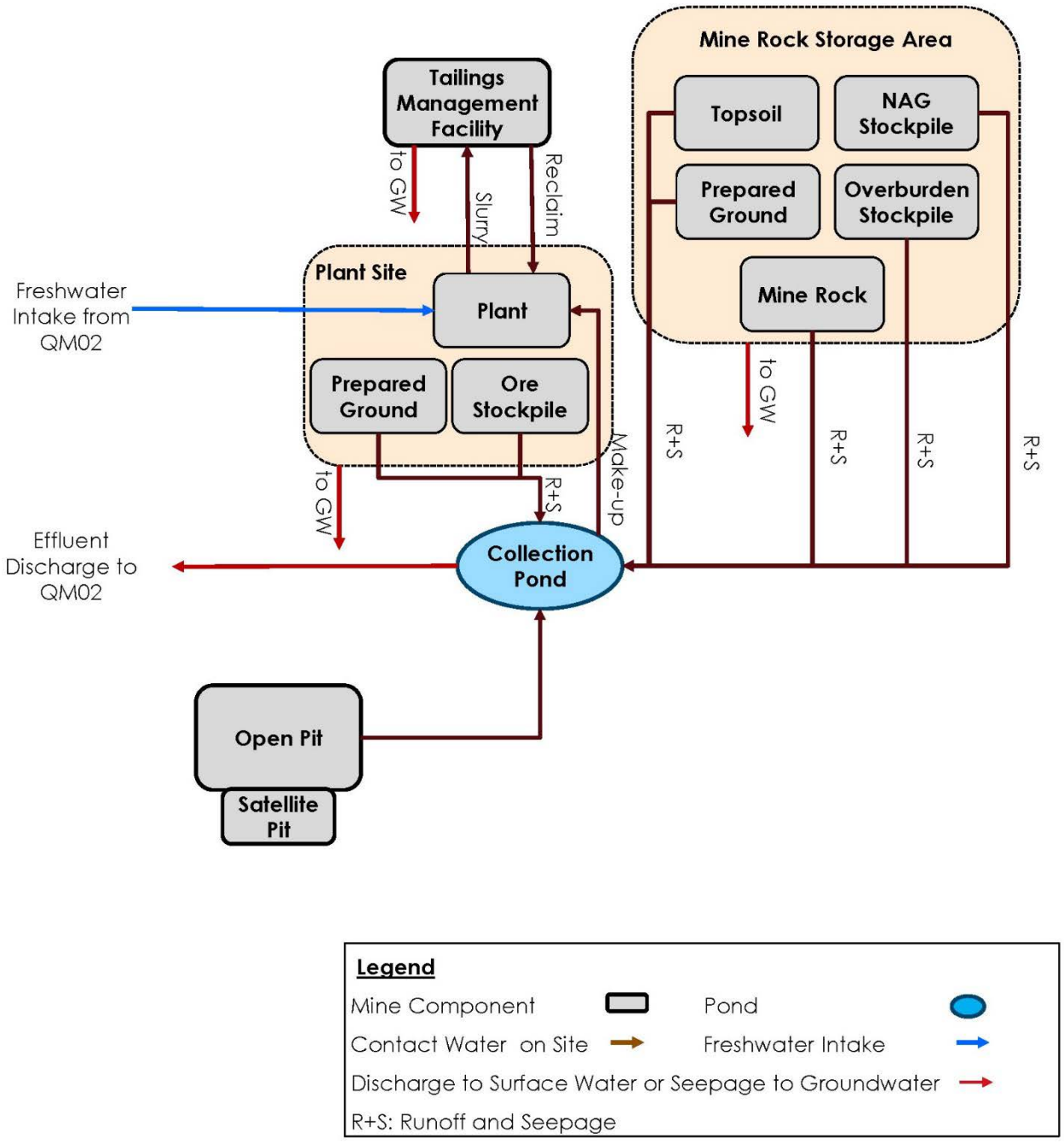


Figure 2.5 Conceptual Water Management during Closure (Pit Filling)

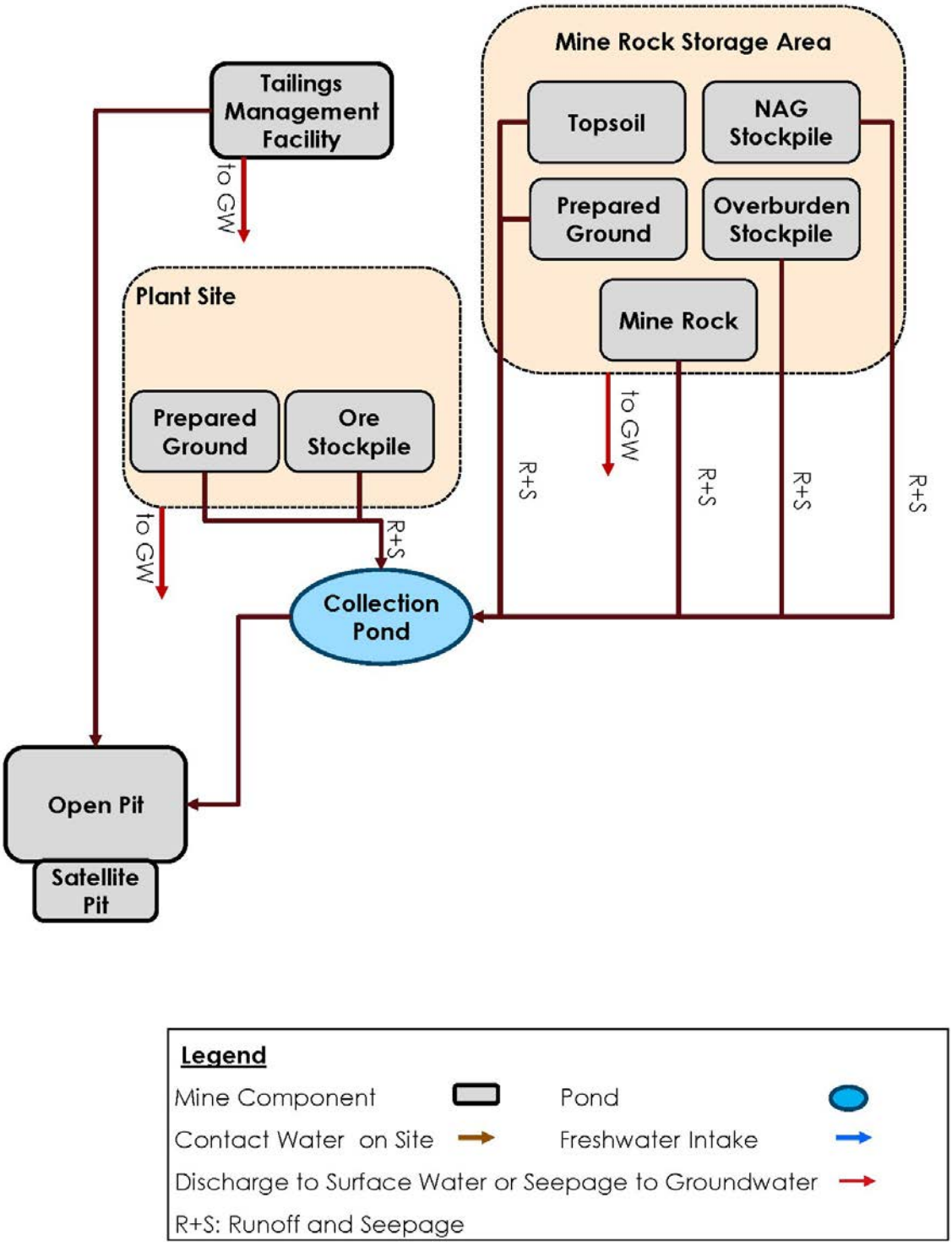
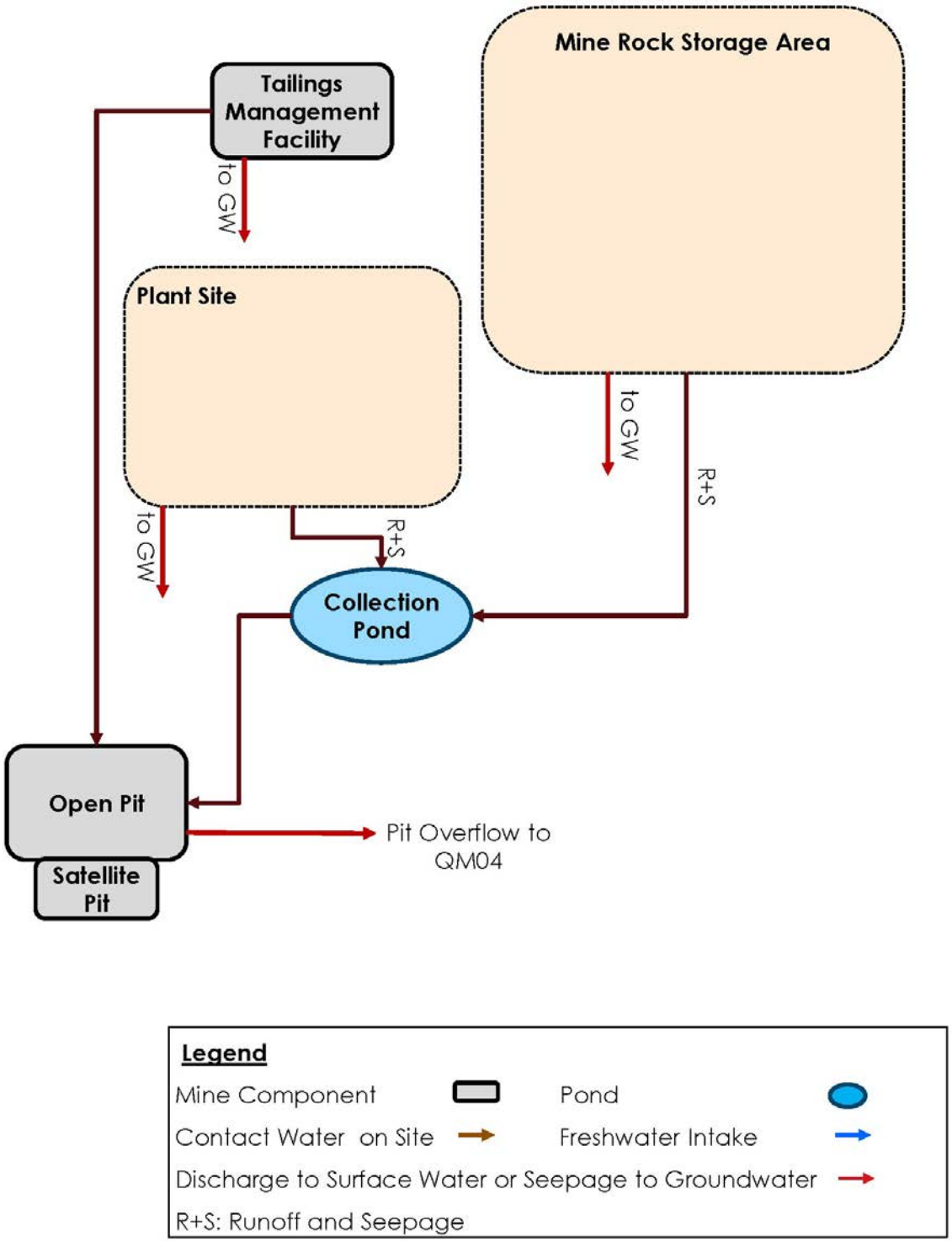


Figure 2.6 Conceptual Water Management at Post-closure (after Pit Filling)



2.1.3 Pit Volume

The EIS model used an estimated Open Pit volume of 52 Mm^3 which was subsequently updated toa design volume of 95.8 Mm^3. This updated model incorporates the Open Pit volume of 95.8 Mm^3.

The volume of the proposed alteration Satellite Pit, which did not exist in the EIS model, is 1.3 Mm^3.

2.1.4 Runoff Coefficients

Monthly runoff coefficients, used to transform precipitation into site runoff, were updated based on estimates provided by WSP (2023) and are summarized in Table 2.2.

Table 2.2 Runoff Coefficients for Site Runoff

Month	Runoff Coefficient							
	Natural Ground	Prepared Ground	Ponds	Dry Tailings	Wet Tailings	Mine Rock	Overburden	Pit Walls
Jan	0.40	0.90	1.00	0.70	0.95	0.60	0.50	0.95
Feb	0.40	0.90	1.00	0.70	0.95	0.60	0.50	0.95
Mar	0.40	0.90	1.00	0.70	0.95	0.60	0.50	0.95
Apr	0.35	0.85	1.00	0.70	0.95	0.60	0.50	0.95
May	0.35	0.85	1.00	0.60	0.95	0.50	0.40	0.95
Jun	0.30	0.85	1.00	0.60	0.95	0.50	0.40	0.95
Jul	0.30	0.85	1.00	0.60	0.95	0.50	0.40	0.95
Aug	0.30	0.85	1.00	0.60	0.95	0.50	0.40	0.95
Sep	0.30	0.85	1.00	0.60	0.95	0.50	0.40	0.95
Oct	0.40	0.85	1.00	0.70	0.95	0.60	0.50	0.95
Nov	0.40	0.90	1.00	0.70	0.95	0.60	0.50	0.95
Dec	0.40	0.90	1.00	0.70	0.95	0.60	0.50	0.95

Source: WSP (2023)

2.1.5 Groundwater

The groundwater inputs to the water balance model including groundwater inflow into the pit; baseflow changes at Payne Lake, Dot Lake, and Minton Lake; and contact groundwater inflow into Payne Lake, Minton Lake, Cockeram Lake, and Keewatin River were updated based on Figure 5.1 and Tables 5.3 to 5-8 in the updated groundwater model report (Appendix E of the MacLellan Mine Plan NOA/NOC).

2.1.6 Operations Data

Production rates, material properties, and process water data from WSP (2023) were updated in the model and are shown in Table 2.3 (production rates) and Table 2.4 (material properties and process water).

Table 2.3 Ore Processing Tonnage

Project Year	Ore Processing Tonnage (t/day)
-1	0
1	6,600
2 to 17	8,000
18	4,500
19	0

Source: WSP (2023)

Table 2.4 Material Properties and Process Water Data

Property	Value	Unit
Tailings dry density	1.5	t/m^3
Tailings specific gravity	3	–
Tailings void ratio	1	–
Ore moisture content	5.3%	–
Slurry solids content (by weight)	50.8%	–
Freshwater requirement	16.5	m^3/hr
Mill water loss	1%	–
Water density	1	t/m^3

Source: WSP (2023)

2.2 Methods

Similar to the EIS model, the water balance model was run for the average, 1:25-year dry, and 1:25-year wet scenarios. The method for estimating receiving environment streamflow was improved using a combination of site-specific and long-term regional data, as described below. Other methods, as well as the use of the GoldSim software package with monthly time steps, remain unchanged from the EIS model.

2.2.1 Receiving Environment Streamflow

To develop long-term runoff estimates for the MacLellan site watersheds, site-specific streamflow data collected from 2015 to 2022 from a representative station was supplemented with long-term data from the most relevant regional hydrometric station. From on-site hydrometric stations, QM08 was selected due to its relatively long record of data (2015 to 2022) and quality of the collected hydrometric data. The Water Survey of Canada (WSC) station on Footprint River above Footprint Lake (0705TF002; 150 km from the Project; drainage area = 643 km^2) was deemed most reliable for pairing local and regional hydrometric data. This selection was based on proximity, drainage area, elevation, as well as timing of freshet at WSC05TF002 and MacLellan site watersheds during their concurrent period of record.

Two regression analysis methods were used to estimate long-term monthly and annual average runoff in the MacLellan site watersheds:

- Chronological Regression: A linear regression analysis was conducted between the monthly flows measured at QM08 from 2015 to 2022 with corresponding monthly flows at WSC05TF002. Modelled streamflows using the linear regression method generally underestimate the streamflow, except for an overestimation of the high-flow freshet in 2017 (Figure 2.7). The modelled monthly streamflow at QM08 during this period shows a moderate Nash-Sutcliffe Efficiency (NSE) of 0.64.
- Ranked Pairing: This method, frequently used by water resource practitioners in Canada, involves ranking concurrent monthly streamflow data at QM08 and WSC05TF002 (2015 to 2022) from lowest to highest. For historical streamflow at WSC07EE009, the modelled streamflow at QM08 was estimated by interpolation between (and extrapolation beyond) the ranked pairs. The modelled monthly streamflow at QM08 from 2015 to 2022 shows a strong NSE of 0.87 (Figure 2.7).

Due to its strong visual match with observed flows and high NSE value, the ranked pairing method was selected to generate a synthetic long-term time-series of monthly flows in the receiving environment for the MacLellan site. A 46-year time-series was generated for the MacLellan site based on available monthly streamflows at WSC05TF002 from 1977 to 2022.The average, 1:25-year dry, and 1:25-year wet statistics from this long-term time-series were incorporated into the water balance model (Table 2.5).

Figure 2.7 Modelled and Observed Streamflows at QM08 during Concurrent Period of Record with Regional Hydrometric Station (WSC05TF002)

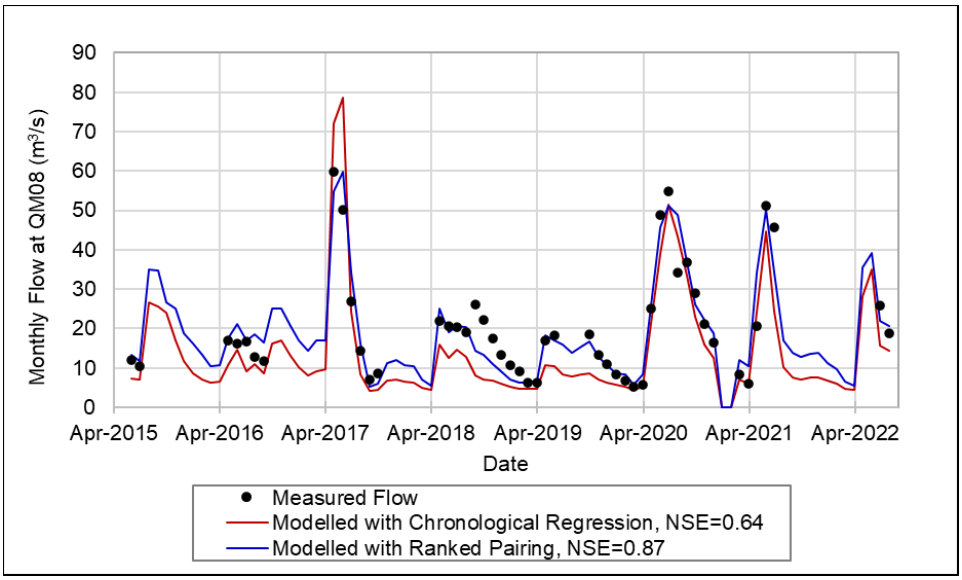


Table 2.5 Long-Term Estimates for Receiving Environment Runoff

Month	**Runoff (mm)**		
	Average	**1:25-Year Dry**	**1:25-Year Wet**
Jan	14.3	6.4	18.4
Feb	10.7	5.3	14.5
Mar	9.8	5.1	13.5
Apr	11.4	8.6	14.3
May	33.8	24.1	48.6
Jun	32.3	20.1	54.2
Jul	23.9	9.8	41.6
Aug	21.4	7.9	40.5
Sep	21.9	6.6	30.5
Oct	22.6	5.4	27.1
Nov	20.8	7.6	27.8
Dec	18.3	7.8	23.9
Annual	**241**	**115**	**355**

2.3 Results

Predicted monthly streamflows for the average scenario at model nodes QM02, QM03, QM04, QM06, QM07, QM08, and QM11, as well as predicted water levels at Minton Lake and Cockeram Lake, are shown in Table 2.6 to Table 2.15 for each phase of mine life. These results are compared to those of the EIS model in Section 2.4. Further detailed results at these model nodes, including the results for the 1:25-year dry and 1:25-year wet scenarios, as well as the variation of flow during each project phase, are provided in Appendix A.

Results at model nodes QM01 and QM05 are not provided because streamflow at these nodes is predicted to remain unchanged from existing conditions (i.e., streamflow is not predicted to be affected by the Project).

Table 2.6 Simulated Average Monthly Streamflows at Model Node QM02

Month	Existing Condition	Construction			Operations			Closure (Pit Filling)			Post-closure		
	Flow (m^3/s)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)
Jan	7.050	7.050	0.000	0%	7.067	0.017	0%	7.049	-0.001	0%	7.047	-0.003	0%
Feb	5.873	5.873	0.000	0%	5.883	0.010	0%	5.872	-0.001	0%	5.870	-0.003	0%
Mar	4.842	4.841	-0.001	0%	4.850	0.008	0%	4.840	-0.002	0%	4.839	-0.003	0%
Apr	5.794	5.835	0.041	1%	5.887	0.093	2%	5.792	-0.002	0%	5.791	-0.003	0%
May	16.690	16.795	0.105	1%	16.819	0.129	1%	16.690	0.000	0%	16.690	0.000	0%
Jun	16.480	16.535	0.055	0%	16.539	0.059	0%	16.477	-0.003	0%	16.470	-0.010	0%
Jul	11.820	11.905	0.085	1%	11.902	0.082	1%	11.820	0.000	0%	11.820	0.000	0%
Aug	10.550	10.625	0.075	1%	10.621	0.071	1%	10.550	0.000	0%	10.550	0.000	0%
Sep	11.200	11.275	0.075	1%	11.278	0.078	1%	11.200	0.000	0%	11.200	0.000	0%
Oct	11.140	11.165	0.025	0%	11.183	0.043	0%	11.130	-0.010	0%	11.130	-0.010	0%
Nov	10.590	10.600	0.010	0%	10.618	0.028	0%	10.590	0.000	0%	10.590	0.000	0%
Dec	9.060	9.065	0.005	0%	9.082	0.022	0%	9.058	-0.002	0%	9.057	-0.003	0%
Annual	10.115	10.155	0.040	0%	10.169	0.054	1%	10.114	-0.002	0%	10.112	-0.003	0%

Note:

0.0% and 0.000 m^3/s in the Table represent < 0.1% and <0.001 m^3/s, respectively.

Table 2.7 Simulated Average Monthly Streamflows at Model Node QM03

Month	Existing Condition	Construction			Operations			Closure (Pit Filling)			Post-closure		
	Flow (m^3/s)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)
Jan	7.113	7.111	-0.002	0%	7.123	0.010	0%	7.105	-0.008	0%	7.105	-0.008	0%
Feb	5.925	5.924	-0.002	0%	5.929	0.004	0%	5.918	-0.007	0%	5.919	-0.006	0%
Mar	4.885	4.883	-0.002	0%	4.887	0.002	0%	4.878	-0.007	0%	4.879	-0.006	0%
Apr	5.845	5.885	0.039	1%	5.932	0.087	1%	5.838	-0.007	0%	5.839	-0.006	0%
May	16.840	16.935	0.095	1%	16.954	0.114	1%	16.820	-0.020	0%	16.820	-0.020	0%
Jun	16.630	16.680	0.050	0%	16.672	0.042	0%	16.610	-0.020	0%	16.610	-0.020	0%
Jul	11.930	12.005	0.075	1%	11.999	0.069	1%	11.920	-0.010	0%	11.920	-0.010	0%
Aug	10.650	10.715	0.065	1%	10.703	0.053	1%	10.640	-0.010	0%	10.640	-0.010	0%
Sep	11.300	11.370	0.070	1%	11.367	0.067	1%	11.290	-0.010	0%	11.290	-0.010	0%
Oct	11.240	11.255	0.015	0%	11.270	0.030	0%	11.220	-0.020	0%	11.220	-0.020	0%
Nov	10.690	10.690	0.000	0%	10.706	0.016	0%	10.680	-0.010	0%	10.680	-0.010	0%
Dec	9.141	9.143	0.002	0%	9.155	0.014	0%	9.130	-0.011	0%	9.131	-0.010	0%
Annual	10.207	10.241	0.034	0%	10.250	0.043	0%	10.195	-0.012	0%	10.196	-0.011	0%

Note:

0.0% in the Table represents < 0.1%.

Table 2.8 Simulated Average Monthly Streamflows at Model Node QM04

Month	Existing Condition	Construction			Operations			Closure (Pit Filling)			Post-closure		
	Flow (m^3/s)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)
Jan	0.030	0.025	-0.005	-17%	0.011	-0.019	-64%	0.010	-0.020	-66%	0.035	0.005	16%
Feb	0.025	0.021	-0.005	-19%	0.009	-0.016	-64%	0.009	-0.017	-66%	0.028	0.002	9%
Mar	0.021	0.016	-0.004	-21%	0.008	-0.013	-64%	0.007	-0.014	-65%	0.025	0.004	18%
Apr	0.025	0.019	-0.006	-24%	0.009	-0.016	-64%	0.009	-0.016	-66%	0.123	0.098	391%
May	0.072	0.053	-0.019	-26%	0.026	-0.046	-64%	0.029	-0.043	-60%	0.193	0.121	168%
Jun	0.071	0.051	-0.020	-28%	0.025	-0.046	-64%	0.026	-0.045	-64%	0.085	0.014	20%
Jul	0.051	0.035	-0.016	-31%	0.018	-0.033	-64%	0.019	-0.031	-62%	0.092	0.041	81%
Aug	0.045	0.030	-0.015	-33%	0.016	-0.029	-64%	0.017	-0.028	-62%	0.079	0.033	73%
Sep	0.048	0.031	-0.017	-36%	0.017	-0.031	-64%	0.019	-0.030	-61%	0.098	0.050	103%
Oct	0.048	0.030	-0.018	-38%	0.017	-0.031	-64%	0.018	-0.030	-62%	0.074	0.026	54%
Nov	0.046	0.027	-0.019	-41%	0.016	-0.029	-64%	0.017	-0.029	-64%	0.047	0.001	3%
Dec	0.039	0.022	-0.017	-43%	0.014	-0.025	-64%	0.014	-0.025	-64%	0.041	0.002	5%
Annual	0.044	0.030	-0.013	-30%	0.016	-0.028	-64%	0.016	-0.027	-63%	0.077	0.033	78%

Table 2.9 Simulated Average Monthly Streamflows at Model Node QM06

Month	Existing Condition	Construction			Operations			Closure (Pit Filling)			Post-closure		
	Flow (m^3/s)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)
Jan	7.168	7.161	-0.007	0%	7.158	-0.010	0%	7.140	-0.028	0%	7.165	-0.003	0%
Feb	5.971	5.965	-0.007	0%	5.958	-0.013	0%	5.947	-0.024	0%	5.966	-0.005	0%
Mar	4.922	4.917	-0.005	0%	4.912	-0.010	0%	4.902	-0.020	0%	4.920	-0.002	0%
Apr	5.890	5.924	0.034	1%	5.961	0.071	1%	5.866	-0.024	0%	5.981	0.091	2%
May	16.970	17.050	0.080	0%	17.037	0.067	0%	16.904	-0.066	0%	17.074	0.104	1%
Jun	16.750	16.790	0.040	0%	16.753	0.003	0%	16.692	-0.058	0%	16.753	0.003	0%
Jul	12.020	12.085	0.065	1%	12.054	0.034	0%	11.974	-0.046	0%	12.052	0.032	0%
Aug	10.730	10.780	0.050	0%	10.760	0.030	0%	10.692	-0.038	0%	10.753	0.023	0%
Sep	11.390	11.440	0.050	0%	11.422	0.032	0%	11.349	-0.041	0%	11.426	0.036	0%
Oct	11.320	11.330	0.010	0%	11.328	0.008	0%	11.282	-0.038	0%	11.335	0.015	0%
Nov	10.770	10.755	-0.015	0%	10.758	-0.012	0%	10.731	-0.039	0%	10.762	-0.008	0%
Dec	9.211	9.197	-0.015	0%	9.200	-0.011	0%	9.176	-0.035	0%	9.204	-0.007	0%
Annual	10.284	10.308	0.024	0%	10.300	0.016	0%	10.246	-0.038	0%	10.308	0.023	0%

Note:

0.0% in the Table represents < 0.1%.

Table 2.10 Simulated Average Monthly Streamflows at Model Node QM07

Month	Existing Condition	Construction			Operations			Closure (Pit Filling)			Post-closure		
	Flow (m^3/s)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)
Jan	0.064	0.056	-0.008	-12%	0.047	-0.017	-26%	0.047	-0.017	-27%	0.047	-0.017	-27%
Feb	0.053	0.046	-0.007	-13%	0.039	-0.014	-27%	0.039	-0.014	-27%	0.039	-0.015	-28%
Mar	0.044	0.038	-0.006	-14%	0.032	-0.012	-27%	0.032	-0.012	-28%	0.032	-0.012	-28%
Apr	0.053	0.045	-0.008	-15%	0.039	-0.014	-27%	0.038	-0.014	-27%	0.038	-0.015	-28%
May	0.151	0.127	-0.024	-16%	0.113	-0.039	-25%	0.112	-0.039	-26%	0.112	-0.039	-26%
Jun	0.150	0.124	-0.025	-17%	0.111	-0.038	-26%	0.111	-0.039	-26%	0.111	-0.039	-26%
Jul	0.107	0.088	-0.019	-18%	0.080	-0.028	-26%	0.079	-0.028	-26%	0.079	-0.028	-26%
Aug	0.096	0.077	-0.018	-19%	0.071	-0.025	-26%	0.071	-0.025	-26%	0.070	-0.025	-27%
Sep	0.102	0.081	-0.020	-20%	0.075	-0.026	-26%	0.075	-0.027	-26%	0.075	-0.027	-26%
Oct	0.101	0.080	-0.021	-21%	0.075	-0.026	-26%	0.075	-0.026	-26%	0.074	-0.027	-26%
Nov	0.096	0.075	-0.021	-22%	0.071	-0.025	-26%	0.071	-0.025	-26%	0.071	-0.026	-27%
Dec	0.082	0.063	-0.019	-23%	0.061	-0.021	-26%	0.060	-0.022	-26%	0.060	-0.022	-27%
Annual	0.092	0.075	-0.017	-18%	0.068	-0.024	-26%	0.068	-0.024	-26%	0.067	-0.024	-27%

Table 2.11 Simulated Average Monthly Streamflows at Model Node QM08

Month	Existing Condition	Construction			Operations			Closure (Pit Filling)			Post-closure		
	Flow (m^3/s)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)
Jan	10.690	10.670	-0.020	0%	10.659	-0.031	0%	10.641	-0.049	0%	10.664	-0.026	0%
Feb	8.901	8.888	-0.013	0%	8.874	-0.027	0%	8.862	-0.039	0%	8.882	-0.019	0%
Mar	7.338	7.326	-0.013	0%	7.315	-0.023	0%	7.305	-0.033	0%	7.323	-0.015	0%
Apr	8.781	8.807	0.025	0%	8.838	0.057	1%	8.742	-0.039	0%	8.857	0.076	1%
May	25.300	25.355	0.055	0%	25.327	0.027	0%	25.194	-0.106	0%	25.363	0.063	0%
Jun	24.980	24.985	0.005	0%	24.941	-0.039	0%	24.872	-0.108	0%	24.935	-0.045	0%
Jul	17.920	17.960	0.040	0%	17.931	0.011	0%	17.852	-0.068	0%	17.923	0.003	0%
Aug	16.000	16.035	0.035	0%	16.000	0.000	0%	15.932	-0.068	0%	15.994	-0.006	0%
Sep	16.980	17.010	0.030	0%	16.983	0.003	0%	16.912	-0.068	0%	16.992	0.012	0%
Oct	16.880	16.865	-0.015	0%	16.858	-0.022	0%	16.812	-0.068	0%	16.865	-0.015	0%
Nov	16.060	16.015	-0.045	0%	16.018	-0.042	0%	15.991	-0.069	0%	16.023	-0.038	0%
Dec	13.730	13.695	-0.035	0%	13.699	-0.031	0%	13.671	-0.059	0%	13.703	-0.027	0%
Annual	15.334	15.338	0.004	0%	15.324	-0.010	0%	15.269	-0.065	0%	15.331	-0.003	0%

Note:

0.0% in the Table represents < 0.1%.

Table 2.12 Simulated Average Monthly Streamflows at Model Node QM09

Month	Existing Condition	Construction			Operations			Closure (Pit Filling)			Post-closure		
	Flow (m^3/s)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)
Jan	0.040	0.040	0.000	0%	0.037	-0.003	-7%	0.037	-0.003	-7%	0.039	-0.001	-2%
Feb	0.033	0.033	0.000	0%	0.031	-0.003	-8%	0.031	-0.003	-8%	0.033	-0.001	-2%
Mar	0.027	0.027	0.000	0%	0.025	-0.003	-10%	0.025	-0.003	-10%	0.027	-0.001	-2%
Apr	0.033	0.033	0.000	0%	0.030	-0.003	-9%	0.030	-0.003	-8%	0.032	-0.001	-2%
May	0.095	0.095	0.000	0%	0.092	-0.003	-3%	0.092	-0.003	-3%	0.094	-0.001	-1%
Jun	0.093	0.093	0.000	0%	0.091	-0.003	-3%	0.091	-0.003	-3%	0.093	-0.001	-1%
Jul	0.067	0.067	0.000	0%	0.064	-0.003	-4%	0.064	-0.003	-4%	0.066	-0.001	-1%
Aug	0.060	0.060	0.000	0%	0.057	-0.003	-5%	0.057	-0.003	-5%	0.059	-0.001	-1%
Sep	0.064	0.063	0.000	0%	0.061	-0.003	-5%	0.061	-0.003	-4%	0.063	-0.001	-1%
Oct	0.063	0.063	0.000	0%	0.060	-0.003	-5%	0.060	-0.003	-4%	0.063	-0.001	-1%
Nov	0.060	0.060	0.000	0%	0.057	-0.003	-5%	0.057	-0.003	-5%	0.059	-0.001	-1%
Dec	0.051	0.051	0.000	0%	0.048	-0.003	-6%	0.049	-0.003	-5%	0.051	-0.001	-1%
Annual	0.057	0.057	0.000	0%	0.054	-0.003	-6%	0.055	-0.003	-6%	0.057	-0.001	-1%

Note:

0.0% and 0.000 m^3/s in the Table represent < 0.1% and < 0.001 m^3/s, respectively.

Table 2.13 Simulated Average Monthly Streamflows at Model Node QM11

Month	Existing Condition	Construction			Operations			Closure (Pit Filling)			Post-closure		
	Flow (m^3/s)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (m^3/s)	Change from Existing (%)
Jan	0.439	0.432	-0.008	-2%	0.422	-0.017	-4%	0.422	-0.017	-4%	0.422	-0.017	-4%
Feb	0.366	0.359	-0.007	-2%	0.352	-0.014	-4%	0.351	-0.015	-4%	0.351	-0.015	-4%
Mar	0.302	0.295	-0.006	-2%	0.290	-0.012	-4%	0.289	-0.012	-4%	0.289	-0.012	-4%
Apr	0.361	0.353	-0.008	-2%	0.347	-0.014	-4%	0.347	-0.014	-4%	0.346	-0.015	-4%
May	1.040	1.016	-0.025	-2%	1.001	-0.039	-4%	1.001	-0.039	-4%	1.000	-0.040	-4%
Jun	1.027	1.001	-0.026	-3%	0.989	-0.038	-4%	0.988	-0.039	-4%	0.988	-0.039	-4%
Jul	0.737	0.717	-0.019	-3%	0.709	-0.028	-4%	0.709	-0.028	-4%	0.708	-0.028	-4%
Aug	0.658	0.639	-0.018	-3%	0.633	-0.025	-4%	0.632	-0.025	-4%	0.632	-0.025	-4%
Sep	0.698	0.677	-0.021	-3%	0.672	-0.026	-4%	0.671	-0.027	-4%	0.671	-0.027	-4%
Oct	0.694	0.672	-0.022	-3%	0.668	-0.026	-4%	0.667	-0.026	-4%	0.667	-0.027	-4%
Nov	0.660	0.639	-0.021	-3%	0.635	-0.025	-4%	0.635	-0.025	-4%	0.635	-0.025	-4%
Dec	0.564	0.545	-0.019	-3%	0.543	-0.021	-4%	0.543	-0.022	-4%	0.542	-0.022	-4%
Annual	0.630	0.614	-0.017	-3%	0.606	-0.024	-4%	0.606	-0.024	-4%	0.606	-0.024	-4%

Table 2.14 Simulated Average Monthly Water Levels at Minton Lake

Month	Existing Condition	Construction		Operations		Closure (Pit Filling)		Post-closure	
	Level (m)	Level (m)	Change from Existing (m)	Level (m)	Change from Existing (m)	Level (m)	Change from Existing (m)	Level (m)	Change from Existing (m)
Jan	330.06	330.04	-0.02	330.01	-0.05	330.01	-0.05	330.01	-0.05
Feb	330.03	330.00	-0.02	329.98	-0.05	329.98	-0.05	329.98	-0.05
Mar	330.00	329.97	-0.02	329.95	-0.04	329.95	-0.04	329.95	-0.05
Apr	330.02	330.00	-0.03	329.98	-0.05	329.98	-0.05	329.98	-0.05
May	330.25	330.20	-0.05	330.17	-0.08	330.17	-0.08	330.17	-0.08
Jun	330.25	330.20	-0.05	330.17	-0.07	330.17	-0.08	330.17	-0.08
Jul	330.16	330.12	-0.04	330.10	-0.06	330.10	-0.07	330.10	-0.07
Aug	330.14	330.09	-0.04	330.08	-0.06	330.08	-0.06	330.08	-0.06
Sep	330.15	330.10	-0.05	330.09	-0.06	330.09	-0.06	330.09	-0.06
Oct	330.15	330.10	-0.05	330.09	-0.06	330.09	-0.06	330.09	-0.06
Nov	330.14	330.09	-0.05	330.08	-0.06	330.08	-0.06	330.08	-0.06
Dec	330.11	330.05	-0.05	330.05	-0.06	330.05	-0.06	330.05	-0.06
Annual	330.12	330.08	-0.04	330.06	-0.06	330.06	-0.06	330.06	-0.06

Table 2.15 Simulated Average Monthly Water Levels at Cockeram Lake

Month	Existing Condition	Construction		Operations		Closure (Pit Filling)		Post-closure	
	Level (m)	Level (m)	Change from Existing (m)	Level (m)	Change from Existing (m)	Level (m)	Change from Existing (m)	Level (m)	Change from Existing (m)
Jan	312.13	312.13	0.00	312.13	0.00	312.13	0.00	312.13	0.00
Feb	312.11	312.11	0.00	312.11	0.00	312.11	0.00	312.11	0.00
Mar	312.08	312.08	0.00	312.08	0.00	312.08	0.00	312.08	0.00
Apr	312.10	312.10	0.00	312.10	0.00	312.10	0.00	312.11	0.00
May	312.29	312.29	0.00	312.29	0.00	312.29	0.00	312.29	0.00
Jun	312.29	312.29	0.00	312.28	0.00	312.28	0.00	312.28	0.00
Jul	312.22	312.22	0.00	312.22	0.00	312.22	0.00	312.22	0.00
Aug	312.20	312.20	0.00	312.20	0.00	312.20	0.00	312.20	0.00
Sep	312.21	312.21	0.00	312.21	0.00	312.21	0.00	312.21	0.00
Oct	312.21	312.21	0.00	312.21	0.00	312.21	0.00	312.21	0.00
Nov	312.20	312.20	0.00	312.20	0.00	312.20	0.00	312.20	0.00
Dec	312.17	312.17	0.00	312.17	0.00	312.17	0.00	312.17	0.00
Annual	312.18	312.18	0.00	312.18	0.00	312.18	0.00	312.18	0.00

Note:

0.00 m in the Table represents < 0.01 m.

2.4 Comparison with EIS Model Results

The EIS model used an estimated Open Pit volume of 52 Mm^3, resulting in a predicted pit filling period of 21 years. In contrast, this updated model used the detailed design volume of 95.8 Mm^3 which resulted in a predicted 40-year pit filling period.

Both the EIS model results (Stantec 2021) and updated results (Table 2.6 to Table 2.15) indicate the following effects (Table 2.16 and Table 2.17):

- Predicted changes in average monthly streamflows between project-affected and existing conditions at QM02, QM03, QM06, QM08, and QM11 are lower than 10%.
- Predicted changes in average monthly streamflows between project-affected and existing conditions at QM04 and QM07 are greater than 10%.
- Predicted changes in average monthly water levels between project-affected and existing conditions at Minton Lake are lower than 0.10 m.
- Predicted changes in average monthly water levels between project-affected and existing conditions at Cockeram Lake are lower than 0.01 m.

While the EIS model results (Stantec 2021) did not predict streamflow changes at QM09, the updated results predict up to a 10% flow reduction at this modelling node (Table 2.16). This predicted streamflow reduction is attributed to a predicted baseflow reduction in Dot Lake (Appendix E of the MacLellan Mine Plan NOA/NOC).

Table 2.16 Comparison of Updated Water Balance Model Results with EIS Results – Streamflows

Model Node	Source	Construction		Operations		Closure (Pit Filling)		Post-closure		Maximum of All Phases[3]	
		decrease[1]	Increase[2]	decrease[1]	Increase[2]	decrease[1]	Increase[2]	decrease[1]	Increase[2]	Decrease[3]	Increase[3]
QM02	EIS[4]	0%	0%	0%	0%	0%	0%	0%	0%	**0%**	**0%**
	Updated[5]	0%	1%	0%	2%	0%	0%	0%	0%	**0%**	**2%**
QM03	EIS[4]	0%	0%	0%	1%	0%	0%	0%	0%	**0%**	**1%**
	Updated[5]	0%	1%	0%	1%	0%	0%	0%	0%	**0%**	**1%**
QM04	EIS[4]	-64%	0%	-64%	0%	-64%	0%	0%	800%[6]	**-64%**	**800%[6]**
	Updated[5]	-43%	0%	-64%	0%	-66%	0%	0%	391%	**-66%**	**391%**
QM06	EIS[4]	-1%	0%	-1%	1%	-1%	0%	0%	0%	**-1%**	**1%**
	Updated[5]	0%	1%	0%	1%	0%	0%	0%	2%	**0%**	**2%**
QM07	EIS[4]	-24%	5%	-24%	3%	-26%	0%	-26%	0%	**-26%**	**5%**
	Updated[5]	-23%	0%	-27%	0%	-28%	0%	-28%	0%	**-28%**	**0%**
QM08	EIS[4]	-3%	5%	-3%	5%	-3%	5%	-2%	5%	**-3%**	**5%**
	Updated[5]	0%	0%	0%	1%	0%	0%	0%	1%	**0%**	**1%**
QM09	EIS[4]	0%	0%	0%	0%	0%	0%	0%	0%	**0%**	**0%**
	Updated[5]	0%	0%	-10%	0%	-10%	0%	-2%	0%	**-10%**	**0%**
QM11	EIS[4]	-1%	0%	-1%	0%	-1%	0%	-1%	0%	**-1%**	**0%**
	Updated[5]	-3%	0%	-4%	0%	-4%	0%	-4%	0%	**-4%**	**0%**

Notes:

1 maximum decrease of monthly flows during each Phase of the Project. For example, in Table 2.10 (for QM07), during construction, maximum reduction of average monthly flows is 23% which occurs in December. This -23% flow change is shown in this Table, for 'updated' results for 'QM07' flow decrease during 'construction'.

2 maximum increase of monthly flows during each Phase of the Project.

3 maximum of percent decrease and increase values for individual phases, as provided in the Construction, Operations, Closure (Pit Filling) and Post-closure columns of this table.

4 EIS results (Stantec 2021)

5 Updated Results (Table 2.6 to Table 2.13)

6 The summary tables and appendices in Stantec (2021) indicate that streamflow could increase by up to 89% following pit filling. However, a significantly higher 800% increase was deemed not applicable due to a modeling artifact that affected the representation of very small flows.

– : Lower than 1% change in streamflow

Table 2.17 Comparison of Updated Water Balance Model Results with EIS Results – Lake Levels

Model Node	Source	Construction		Operations		Closure (Pit Filling)		Post-closure		Maximum of All Phases[3]	
		decrease[1]	Increase[2]	decrease[1]	Increase[2]	decrease[1]	Increase[2]	decrease[1]	Increase[2]	Decrease[3]	Increase[3]
Minton Lake	EIS[4]	-0.04	0.00	-0.04	0.00	-0.05	0.00	-0.05	0.00	**-0.05**	**0.00**
	Updated[5]	0.00	0.00	-0.08	0.00	0.00	0.00	0.00	0.00	**-0.08**	**0.00**
Cockeram Lake	EIS[4]	0.00	0.01	0.00	0.01	-0.01	0.01	0.00	0.01	**-0.01**	**0.01**
	Updated[5]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**

Notes:

1 maximum decrease of monthly water level during each Phase of the Project. For example, in Table 2.14 (for Minton Lake), during operations, maximum reduction of average monthly lake level is 0.08 m which occurs in May. This -0.08 m level change is shown in this Table, for 'updated' results for 'Minton Lake' water level decrease during 'operation'.

2 maximum increase of monthly water level during each Phase of the Project.

4 EIS results (Stantec 2021)

5 Updated Results (Table 2.14 and Table 2.15)

– : Lower than 0.01m in lake level

3 Water Quality Model Updates

3.1 Inputs

The following sections present updates to the water quality model inputs resulting from the proposed alteration for the expected case and upper case source terms. Water quality model inputs remain unchanged from the EIS model (Stantec 2021) except for the following changes presented in this section.

3.1.1 Potential Development of Acidity

Consistent with the EIS model (Stantec 2021), the updated water quality model assumes that the seepages from Project components will not generate acid rock drainage (ARD) in post-closure because of mitigation and management strategies implemented during operations and closure. However, the model inputs to calculate chemical mass loadings accounted for the potential release of metals under acidic conditions as in the EIS model (Stantec 2021). In the EIS model (Stantec 2021), approximately 28% of mine rock material at the MacLellan site was classified as potentially acid generating (PAG), whereas, in the updated model about 41% of mined rock was classified as PAG. Overall, chemical mass loadings from the Mine Rock Storage Area and pit wall slightly increased because of the increase in the estimated proportion of PAG material in addition to the changes below.

3.1.2 Mine Components Assumptions and Source Terms

3.1.2.1 Waste Rock and Ore Production Schedule

The EIS model was based on older estimated quantities of waste rock and ore of approximately 266 Mt and 26.8 Mt, respectively (Table 3.1), with an estimate of 28% of the total waste rock mass as PAG. Updated estimates of waste rock volume include a total of 250.9 Mt of waste rock of which 146.8 Mt is NAG rock and 104.1 Mt is PAG rock (41% of total waste rock). Overall, the total waste rock is comparable to the waste rock mass used in the EIS model. However, the percentage of PAG rock in the updated water quality model (41%) is greater than in the EIS model.

The updated estimate of ore in the updated water quality model is 39.7 Mt which is about 48% greater than the older estimate of 26.8 Mt in the EIS model (Table 3.1).

Table 3.1 Waste Rock and Ore Production Rates

Mine Year	Updated Model			EIS Model	
	NAG (t/yr)	PAG (t/yr)	Ore (t/yr)	Waste Rock (t/yr)[1]	Ore (t/yr)
1	1,224,993	893,052	66,724	3,099,000	720,000
2	5,145,517	3,173,247	520,515	6,502,000	1,778,000
3	8,019,149	7,534,183	4,285,707	13,750,000	1,534,000
4	12,037,321	10,637,580	7,507,386	17,164,000	1,063,000
5	16,672,854	11,285,988	2,728,607	17,970,000	767,000
6	20,042,877	11,867,380	1,089,743	21,999,000	1,266,000
7	19,843,414	11,281,318	1,875,268	24,501,000	3,303,000
8	18,770,186	11,449,217	2,780,597	28,025,000	3,551,000
9	16,143,893	12,244,846	4,611,261	28,024,000	2,889,000
10	14,465,310	11,844,794	5,380,682	27,011,000	1,091,000
11	9,231,426	6,641,437	4,502,634	24,501,000	1,993,000
12	3,984,642	3,847,079	2,725,698	22,800,000	2,740,000
13	1,259,669	1,444,429	1,662,808	17,699,000	3,095,000
14				11,106,000	1,031,000
15				1,838,000	

Notes:

NAG = non-acid generating

PAG = potentially acid generating

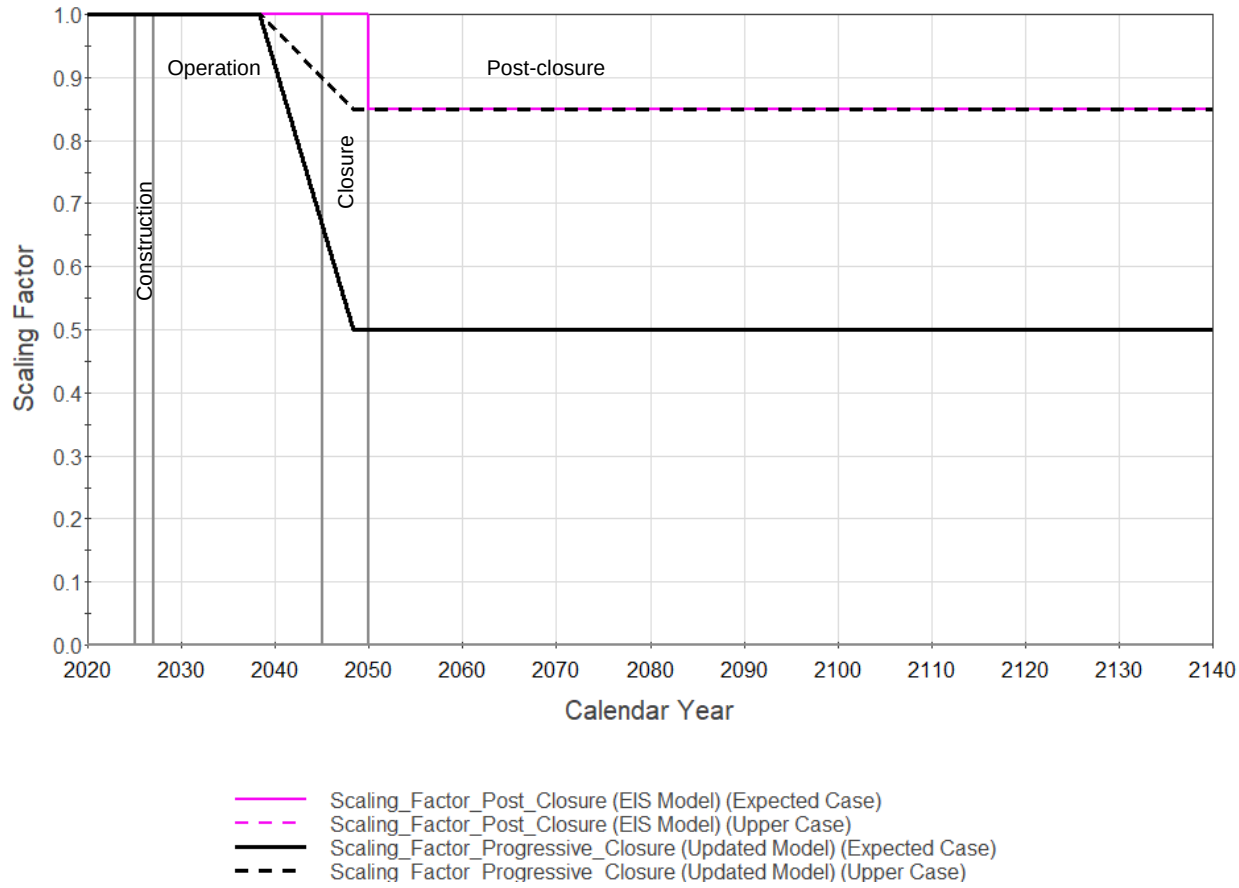
[1]PAG proportion was estimated to be 28%

3.1.2.2 Scaling Factors for Calculation of Elemental Leaching Rates

Three scaling factors were applied to calculate the elemental leaching rates that were used in the EIS model. The first two scaling factors for surface areas and contact remain unchanged for both expected case and upper case source terms. The third scaling factor applied to the elemental leaching rates during post-closure was changed. This scaling factor was applied to account for the reduction in infiltration through the MRSA as a result of reclamation activities (e.g., placement of soil cover). In the EIS model, the scaling factor was equal to 1 during the operation phase (no reduction in the elemental leaching rates) and reduced to 0.8 to account for the reduction in filtration in post-closure. In the updated model, progressive closure activities are assumed to take place in the operation phase when all waste rock is deposited at the MRSA and the reclamation activities at the MRSA is assumed to take 10 years to complete. Before the progressive reclamation starts, the scaling factor is equal to 1, then gradually

decreased to 0.5 when the reclamation activities are completed and remained at 0.5 in post-closure (Figure 3.1). A scaling factor for the reduction of the chemical leaching rates by half remains a conservative assumption for the reduction in the infiltration and exposure to oxygen from the atmosphere due to soil cover (Steinepreis 2017). A progressive closure scaling factor of 1 to 0.85 is used for the upper case source term.

Figure 3.1 Scaling Factor for Progressive Closure for Expected Case and Upper Case Source Terms



3.1.2.3 Source Terms for Nitrogen Species

The mass rate of non-exploded nitrogen was calculated following the same approach as in the EIS model. However, the percentage of total nitrogen loss (nitrogen in unexploded explosive) used for the expected case source term in the updated model was 1%. This estimate is higher than the value of 0.2% used in the EIS model and is closer to the midrange value of the reported range from 0.1% to 4.3% (Ferguson and Leask 1988; Golder 2008). For the upper case in the updated model, 3% was used in comparison with 1% for the upper case in the EIS model.

3.1.2.4 Open Pit Assumptions

Assumptions for the open pit in the EIS model are also applied in the updated model.

3.1.2.5 TMF and MRSA Seepage Assumptions

Assumptions for the seepages from the TMF and the MRSA in the EIS model are also applied in the updated model except for the following:

- Particulate in the groundwater seepage is not expected to transport through the aquifer. Thus, the total concentration in groundwater seepage discharging to surface water is set to be equal to the dissolved concentration.
- In the EIS model, uncertainty related to seepage travel time was captured by using the mean travel time for the expected source term and minimum travel time for the upper case source term (i.e., it took the seepage a minimal travel time to reach the receptor at the predicted flow rate). In the updated model, uncertainty related to the travel time was captured by interpolating the predicted flow rate. The seepage flow rate arriving at different receiving environment nodes was set to increase linearly from 0 (m^3/s) through the predicted flow rate at the end of construction, operations, and closure phases (presented in Tables 5.4, 5.6, and 5.8 of the Groundwater Model Report) . This approach was used for both expected case and upper case source terms of the updated model.

3.1.2.6 Particulate Contribution to Total Concentration in Receiving Environment Model Node Assumption

In the EIS model, a mass load equivalent to 15 mg/L of suspended solids was added to seepage from the MRSA and ore stockpile to represent the contribution of particulates to the total concentrations of model parameters. In the updated model, it is assumed that discharges from the overflows of the open pit, satellite pit, and the collection pond to the receiving environment carry a suspended sediment load equivalent to TSS of 10 mg/L. This is a more conservative approach to evaluate the impacts of particulate in the discharges to the receiving environment.

3.2 Model Scenarios

The water quality model was updated for the expected case and upper case source term scenarios. This report presents the water quality model results for two scenarios: average climate and expected case source term scenario (Expected Case), average climate and upper case source term scenario (Upper Case), and a comparison to the water quality EIS model results.

3.3 Results

3.3.1 Updated Model Results

Summary statistics of the updated water quality model results for the Expected Case and the Upper Case scenarios are presented in Appendix B and Appendix C, respectively, for the following locations: open pit discharge, satellite pit discharge, collection pond discharge, TMF pond, QM02, QM03, QM04, QM06, QM29, QM07 (Minton Lake), QM11, Cockeram Lake, and Payne Lake.

Water quality results at model nodes QM01 and QM05 are not provided because the water quality results at these nodes remain unchanged from existing conditions (i.e., water quality is not predicted to be affected by the Project).

3.3.2 Comparison with EIS Model Results

Summary statistics of the updated water quality model results for the average – expected scenario are compared to the summary statistics of the EIS model (Stantec 2021). The comparison is completed by calculating the percentage changes to the summary statistics values (minimum, mean, median, and max) of the updated model Expected Case results to the EIS model Expected Case results (Stantec 2021) for the following locations: open pit discharge, collection pond discharge, TMF pond, and model nodes receiving discharges or seepages from the Project including QM02, QM04, QM07 (Minton Lake), Cockeram Lake, and Payne Lake. The comparison results are shown in Appendix D and summarized for some of the model nodes within the Mine site as below.

- Open pit discharge:
    - Median and maximum concentrations predicted by the updated model for the Post-closure phase were between half and two times (2x) the respective concentrations predicted by the EIS model except for the median and maximum concentrations of total iron and the maedian concentration of radium-226 (> 2x). Maximum concentrations of total cyanide, total copper, total and dissolved arsenic, total and dissolved cadmium, total and dissolved molybdenum predicted by the updated model for the post-closure phase are less than half of the respective maximum concentrations predicted by the EIS model.
    - The differences in the updated model results for the open pit discharge in comparison to the EIS model are primarily due to changes in the pit wall surface area and pit volume (i.e., increase in pit lake filling time). In particular, the higher total concentration predicted by the updated model is reflective of the assumption regarding the contribution of particulate to the discharges.

- Collection pond discharge:
    - Median concentrations predicted by the updated model for the Operations phase were between half and 2x the respective concentrations predicted by the EIS model except for total and dissolved antimony, total and dissolved arsenic, total and dissolved cadmium, total chromium, total and dissolved cobalt, total iron, total and dissolved lead, nitrate and nitrite, total and dissolved nickel, and total and dissolved zinc with the concentrations more than 2x the respective concentrations predicted by the EIS model.
    - Maximum concentrations predicted by the updated model for the Operations phase were more than 2x the respective concentrations predicted by the EIS model except for total and dissolved aluminum, bromide, chloride, total chromium, total and dissolved copper, cyanide species, dissolved iron, total lead, total and dissolved manganese, total and dissolved mercury, total phosphorus, radium-226, total silver, and total thallium (< 2x).
    - The increase in the concentrations of the metal and metalloid parameters are due to the increase in mass loads from the MRSA and TMF seepages, reflecting the increases in the updated estimates of ore and the proportion of PAG waste rock. The increases in the concentrations of nitrogen species in the collection pond discharge are primarily due to the assumed proportion of nitrogen from the explosives use (see Section 3.1.2.3).
- TMF pond:
    - Median and maximum concentrations predicted by the updated model for the Operations phase were between half and 2x the respective concentrations predicted by the EIS model except for total and dissolved iron with the concentrations more than 2x the respective concentrations predicted by the EIS model.
    - Median concentrations predicted by the updated model for the Post-closure phase were between half and 2x the respective concentrations predicted by the EIS model except for total aluminum, total and dissolved barium, bromide, total and dissolved cadmium, dissolved calcium, chloride, total and dissolved chromium, dissolved chromium(VI), total and dissolved copper, total iron, total and dissolved lead, dissolved magnesium, total and dissolved manganese, nitrogen species including ammonia, nitrate, and nitrate-nitrite, total phosphorus, radium-226, total and dissolved thallium, and total vanadium with the concentrations more than 2x the respective concentrations predicted by the EIS model.
    - Maximum concentrations predicted by the updated model for the Post-closure phase were between half and 2x the respective concentrations predicted by the EIS model except for bromide, total cadmium, dissolved chromium, dissolved chromium(VI), total and dissolved iron, total and dissolved lead, total phosphorus, radium-226, and total and dissolved thallium with the concentrations more than 2x the respective concentrations predicted by the EIS model.
    - Overall, there were no notable differences in the concentrations predicted by the updated model for the Operations phase in comparison to the EIS model. Most of the increases predicted by the updated model in comparison to the EIS model were for the Post-closure phase due to the increase in mass loads from beach tailings (i.e., increase in the beach tailings areas).

4 Closing

Stantec has prepared this water balance and water quality model update in support of the MacLellan Mine Plan Amendment NOA/NOC with respect to *Environment Act* License No. 3390 for the Lynn Lake Gold Project. The results of this model are assessed in Section 3.3.4 (Surface Water) of the MacLellan Mine Plan Amendment NOA/NOC.

5 References

Alamos Gold Inc. (Alamos). 2023. Feasibility Study Update, NI-43-101 Technical Report for the Lynn Lake Project. Issue date: August 22, 2023.

Ferguson, K.D. and S.M. Leask. 1988. The Export of Nutrients from Surface Coal Mines. Environment Canada Regional Program Report 87-12, dated March, 1988, p. 127.

Golder Associates Ltd. (Golder). 2008. Blasting practices at Ekati mine and sources of nitrate available for dissolution of mine drainage water. Prepared for Ekati Diamond Mine, BHP Billiton Diamond Mines Ltd. December, 2008.

Golder Associates. (Golder). 2020. Lynn Lake Gold Project: Water Management Feasibility Level Design Report. Prepared for Alamos Gold Inc. April 13, 2020.

Stantec Consulting Ltd. (Stantec). 2020a. Lynn Lake Gold Project Environmental Impact Statement Chapter 9 – Assessment of Potential Effects on Surface Water, Prepared by Stantec Consulting Ltd. For Alamos Gold Inc., May 2020.

Stantec Consulting Ltd. (Stantec). 2020b. Lynn Lake Gold Project Hydrology Water Balance and Water Quality Impact Assessment: MacLellan Site, Technical Modelling Report, Prepared by Stantec Consulting Ltd. For Alamos Gold Inc., April 2020.

Stantec Consulting Ltd. (Stantec). 2021. Lynn Lake Gold Project Environmental Impact Statement: Supplemental Filing Re: MacLellan Site Water Balance/Water Quality Model Update Following Mine Rock Storage Area Refinement, Prepared by Stantec Consulting Ltd. For Alamos Gold Inc., May 2021.

Steinepreis, M (2017). Investigation of Gas Transport Rates Through a Covered Waste Rock Pile and Synchrotron Studies on the Sulfide Oxidation Reaction. MS thesis. Department of Earth and Environmental Sciences, University of Waterloo, Ontario, Canada.

WSP Inc. Canada (WSP). 2023. MacLellan Site Water Balance Update, Technical Memorandum prepared by WSP Canada Inc. for Alamos Gold Inc., August 2023.

Appendices

Appendix A Water Balance Results

Table A.1 Simulated Monthly Streamflows at Model Node QM02

Climate Scenario	Month	Existing Condition	Construction						Operations						Closure (Pit Filling)						Post-closure (after Pit Filling)					
			Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum	
		Flow (m^3/s)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)
Average	Jan	7.050	7.050	0.0%	7.049	0.0%	7.050	0.0%	7.067	0.2%	6.982	-1.0%	7.080	0.4%	7.049	0.0%	7.048	0.0%	7.081	0.4%	7.047	0.0%	7.047	0.0%	7.048	0.0%
	Feb	5.873	5.873	0.0%	5.872	0.0%	5.873	0.0%	5.883	0.2%	5.804	-1.2%	5.894	0.4%	5.872	0.0%	5.871	0.0%	5.883	0.2%	5.870	0.0%	5.870	-0.1%	5.871	0.0%
	Mar	4.842	4.841	0.0%	4.840	0.0%	4.842	0.0%	4.850	0.2%	4.772	-1.4%	4.861	0.4%	4.840	0.0%	4.840	0.0%	4.841	0.0%	4.839	-0.1%	4.839	-0.1%	4.840	0.0%
	Apr	5.794	5.835	0.7%	5.823	0.5%	5.846	0.9%	5.887	1.6%	5.824	0.5%	5.896	1.8%	5.792	0.0%	5.792	0.0%	5.793	0.0%	5.791	0.0%	5.791	-0.1%	5.792	0.0%
	May	16.690	16.795	0.6%	16.750	0.4%	16.840	0.9%	16.819	0.8%	16.760	0.4%	16.830	0.8%	16.690	0.0%	16.690	0.0%	16.690	0.0%	16.690	0.0%	16.690	0.0%	16.690	0.0%
	Jun	16.480	16.535	0.3%	16.510	0.2%	16.560	0.5%	16.539	0.4%	16.480	0.0%	16.550	0.4%	16.477	0.0%	16.470	-0.1%	16.480	0.0%	16.470	-0.1%	16.470	-0.1%	16.470	-0.1%
	Jul	11.820	11.905	0.7%	11.880	0.5%	11.930	0.9%	11.902	0.7%	11.860	0.3%	11.910	0.8%	11.820	0.0%	11.820	0.0%	11.820	0.0%	11.820	0.0%	11.820	0.0%	11.820	0.0%
	Aug	10.550	10.625	0.7%	10.610	0.6%	10.640	0.9%	10.621	0.7%	10.570	0.2%	10.630	0.8%	10.550	0.0%	10.550	0.0%	10.550	0.0%	10.550	0.0%	10.550	0.0%	10.550	0.0%
	Sep	11.200	11.275	0.7%	11.260	0.5%	11.290	0.8%	11.278	0.7%	11.220	0.2%	11.290	0.8%	11.200	0.0%	11.200	0.0%	11.200	0.0%	11.200	0.0%	11.200	0.0%	11.200	0.0%
	Oct	11.140	11.165	0.2%	11.160	0.2%	11.170	0.3%	11.183	0.4%	11.100	-0.4%	11.200	0.5%	11.130	-0.1%	11.130	-0.1%	11.130	-0.1%	11.130	-0.1%	11.130	-0.1%	11.130	-0.1%
	Nov	10.590	10.600	0.1%	10.600	0.1%	10.600	0.1%	10.618	0.3%	10.540	-0.5%	10.630	0.4%	10.590	0.0%	10.590	0.0%	10.590	0.0%	10.590	0.0%	10.590	0.0%	10.590	0.0%
	Dec	9.060	9.065	0.1%	9.062	0.0%	9.068	0.1%	9.082	0.2%	9.001	-0.7%	9.095	0.4%	9.058	0.0%	9.057	0.0%	9.059	0.0%	9.057	0.0%	9.057	0.0%	9.057	0.0%
	Annual	10.115	10.155	0.4%	10.143	0.3%	10.167	0.5%	10.169	0.5%	10.101	-0.1%	10.180	0.6%	10.114	0.0%	10.113	0.0%	10.118	0.0%	10.112	0.0%	10.112	0.0%	10.113	0.0%
1:25-Year Dry	Jan	3.175	3.175	0.0%	3.174	0.0%	3.175	0.0%	3.193	0.6%	3.108	-2.1%	3.206	1.0%	3.175	0.0%	3.174	0.0%	3.207	1.0%	3.173	-0.1%	3.173	-0.1%	3.174	0.0%
	Feb	2.924	2.924	0.0%	2.923	0.0%	2.924	0.0%	2.934	0.4%	2.855	-2.4%	2.946	0.8%	2.924	0.0%	2.923	0.0%	2.934	0.3%	2.922	-0.1%	2.922	-0.1%	2.923	0.0%
	Mar	2.527	2.527	0.0%	2.526	0.0%	2.527	0.0%	2.536	0.3%	2.458	-2.7%	2.547	0.8%	2.527	0.0%	2.526	0.0%	2.527	0.0%	2.525	-0.1%	2.525	-0.1%	2.526	0.0%
	Apr	4.392	4.414	0.5%	4.413	0.5%	4.415	0.5%	4.462	1.6%	4.395	0.1%	4.472	1.8%	4.391	0.0%	4.390	0.0%	4.391	0.0%	4.390	-0.1%	4.389	-0.1%	4.390	0.0%
	May	11.900	11.975	0.6%	11.940	0.3%	12.010	0.9%	11.993	0.8%	11.940	0.3%	12.000	0.8%	11.900	0.0%	11.900	0.0%	11.900	0.0%	11.900	0.0%	11.900	0.0%	11.900	0.0%
	Jun	10.260	10.300	0.4%	10.290	0.3%	10.310	0.5%	10.292	0.3%	10.240	-0.2%	10.300	0.4%	10.260	0.0%	10.260	0.0%	10.260	0.0%	10.260	0.0%	10.260	0.0%	10.260	0.0%
	Jul	4.868	4.922	1.1%	4.906	0.8%	4.938	1.4%	4.906	0.8%	4.861	-0.1%	4.917	1.0%	4.867	0.0%	4.866	0.0%	4.867	0.0%	4.866	-0.1%	4.865	-0.1%	4.866	0.0%
	Aug	3.903	3.948	1.2%	3.938	0.9%	3.958	1.4%	3.935	0.8%	3.884	-0.5%	3.946	1.1%	3.902	0.0%	3.901	-0.1%	3.902	0.0%	3.900	-0.1%	3.900	-0.1%	3.901	-0.1%
	Sep	3.387	3.435	1.4%	3.425	1.1%	3.445	1.7%	3.434	1.4%	3.373	-0.4%	3.447	1.8%	3.386	0.0%	3.385	-0.1%	3.387	0.0%	3.385	-0.1%	3.385	-0.1%	3.385	-0.1%
	Oct	2.686	2.707	0.8%	2.701	0.6%	2.713	1.0%	2.727	1.5%	2.646	-1.5%	2.741	2.0%	2.685	0.0%	2.685	0.0%	2.686	0.0%	2.684	-0.1%	2.684	-0.1%	2.685	0.0%
	Nov	3.889	3.895	0.2%	3.891	0.1%	3.899	0.3%	3.916	0.7%	3.832	-1.5%	3.930	1.1%	3.888	0.0%	3.888	0.0%	3.889	0.0%	3.887	0.0%	3.887	-0.1%	3.888	0.0%
	Dec	3.876	3.882	0.1%	3.878	0.1%	3.885	0.2%	3.899	0.6%	3.817	-1.5%	3.912	0.9%	3.875	0.0%	3.875	0.0%	3.876	0.0%	3.874	0.0%	3.874	-0.1%	3.875	0.0%
	Annual	4.824	4.850	0.5%	4.842	0.4%	4.858	0.7%	4.861	0.8%	4.793	-0.6%	4.872	1.0%	4.823	0.0%	4.823	0.0%	4.827	0.1%	4.822	0.0%	4.822	0.0%	4.823	0.0%

Climate Scenario	Month	Existing Condition	Construction						Operations						Closure (Pit Filling)						Post-closure (after Pit Filling)					
			Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum	
		Flow (m^3/s)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)
1:25-Year Wet	Jan	9.074	9.073	0.0%	9.072	0.0%	9.074	0.0%	9.090	0.2%	9.005	-0.8%	9.103	0.3%	9.072	0.0%	9.071	0.0%	9.104	0.3%	9.070	0.0%	9.070	0.0%	9.071	0.0%
	Feb	7.950	7.949	0.0%	7.948	0.0%	7.950	0.0%	7.959	0.1%	7.880	-0.9%	7.970	0.3%	7.948	0.0%	7.947	0.0%	7.958	0.1%	7.946	0.0%	7.946	-0.1%	7.947	0.0%
	Mar	6.667	6.666	0.0%	6.665	0.0%	6.667	0.0%	6.675	0.1%	6.597	-1.0%	6.686	0.3%	6.665	0.0%	6.664	0.0%	6.665	0.0%	6.664	-0.1%	6.663	-0.1%	6.664	0.0%
	Apr	7.315	7.380	0.9%	7.354	0.5%	7.405	1.2%	7.438	1.7%	7.380	0.9%	7.452	1.9%	7.313	0.0%	7.312	0.0%	7.313	0.0%	7.311	0.0%	7.311	-0.1%	7.312	0.0%
	May	24.010	24.145	0.6%	24.080	0.3%	24.210	0.8%	24.175	0.7%	24.130	0.5%	24.200	0.8%	24.000	0.0%	24.000	0.0%	24.000	0.0%	24.000	0.0%	24.000	0.0%	24.000	0.0%
	Jun	27.640	27.720	0.3%	27.690	0.2%	27.750	0.4%	27.730	0.3%	27.680	0.1%	27.740	0.4%	27.630	0.0%	27.630	0.0%	27.630	0.0%	27.630	0.0%	27.630	0.0%	27.630	0.0%
	Jul	20.540	20.655	0.6%	20.620	0.4%	20.690	0.7%	20.653	0.5%	20.610	0.3%	20.670	0.6%	20.530	0.0%	20.530	0.0%	20.530	0.0%	20.530	0.0%	20.530	0.0%	20.530	0.0%
	Aug	20.010	20.105	0.5%	20.080	0.3%	20.130	0.6%	20.108	0.5%	20.060	0.2%	20.120	0.5%	20.008	0.0%	20.000	0.0%	20.010	0.0%	20.000	0.0%	20.000	0.0%	20.000	0.0%
	Sep	15.580	15.680	0.6%	15.660	0.5%	15.700	0.8%	15.680	0.6%	15.620	0.3%	15.690	0.7%	15.580	0.0%	15.580	0.0%	15.580	0.0%	15.574	0.0%	15.570	-0.1%	15.580	0.0%
	Oct	13.400	13.435	0.3%	13.430	0.2%	13.440	0.3%	13.449	0.4%	13.370	-0.2%	13.460	0.4%	13.392	-0.1%	13.390	-0.1%	13.400	0.0%	13.390	-0.1%	13.390	-0.1%	13.390	-0.1%
	Nov	14.170	14.170	0.0%	14.170	0.0%	14.170	0.0%	14.188	0.1%	14.110	-0.4%	14.200	0.2%	14.160	-0.1%	14.160	-0.1%	14.160	-0.1%	14.160	-0.1%	14.160	-0.1%	14.160	-0.1%
	Dec	11.810	11.815	0.0%	11.810	0.0%	11.820	0.1%	11.831	0.2%	11.750	-0.5%	11.850	0.3%	11.810	0.0%	11.810	0.0%	11.810	0.0%	11.810	0.0%	11.810	0.0%	11.810	0.0%
	Annual	14.889	14.942	0.4%	14.924	0.2%	14.960	0.5%	14.957	0.5%	14.892	0.0%	14.971	0.5%	14.884	0.0%	14.883	0.0%	14.889	0.0%	14.883	0.0%	14.882	0.0%	14.883	0.0%

Note:
Changes lower than 0.1% are shown as 0.0%.

Table A.2 Simulated Monthly Streamflows at Model Node QM03

Climate Scenario	Month	Existing Condition	Construction						Operations						Closure (Pit Filling)						Post-closure (after Pit Filling)					
			Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum	
		Flow (m^3/s)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)
Average	Jan	7.113	7.111	0.0%	7.109	-0.1%	7.113	0.0%	7.123	0.1%	7.042	-1.0%	7.135	0.3%	7.105	-0.1%	7.104	-0.1%	7.136	0.3%	7.105	-0.1%	7.104	-0.1%	7.105	-0.1%
	Feb	5.925	5.924	0.0%	5.922	-0.1%	5.925	0.0%	5.929	0.1%	5.854	-1.2%	5.939	0.2%	5.918	-0.1%	5.917	-0.1%	5.928	0.1%	5.919	-0.1%	5.918	-0.1%	5.919	-0.1%
	Mar	4.885	4.883	0.0%	4.882	-0.1%	4.884	0.0%	4.887	0.0%	4.813	-1.5%	4.897	0.2%	4.878	-0.1%	4.877	-0.2%	4.878	-0.1%	4.879	-0.1%	4.878	-0.1%	4.879	-0.1%
	Apr	5.845	5.885	0.7%	5.874	0.5%	5.895	0.9%	5.932	1.5%	5.873	0.5%	5.943	1.7%	5.838	-0.1%	5.837	-0.1%	5.838	-0.1%	5.839	-0.1%	5.838	-0.1%	5.839	-0.1%
	May	16.840	16.935	0.6%	16.890	0.3%	16.980	0.8%	16.954	0.7%	16.910	0.4%	16.970	0.8%	16.820	-0.1%	16.820	-0.1%	16.820	-0.1%	16.820	-0.1%	16.820	-0.1%	16.820	-0.1%
	Jun	16.630	16.680	0.3%	16.660	0.2%	16.700	0.4%	16.672	0.3%	16.620	-0.1%	16.680	0.3%	16.610	-0.1%	16.610	-0.1%	16.610	-0.1%	16.610	-0.1%	16.610	-0.1%	16.610	-0.1%
	Jul	11.930	12.005	0.6%	11.980	0.4%	12.030	0.8%	11.999	0.6%	11.960	0.3%	12.010	0.7%	11.920	-0.1%	11.920	-0.1%	11.920	-0.1%	11.920	-0.1%	11.920	-0.1%	11.920	-0.1%
	Aug	10.650	10.715	0.6%	10.700	0.5%	10.730	0.8%	10.703	0.5%	10.660	0.1%	10.720	0.7%	10.640	-0.1%	10.640	-0.1%	10.640	-0.1%	10.640	-0.1%	10.640	-0.1%	10.640	-0.1%
	Sep	11.300	11.370	0.6%	11.360	0.5%	11.380	0.7%	11.367	0.6%	11.310	0.1%	11.380	0.7%	11.290	-0.1%	11.290	-0.1%	11.290	-0.1%	11.290	-0.1%	11.290	-0.1%	11.290	-0.1%
	Oct	11.240	11.255	0.1%	11.250	0.1%	11.260	0.2%	11.270	0.3%	11.200	-0.4%	11.280	0.4%	11.220	-0.2%	11.220	-0.2%	11.220	-0.2%	11.220	-0.2%	11.220	-0.2%	11.220	-0.2%
	Nov	10.690	10.690	0.0%	10.690	0.0%	10.690	0.0%	10.706	0.2%	10.630	-0.6%	10.720	0.3%	10.680	-0.1%	10.680	-0.1%	10.680	-0.1%	10.680	-0.1%	10.680	-0.1%	10.680	-0.1%
	Dec	9.141	9.143	0.0%	9.140	0.0%	9.146	0.1%	9.155	0.1%	9.077	-0.7%	9.167	0.3%	9.130	-0.1%	9.130	-0.1%	9.131	-0.1%	9.131	-0.1%	9.131	-0.1%	9.132	-0.1%
	Annual	10.207	10.241	0.3%	10.230	0.2%	10.253	0.4%	10.250	0.4%	10.187	-0.2%	10.262	0.5%	10.195	-0.1%	10.195	-0.1%	10.199	-0.1%	10.196	-0.1%	10.195	-0.1%	10.196	-0.1%
1:25-Year Dry	Jan	3.203	3.202	0.0%	3.201	-0.1%	3.203	0.0%	3.216	0.4%	3.135	-2.1%	3.228	0.8%	3.199	-0.1%	3.198	-0.2%	3.230	0.8%	3.199	-0.1%	3.198	-0.2%	3.199	-0.1%
	Feb	2.950	2.949	0.0%	2.948	-0.1%	2.950	0.0%	2.956	0.2%	2.880	-2.4%	2.966	0.5%	2.945	-0.2%	2.944	-0.2%	2.955	0.2%	2.946	-0.1%	2.945	-0.2%	2.946	-0.1%
	Mar	2.550	2.549	0.0%	2.548	-0.1%	2.550	0.0%	2.554	0.2%	2.480	-2.7%	2.564	0.5%	2.545	-0.2%	2.544	-0.2%	2.545	-0.2%	2.546	-0.2%	2.545	-0.2%	2.546	-0.2%
	Apr	4.431	4.452	0.5%	4.451	0.5%	4.452	0.5%	4.496	1.5%	4.432	0.0%	4.505	1.7%	4.425	-0.1%	4.424	-0.2%	4.425	-0.1%	4.426	-0.1%	4.425	-0.1%	4.426	-0.1%
	May	12.010	12.080	0.6%	12.050	0.3%	12.110	0.8%	12.091	0.7%	12.040	0.2%	12.100	0.7%	12.000	-0.1%	12.000	-0.1%	12.000	-0.1%	12.000	-0.1%	12.000	-0.1%	12.000	-0.1%
	Jun	10.360	10.390	0.3%	10.380	0.2%	10.400	0.4%	10.373	0.1%	10.330	-0.3%	10.380	0.2%	10.340	-0.2%	10.340	-0.2%	10.340	-0.2%	10.340	-0.2%	10.340	-0.2%	10.340	-0.2%
	Jul	4.911	4.964	1.1%	4.949	0.8%	4.979	1.4%	4.944	0.7%	4.902	-0.2%	4.957	0.9%	4.904	-0.1%	4.904	-0.1%	4.905	-0.1%	4.905	-0.1%	4.905	-0.1%	4.906	-0.1%
	Aug	3.937	3.982	1.1%	3.972	0.9%	3.991	1.4%	3.965	0.7%	3.917	-0.5%	3.975	1.0%	3.931	-0.1%	3.931	-0.2%	3.932	-0.1%	3.932	-0.1%	3.932	-0.1%	3.932	-0.1%
	Sep	3.417	3.465	1.4%	3.455	1.1%	3.474	1.7%	3.460	1.2%	3.402	-0.4%	3.471	1.6%	3.411	-0.2%	3.411	-0.2%	3.412	-0.1%	3.412	-0.1%	3.412	-0.1%	3.413	-0.1%
	Oct	2.710	2.730	0.7%	2.724	0.5%	2.735	0.9%	2.746	1.3%	2.668	-1.5%	2.759	1.8%	2.705	-0.2%	2.704	-0.2%	2.705	-0.2%	2.706	-0.2%	2.705	-0.2%	2.706	-0.1%
	Nov	3.924	3.929	0.1%	3.925	0.0%	3.932	0.2%	3.945	0.5%	3.865	-1.5%	3.958	0.9%	3.918	-0.2%	3.918	-0.2%	3.918	-0.2%	3.919	-0.1%	3.918	-0.2%	3.919	-0.1%
	Dec	3.911	3.915	0.1%	3.911	0.0%	3.918	0.2%	3.928	0.4%	3.850	-1.6%	3.941	0.8%	3.905	-0.2%	3.904	-0.2%	3.905	-0.2%	3.906	-0.1%	3.905	-0.2%	3.906	-0.1%
	Annual	4.868	4.892	0.5%	4.885	0.3%	4.900	0.7%	4.898	0.6%	4.834	-0.7%	4.909	0.8%	4.861	-0.1%	4.860	-0.2%	4.864	-0.1%	4.861	-0.1%	4.861	-0.1%	4.862	-0.1%

Climate Scenario	Month	Existing Condition	Construction						Operations						Closure (Pit Filling)						Post-closure (after Pit Filling)					
			Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum	
		Flow (m^3/s)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)
1:25-Year Wet	Jan	9.154	9.152	0.0%	9.150	0.0%	9.154	0.0%	9.163	0.1%	9.083	-0.8%	9.175	0.2%	9.145	-0.1%	9.143	-0.1%	9.176	0.2%	9.145	-0.1%	9.144	-0.1%	9.145	-0.1%
	Feb	8.020	8.018	0.0%	8.016	0.0%	8.020	0.0%	8.022	0.0%	7.947	-0.9%	8.032	0.1%	8.011	-0.1%	8.010	-0.1%	8.021	0.0%	8.012	-0.1%	8.011	-0.1%	8.012	-0.1%
	Mar	6.726	6.724	0.0%	6.722	-0.1%	6.726	0.0%	6.727	0.0%	6.654	-1.1%	6.737	0.2%	6.717	-0.1%	6.717	-0.1%	6.718	-0.1%	6.719	-0.1%	6.718	-0.1%	6.719	-0.1%
	Apr	7.380	7.444	0.9%	7.419	0.5%	7.468	1.2%	7.496	1.6%	7.443	0.9%	7.513	1.8%	7.371	-0.1%	7.370	-0.1%	7.371	-0.1%	7.372	-0.1%	7.371	-0.1%	7.372	-0.1%
	May	24.220	24.355	0.6%	24.290	0.3%	24.420	0.8%	24.374	0.6%	24.340	0.5%	24.400	0.7%	24.190	-0.1%	24.190	-0.1%	24.190	-0.1%	24.200	-0.1%	24.190	-0.1%	24.200	-0.1%
	Jun	27.890	27.960	0.3%	27.930	0.1%	27.990	0.4%	27.953	0.2%	27.910	0.1%	27.970	0.3%	27.860	-0.1%	27.860	-0.1%	27.860	-0.1%	27.860	-0.1%	27.860	-0.1%	27.860	-0.1%
	Jul	20.720	20.835	0.6%	20.800	0.4%	20.870	0.7%	20.823	0.5%	20.790	0.3%	20.840	0.6%	20.700	-0.1%	20.700	-0.1%	20.700	-0.1%	20.700	-0.1%	20.700	-0.1%	20.700	-0.1%
	Aug	20.190	20.280	0.4%	20.260	0.3%	20.300	0.5%	20.271	0.4%	20.230	0.2%	20.280	0.4%	20.170	-0.1%	20.170	-0.1%	20.170	-0.1%	20.170	-0.1%	20.170	-0.1%	20.170	-0.1%
	Sep	15.720	15.810	0.6%	15.790	0.4%	15.830	0.7%	15.807	0.6%	15.760	0.3%	15.820	0.6%	15.700	-0.1%	15.700	-0.1%	15.700	-0.1%	15.700	-0.1%	15.700	-0.1%	15.700	-0.1%
	Oct	13.520	13.550	0.2%	13.540	0.1%	13.560	0.3%	13.559	0.3%	13.490	-0.2%	13.570	0.4%	13.500	-0.1%	13.500	-0.1%	13.500	-0.1%	13.500	-0.1%	13.500	-0.1%	13.500	-0.1%
	Nov	14.290	14.290	0.0%	14.290	0.0%	14.290	0.0%	14.306	0.1%	14.230	-0.4%	14.320	0.2%	14.280	-0.1%	14.280	-0.1%	14.280	-0.1%	14.280	-0.1%	14.280	-0.1%	14.280	-0.1%
	Dec	11.920	11.915	0.0%	11.910	-0.1%	11.920	0.0%	11.928	0.1%	11.850	-0.6%	11.940	0.2%	11.900	-0.2%	11.900	-0.2%	11.900	-0.2%	11.900	-0.2%	11.900	-0.2%	11.900	-0.2%
	Annual	15.022	15.071	0.3%	15.052	0.2%	15.089	0.4%	15.079	0.4%	15.020	0.0%	15.093	0.5%	15.004	-0.1%	15.004	-0.1%	15.008	-0.1%	15.005	-0.1%	15.004	-0.1%	15.006	-0.1%

Note:
Changes lower than 0.1% are shown as 0.0%.

Table A.3 Simulated Monthly Streamflows at Model Node QM04

Climate Scenario	Month	Existing Condition	Construction						Operations						Closure (Pit Filling)						Post-closure (after Pit Filling)					
			Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum	
		Flow (m^3/s)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)
Average	Jan	0.030	0.025	-16.6%	0.021	-31.9%	0.030	-1.3%	0.011	-63.7%	0.010	-65.7%	0.013	-57.9%	0.010	-65.8%	0.010	-65.9%	0.010	-65.7%	0.035	16.3%	0.032	6.7%	0.041	36.4%
	Feb	0.025	0.021	-18.9%	0.017	-34.1%	0.024	-3.8%	0.009	-63.7%	0.009	-65.5%	0.011	-58.1%	0.009	-65.7%	0.009	-65.8%	0.009	-65.6%	0.028	8.8%	0.025	0.2%	0.032	26.8%
	Mar	0.021	0.016	-21.2%	0.013	-36.2%	0.020	-6.2%	0.008	-63.6%	0.007	-65.4%	0.009	-58.4%	0.007	-65.5%	0.007	-65.6%	0.007	-65.4%	0.025	17.5%	0.023	8.2%	0.029	37.3%
	Apr	0.025	0.019	-23.7%	0.015	-38.5%	0.023	-8.8%	0.009	-63.8%	0.009	-65.5%	0.010	-58.6%	0.009	-65.7%	0.009	-65.8%	0.009	-65.5%	0.123	390.7%	0.120	380.2%	0.128	411.8%
	May	0.072	0.053	-26.1%	0.043	-40.8%	0.064	-11.4%	0.026	-64.2%	0.024	-66.1%	0.030	-58.8%	0.029	-60.2%	0.024	-66.2%	0.192	166.2%	0.193	168.0%	0.190	164.1%	0.199	176.0%
	Jun	0.071	0.051	-28.5%	0.040	-43.0%	0.061	-14.0%	0.025	-64.2%	0.024	-66.1%	0.029	-59.1%	0.026	-63.6%	0.024	-66.2%	0.094	32.9%	0.085	20.4%	0.082	14.9%	0.094	32.3%
	Jul	0.051	0.035	-30.9%	0.028	-45.3%	0.043	-16.5%	0.018	-64.2%	0.017	-66.0%	0.021	-59.3%	0.019	-61.8%	0.017	-66.1%	0.102	100.0%	0.092	81.4%	0.088	73.1%	0.102	99.2%
	Aug	0.045	0.030	-33.4%	0.024	-47.6%	0.037	-19.1%	0.016	-64.2%	0.016	-65.9%	0.018	-59.6%	0.017	-61.9%	0.015	-66.0%	0.088	93.1%	0.079	72.6%	0.074	63.7%	0.087	92.1%
	Sep	0.048	0.031	-35.8%	0.024	-49.8%	0.038	-21.7%	0.017	-64.2%	0.016	-65.9%	0.019	-59.8%	0.019	-61.2%	0.016	-66.1%	0.107	120.8%	0.098	102.9%	0.094	95.0%	0.106	119.8%
	Oct	0.048	0.030	-38.2%	0.023	-52.1%	0.036	-24.3%	0.017	-64.3%	0.016	-66.0%	0.019	-60.0%	0.018	-62.5%	0.016	-66.1%	0.082	70.8%	0.074	53.8%	0.070	46.3%	0.082	69.9%
	Nov	0.046	0.027	-40.6%	0.021	-54.4%	0.033	-26.9%	0.016	-64.3%	0.016	-65.9%	0.018	-60.3%	0.017	-63.8%	0.016	-66.1%	0.055	19.5%	0.047	2.7%	0.044	-4.7%	0.054	18.7%
	Dec	0.039	0.022	-43.0%	0.017	-56.6%	0.028	-29.4%	0.014	-64.3%	0.013	-65.9%	0.015	-60.5%	0.014	-63.6%	0.013	-66.0%	0.048	22.9%	0.041	4.8%	0.038	-3.2%	0.048	21.9%
	Annual	0.044	0.030	-30.9%	0.024	-45.3%	0.036	-16.5%	0.016	-64.1%	0.015	-65.9%	0.018	-59.3%	0.016	-62.9%	0.015	-66.0%	0.067	54.4%	0.077	76.2%	0.074	68.9%	0.084	91.9%
1:25-Year Dry	Jan	0.014	0.011	-16.6%	0.009	-31.9%	0.014	-1.2%	0.005	-63.2%	0.005	-64.8%	0.006	-57.9%	0.005	-65.0%	0.005	-65.2%	0.005	-64.8%	0.014	3.7%	0.005	-65.6%	0.027	96.4%
	Feb	0.013	0.010	-18.9%	0.008	-34.1%	0.012	-3.8%	0.005	-63.1%	0.004	-64.7%	0.005	-58.1%	0.004	-64.9%	0.004	-65.1%	0.004	-64.7%	0.011	-8.8%	0.004	-65.5%	0.021	67.1%
	Mar	0.011	0.009	-21.3%	0.007	-36.3%	0.010	-6.2%	0.004	-63.0%	0.004	-64.4%	0.005	-58.3%	0.004	-64.7%	0.004	-64.9%	0.004	-64.4%	0.010	-5.1%	0.004	-65.3%	0.019	75.2%
	Apr	0.019	0.014	-23.6%	0.012	-38.5%	0.017	-8.8%	0.007	-63.6%	0.007	-65.3%	0.008	-58.6%	0.007	-65.4%	0.007	-65.5%	0.007	-65.3%	0.034	78.8%	0.006	-65.8%	0.068	261.7%
	May	0.051	0.038	-26.1%	0.030	-40.8%	0.045	-11.4%	0.018	-64.1%	0.017	-66.0%	0.021	-58.8%	0.017	-66.0%	0.017	-66.1%	0.017	-66.0%	0.056	8.4%	0.017	-66.2%	0.105	103.7%
	Jun	0.044	0.032	-28.5%	0.025	-43.0%	0.038	-13.9%	0.016	-64.1%	0.015	-65.9%	0.018	-59.1%	0.015	-66.0%	0.015	-66.0%	0.015	-65.9%	0.021	-52.1%	0.015	-66.1%	0.030	-33.1%
	Jul	0.021	0.014	-30.9%	0.011	-45.3%	0.018	-16.5%	0.008	-63.7%	0.007	-65.4%	0.009	-59.3%	0.007	-65.5%	0.007	-65.6%	0.007	-65.4%	0.012	-41.0%	0.007	-65.9%	0.020	-4.6%
	Aug	0.017	0.011	-33.4%	0.009	-47.6%	0.014	-19.1%	0.006	-63.6%	0.006	-65.1%	0.007	-59.5%	0.006	-65.3%	0.006	-65.5%	0.006	-65.1%	0.011	-33.5%	0.006	-65.7%	0.019	12.8%
	Sep	0.015	0.009	-35.8%	0.007	-49.8%	0.011	-21.7%	0.005	-63.5%	0.005	-64.9%	0.006	-59.7%	0.005	-65.1%	0.005	-65.3%	0.005	-64.9%	0.019	32.1%	0.005	-65.6%	0.037	155.4%
	Oct	0.012	0.007	-38.2%	0.006	-52.1%	0.009	-24.3%	0.004	-63.2%	0.004	-64.5%	0.005	-59.9%	0.004	-64.8%	0.004	-65.0%	0.004	-64.6%	0.021	82.0%	0.004	-65.4%	0.042	263.4%
	Nov	0.017	0.010	-40.6%	0.008	-54.3%	0.012	-26.8%	0.006	-63.7%	0.006	-65.1%	0.007	-60.2%	0.006	-65.3%	0.006	-65.5%	0.006	-65.1%	0.018	7.5%	0.006	-65.7%	0.033	99.2%
	Dec	0.017	0.010	-43.0%	0.007	-56.6%	0.012	-29.4%	0.006	-63.7%	0.006	-65.1%	0.007	-60.4%	0.006	-65.3%	0.006	-65.4%	0.006	-65.1%	0.017	0.1%	0.006	-65.7%	0.030	82.5%
	Annual	0.021	0.015	-29.4%	0.012	-43.9%	0.018	-14.9%	0.008	-63.7%	0.007	-65.4%	0.008	-59.1%	0.007	-65.5%	0.007	-65.6%	0.007	-65.4%	0.020	-1.5%	0.007	-65.8%	0.038	81.5%

Climate Scenario	Month	Existing Condition	Construction						Operations						Closure (Pit Filling)						Post-closure (after Pit Filling)					
			Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum	
		Flow (m^3/s)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)
1:25-Year Wet	Jan	0.039	0.033	-16.6%	0.027	-31.9%	0.039	-1.3%	0.014	-63.9%	0.013	-65.8%	0.016	-57.9%	0.023	-41.6%	0.013	-65.9%	0.048	23.6%	0.039	-0.8%	0.036	-8.6%	0.045	15.9%
	Feb	0.034	0.028	-18.9%	0.023	-34.1%	0.033	-3.8%	0.012	-63.8%	0.012	-65.8%	0.014	-58.1%	0.019	-44.8%	0.012	-65.9%	0.038	11.2%	0.031	-9.5%	0.029	-16.2%	0.036	4.8%
	Mar	0.029	0.023	-21.2%	0.018	-36.3%	0.027	-6.2%	0.010	-63.8%	0.010	-65.6%	0.012	-58.4%	0.016	-42.7%	0.010	-65.8%	0.034	18.6%	0.028	-3.7%	0.026	-11.0%	0.032	11.8%
	Apr	0.032	0.024	-23.7%	0.019	-38.5%	0.029	-8.8%	0.011	-63.9%	0.011	-65.7%	0.013	-58.6%	0.058	84.3%	0.011	-65.8%	0.180	469.5%	0.171	441.6%	0.168	431.7%	0.177	462.2%
	May	0.104	0.076	-26.1%	0.061	-40.8%	0.092	-11.4%	0.037	-64.3%	0.035	-66.2%	0.043	-58.9%	0.107	3.5%	0.035	-66.2%	0.279	169.5%	0.269	159.9%	0.266	156.7%	0.276	166.7%
	Jun	0.119	0.085	-28.5%	0.068	-43.0%	0.103	-13.9%	0.043	-64.3%	0.040	-66.2%	0.049	-59.1%	0.077	-35.0%	0.040	-66.2%	0.163	36.6%	0.150	26.0%	0.146	22.7%	0.159	33.2%
	Jul	0.089	0.061	-30.9%	0.048	-45.3%	0.074	-16.5%	0.032	-64.3%	0.030	-66.2%	0.036	-59.3%	0.076	-14.2%	0.030	-66.2%	0.181	104.5%	0.168	89.4%	0.163	84.6%	0.177	99.8%
	Aug	0.086	0.057	-33.4%	0.045	-47.6%	0.070	-19.1%	0.031	-64.3%	0.029	-66.1%	0.035	-59.6%	0.068	-21.2%	0.029	-66.2%	0.157	82.1%	0.144	66.8%	0.140	62.0%	0.153	77.2%
	Sep	0.067	0.043	-35.8%	0.034	-49.8%	0.053	-21.7%	0.024	-64.3%	0.023	-66.1%	0.027	-59.8%	0.064	-4.0%	0.023	-66.1%	0.160	137.8%	0.147	119.1%	0.143	113.0%	0.156	132.2%
	Oct	0.058	0.036	-38.2%	0.028	-52.1%	0.044	-24.3%	0.021	-64.3%	0.020	-66.0%	0.023	-60.0%	0.045	-21.9%	0.020	-66.1%	0.104	79.9%	0.092	58.5%	0.088	51.7%	0.100	73.2%
	Nov	0.061	0.036	-40.6%	0.028	-54.3%	0.045	-26.9%	0.022	-64.4%	0.021	-66.0%	0.024	-60.3%	0.034	-44.6%	0.021	-66.1%	0.065	6.5%	0.053	-12.9%	0.050	-18.8%	0.061	0.0%
	Dec	0.051	0.029	-43.0%	0.022	-56.6%	0.036	-29.4%	0.018	-64.4%	0.017	-66.0%	0.020	-60.5%	0.029	-43.4%	0.017	-66.1%	0.056	10.7%	0.045	-10.8%	0.042	-17.2%	0.053	3.2%
	Annual	0.064	0.044	-30.8%	0.035	-45.2%	0.054	-16.4%	0.023	-64.2%	0.022	-66.1%	0.026	-59.3%	0.052	-19.6%	0.022	-66.1%	0.123	90.9%	0.112	74.2%	0.108	68.9%	0.119	85.7%

Note:
Changes lower than 0.1% are shown as 0.0%.

Table A.4 Simulated Monthly Streamflows at Model Node QM06

Climate Scenario	Month	Existing Condition	Construction						Operations						Closure (Pit Filling)						Post-closure (after Pit Filling)					
			Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum	
		Flow (m^3/s)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)
Average	Jan	7.168	7.161	-0.1%	7.155	-0.2%	7.167	0.0%	7.158	-0.1%	7.079	-1.2%	7.170	0.0%	7.140	-0.4%	7.138	-0.4%	7.171	0.0%	7.165	0.0%	7.162	-0.1%	7.170	0.0%
	Feb	5.971	5.965	-0.1%	5.959	-0.2%	5.970	0.0%	5.958	-0.2%	5.884	-1.5%	5.968	-0.1%	5.947	-0.4%	5.946	-0.4%	5.957	-0.2%	5.966	-0.1%	5.964	-0.1%	5.970	0.0%
	Mar	4.922	4.917	-0.1%	4.912	-0.2%	4.921	0.0%	4.912	-0.2%	4.839	-1.7%	4.921	0.0%	4.902	-0.4%	4.901	-0.4%	4.902	-0.4%	4.920	0.0%	4.918	-0.1%	4.924	0.0%
	Apr	5.890	5.924	0.6%	5.917	0.5%	5.931	0.7%	5.961	1.2%	5.903	0.2%	5.973	1.4%	5.866	-0.4%	5.866	-0.4%	5.867	-0.4%	5.981	1.5%	5.979	1.5%	5.986	1.6%
	May	16.970	17.050	0.5%	17.010	0.2%	17.090	0.7%	17.037	0.4%	16.990	0.1%	17.060	0.5%	16.904	-0.4%	16.900	-0.4%	17.070	0.6%	17.074	0.6%	17.070	0.6%	17.080	0.6%
	Jun	16.750	16.790	0.2%	16.780	0.2%	16.800	0.3%	16.753	0.0%	16.710	-0.2%	16.770	0.1%	16.692	-0.3%	16.690	-0.4%	16.760	0.1%	16.753	0.0%	16.750	0.0%	16.760	0.1%
	Jul	12.020	12.085	0.5%	12.070	0.4%	12.100	0.7%	12.054	0.3%	12.020	0.0%	12.070	0.4%	11.974	-0.4%	11.970	-0.4%	12.060	0.3%	12.052	0.3%	12.050	0.2%	12.060	0.3%
	Aug	10.730	10.780	0.5%	10.770	0.4%	10.790	0.6%	10.760	0.3%	10.710	-0.2%	10.770	0.4%	10.692	-0.4%	10.690	-0.4%	10.760	0.3%	10.753	0.2%	10.750	0.2%	10.760	0.3%
	Sep	11.390	11.440	0.4%	11.430	0.4%	11.450	0.5%	11.422	0.3%	11.370	-0.2%	11.430	0.4%	11.349	-0.4%	11.340	-0.4%	11.440	0.4%	11.426	0.3%	11.420	0.3%	11.440	0.4%
	Oct	11.320	11.330	0.1%	11.330	0.1%	11.330	0.1%	11.328	0.1%	11.250	-0.6%	11.340	0.2%	11.282	-0.3%	11.280	-0.4%	11.340	0.2%	11.335	0.1%	11.330	0.1%	11.340	0.2%
	Nov	10.770	10.755	-0.1%	10.750	-0.2%	10.760	-0.1%	10.758	-0.1%	10.680	-0.8%	10.770	0.0%	10.731	-0.4%	10.730	-0.4%	10.770	0.0%	10.762	-0.1%	10.760	-0.1%	10.770	0.0%
	Dec	9.211	9.197	-0.2%	9.194	-0.2%	9.199	-0.1%	9.200	-0.1%	9.124	-0.9%	9.211	0.0%	9.176	-0.4%	9.175	-0.4%	9.210	0.0%	9.204	-0.1%	9.201	-0.1%	9.210	0.0%
	Annual	10.284	10.308	0.2%	10.298	0.1%	10.318	0.3%	10.300	0.2%	10.238	-0.4%	10.313	0.3%	10.246	-0.4%	10.244	-0.4%	10.301	0.2%	10.308	0.2%	10.305	0.2%	10.314	0.3%
1:25-Year Dry	Jan	3.228	3.225	-0.1%	3.222	-0.2%	3.228	0.0%	3.232	0.1%	3.151	-2.4%	3.244	0.5%	3.215	-0.4%	3.213	-0.5%	3.245	0.5%	3.224	-0.1%	3.214	-0.4%	3.237	0.3%
	Feb	2.973	2.969	-0.1%	2.966	-0.2%	2.972	0.0%	2.971	-0.1%	2.895	-2.6%	2.981	0.3%	2.959	-0.5%	2.959	-0.5%	2.969	-0.1%	2.967	-0.2%	2.960	-0.4%	2.977	0.1%
	Mar	2.569	2.566	-0.1%	2.563	-0.2%	2.569	0.0%	2.567	-0.1%	2.493	-3.0%	2.577	0.3%	2.557	-0.5%	2.557	-0.5%	2.558	-0.4%	2.565	-0.2%	2.558	-0.4%	2.574	0.2%
	Apr	4.465	4.482	0.4%	4.479	0.3%	4.484	0.4%	4.518	1.2%	4.455	-0.2%	4.527	1.4%	4.446	-0.4%	4.446	-0.4%	4.447	-0.4%	4.475	0.2%	4.447	-0.4%	4.509	1.0%
	May	12.100	12.155	0.5%	12.130	0.2%	12.180	0.7%	12.151	0.4%	12.100	0.0%	12.160	0.5%	12.056	-0.4%	12.050	-0.4%	12.060	-0.3%	12.095	0.0%	12.060	-0.3%	12.140	0.3%
	Jun	10.430	10.455	0.2%	10.450	0.2%	10.460	0.3%	10.424	-0.1%	10.380	-0.5%	10.440	0.1%	10.390	-0.4%	10.390	-0.4%	10.390	-0.4%	10.400	-0.3%	10.390	-0.4%	10.410	-0.2%
	Jul	4.949	4.995	0.9%	4.983	0.7%	5.007	1.2%	4.968	0.4%	4.927	-0.4%	4.982	0.7%	4.928	-0.4%	4.928	-0.4%	4.929	-0.4%	4.934	-0.3%	4.929	-0.4%	4.942	-0.1%
	Aug	3.968	4.007	1.0%	3.999	0.8%	4.014	1.2%	3.984	0.4%	3.937	-0.8%	3.994	0.7%	3.951	-0.4%	3.950	-0.5%	3.951	-0.4%	3.957	-0.3%	3.951	-0.4%	3.965	-0.1%
	Sep	3.443	3.486	1.2%	3.478	1.0%	3.493	1.5%	3.477	1.0%	3.419	-0.7%	3.488	1.3%	3.428	-0.4%	3.428	-0.4%	3.429	-0.4%	3.443	0.0%	3.429	-0.4%	3.461	0.5%
	Oct	2.731	2.746	0.5%	2.742	0.4%	2.750	0.7%	2.760	1.0%	2.682	-1.8%	2.773	1.5%	2.718	-0.5%	2.718	-0.5%	2.719	-0.4%	2.736	0.2%	2.719	-0.4%	2.757	1.0%
	Nov	3.954	3.952	-0.1%	3.950	-0.1%	3.953	0.0%	3.965	0.3%	3.885	-1.7%	3.978	0.6%	3.937	-0.4%	3.937	-0.4%	3.938	-0.4%	3.951	-0.1%	3.938	-0.4%	3.966	0.3%
	Dec	3.941	3.938	-0.1%	3.936	-0.1%	3.939	-0.1%	3.948	0.2%	3.870	-1.8%	3.960	0.5%	3.924	-0.4%	3.923	-0.5%	3.924	-0.4%	3.936	-0.1%	3.924	-0.4%	3.950	0.2%
	Annual	4.904	4.923	0.4%	4.917	0.3%	4.929	0.5%	4.922	0.4%	4.858	-0.9%	4.934	0.6%	4.884	-0.4%	4.883	-0.4%	4.888	-0.3%	4.899	-0.1%	4.885	-0.4%	4.916	0.2%

Climate Scenario	Month	Existing Condition	Construction						Operations						Closure (Pit Filling)						Post-closure (after Pit Filling)					
			Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum	
		Flow (m^3/s)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)
1:25-Year Wet	Jan	9.225	9.216	-0.1%	9.208	-0.2%	9.224	0.0%	9.208	-0.2%	9.130	-1.0%	9.220	-0.1%	9.199	-0.3%	9.188	-0.4%	9.224	0.0%	9.215	-0.1%	9.212	-0.1%	9.221	0.0%
	Feb	8.082	8.073	-0.1%	8.066	-0.2%	8.080	0.0%	8.062	-0.2%	7.989	-1.2%	8.071	-0.1%	8.057	-0.3%	8.049	-0.4%	8.076	-0.1%	8.070	-0.1%	8.068	-0.2%	8.074	-0.1%
	Mar	6.778	6.770	-0.1%	6.764	-0.2%	6.776	0.0%	6.761	-0.3%	6.689	-1.3%	6.770	-0.1%	6.757	-0.3%	6.750	-0.4%	6.775	0.0%	6.769	-0.1%	6.767	-0.2%	6.773	-0.1%
	Apr	7.437	7.493	0.7%	7.473	0.5%	7.512	1.0%	7.533	1.3%	7.481	0.6%	7.550	1.5%	7.454	0.2%	7.406	-0.4%	7.576	1.9%	7.568	1.8%	7.565	1.7%	7.574	1.8%
	May	24.400	24.515	0.5%	24.470	0.3%	24.560	0.7%	24.491	0.4%	24.460	0.2%	24.520	0.5%	24.383	-0.1%	24.310	-0.4%	24.560	0.7%	24.546	0.6%	24.540	0.6%	24.550	0.6%
	Jun	28.100	28.140	0.1%	28.130	0.1%	28.150	0.2%	28.093	0.0%	28.060	-0.1%	28.110	0.0%	28.037	-0.2%	28.000	-0.4%	28.120	0.1%	28.106	0.0%	28.100	0.0%	28.120	0.1%
	Jul	20.880	20.965	0.4%	20.940	0.3%	20.990	0.5%	20.924	0.2%	20.890	0.0%	20.950	0.3%	20.846	-0.2%	20.800	-0.4%	20.950	0.3%	20.943	0.3%	20.940	0.3%	20.950	0.3%
	Aug	20.340	20.410	0.3%	20.400	0.3%	20.420	0.4%	20.372	0.2%	20.330	0.0%	20.390	0.2%	20.307	-0.2%	20.270	-0.3%	20.390	0.2%	20.383	0.2%	20.380	0.2%	20.390	0.2%
	Sep	15.840	15.910	0.4%	15.900	0.4%	15.920	0.5%	15.882	0.3%	15.840	0.0%	15.890	0.3%	15.822	-0.1%	15.780	-0.4%	15.920	0.5%	15.904	0.4%	15.900	0.4%	15.910	0.4%
	Oct	13.620	13.630	0.1%	13.630	0.1%	13.630	0.1%	13.629	0.1%	13.560	-0.4%	13.640	0.1%	13.595	-0.2%	13.570	-0.4%	13.650	0.2%	13.643	0.2%	13.640	0.1%	13.650	0.2%
	Nov	14.400	14.375	-0.2%	14.370	-0.2%	14.380	-0.1%	14.378	-0.2%	14.300	-0.7%	14.390	-0.1%	14.362	-0.3%	14.350	-0.3%	14.390	-0.1%	14.381	-0.1%	14.380	-0.1%	14.390	-0.1%
	Dec	12.010	11.985	-0.2%	11.980	-0.2%	11.990	-0.2%	11.988	-0.2%	11.910	-0.8%	12.000	-0.1%	11.972	-0.3%	11.960	-0.4%	12.000	-0.1%	11.991	-0.2%	11.990	-0.2%	12.000	-0.1%
	Annual	15.135	15.167	0.2%	15.154	0.1%	15.179	0.3%	15.153	0.1%	15.096	-0.3%	15.168	0.2%	15.109	-0.2%	15.079	-0.4%	15.179	0.3%	15.170	0.2%	15.167	0.2%	15.177	0.3%

Note:
Changes lower than 0.1% are shown as 0.0%.

Table A.5 Simulated Monthly Streamflows at Model Node QM07

Climate Scenario	Month	Existing Condition	Construction						Operations						Closure (Pit Filling)						Post-closure (after Pit Filling)					
			Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum	
		Flow (m^3/s)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)
Average	Jan	0.064	0.056	-11.9%	0.049	-22.9%	0.063	-0.9%	0.047	-26.3%	0.047	-26.7%	0.048	-25.7%	0.047	-26.8%	0.047	-27.0%	0.047	-26.7%	0.047	-27.3%	0.046	-27.4%	0.047	-27.0%
	Feb	0.053	0.046	-13.0%	0.041	-23.3%	0.052	-2.8%	0.039	-26.6%	0.039	-27.0%	0.039	-25.9%	0.039	-27.2%	0.039	-27.4%	0.039	-27.0%	0.039	-27.7%	0.038	-27.8%	0.039	-27.4%
	Mar	0.044	0.038	-14.2%	0.034	-23.7%	0.042	-4.7%	0.032	-26.9%	0.032	-27.4%	0.032	-26.2%	0.032	-27.6%	0.032	-27.9%	0.032	-27.4%	0.032	-28.2%	0.031	-28.4%	0.032	-27.9%
	Apr	0.053	0.045	-15.2%	0.040	-23.8%	0.049	-6.5%	0.039	-26.6%	0.038	-27.0%	0.039	-26.0%	0.038	-27.2%	0.038	-27.5%	0.038	-27.0%	0.038	-27.7%	0.038	-27.9%	0.038	-27.5%
	May	0.151	0.127	-15.8%	0.116	-23.4%	0.139	-8.3%	0.113	-25.5%	0.112	-25.8%	0.113	-25.1%	0.112	-25.8%	0.112	-25.9%	0.112	-25.8%	0.112	-26.0%	0.112	-26.0%	0.112	-25.9%
	Jun	0.150	0.124	-16.9%	0.114	-23.6%	0.134	-10.2%	0.111	-25.5%	0.111	-25.8%	0.112	-25.2%	0.111	-25.8%	0.111	-25.9%	0.111	-25.8%	0.111	-26.0%	0.111	-26.1%	0.111	-25.9%
	Jul	0.107	0.088	-18.1%	0.082	-24.0%	0.094	-12.1%	0.080	-25.8%	0.079	-26.0%	0.080	-25.4%	0.079	-26.2%	0.079	-26.3%	0.079	-26.0%	0.079	-26.4%	0.079	-26.5%	0.079	-26.3%
	Aug	0.096	0.077	-19.2%	0.073	-24.3%	0.082	-14.0%	0.071	-25.9%	0.071	-26.1%	0.071	-25.4%	0.071	-26.3%	0.070	-26.4%	0.071	-26.1%	0.070	-26.5%	0.070	-26.6%	0.070	-26.4%
	Sep	0.102	0.081	-20.2%	0.077	-24.5%	0.085	-15.9%	0.075	-25.8%	0.075	-26.0%	0.076	-25.4%	0.075	-26.2%	0.075	-26.3%	0.075	-26.1%	0.075	-26.4%	0.075	-26.5%	0.075	-26.3%
	Oct	0.101	0.080	-21.2%	0.076	-24.7%	0.083	-17.8%	0.075	-25.8%	0.075	-26.0%	0.075	-25.4%	0.075	-26.2%	0.074	-26.3%	0.075	-26.1%	0.074	-26.4%	0.074	-26.5%	0.074	-26.3%
	Nov	0.096	0.075	-22.3%	0.072	-25.0%	0.077	-19.7%	0.071	-25.9%	0.071	-26.1%	0.072	-25.5%	0.071	-26.3%	0.071	-26.4%	0.071	-26.1%	0.071	-26.5%	0.071	-26.6%	0.071	-26.4%
	Dec	0.082	0.063	-23.5%	0.061	-25.3%	0.064	-21.7%	0.061	-26.0%	0.061	-26.3%	0.061	-25.6%	0.060	-26.5%	0.060	-26.6%	0.061	-26.3%	0.060	-26.8%	0.060	-26.9%	0.060	-26.6%
	Annual	0.092	0.075	-18.1%	0.070	-24.1%	0.081	-12.1%	0.068	-25.9%	0.068	-26.2%	0.068	-25.5%	0.068	-26.3%	0.068	-26.4%	0.068	-26.2%	0.067	-26.6%	0.067	-26.7%	0.068	-26.4%
1:25-Year Dry	Jan	0.029	0.025	-12.3%	0.022	-23.6%	0.029	-1.0%	0.021	-28.0%	0.021	-28.5%	0.021	-27.0%	0.020	-29.0%	0.020	-29.4%	0.021	-28.6%	0.020	-29.9%	0.020	-30.1%	0.020	-29.4%
	Feb	0.027	0.023	-13.4%	0.020	-24.0%	0.026	-2.9%	0.019	-28.2%	0.019	-28.8%	0.019	-27.3%	0.019	-29.3%	0.019	-29.8%	0.019	-28.9%	0.018	-30.3%	0.018	-30.5%	0.019	-29.8%
	Mar	0.023	0.020	-14.7%	0.017	-24.5%	0.022	-4.8%	0.016	-28.8%	0.016	-29.5%	0.017	-27.7%	0.016	-30.0%	0.016	-30.5%	0.016	-29.5%	0.016	-31.1%	0.016	-31.4%	0.016	-30.5%
	Apr	0.040	0.034	-15.3%	0.030	-24.0%	0.037	-6.6%	0.029	-27.2%	0.029	-27.6%	0.029	-26.4%	0.029	-27.9%	0.029	-28.2%	0.029	-27.6%	0.028	-28.6%	0.028	-28.7%	0.029	-28.2%
	May	0.108	0.091	-15.9%	0.083	-23.5%	0.099	-8.3%	0.080	-25.8%	0.080	-26.0%	0.081	-25.3%	0.080	-26.1%	0.080	-26.2%	0.080	-26.0%	0.080	-26.4%	0.079	-26.4%	0.080	-26.3%
	Jun	0.093	0.077	-17.0%	0.071	-23.8%	0.084	-10.2%	0.069	-25.9%	0.069	-26.2%	0.069	-25.4%	0.069	-26.3%	0.069	-26.4%	0.069	-26.2%	0.068	-26.6%	0.068	-26.7%	0.069	-26.4%
	Jul	0.044	0.036	-18.5%	0.033	-24.7%	0.039	-12.4%	0.032	-26.9%	0.032	-27.4%	0.033	-26.3%	0.032	-27.6%	0.032	-27.9%	0.032	-27.4%	0.032	-28.2%	0.032	-28.4%	0.032	-27.9%
	Aug	0.035	0.028	-19.9%	0.026	-25.3%	0.030	-14.4%	0.026	-27.5%	0.026	-27.9%	0.026	-26.7%	0.025	-28.3%	0.025	-28.6%	0.026	-27.9%	0.025	-29.0%	0.025	-29.2%	0.025	-28.6%
	Sep	0.031	0.024	-21.2%	0.023	-25.8%	0.026	-16.5%	0.022	-27.8%	0.022	-28.4%	0.022	-27.1%	0.022	-28.7%	0.022	-29.1%	0.022	-28.4%	0.022	-29.6%	0.022	-29.8%	0.022	-29.2%
	Oct	0.024	0.019	-22.7%	0.018	-26.7%	0.020	-18.7%	0.017	-28.6%	0.017	-29.2%	0.018	-27.7%	0.017	-29.7%	0.017	-30.2%	0.017	-29.2%	0.017	-30.8%	0.017	-31.0%	0.017	-30.2%
	Nov	0.035	0.027	-23.2%	0.026	-26.2%	0.028	-20.3%	0.026	-27.5%	0.025	-27.9%	0.026	-26.8%	0.025	-28.3%	0.025	-28.6%	0.025	-27.9%	0.025	-29.0%	0.025	-29.2%	0.025	-28.6%
	Dec	0.035	0.027	-24.3%	0.026	-26.5%	0.027	-22.2%	0.025	-27.5%	0.025	-27.9%	0.026	-26.8%	0.025	-28.3%	0.025	-28.6%	0.025	-28.0%	0.025	-29.0%	0.025	-29.2%	0.025	-28.6%
	Annual	0.044	0.036	-17.9%	0.033	-24.6%	0.039	-11.2%	0.032	-27.0%	0.032	-27.4%	0.032	-26.3%	0.032	-27.7%	0.032	-27.9%	0.032	-27.4%	0.031	-28.3%	0.031	-28.4%	0.032	-27.9%

Climate Scenario	Month	Existing Condition	Construction						Operations						Closure (Pit Filling)						Post-closure (after Pit Filling)					
			Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum	
		Flow (m^3/s)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)
1:25-Year Wet	Jan	0.082	0.073	-11.9%	0.064	-22.8%	0.082	-0.9%	0.061	-26.0%	0.061	-26.3%	0.061	-25.4%	0.061	-26.5%	0.060	-26.6%	0.061	-26.3%	0.060	-26.8%	0.060	-26.9%	0.060	-26.6%
	Feb	0.072	0.063	-12.9%	0.055	-23.1%	0.070	-2.8%	0.053	-26.1%	0.053	-26.5%	0.054	-25.6%	0.053	-26.6%	0.053	-26.8%	0.053	-26.5%	0.053	-27.0%	0.053	-27.1%	0.053	-26.8%
	Mar	0.060	0.052	-14.0%	0.046	-23.4%	0.058	-4.6%	0.045	-26.4%	0.044	-26.7%	0.045	-25.8%	0.044	-26.9%	0.044	-27.1%	0.044	-26.8%	0.044	-27.4%	0.044	-27.5%	0.044	-27.1%
	Apr	0.066	0.056	-15.0%	0.051	-23.6%	0.062	-6.5%	0.049	-26.3%	0.049	-26.6%	0.049	-25.7%	0.049	-26.8%	0.048	-27.0%	0.049	-26.6%	0.048	-27.2%	0.048	-27.3%	0.048	-27.0%
	May	0.218	0.183	-15.8%	0.167	-23.3%	0.200	-8.3%	0.163	-25.3%	0.162	-25.6%	0.163	-25.0%	0.162	-25.6%	0.162	-25.7%	0.162	-25.6%	0.162	-25.7%	0.162	-25.8%	0.162	-25.7%
	Jun	0.251	0.209	-16.8%	0.192	-23.5%	0.225	-10.1%	0.187	-25.3%	0.187	-25.5%	0.188	-25.0%	0.187	-25.5%	0.187	-25.6%	0.187	-25.5%	0.186	-25.6%	0.186	-25.7%	0.187	-25.6%
	Jul	0.186	0.153	-17.9%	0.142	-23.8%	0.164	-12.1%	0.139	-25.4%	0.139	-25.6%	0.140	-25.1%	0.138	-25.7%	0.138	-25.8%	0.139	-25.6%	0.138	-25.9%	0.138	-25.9%	0.138	-25.8%
	Aug	0.182	0.147	-19.0%	0.138	-24.0%	0.156	-14.0%	0.135	-25.4%	0.135	-25.7%	0.136	-25.1%	0.135	-25.7%	0.135	-25.8%	0.135	-25.7%	0.135	-25.9%	0.135	-25.9%	0.135	-25.8%
	Sep	0.141	0.113	-20.1%	0.107	-24.3%	0.119	-15.9%	0.105	-25.6%	0.105	-25.8%	0.106	-25.2%	0.105	-25.9%	0.105	-26.0%	0.105	-25.8%	0.104	-26.1%	0.104	-26.2%	0.105	-26.0%
	Oct	0.122	0.096	-21.2%	0.092	-24.6%	0.100	-17.8%	0.090	-25.7%	0.090	-25.9%	0.091	-25.3%	0.090	-26.0%	0.090	-26.1%	0.090	-25.9%	0.090	-26.3%	0.090	-26.3%	0.090	-26.1%
	Nov	0.129	0.100	-22.2%	0.097	-24.8%	0.103	-19.6%	0.096	-25.6%	0.095	-25.9%	0.096	-25.3%	0.095	-26.0%	0.095	-26.0%	0.095	-25.9%	0.095	-26.2%	0.095	-26.2%	0.095	-26.1%
	Dec	0.107	0.082	-23.4%	0.080	-25.2%	0.084	-21.6%	0.080	-25.8%	0.079	-26.1%	0.080	-25.5%	0.079	-26.2%	0.079	-26.3%	0.079	-26.1%	0.079	-26.4%	0.079	-26.5%	0.079	-26.3%
	Annual	0.135	0.111	-17.9%	0.103	-23.9%	0.119	-12.0%	0.101	-25.6%	0.100	-25.8%	0.101	-25.2%	0.100	-25.9%	0.100	-26.0%	0.100	-25.8%	0.100	-26.1%	0.100	-26.2%	0.100	-26.0%

Note:
Changes lower than 0.1% are shown as 0.0%.

Table A.6 Simulated Monthly Streamflows at Model Node QM08

Climate Scenario	Month	Existing Condition	Construction						Operations						Closure (Pit Filling)						Post-closure (after Pit Filling)					
			Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum	
		Flow (m^3/s)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)
Average	Jan	10.690	10.670	-0.2%	10.660	-0.3%	10.680	-0.1%	10.659	-0.3%	10.580	-1.0%	10.670	-0.2%	10.641	-0.5%	10.640	-0.5%	10.670	-0.2%	10.664	-0.2%	10.660	-0.3%	10.670	-0.2%
	Feb	8.901	8.888	-0.1%	8.877	-0.3%	8.899	0.0%	8.874	-0.3%	8.801	-1.1%	8.884	-0.2%	8.862	-0.4%	8.862	-0.4%	8.872	-0.3%	8.882	-0.2%	8.880	-0.2%	8.886	-0.2%
	Mar	7.338	7.326	-0.2%	7.317	-0.3%	7.334	-0.1%	7.315	-0.3%	7.243	-1.3%	7.325	-0.2%	7.305	-0.4%	7.305	-0.4%	7.305	-0.4%	7.323	-0.2%	7.321	-0.2%	7.327	-0.1%
	Apr	8.781	8.807	0.3%	8.804	0.3%	8.809	0.3%	8.838	0.6%	8.780	0.0%	8.849	0.8%	8.742	-0.4%	8.742	-0.4%	8.743	-0.4%	8.857	0.9%	8.855	0.8%	8.862	0.9%
	May	25.300	25.355	0.2%	25.330	0.1%	25.380	0.3%	25.327	0.1%	25.280	-0.1%	25.350	0.2%	25.194	-0.4%	25.190	-0.4%	25.360	0.2%	25.363	0.2%	25.360	0.2%	25.370	0.3%
	Jun	24.980	24.985	0.0%	24.980	0.0%	24.990	0.0%	24.941	-0.2%	24.900	-0.3%	24.950	-0.1%	24.872	-0.4%	24.870	-0.4%	24.950	-0.1%	24.935	-0.2%	24.930	-0.2%	24.940	-0.2%
	Jul	17.920	17.960	0.2%	17.950	0.2%	17.970	0.3%	17.931	0.1%	17.890	-0.2%	17.940	0.1%	17.852	-0.4%	17.850	-0.4%	17.930	0.1%	17.923	0.0%	17.920	0.0%	17.930	0.1%
	Aug	16.000	16.035	0.2%	16.030	0.2%	16.040	0.2%	16.000	0.0%	15.950	-0.3%	16.010	0.1%	15.932	-0.4%	15.930	-0.4%	16.000	0.0%	15.994	0.0%	15.990	-0.1%	16.000	0.0%
	Sep	16.980	17.010	0.2%	17.010	0.2%	17.010	0.2%	16.983	0.0%	16.930	-0.3%	16.990	0.1%	16.912	-0.4%	16.910	-0.4%	17.000	0.1%	16.992	0.1%	16.990	0.1%	17.000	0.1%
	Oct	16.880	16.865	-0.1%	16.860	-0.1%	16.870	-0.1%	16.858	-0.1%	16.780	-0.6%	16.870	-0.1%	16.812	-0.4%	16.810	-0.4%	16.870	-0.1%	16.865	-0.1%	16.860	-0.1%	16.870	-0.1%
	Nov	16.060	16.015	-0.3%	16.010	-0.3%	16.020	-0.2%	16.018	-0.3%	15.940	-0.7%	16.030	-0.2%	15.991	-0.4%	15.990	-0.4%	16.030	-0.2%	16.023	-0.2%	16.020	-0.2%	16.030	-0.2%
	Dec	13.730	13.695	-0.3%	13.690	-0.3%	13.700	-0.2%	13.699	-0.2%	13.620	-0.8%	13.710	-0.1%	13.671	-0.4%	13.670	-0.4%	13.710	-0.1%	13.703	-0.2%	13.700	-0.2%	13.710	-0.1%
	Annual	15.334	15.338	0.0%	15.330	0.0%	15.346	0.1%	15.324	-0.1%	15.262	-0.5%	15.335	0.0%	15.269	-0.4%	15.268	-0.4%	15.324	-0.1%	15.331	0.0%	15.328	0.0%	15.337	0.0%
1:25-Year Dry	Jan	4.812	4.805	-0.1%	4.799	-0.3%	4.811	0.0%	4.808	-0.1%	4.728	-1.7%	4.820	0.2%	4.790	-0.5%	4.789	-0.5%	4.821	0.2%	4.799	-0.3%	4.790	-0.5%	4.812	0.0%
	Feb	4.431	4.424	-0.2%	4.418	-0.3%	4.430	0.0%	4.421	-0.2%	4.346	-1.9%	4.431	0.0%	4.410	-0.5%	4.410	-0.5%	4.420	-0.2%	4.418	-0.3%	4.410	-0.5%	4.427	-0.1%
	Mar	3.830	3.823	-0.2%	3.818	-0.3%	3.828	-0.1%	3.821	-0.2%	3.747	-2.2%	3.831	0.0%	3.811	-0.5%	3.811	-0.5%	3.811	-0.5%	3.818	-0.3%	3.811	-0.5%	3.827	-0.1%
	Apr	6.656	6.667	0.2%	6.661	0.1%	6.672	0.2%	6.698	0.6%	6.635	-0.3%	6.707	0.8%	6.626	-0.5%	6.626	-0.5%	6.626	-0.5%	6.654	0.0%	6.626	-0.5%	6.689	0.5%
	May	18.040	18.080	0.2%	18.060	0.1%	18.100	0.3%	18.062	0.1%	18.010	-0.2%	18.080	0.2%	17.970	-0.4%	17.970	-0.4%	17.970	-0.4%	18.005	-0.2%	17.970	-0.4%	18.050	0.1%
	Jun	15.560	15.560	0.0%	15.560	0.0%	15.560	0.0%	15.523	-0.2%	15.480	-0.5%	15.530	-0.2%	15.490	-0.4%	15.490	-0.4%	15.490	-0.4%	15.499	-0.4%	15.490	-0.4%	15.510	-0.3%
	Jul	7.378	7.416	0.5%	7.406	0.4%	7.425	0.6%	7.385	0.1%	7.344	-0.5%	7.399	0.3%	7.345	-0.4%	7.345	-0.4%	7.345	-0.4%	7.351	-0.4%	7.345	-0.4%	7.359	-0.3%
	Aug	5.914	5.947	0.5%	5.941	0.5%	5.952	0.6%	5.921	0.1%	5.874	-0.7%	5.931	0.3%	5.887	-0.5%	5.887	-0.5%	5.888	-0.4%	5.893	-0.3%	5.888	-0.4%	5.901	-0.2%
	Sep	5.133	5.168	0.7%	5.162	0.6%	5.174	0.8%	5.157	0.5%	5.101	-0.6%	5.168	0.7%	5.109	-0.5%	5.108	-0.5%	5.109	-0.5%	5.124	-0.2%	5.109	-0.5%	5.142	0.2%
	Oct	4.070	4.080	0.2%	4.077	0.2%	4.083	0.3%	4.092	0.5%	4.015	-1.4%	4.105	0.9%	4.051	-0.5%	4.050	-0.5%	4.051	-0.5%	4.068	0.0%	4.051	-0.5%	4.089	0.5%
	Nov	5.894	5.884	-0.2%	5.883	-0.2%	5.884	-0.2%	5.895	0.0%	5.816	-1.3%	5.908	0.2%	5.867	-0.5%	5.867	-0.5%	5.868	-0.4%	5.881	-0.2%	5.868	-0.4%	5.896	0.0%
	Dec	5.874	5.863	-0.2%	5.862	-0.2%	5.863	-0.2%	5.872	0.0%	5.794	-1.4%	5.884	0.2%	5.848	-0.5%	5.847	-0.5%	5.848	-0.4%	5.859	-0.3%	5.848	-0.4%	5.873	0.0%
	Annual	7.312	7.322	0.1%	7.317	0.1%	7.328	0.2%	7.317	0.1%	7.253	-0.8%	7.329	0.2%	7.279	-0.4%	7.279	-0.4%	7.283	-0.4%	7.293	-0.3%	7.280	-0.4%	7.310	0.0%

Climate Scenario	Month	Existing Condition	Construction						Operations						Closure (Pit Filling)						Post-closure (after Pit Filling)					
			Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum	
		Flow (m^3/s)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)
1:25-Year Wet	Jan	13.750	13.735	-0.1%	13.720	-0.2%	13.750	0.0%	13.713	-0.3%	13.640	-0.8%	13.730	-0.1%	13.702	-0.3%	13.690	-0.4%	13.730	-0.1%	13.721	-0.2%	13.720	-0.2%	13.730	-0.1%
	Feb	12.050	12.030	-0.2%	12.020	-0.2%	12.040	-0.1%	12.012	-0.3%	11.940	-0.9%	12.020	-0.2%	12.006	-0.4%	12.000	-0.4%	12.020	-0.2%	12.016	-0.3%	12.010	-0.3%	12.020	-0.2%
	Mar	10.100	10.090	-0.1%	10.080	-0.2%	10.100	0.0%	10.072	-0.3%	9.999	-1.0%	10.080	-0.2%	10.066	-0.3%	10.060	-0.4%	10.080	-0.2%	10.080	-0.2%	10.080	-0.2%	10.080	-0.2%
	Apr	11.090	11.135	0.4%	11.120	0.3%	11.150	0.5%	11.164	0.7%	11.110	0.2%	11.180	0.8%	11.088	0.0%	11.040	-0.5%	11.210	1.1%	11.200	1.0%	11.200	1.0%	11.210	1.1%
	May	36.380	36.460	0.2%	36.430	0.1%	36.490	0.3%	36.417	0.1%	36.380	0.0%	36.450	0.2%	36.304	-0.2%	36.230	-0.4%	36.480	0.3%	36.471	0.2%	36.470	0.2%	36.480	0.3%
	Jun	41.900	41.895	0.0%	41.890	0.0%	41.900	0.0%	41.823	-0.2%	41.790	-0.3%	41.840	-0.1%	41.765	-0.3%	41.720	-0.4%	41.850	-0.1%	41.835	-0.2%	41.830	-0.2%	41.840	-0.1%
	Jul	31.130	31.180	0.2%	31.170	0.1%	31.190	0.2%	31.126	0.0%	31.100	-0.1%	31.150	0.1%	31.046	-0.3%	31.000	-0.4%	31.150	0.1%	31.143	0.0%	31.140	0.0%	31.150	0.1%
	Aug	30.330	30.360	0.1%	30.360	0.1%	30.360	0.1%	30.308	-0.1%	30.270	-0.2%	30.320	0.0%	30.245	-0.3%	30.200	-0.4%	30.330	0.0%	30.322	0.0%	30.320	0.0%	30.330	0.0%
	Sep	23.610	23.655	0.2%	23.650	0.2%	23.660	0.2%	23.622	0.0%	23.570	-0.2%	23.630	0.1%	23.560	-0.2%	23.520	-0.4%	23.650	0.2%	23.643	0.1%	23.640	0.1%	23.650	0.2%
	Oct	20.310	20.290	-0.1%	20.280	-0.1%	20.300	0.0%	20.279	-0.2%	20.210	-0.5%	20.290	-0.1%	20.247	-0.3%	20.220	-0.4%	20.310	0.0%	20.294	-0.1%	20.290	-0.1%	20.300	0.0%
	Nov	21.470	21.420	-0.2%	21.410	-0.3%	21.430	-0.2%	21.409	-0.3%	21.330	-0.7%	21.420	-0.2%	21.393	-0.4%	21.380	-0.4%	21.430	-0.2%	21.414	-0.3%	21.410	-0.3%	21.420	-0.2%
	Dec	17.900	17.855	-0.3%	17.850	-0.3%	17.860	-0.2%	17.851	-0.3%	17.780	-0.7%	17.860	-0.2%	17.840	-0.3%	17.830	-0.4%	17.870	-0.2%	17.855	-0.3%	17.850	-0.3%	17.860	-0.2%
	Annual	22.565	22.573	0.0%	22.562	0.0%	22.583	0.1%	22.547	-0.1%	22.491	-0.3%	22.561	0.0%	22.502	-0.3%	22.471	-0.4%	22.573	0.0%	22.563	0.0%	22.561	0.0%	22.570	0.0%

Note:
Changes lower than 0.1% are shown as 0.0%.

Table A.7 Simulated Monthly Streamflows at Model Node QM09

Climate Scenario	Month	Existing Condition	Construction						Operations						Closure (Pit Filling)						Post-closure (after Pit Filling)					
			Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum	
		Flow (m^3/s)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)
Average	Jan	0.040	0.040	-0.2%	0.040	-0.4%	0.040	0.0%	0.037	-6.9%	0.036	-10.2%	0.040	-0.8%	0.037	-7.0%	0.036	-9.4%	0.038	-4.6%	0.039	-1.5%	0.038	-4.5%	0.040	-0.2%
	Feb	0.033	0.033	-0.3%	0.033	-0.5%	0.033	-0.1%	0.031	-8.4%	0.029	-12.3%	0.033	-1.0%	0.031	-8.4%	0.030	-11.3%	0.031	-5.5%	0.033	-1.9%	0.032	-5.3%	0.033	-0.3%
	Mar	0.027	0.027	-0.4%	0.027	-0.7%	0.027	-0.1%	0.025	-10.2%	0.023	-14.9%	0.027	-1.3%	0.025	-10.1%	0.024	-13.6%	0.026	-6.7%	0.027	-2.2%	0.026	-6.5%	0.027	-0.4%
	Apr	0.033	0.033	-0.4%	0.033	-0.6%	0.033	-0.1%	0.030	-8.6%	0.029	-12.5%	0.032	-1.2%	0.030	-8.5%	0.029	-11.4%	0.031	-5.6%	0.032	-1.9%	0.031	-5.4%	0.033	-0.3%
	May	0.095	0.095	-0.1%	0.094	-0.2%	0.095	-0.1%	0.092	-3.0%	0.091	-4.3%	0.094	-0.5%	0.092	-2.9%	0.091	-3.9%	0.093	-1.9%	0.094	-0.6%	0.093	-1.9%	0.095	-0.1%
	Jun	0.093	0.093	-0.2%	0.093	-0.2%	0.093	-0.1%	0.091	-3.1%	0.089	-4.4%	0.093	-0.5%	0.091	-3.0%	0.090	-4.0%	0.092	-1.9%	0.093	-0.7%	0.092	-1.9%	0.093	-0.1%
	Jul	0.067	0.067	-0.2%	0.067	-0.3%	0.067	-0.1%	0.064	-4.3%	0.063	-6.1%	0.067	-0.7%	0.064	-4.1%	0.063	-5.5%	0.065	-2.7%	0.066	-0.9%	0.065	-2.6%	0.067	-0.1%
	Aug	0.060	0.060	-0.3%	0.060	-0.4%	0.060	-0.2%	0.057	-4.8%	0.056	-6.8%	0.059	-0.9%	0.057	-4.6%	0.056	-6.2%	0.058	-3.0%	0.059	-1.0%	0.058	-2.9%	0.060	-0.2%
	Sep	0.064	0.063	-0.3%	0.063	-0.4%	0.063	-0.2%	0.061	-4.6%	0.059	-6.4%	0.063	-0.9%	0.061	-4.3%	0.060	-5.8%	0.062	-2.8%	0.063	-0.9%	0.062	-2.8%	0.063	-0.2%
	Oct	0.063	0.063	-0.3%	0.063	-0.4%	0.063	-0.2%	0.060	-4.6%	0.059	-6.4%	0.063	-0.9%	0.060	-4.4%	0.059	-5.9%	0.061	-2.9%	0.063	-0.9%	0.061	-2.8%	0.063	-0.2%
	Nov	0.060	0.060	-0.4%	0.060	-0.5%	0.060	-0.2%	0.057	-4.9%	0.056	-6.8%	0.059	-1.0%	0.057	-4.6%	0.056	-6.2%	0.058	-3.0%	0.059	-1.0%	0.058	-2.9%	0.060	-0.2%
	Dec	0.051	0.051	-0.4%	0.051	-0.6%	0.051	-0.3%	0.048	-5.7%	0.047	-7.9%	0.051	-1.2%	0.049	-5.3%	0.048	-7.2%	0.050	-3.5%	0.051	-1.1%	0.050	-3.4%	0.051	-0.2%
	Annual	0.057	0.057	-0.3%	0.057	-0.4%	0.057	-0.1%	0.054	-5.0%	0.053	-7.1%	0.057	-0.8%	0.055	-4.8%	0.054	-6.5%	0.056	-3.2%	0.057	-1.1%	0.056	-3.1%	0.057	-0.2%
1:25-Year Dry	Jan	0.018	0.018	-0.5%	0.018	-0.9%	0.018	-0.1%	0.015	-15.4%	0.014	-22.7%	0.018	-1.7%	0.015	-15.5%	0.014	-20.8%	0.016	-10.2%	0.017	-3.5%	0.016	-9.9%	0.018	-0.6%
	Feb	0.017	0.016	-0.5%	0.016	-1.0%	0.017	-0.1%	0.014	-16.8%	0.012	-24.7%	0.016	-2.1%	0.014	-16.8%	0.013	-22.6%	0.015	-11.0%	0.016	-3.7%	0.015	-10.7%	0.016	-0.5%
	Mar	0.014	0.014	-0.7%	0.014	-1.3%	0.014	-0.2%	0.012	-19.6%	0.010	-28.6%	0.014	-2.6%	0.012	-19.4%	0.011	-26.1%	0.012	-12.8%	0.014	-4.3%	0.013	-12.4%	0.014	-0.7%
	Apr	0.025	0.025	-0.5%	0.025	-0.8%	0.025	-0.2%	0.022	-11.3%	0.021	-16.4%	0.025	-1.6%	0.022	-11.2%	0.021	-15.0%	0.023	-7.3%	0.024	-2.5%	0.023	-7.1%	0.025	-0.4%
	May	0.068	0.067	-0.2%	0.067	-0.3%	0.067	-0.1%	0.065	-4.2%	0.063	-6.0%	0.067	-0.6%	0.065	-4.1%	0.064	-5.5%	0.066	-2.7%	0.067	-0.9%	0.066	-2.6%	0.067	-0.1%
	Jun	0.058	0.058	-0.2%	0.058	-0.4%	0.058	-0.1%	0.055	-4.9%	0.054	-7.0%	0.058	-0.8%	0.055	-4.8%	0.054	-6.4%	0.056	-3.1%	0.058	-1.0%	0.056	-3.0%	0.058	-0.2%
	Jul	0.028	0.027	-0.6%	0.027	-0.8%	0.028	-0.3%	0.025	-10.4%	0.024	-14.8%	0.027	-1.8%	0.025	-10.0%	0.024	-13.5%	0.026	-6.6%	0.027	-2.2%	0.026	-6.4%	0.028	-0.4%
	Aug	0.022	0.022	-0.7%	0.022	-1.1%	0.022	-0.4%	0.019	-13.0%	0.018	-18.4%	0.022	-2.3%	0.019	-12.5%	0.018	-16.8%	0.020	-8.2%	0.022	-2.7%	0.020	-7.9%	0.022	-0.5%
	Sep	0.019	0.019	-1.0%	0.019	-1.4%	0.019	-0.6%	0.016	-15.1%	0.015	-21.2%	0.019	-2.8%	0.016	-14.4%	0.015	-19.4%	0.017	-9.4%	0.019	-3.1%	0.017	-9.2%	0.019	-0.5%
	Oct	0.015	0.015	-1.3%	0.015	-1.8%	0.015	-0.8%	0.012	-19.2%	0.011	-26.7%	0.015	-3.8%	0.012	-18.1%	0.012	-24.4%	0.013	-11.9%	0.015	-4.0%	0.013	-11.6%	0.015	-0.7%
	Nov	0.022	0.022	-0.9%	0.022	-1.3%	0.022	-0.6%	0.019	-13.3%	0.018	-18.4%	0.021	-2.7%	0.019	-12.5%	0.018	-16.8%	0.020	-8.2%	0.021	-2.7%	0.020	-7.9%	0.022	-0.5%
	Dec	0.022	0.022	-1.0%	0.022	-1.4%	0.022	-0.7%	0.019	-13.5%	0.018	-18.5%	0.021	-2.9%	0.019	-12.5%	0.018	-16.9%	0.020	-8.2%	0.021	-2.7%	0.020	-8.0%	0.022	-0.5%
	Annual	0.027	0.027	-0.5%	0.027	-0.8%	0.027	-0.3%	0.024	-10.5%	0.023	-14.9%	0.027	-1.7%	0.025	-10.1%	0.024	-13.6%	0.026	-6.6%	0.027	-2.2%	0.026	-6.5%	0.027	-0.4%

Climate Scenario	Month	Existing Condition	Construction						Operations						Closure (Pit Filling)						Post-closure (after Pit Filling)					
			Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum	
		Flow (m^3/s)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)
1:25-Year Wet	Jan	0.051	0.051	-0.2%	0.051	-0.3%	0.051	0.0%	0.049	-5.4%	0.047	-7.9%	0.051	-0.6%	0.049	-5.4%	0.048	-7.3%	0.050	-3.6%	0.051	-1.2%	0.050	-3.5%	0.051	-0.2%
	Feb	0.045	0.045	-0.2%	0.045	-0.4%	0.045	0.0%	0.042	-6.2%	0.041	-9.1%	0.045	-0.8%	0.042	-6.2%	0.041	-8.3%	0.043	-4.1%	0.044	-1.4%	0.043	-3.9%	0.045	-0.2%
	Mar	0.038	0.038	-0.3%	0.038	-0.5%	0.038	-0.1%	0.035	-7.4%	0.034	-10.8%	0.037	-1.0%	0.035	-7.4%	0.034	-9.9%	0.036	-4.8%	0.037	-1.6%	0.036	-4.7%	0.038	-0.3%
	Apr	0.041	0.041	-0.3%	0.041	-0.5%	0.041	-0.1%	0.039	-6.8%	0.037	-9.8%	0.041	-0.9%	0.039	-6.7%	0.038	-9.0%	0.040	-4.4%	0.041	-1.5%	0.040	-4.3%	0.041	-0.2%
	May	0.136	0.136	-0.1%	0.136	-0.1%	0.136	0.0%	0.133	-2.1%	0.132	-3.0%	0.136	-0.3%	0.133	-2.0%	0.132	-2.7%	0.134	-1.3%	0.136	-0.4%	0.134	-1.2%	0.136	-0.1%
	Jun	0.157	0.157	-0.1%	0.157	-0.2%	0.157	-0.1%	0.154	-1.9%	0.153	-2.6%	0.156	-0.3%	0.154	-1.8%	0.153	-2.4%	0.155	-1.2%	0.156	-0.4%	0.155	-1.1%	0.157	-0.1%
	Jul	0.117	0.116	-0.2%	0.116	-0.3%	0.116	-0.1%	0.114	-2.5%	0.112	-3.5%	0.116	-0.4%	0.114	-2.4%	0.113	-3.2%	0.115	-1.5%	0.116	-0.5%	0.115	-1.5%	0.116	-0.1%
	Aug	0.114	0.113	-0.2%	0.113	-0.3%	0.113	-0.1%	0.111	-2.6%	0.109	-3.6%	0.113	-0.4%	0.111	-2.4%	0.110	-3.3%	0.112	-1.6%	0.113	-0.5%	0.112	-1.6%	0.113	-0.1%
	Sep	0.088	0.088	-0.2%	0.088	-0.3%	0.088	-0.1%	0.085	-3.3%	0.084	-4.6%	0.088	-0.6%	0.086	-3.1%	0.085	-4.2%	0.087	-2.0%	0.088	-0.7%	0.087	-2.0%	0.088	-0.1%
	Oct	0.076	0.076	-0.3%	0.076	-0.4%	0.076	-0.2%	0.073	-3.9%	0.072	-5.4%	0.075	-0.8%	0.073	-3.6%	0.072	-4.9%	0.074	-2.4%	0.075	-0.8%	0.074	-2.3%	0.076	-0.1%
	Nov	0.080	0.080	-0.3%	0.080	-0.3%	0.080	-0.2%	0.077	-3.6%	0.076	-5.0%	0.080	-0.7%	0.078	-3.4%	0.077	-4.6%	0.079	-2.2%	0.080	-0.7%	0.079	-2.2%	0.080	-0.1%
	Dec	0.067	0.067	-0.3%	0.067	-0.4%	0.067	-0.2%	0.064	-4.4%	0.063	-6.1%	0.066	-1.0%	0.064	-4.1%	0.063	-5.5%	0.065	-2.7%	0.066	-0.9%	0.065	-2.6%	0.067	-0.1%
	Annual	0.084	0.084	-0.2%	0.084	-0.3%	0.084	-0.1%	0.082	-3.4%	0.080	-4.8%	0.084	-0.6%	0.082	-3.3%	0.081	-4.4%	0.083	-2.2%	0.084	-0.7%	0.083	-2.1%	0.084	-0.1%

Note:
Changes lower than 0.1% are shown as 0.0%.

Table A.8 Simulated Monthly Streamflows at Model Node QM11

Climate Scenario	Month	Existing Condition	Construction						Operations						Closure (Pit Filling)						Post-closure (after Pit Filling)					
			Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum	
		Flow (m^3/s)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)
Average	Jan	0.439	0.432	-1.7%	0.425	-3.3%	0.439	-0.1%	0.422	-3.8%	0.422	-3.9%	0.423	-3.7%	0.422	-3.9%	0.422	-3.9%	0.422	-3.9%	0.422	-4.0%	0.422	-4.0%	0.422	-3.9%
	Feb	0.366	0.359	-1.9%	0.354	-3.4%	0.364	-0.4%	0.352	-3.9%	0.352	-3.9%	0.352	-3.8%	0.351	-4.0%	0.351	-4.0%	0.352	-3.9%	0.351	-4.0%	0.351	-4.1%	0.351	-4.0%
	Mar	0.302	0.295	-2.1%	0.291	-3.4%	0.300	-0.7%	0.290	-3.9%	0.290	-4.0%	0.290	-3.8%	0.289	-4.0%	0.289	-4.1%	0.290	-4.0%	0.289	-4.1%	0.289	-4.1%	0.289	-4.1%
	Apr	0.361	0.353	-2.2%	0.348	-3.5%	0.358	-0.9%	0.347	-3.9%	0.347	-3.9%	0.347	-3.8%	0.347	-4.0%	0.347	-4.0%	0.347	-3.9%	0.346	-4.0%	0.346	-4.0%	0.347	-4.0%
	May	1.040	1.016	-2.4%	1.004	-3.5%	1.027	-1.3%	1.001	-3.7%	1.001	-3.8%	1.002	-3.7%	1.001	-3.8%	1.001	-3.8%	1.001	-3.8%	1.000	-3.8%	1.000	-3.8%	1.001	-3.8%
	Jun	1.027	1.001	-2.5%	0.991	-3.5%	1.011	-1.6%	0.989	-3.7%	0.988	-3.8%	0.989	-3.7%	0.988	-3.8%	0.988	-3.8%	0.988	-3.8%	0.988	-3.8%	0.988	-3.8%	0.988	-3.8%
	Jul	0.737	0.717	-2.6%	0.711	-3.5%	0.724	-1.8%	0.709	-3.8%	0.709	-3.8%	0.710	-3.7%	0.709	-3.8%	0.709	-3.8%	0.709	-3.8%	0.708	-3.8%	0.708	-3.9%	0.709	-3.8%
	Aug	0.658	0.639	-2.8%	0.634	-3.5%	0.644	-2.1%	0.633	-3.8%	0.633	-3.8%	0.633	-3.7%	0.632	-3.8%	0.632	-3.8%	0.633	-3.8%	0.632	-3.9%	0.632	-3.9%	0.632	-3.8%
	Sep	0.698	0.677	-2.9%	0.673	-3.6%	0.682	-2.3%	0.672	-3.8%	0.671	-3.8%	0.672	-3.7%	0.671	-3.8%	0.671	-3.8%	0.671	-3.8%	0.671	-3.8%	0.671	-3.9%	0.671	-3.8%
	Oct	0.694	0.672	-3.1%	0.669	-3.6%	0.676	-2.6%	0.668	-3.8%	0.668	-3.8%	0.668	-3.7%	0.667	-3.8%	0.667	-3.8%	0.667	-3.8%	0.667	-3.9%	0.667	-3.9%	0.667	-3.8%
	Nov	0.660	0.639	-3.3%	0.636	-3.6%	0.641	-2.9%	0.635	-3.8%	0.635	-3.8%	0.636	-3.7%	0.635	-3.8%	0.635	-3.8%	0.635	-3.8%	0.635	-3.9%	0.635	-3.9%	0.635	-3.8%
	Dec	0.564	0.545	-3.4%	0.544	-3.7%	0.547	-3.2%	0.543	-3.8%	0.543	-3.8%	0.543	-3.7%	0.543	-3.8%	0.543	-3.9%	0.543	-3.8%	0.542	-3.9%	0.542	-3.9%	0.543	-3.9%
	Annual	0.630	0.614	-2.6%	0.608	-3.5%	0.619	-1.8%	0.606	-3.8%	0.606	-3.8%	0.607	-3.7%	0.606	-3.8%	0.606	-3.9%	0.606	-3.8%	0.606	-3.9%	0.606	-3.9%	0.606	-3.9%
1:25-Year Dry	Jan	0.198	0.194	-1.8%	0.191	-3.4%	0.198	-0.2%	0.190	-4.1%	0.190	-4.2%	0.190	-3.9%	0.189	-4.2%	0.189	-4.3%	0.190	-4.2%	0.189	-4.4%	0.189	-4.4%	0.189	-4.3%
	Feb	0.182	0.179	-2.0%	0.176	-3.5%	0.181	-0.4%	0.175	-4.1%	0.175	-4.2%	0.175	-4.0%	0.174	-4.3%	0.174	-4.3%	0.174	-4.2%	0.174	-4.4%	0.174	-4.4%	0.174	-4.3%
	Mar	0.157	0.154	-2.1%	0.152	-3.6%	0.156	-0.7%	0.151	-4.2%	0.151	-4.3%	0.151	-4.1%	0.151	-4.4%	0.150	-4.4%	0.151	-4.3%	0.150	-4.5%	0.150	-4.6%	0.150	-4.4%
	Apr	0.274	0.267	-2.2%	0.264	-3.5%	0.271	-1.0%	0.263	-4.0%	0.263	-4.0%	0.263	-3.9%	0.262	-4.1%	0.262	-4.1%	0.263	-4.0%	0.262	-4.2%	0.262	-4.2%	0.262	-4.1%
	May	0.742	0.724	-2.3%	0.716	-3.4%	0.733	-1.2%	0.714	-3.8%	0.714	-3.8%	0.714	-3.7%	0.713	-3.8%	0.713	-3.8%	0.714	-3.8%	0.713	-3.8%	0.713	-3.9%	0.713	-3.8%
	Jun	0.639	0.624	-2.5%	0.617	-3.5%	0.630	-1.5%	0.615	-3.8%	0.615	-3.8%	0.616	-3.7%	0.615	-3.8%	0.615	-3.8%	0.615	-3.8%	0.615	-3.9%	0.615	-3.9%	0.615	-3.8%
	Jul	0.303	0.295	-2.7%	0.292	-3.6%	0.298	-1.8%	0.291	-3.9%	0.291	-4.0%	0.292	-3.8%	0.291	-4.0%	0.291	-4.1%	0.291	-4.0%	0.291	-4.1%	0.291	-4.1%	0.291	-4.1%
	Aug	0.243	0.236	-2.9%	0.234	-3.7%	0.238	-2.1%	0.233	-4.0%	0.233	-4.1%	0.234	-3.9%	0.233	-4.1%	0.233	-4.2%	0.233	-4.1%	0.233	-4.2%	0.233	-4.3%	0.233	-4.2%
	Sep	0.211	0.204	-3.1%	0.203	-3.7%	0.206	-2.4%	0.202	-4.0%	0.202	-4.1%	0.203	-3.9%	0.202	-4.2%	0.202	-4.2%	0.202	-4.1%	0.202	-4.3%	0.202	-4.3%	0.202	-4.2%
	Oct	0.167	0.162	-3.3%	0.161	-3.9%	0.163	-2.7%	0.160	-4.2%	0.160	-4.2%	0.161	-4.1%	0.160	-4.3%	0.160	-4.4%	0.160	-4.2%	0.160	-4.5%	0.160	-4.5%	0.160	-4.4%
	Nov	0.242	0.234	-3.4%	0.233	-3.8%	0.235	-3.0%	0.233	-4.0%	0.232	-4.1%	0.233	-3.9%	0.232	-4.1%	0.232	-4.2%	0.232	-4.1%	0.232	-4.2%	0.232	-4.3%	0.232	-4.2%
	Dec	0.241	0.233	-3.5%	0.232	-3.9%	0.234	-3.2%	0.232	-4.0%	0.232	-4.1%	0.232	-3.9%	0.231	-4.1%	0.231	-4.1%	0.232	-4.1%	0.231	-4.2%	0.231	-4.2%	0.231	-4.1%
	Annual	0.301	0.293	-2.6%	0.290	-3.6%	0.296	-1.6%	0.289	-3.9%	0.289	-4.0%	0.289	-3.8%	0.288	-4.0%	0.288	-4.1%	0.289	-4.0%	0.288	-4.1%	0.288	-4.1%	0.288	-4.1%

Climate Scenario	Month	Existing Condition	Construction						Operations						Closure (Pit Filling)						Post-closure (after Pit Filling)					
			Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum		Average		Minimum		Maximum	
		Flow (m^3/s)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)	Flow (m^3/s)	Change from Existing (%)
1:25-Year Wet	Jan	0.565	0.556	-1.7%	0.547	-3.3%	0.565	-0.1%	0.544	-3.8%	0.544	-3.8%	0.544	-3.7%	0.543	-3.9%	0.543	-3.9%	0.544	-3.8%	0.543	-3.9%	0.543	-3.9%	0.543	-3.9%
	Feb	0.495	0.486	-1.9%	0.479	-3.4%	0.493	-0.4%	0.476	-3.8%	0.476	-3.9%	0.477	-3.7%	0.476	-3.9%	0.476	-3.9%	0.476	-3.9%	0.476	-3.9%	0.476	-3.9%	0.476	-3.9%
	Mar	0.415	0.407	-2.0%	0.401	-3.4%	0.413	-0.7%	0.399	-3.8%	0.399	-3.9%	0.400	-3.8%	0.399	-3.9%	0.399	-3.9%	0.399	-3.9%	0.399	-4.0%	0.399	-4.0%	0.399	-3.9%
	Apr	0.456	0.446	-2.2%	0.440	-3.4%	0.451	-1.0%	0.438	-3.8%	0.438	-3.9%	0.439	-3.8%	0.438	-3.9%	0.438	-3.9%	0.438	-3.9%	0.438	-4.0%	0.438	-4.0%	0.438	-3.9%
	May	1.496	1.462	-2.3%	1.445	-3.4%	1.478	-1.2%	1.440	-3.7%	1.440	-3.7%	1.441	-3.7%	1.440	-3.7%	1.440	-3.7%	1.440	-3.7%	1.439	-3.8%	1.439	-3.8%	1.440	-3.7%
	Jun	1.722	1.680	-2.4%	1.663	-3.4%	1.697	-1.5%	1.659	-3.7%	1.658	-3.7%	1.660	-3.6%	1.658	-3.7%	1.658	-3.7%	1.658	-3.7%	1.658	-3.7%	1.658	-3.7%	1.658	-3.7%
	Jul	1.280	1.246	-2.7%	1.235	-3.5%	1.257	-1.8%	1.232	-3.7%	1.232	-3.8%	1.233	-3.7%	1.232	-3.8%	1.232	-3.8%	1.232	-3.8%	1.231	-3.8%	1.231	-3.8%	1.232	-3.8%
	Aug	1.247	1.212	-2.8%	1.203	-3.5%	1.221	-2.1%	1.201	-3.7%	1.200	-3.8%	1.201	-3.7%	1.200	-3.8%	1.200	-3.8%	1.200	-3.8%	1.200	-3.8%	1.200	-3.8%	1.200	-3.8%
	Sep	0.971	0.942	-2.9%	0.936	-3.5%	0.948	-2.3%	0.935	-3.7%	0.934	-3.8%	0.935	-3.7%	0.934	-3.8%	0.934	-3.8%	0.934	-3.8%	0.934	-3.8%	0.934	-3.8%	0.934	-3.8%
	Oct	0.835	0.809	-3.1%	0.805	-3.6%	0.813	-2.6%	0.803	-3.7%	0.803	-3.8%	0.804	-3.7%	0.803	-3.8%	0.803	-3.8%	0.803	-3.8%	0.803	-3.8%	0.803	-3.8%	0.803	-3.8%
	Nov	0.883	0.854	-3.2%	0.851	-3.6%	0.857	-2.9%	0.850	-3.7%	0.849	-3.8%	0.850	-3.7%	0.849	-3.8%	0.849	-3.8%	0.849	-3.8%	0.849	-3.8%	0.849	-3.8%	0.849	-3.8%
	Dec	0.736	0.711	-3.4%	0.709	-3.7%	0.713	-3.1%	0.708	-3.8%	0.708	-3.8%	0.709	-3.7%	0.708	-3.8%	0.708	-3.8%	0.708	-3.8%	0.708	-3.8%	0.708	-3.8%	0.708	-3.8%
	Annual	0.928	0.903	-2.6%	0.895	-3.5%	0.911	-1.8%	0.893	-3.7%	0.893	-3.8%	0.894	-3.7%	0.893	-3.8%	0.893	-3.8%	0.893	-3.8%	0.892	-3.8%	0.892	-3.8%	0.893	-3.8%

Note:
Changes lower than 0.1% are shown as 0.0%.

Appendix B Water Quality Results For the Expected Case Scenario – Summary Statistics

Summary Statistics of the Updated Model Results (mg/L) for the Expected Case Scenario - Open Pit Discharge

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	na	na	na	na	na	na	1.9	9.9	10	10	10	10
Alkalinity_T	na	na	na	na	na	na	27	140	140	140	140	140
Aluminum_D	na	na	na	na	na	na	0.010	0.051	0.051	0.051	0.051	0.052
Aluminum_T	na	na	na	na	na	na	0.077	0.39	0.39	0.39	0.39	0.39
Antimony_D	na	na	na	na	na	na	0.00061	0.0027	0.0028	0.0028	0.0030	0.0031
Antimony_T	na	na	na	na	na	na	0.00061	0.0027	0.0028	0.0028	0.0030	0.0031
Arsenic_D	na	na	na	na	na	na	0.0030	0.015	0.015	0.016	0.016	0.016
Arsenic_T	na	na	na	na	na	na	0.0038	0.019	0.019	0.019	0.020	0.020
Barium_D	na	na	na	na	na	na	0.013	0.068	0.071	0.071	0.073	0.074
Barium_T	na	na	na	na	na	na	0.014	0.070	0.072	0.072	0.075	0.076
Beryllium_T	na	na	na	na	na	na	0.000036	0.00019	0.00019	0.00019	0.00020	0.00020
Boron_D	na	na	na	na	na	na	0.0043	0.022	0.023	0.023	0.023	0.023
Boron_T	na	na	na	na	na	na	0.0044	0.022	0.023	0.023	0.023	0.024
Bromide	na	na	na	na	na	na	0.015	0.075	0.076	0.076	0.077	0.078
Cadmium_D	na	na	na	na	na	na	0.000040	0.00020	0.00021	0.00021	0.00022	0.00023
Cadmium_T	na	na	na	na	na	na	0.000047	0.00024	0.00025	0.00025	0.00026	0.00026
Calcium_D	na	na	na	na	na	na	36	180	190	190	200	200
Chloride	na	na	na	na	na	na	0.78	3.8	3.8	3.8	3.9	4.0
Chromium_D	na	na	na	na	na	na	0.000074	0.00038	0.00039	0.00039	0.00040	0.00040
Chromium_D_Hex	na	na	na	na	na	na	0.000074	0.00038	0.00039	0.00039	0.00040	0.00040
Chromium_T	na	na	na	na	na	na	0.00053	0.0027	0.0027	0.0027	0.0027	0.0027
Cobalt_D	na	na	na	na	na	na	0.00087	0.0040	0.0041	0.0041	0.0043	0.0044
Cobalt_T	na	na	na	na	na	na	0.00093	0.0044	0.0045	0.0045	0.0046	0.0047
Copper_D	na	na	na	na	na	na	0.0014	0.0058	0.0069	0.0067	0.0073	0.0074
Copper_T	na	na	na	na	na	na	0.0017	0.0087	0.0092	0.0091	0.0096	0.0097
Cyanide_F	na	na	na	na	na	na	0.00075	0.0037	0.0038	0.0038	0.0038	0.0038
Cyanide_T	na	na	na	na	na	na	0.0014	0.0074	0.0083	0.0082	0.0090	0.0092
Cyanide_WAD	na	na	na	na	na	na	0.00086	0.0046	0.0051	0.0051	0.0056	0.0057
Fluoride	na	na	na	na	na	na	0.035	0.17	0.17	0.17	0.18	0.18
Hardness	na	na	na	na	na	na	51	260	270	270	280	280
Iron_D	na	na	na	na	na	na	0.033	0.17	0.17	0.17	0.17	0.17
Iron_T	na	na	na	na	na	na	0.15	0.76	0.77	0.77	0.78	0.78
Lead_D	na	na	na	na	na	na	0.000091	0.00046	0.00048	0.00048	0.00049	0.00050
Lead_T	na	na	na	na	na	na	0.00026	0.0013	0.0013	0.0013	0.0014	0.0014
Magnesium_D	na	na	na	na	na	na	3.8	19	20	20	21	21
Manganese_D	na	na	na	na	na	na	0.25	1.3	1.3	1.3	1.4	1.4
Manganese_T	na	na	na	na	na	na	0.073	0.37	0.39	0.39	0.41	0.41
Mercury_D	na	na	na	na	na	na	0.0000014	0.0000070	0.0000070	0.0000071	0.0000072	0.0000073
Mercury_T	na	na	na	na	na	na	0.0000014	0.0000073	0.0000074	0.0000074	0.0000076	0.0000077
Molybdenum_D	na	na	na	na	na	na	0.00079	0.0038	0.0038	0.0038	0.0039	0.0040
Molybdenum_T	na	na	na	na	na	na	0.00080	0.0038	0.0039	0.0039	0.0040	0.0041
N_Ammonia	na	na	na	na	na	na	0.085	0.32	0.36	0.36	0.41	0.43
N_Nitrate_Nitrite	na	na	na	na	na	na	0.023	0.11	0.12	0.12	0.12	0.12
N_Nitrite	na	na	na	na	na	na	0.0026	0.013	0.013	0.013	0.013	0.013
Nickel_D	na	na	na	na	na	na	0.0031	0.016	0.017	0.017	0.018	0.018
Nickel_T	na	na	na	na	na	na	0.0037	0.019	0.019	0.019	0.020	0.021
Phosphorus_T	na	na	na	na	na	na	0.0047	0.024	0.025	0.025	0.025	0.025
Potassium_D	na	na	na	na	na	na	7.5	38	40	40	41	42
Proton	na	na	na	na	na	na	0.000000023	0.00000012	.00000012	.00000012	0.00000012	.00000012
Radium_226	na	na	na	na	na	na	0.0033	0.017	0.017	0.017	0.017	0.017
Selenium_D	na	na	na	na	na	na	0.000079	0.00037	0.00038	0.00038	0.00039	0.00040
Selenium_T	na	na	na	na	na	na	0.000084	0.00040	0.00040	0.00040	0.00042	0.00042
Silicon_D	na	na	na	na	na	na	1.5	7.5	7.6	7.6	7.7	7.7
Silicon_T	na	na	na	na	na	na	1.5	7.6	7.7	7.7	7.8	7.8
Silver_D	na	na	na	na	na	na	0.0000032	0.000016	0.000017	0.000017	0.000017	0.000017
Silver_T	na	na	na	na	na	na	0.0000066	0.000034	0.000034	0.000034	0.000035	0.000035
Sodium_D	na	na	na	na	na	na	6.9	21	25	26	33	35
Sodium_T	na	na	na	na	na	na	7.0	21	26	26	33	35
Strontium_D	na	na	na	na	na	na	0.064	0.33	0.34	0.34	0.35	0.36
Strontium_T	na	na	na	na	na	na	0.065	0.33	0.34	0.34	0.36	0.36
Sulfate	na	na	na	na	na	na	100	510	510	510	520	520
Thallium_D	na	na	na	na	na	na	0.000012	0.000059	0.000061	0.000061	0.000063	0.000064
Thallium_T	na	na	na	na	na	na	0.000015	0.000078	0.000080	0.000080	0.000082	0.000083
TSS	na	na	na	na	na	na	150	750	760	760	780	790
Uranium_D	na	na	na	na	na	na	0.00032	0.0017	0.0017	0.0017	0.0018	0.0018
Uranium_T	na	na	na	na	na	na	0.00033	0.0017	0.0017	0.0017	0.0018	0.0018
Vanadium_T	na	na	na	na	na	na	0.00034	0.0017	0.0017	0.0017	0.0017	0.0017
Zinc_D	na	na	na	na	na	na	0.0019	0.0096	0.0099	0.0099	0.010	0.010
Zinc_T	na	na	na	na	na	na	0.0025	0.013	0.013	0.013	0.013	0.013
N_Ammonia_Un	na	na	na	na	na	na	0.000013	0.000051	0.00027	0.00032	0.00082	0.0010

Notes:

na denotes not applicable. The model results are not reported for the period when the water volume reached the lower bound (empty reservoir)

Summary Statistics of the Updated Model Results (mg/L) for the Expected Case Scenario - Satellite Pit Discharge

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	na	na	na	na	na	na	6.6	9.9	11	11	11	11
Alkalinity_T	na	na	na	na	na	na	93	140	150	150	160	160
Aluminum_D	na	na	na	na	na	na	0.021	0.034	0.035	0.035	0.037	0.038
Aluminum_T	na	na	na	na	na	na	0.21	0.36	0.37	0.37	0.37	0.37
Antimony_D	na	na	na	na	na	na	0.0015	0.0023	0.0024	0.0024	0.0026	0.0026
Antimony_T	na	na	na	na	na	na	0.0015	0.0023	0.0025	0.0025	0.0026	0.0026
Arsenic_D	na	na	na	na	na	na	0.0085	0.013	0.014	0.014	0.015	0.015
Arsenic_T	na	na	na	na	na	na	0.011	0.017	0.018	0.018	0.019	0.019
Barium_D	na	na	na	na	na	na	0.055	0.081	0.087	0.087	0.094	0.096
Barium_T	na	na	na	na	na	na	0.056	0.082	0.089	0.089	0.096	0.098
Beryllium_T	na	na	na	na	na	na	0.00013	0.00019	0.00020	0.00020	0.00022	0.00022
Boron_D	na	na	na	na	na	na	0.017	0.026	0.027	0.027	0.029	0.029
Boron_T	na	na	na	na	na	na	0.017	0.026	0.028	0.028	0.029	0.030
Bromide	na	na	na	na	na	na	0.055	0.085	0.089	0.089	0.094	0.096
Cadmium_D	na	na	na	na	na	na	0.00017	0.00026	0.00027	0.00027	0.00029	0.00029
Cadmium_T	na	na	na	na	na	na	0.00019	0.00030	0.00031	0.00031	0.00033	0.00033
Calcium_D	na	na	na	na	na	na	150	220	240	240	260	260
Chloride	na	na	na	na	na	na	2.8	3.8	4.2	4.3	4.8	4.9
Chromium_D	na	na	na	na	na	na	0.00028	0.00043	0.00046	0.00046	0.00048	0.00048
Chromium_D_Hex	na	na	na	na	na	na	0.00028	0.00043	0.00046	0.00046	0.00048	0.00048
Chromium_T	na	na	na	na	na	na	0.0016	0.0027	0.0028	0.0028	0.0028	0.0028
Cobalt_D	na	na	na	na	na	na	0.0027	0.0041	0.0044	0.0044	0.0046	0.0047
Cobalt_T	na	na	na	na	na	na	0.0029	0.0046	0.0048	0.0048	0.0051	0.0051
Copper_D	na	na	na	na	na	na	0.0014	0.0022	0.0023	0.0023	0.0024	0.0024
Copper_T	na	na	na	na	na	na	0.0023	0.0038	0.0039	0.0039	0.0040	0.0040
Cyanide_F	na	na	na	na	na	na	0.00048	0.00074	0.00078	0.00078	0.00082	0.00083
Cyanide_T	na	na	na	na	na	na	0.00045	0.00069	0.00073	0.00073	0.00078	0.00079
Cyanide_WAD	na	na	na	na	na	na	0.00045	0.00069	0.00073	0.00073	0.00078	0.00079
Fluoride	na	na	na	na	na	na	0.099	0.16	0.16	0.16	0.17	0.17
Hardness	na	na	na	na	na	na	220	320	350	350	380	390
Iron_D	na	na	na	na	na	na	0.11	0.16	0.17	0.17	0.19	0.19
Iron_T	na	na	na	na	na	na	0.42	0.70	0.71	0.71	0.73	0.73
Lead_D	na	na	na	na	na	na	0.00022	0.00034	0.00036	0.00036	0.00038	0.00039
Lead_T	na	na	na	na	na	na	0.00072	0.0012	0.0012	0.0012	0.0012	0.0013
Magnesium_D	na	na	na	na	na	na	16	24	26	26	28	28
Manganese_D	na	na	na	na	na	na	0.27	0.38	0.42	0.42	0.46	0.47
Manganese_T	na	na	na	na	na	na	0.30	0.43	0.47	0.47	0.52	0.53
Mercury_D	na	na	na	na	na	na	0.0000012	0.0000019	0.0000019	0.0000020	0.0000021	0.0000021
Mercury_T	na	na	na	na	na	na	0.0000015	0.0000023	0.0000024	0.0000024	0.0000026	0.0000026
Molybdenum_D	na	na	na	na	na	na	0.0023	0.0035	0.0037	0.0037	0.0039	0.0040
Molybdenum_T	na	na	na	na	na	na	0.0023	0.0036	0.0037	0.0037	0.0039	0.0040
N_Ammonia	na	na	na	na	na	na	0.092	0.13	0.14	0.14	0.16	0.16
N_Nitrate_Nitrite	na	na	na	na	na	na	0.075	0.12	0.13	0.13	0.13	0.13
N_Nitrite	na	na	na	na	na	na	0.0084	0.013	0.014	0.014	0.014	0.015
Nickel_D	na	na	na	na	na	na	0.014	0.021	0.023	0.023	0.024	0.024
Nickel_T	na	na	na	na	na	na	0.016	0.024	0.025	0.025	0.027	0.027
Phosphorus_T	na	na	na	na	na	na	0.016	0.024	0.025	0.025	0.027	0.028
Potassium_D	na	na	na	na	na	na	31	46	50	49	53	53
Proton	na	na	na	na	na	na	0.000000085	0.00000013	.00000014	.00000014	0.00000015	.00000015
Radium_226	na	na	na	na	na	na	0.010	0.017	0.017	0.017	0.017	0.018
Selenium_D	na	na	na	na	na	na	0.00025	0.00039	0.00041	0.00041	0.00044	0.00044
Selenium_T	na	na	na	na	na	na	0.00027	0.00042	0.00044	0.00044	0.00046	0.00047
Silicon_D	na	na	na	na	na	na	5.3	8.2	8.6	8.6	9.1	9.2
Silicon_T	na	na	na	na	na	na	5.3	8.3	8.7	8.7	9.2	9.3
Silver_D	na	na	na	na	na	na	0.000012	0.000018	0.000019	0.000019	0.000020	0.000021
Silver_T	na	na	na	na	na	na	0.000022	0.000036	0.000037	0.000037	0.000038	0.000038
Sodium_D	na	na	na	na	na	na	6.4	9.7	10	10	11	11
Sodium_T	na	na	na	na	na	na	6.5	9.8	10	10	11	11
Strontium_D	na	na	na	na	na	na	0.27	0.40	0.43	0.43	0.46	0.47
Strontium_T	na	na	na	na	na	na	0.27	0.40	0.43	0.43	0.46	0.47
Sulfate	na	na	na	na	na	na	390	570	620	620	660	680
Thallium_D	na	na	na	na	na	na	0.000045	0.000067	0.000072	0.000072	0.000077	0.000079
Thallium_T	na	na	na	na	na	na	0.000056	0.000087	0.000091	0.000091	0.000097	0.000098
TSS	na	na	na	na	na	na	570	930	960	960	990	1,000
Uranium_D	na	na	na	na	na	na	0.0013	0.0020	0.0021	0.0021	0.0022	0.0022
Uranium_T	na	na	na	na	na	na	0.0013	0.0020	0.0021	0.0021	0.0022	0.0022
Vanadium_T	na	na	na	na	na	na	0.00091	0.0016	0.0016	0.0016	0.0016	0.0016
Zinc_D	na	na	na	na	na	na	0.0070	0.011	0.012	0.012	0.012	0.012
Zinc_T	na	na	na	na	na	na	0.0088	0.014	0.015	0.015	0.015	0.015
N_Ammonia_Un	na	na	na	na	na	na	0.000020	0.000021	0.000052	0.00013	0.00033	0.00038

Notes:

na denotes not applicable. The model results are not reported for the period when the water volume reached the lower bound (empty reservoir)

Summary Statistics of the Updated Model Results (mg/L) for the Expected Case Scenario - Collection Pond Discharge

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	4.2	5.9	7.0	7.6	9.1	13	na	na	na	na	na	na
Alkalinity_T	78	84	110	120	180	210	na	na	na	na	na	na
Aluminum_D	0.0068	0.014	0.025	0.029	0.044	0.047	na	na	na	na	na	na
Aluminum_T	0.32	0.33	0.36	0.36	0.37	0.38	na	na	na	na	na	na
Antimony_D	0.000068	0.00039	0.0050	0.0061	0.014	0.022	na	na	na	na	na	na
Antimony_T	0.000077	0.00040	0.0050	0.0062	0.014	0.022	na	na	na	na	na	na
Arsenic_D	0.00054	0.0019	0.022	0.029	0.068	0.091	na	na	na	na	na	na
Arsenic_T	0.0021	0.0041	0.027	0.033	0.071	0.095	na	na	na	na	na	na
Barium_D	0.020	0.024	0.055	0.065	0.12	0.14	na	na	na	na	na	na
Barium_T	0.022	0.025	0.056	0.066	0.12	0.15	na	na	na	na	na	na
Beryllium_T	0.000062	0.000071	0.00012	0.00014	0.00024	0.00029	na	na	na	na	na	na
Boron_D	0.0055	0.0079	0.028	0.036	0.076	0.095	na	na	na	na	na	na
Boron_T	0.0055	0.0079	0.028	0.036	0.076	0.096	na	na	na	na	na	na
Bromide	0.043	0.053	0.063	0.069	0.094	0.10	na	na	na	na	na	na
Cadmium_D	0.0000052	0.000013	0.00015	0.00019	0.00043	0.00068	na	na	na	na	na	na
Cadmium_T	0.000022	0.000038	0.00019	0.00023	0.00047	0.00071	na	na	na	na	na	na
Calcium_D	37	48	130	160	330	390	na	na	na	na	na	na
Chloride	0.53	0.62	2.3	2.2	3.6	4.9	na	na	na	na	na	na
Chromium_D	0.000067	0.00012	0.00025	0.00031	0.00059	0.00077	na	na	na	na	na	na
Chromium_D_Hex	0.000067	0.00012	0.00025	0.00031	0.00059	0.00077	na	na	na	na	na	na
Chromium_T	0.0022	0.0024	0.0025	0.0026	0.0029	0.0031	na	na	na	na	na	na
Cobalt_D	0.00011	0.00027	0.0021	0.0028	0.0065	0.0089	na	na	na	na	na	na
Cobalt_T	0.00053	0.00070	0.0025	0.0032	0.0070	0.0094	na	na	na	na	na	na
Copper_D	0.00037	0.00097	0.0018	0.0020	0.0032	0.0035	na	na	na	na	na	na
Copper_T	0.0018	0.0025	0.0034	0.0035	0.0047	0.0051	na	na	na	na	na	na
Cyanide_F	0.00045	0.00054	0.00064	0.00064	0.00076	0.00082	na	na	na	na	na	na
Cyanide_T	0.00042	0.00050	0.00055	0.00058	0.00071	0.00076	na	na	na	na	na	na
Cyanide_WAD	0.00042	0.00050	0.00055	0.00058	0.00071	0.00076	na	na	na	na	na	na
Fluoride	0.036	0.062	0.10	0.12	0.20	0.23	na	na	na	na	na	na
Hardness	100	110	210	210	330	370	na	na	na	na	na	na
Iron_D	0.059	0.093	0.12	0.13	0.17	0.18	na	na	na	na	na	na
Iron_T	0.55	0.60	0.63	0.64	0.69	0.70	na	na	na	na	na	na
Lead_D	0.000043	0.000070	0.00022	0.00026	0.00053	0.00076	na	na	na	na	na	na
Lead_T	0.00046	0.00058	0.0011	0.0011	0.0014	0.0016	na	na	na	na	na	na
Magnesium_D	3.9	5.6	18	22	46	56	na	na	na	na	na	na
Manganese_D	0.066	0.089	0.20	0.23	0.42	0.56	na	na	na	na	na	na
Manganese_T	0.089	0.10	0.23	0.26	0.47	0.58	na	na	na	na	na	na
Mercury_D	0.0000011	0.0000014	0.0000017	0.0000018	0.0000023	0.0000026	na	na	na	na	na	na
Mercury_T	0.0000013	0.0000016	0.0000019	0.0000020	0.0000026	0.0000029	na	na	na	na	na	na
Molybdenum_D	0.00017	0.0010	0.0091	0.013	0.029	0.036	na	na	na	na	na	na
Molybdenum_T	0.00021	0.0010	0.0092	0.013	0.029	0.036	na	na	na	na	na	na
N_Ammonia	0.049	0.085	0.49	0.69	1.5	2.8	na	na	na	na	na	na
N_Nitrate_Nitrite	0.10	0.33	3.6	5.0	11	22	na	na	na	na	na	na
N_Nitrite	0.0099	0.017	0.089	0.12	0.26	0.50	na	na	na	na	na	na
Nickel_D	0.00054	0.0012	0.013	0.017	0.039	0.051	na	na	na	na	na	na
Nickel_T	0.0030	0.0038	0.016	0.020	0.042	0.054	na	na	na	na	na	na
Phosphorus_T	0.012	0.013	0.017	0.017	0.023	0.025	na	na	na	na	na	na
Potassium_D	2.4	5.0	27	35	78	100	na	na	na	na	na	na
Proton	000000058	0.000000082	000000098	.00000011	0.00000014	.00000018	na	na	na	na	na	na
Radium_226	0.0092	0.012	0.019	0.017	0.021	0.022	na	na	na	na	na	na
Selenium_D	0.000047	0.000078	0.00031	0.00040	0.00085	0.0011	na	na	na	na	na	na
Selenium_T	0.000058	0.000092	0.00034	0.00042	0.00087	0.0011	na	na	na	na	na	na
Silicon_D	4.7	5.5	6.7	7.2	9.6	11	na	na	na	na	na	na
Silicon_T	4.7	5.6	6.7	7.2	9.6	11	na	na	na	na	na	na
Silver_D	0.0000047	0.0000059	0.000011	0.000014	0.000025	0.000031	na	na	na	na	na	na
Silver_T	0.000014	0.000017	0.000030	0.000030	0.000042	0.000049	na	na	na	na	na	na
Sodium_D	5.5	6.3	9.9	12	20	23	na	na	na	na	na	na
Sodium_T	5.7	6.3	10	12	20	23	na	na	na	na	na	na
Strontium_D	0.075	0.11	0.29	0.37	0.76	0.93	na	na	na	na	na	na
Strontium_T	0.077	0.11	0.30	0.37	0.76	0.93	na	na	na	na	na	na
Sulfate	36	69	330	420	910	1,100	na	na	na	na	na	na
Thallium_D	0.000025	0.000028	0.000049	0.000056	0.000096	0.00011	na	na	na	na	na	na
Thallium_T	0.000032	0.000043	0.000070	0.000074	0.00011	0.00013	na	na	na	na	na	na
TSS	73	280	640	750	1,400	1,900	na	na	na	na	na	na
Uranium_D	0.000094	0.00038	0.0018	0.0025	0.0055	0.0068	na	na	na	na	na	na
Uranium_T	0.00010	0.00039	0.0019	0.0025	0.0055	0.0068	na	na	na	na	na	na
Vanadium_T	0.0012	0.0014	0.0018	0.0020	0.0028	0.0032	na	na	na	na	na	na
Zinc_D	0.0012	0.0026	0.0072	0.0087	0.017	0.024	na	na	na	na	na	na
Zinc_T	0.0030	0.0046	0.010	0.012	0.020	0.027	na	na	na	na	na	na
N_Ammonia_Un	0.0000077	0.000014	0.00021	0.00073	0.0025	0.0036	na	na	na	na	na	na

Notes:

na denotes not applicable. The model results are not reported for the period when the collection pond does not discharge

Summary Statistics of the Updated Model Results (mg/L) for the Expected Case Scenario - TMF Pond Water

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	2.5	4.1	5.2	5.3	6.5	8.6	15	15	16	16	16	17
Alkalinity_T	63	88	100	100	120	140	180	180	190	190	200	230
Aluminum_D	0.0062	0.11	0.13	0.13	0.15	0.16	0.10	0.10	0.11	0.12	0.15	0.20
Aluminum_T	0.011	0.20	0.20	0.20	0.20	0.20	0.11	0.12	0.20	0.18	0.20	0.20
Antimony_D	0.00011	0.032	0.063	0.057	0.068	0.070	0.0018	0.0018	0.0019	0.0040	0.0094	0.027
Antimony_T	0.00012	0.030	0.061	0.055	0.065	0.068	0.0018	0.0018	0.0019	0.0039	0.0091	0.026
Arsenic_D	0.0012	0.025	0.057	0.050	0.063	0.064	0.025	0.025	0.026	0.029	0.038	0.068
Arsenic_T	0.0012	0.026	0.057	0.050	0.063	0.065	0.025	0.025	0.026	0.030	0.038	0.069
Barium_D	0.062	0.085	0.090	0.090	0.096	0.099	0.083	0.083	0.085	0.086	0.091	0.11
Barium_T	0.064	0.088	0.093	0.092	0.099	0.10	0.084	0.085	0.086	0.088	0.093	0.11
Beryllium_T	0.000027	0.00010	0.00014	0.00015	0.00020	0.00024	0.00025	0.00026	0.00026	0.00027	0.00030	0.00040
Boron_D	0.0072	0.039	0.043	0.042	0.046	0.047	0.013	0.014	0.014	0.015	0.019	0.033
Boron_T	0.0075	0.041	0.045	0.045	0.048	0.049	0.014	0.014	0.014	0.016	0.020	0.034
Bromide	0.045	0.046	0.050	0.050	0.054	0.064	0.060	0.064	0.066	0.065	0.066	0.066
Cadmium_D	0.0000054	0.000073	0.000091	0.000089	0.00011	0.00011	0.000092	0.000093	0.000097	0.00010	0.00013	0.00020
Cadmium_T	0.0000054	0.000057	0.000075	0.000074	0.000093	0.000100	0.000092	0.000093	0.000097	0.00010	0.00013	0.00020
Calcium_D	110	240	260	250	270	270	150	160	160	170	180	250
Chloride	7.0	30	55	50	59	61	7.1	7.2	7.3	8.7	13	25
Chromium_D	0.000069	0.00011	0.00014	0.00014	0.00017	0.00018	0.00023	0.00023	0.00024	0.00025	0.00028	0.00039
Chromium_D_Hex	0.000069	0.00011	0.00014	0.00014	0.00017	0.00018	0.00023	0.00023	0.00024	0.00025	0.00028	0.00039
Chromium_T	0.000098	0.00060	0.00063	0.00062	0.00064	0.00065	0.00027	0.00027	0.00028	0.00030	0.00037	0.00060
Cobalt_D	0.00011	0.069	0.072	0.071	0.076	0.078	0.0010	0.0010	0.0011	0.0035	0.0096	0.030
Cobalt_T	0.00011	0.061	0.064	0.064	0.068	0.070	0.0010	0.0010	0.0011	0.0032	0.0087	0.027
Copper_D	0.00023	0.030	0.030	0.030	0.030	0.030	0.0034	0.0039	0.030	0.021	0.030	0.030
Copper_T	0.00033	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Cyanide_F	0.00067	0.014	0.025	0.023	0.027	0.028	0.013	0.014	0.014	0.016	0.020	0.035
Cyanide_T	0.00067	1.5	2.1	2.1	2.9	3.1	0.019	0.036	0.044	0.042	0.045	0.045
Cyanide_WAD	0.00067	0.097	0.13	0.13	0.17	0.18	0.011	0.022	0.027	0.025	0.027	0.027
Fluoride	0.047	0.50	0.95	0.85	1.00	1.0	0.19	0.20	0.20	0.24	0.34	0.67
Hardness	42	52	70	72	88	330	240	310	340	330	350	350
Iron_D	0.12	0.67	0.70	0.69	0.70	0.70	0.20	0.20	0.20	0.22	0.28	0.45
Iron_T	0.19	0.70	0.70	0.70	0.70	0.70	0.59	0.70	0.70	0.70	0.70	0.70
Lead_D	0.000050	0.00047	0.00050	0.00050	0.00054	0.00055	0.00098	0.00099	0.0010	0.0011	0.0013	0.0019
Lead_T	0.000068	0.0011	0.0012	0.0011	0.0012	0.0012	0.0010	0.0010	0.0011	0.0011	0.0014	0.0022
Magnesium_D	8.5	11	13	14	16	18	18	19	19	19	20	23
Manganese_D	0.10	0.16	0.20	0.20	0.25	0.37	5.1	5.2	5.4	5.6	6.3	8.8
Manganese_T	0.12	0.17	0.22	0.22	0.27	0.43	0.63	0.66	0.66	0.67	0.68	0.68
Mercury_D	0.0000015	0.000012	0.000016	0.000016	0.000020	0.000023	0.000025	0.000026	0.000027	0.000029	0.000034	0.000053
Mercury_T	0.0000021	0.000012	0.000016	0.000016	0.000020	0.000023	0.000026	0.000026	0.000027	0.000029	0.000035	0.000053
Molybdenum_D	0.000058	0.021	0.045	0.040	0.048	0.050	0.0025	0.0026	0.0027	0.0043	0.0085	0.022
Molybdenum_T	0.00011	0.022	0.048	0.043	0.051	0.052	0.0026	0.0026	0.0027	0.0044	0.0088	0.023
N_Ammonia	0.15	5.7	11	10	12	13	0.67	0.68	0.70	1.1	2.2	5.7
N_Nitrate_Nitrite	0.032	0.45	1.6	1.6	2.7	2.8	0.044	0.045	0.046	0.065	0.12	0.29
N_Nitrite	0.010	0.036	0.078	0.076	0.11	0.11	0.011	0.011	0.012	0.013	0.017	0.029
Nickel_D	0.00066	0.012	0.014	0.015	0.017	0.018	0.0031	0.0032	0.0033	0.0039	0.0057	0.012
Nickel_T	0.00075	0.012	0.014	0.015	0.017	0.018	0.0032	0.0033	0.0034	0.0040	0.0058	0.012
Phosphorus_T	0.014	0.023	0.030	0.029	0.032	0.034	0.044	0.044	0.045	0.046	0.049	0.059
Potassium_D	6.7	74	80	79	85	87	24	24	25	28	37	68
Proton	000000014	0.000000018	000000025	000000025	0.000000030	00000097	0.000000076	0.000000098	.00000011	.00000011	0.00000011	.00000011
Radium_226	0.0057	0.0060	0.0064	0.0065	0.0069	0.0087	0.0084	0.0092	0.0095	0.0094	0.0096	0.0096
Selenium_D	0.000054	0.0028	0.0055	0.0050	0.0059	0.0061	0.000099	0.00010	0.00011	0.00028	0.00074	0.0023
Selenium_T	0.000054	0.0028	0.0055	0.0050	0.0059	0.0061	0.000099	0.00010	0.00011	0.00028	0.00074	0.0023
Silicon_D	1.2	1.5	2.0	2.0	2.6	6.1	6.1	6.9	7.2	7.2	7.3	7.3
Silicon_T	1.3	1.5	2.0	2.1	2.6	6.3	6.2	7.1	7.4	7.3	7.5	7.5
Silver_D	0.0000064	0.000025	0.000029	0.000028	0.000033	0.000035	0.000014	0.000014	0.000014	0.000015	0.000019	0.000030
Silver_T	0.0000064	0.000017	0.000021	0.000021	0.000026	0.000028	0.000014	0.000014	0.000014	0.000015	0.000018	0.000027
Sodium_D	8.4	780	1,500	1,400	1,600	1,700	9.3	9.5	11	58	180	580
Sodium_T	8.7	790	1,500	1,400	1,600	1,700	9.7	9.8	11	58	180	580
Strontium_D	0.17	0.45	0.49	0.49	0.53	0.54	0.26	0.26	0.27	0.28	0.32	0.46
Strontium_T	0.18	0.46	0.50	0.50	0.54	0.55	0.27	0.27	0.27	0.29	0.33	0.47
Sulfate	220	2,200	4,300	3,900	4,600	4,700	330	340	340	480	820	2,000
Thallium_D	0.000013	0.000017	0.000022	0.000022	0.000028	0.000047	0.000069	0.000069	0.000070	0.000070	0.000071	0.000074
Thallium_T	0.000017	0.000022	0.000027	0.000027	0.000033	0.000047	0.000069	0.000069	0.000070	0.000070	0.000072	0.000076
TSS	8.2	14	46	40	59	69	1.2	6.9	9.2	8.6	9.4	9.4
Uranium_D	0.000049	0.0014	0.0017	0.0016	0.0019	0.0019	0.00063	0.00064	0.00066	0.00074	0.00098	0.0018
Uranium_T	0.000049	0.0016	0.0018	0.0018	0.0020	0.0021	0.00063	0.00064	0.00066	0.00075	0.00100	0.0018
Vanadium_T	0.00021	0.0011	0.0021	0.0019	0.0023	0.0023	0.00097	0.00098	0.0010	0.0011	0.0014	0.0024
Zinc_D	0.00100	0.0028	0.0038	0.0039	0.0052	0.0058	0.0059	0.0060	0.0062	0.0066	0.0077	0.011
Zinc_T	0.0017	0.0037	0.0047	0.0048	0.0061	0.0067	0.0066	0.0066	0.0069	0.0073	0.0084	0.012
N_Ammonia_Un	0.000023	0.0014	0.0023	0.0089	0.026	0.028	0.00011	0.00011	0.00059	0.00096	0.0019	0.012

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Expected Case Scenario - Model Node QM02

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	2.3	2.4	3.4	3.3	4.0	4.1	2.3	2.3	3.4	3.2	4.0	4.0
Alkalinity_T	8.1	8.6	10.0	9.9	11	14	7.8	7.9	9.1	9.1	10	10
Aluminum_D	0.0065	0.0068	0.0085	0.0091	0.013	0.013	0.0065	0.0067	0.0084	0.0090	0.013	0.013
Aluminum_T	0.014	0.014	0.025	0.025	0.037	0.037	0.013	0.013	0.021	0.023	0.034	0.035
Antimony_D	0.000071	0.000100	0.00012	0.00015	0.00022	0.00052	0.000070	0.000071	0.000097	0.000091	0.00010	0.00010
Antimony_T	0.000071	0.000100	0.00012	0.00015	0.00022	0.00052	0.000070	0.000071	0.000097	0.000091	0.00010	0.00010
Arsenic_D	0.00012	0.00015	0.00025	0.00039	0.00073	0.0018	0.00012	0.00012	0.00014	0.00014	0.00014	0.00014
Arsenic_T	0.00013	0.00016	0.00028	0.00043	0.00079	0.0019	0.00012	0.00012	0.00014	0.00015	0.00018	0.00018
Barium_D	0.0050	0.0053	0.0064	0.0063	0.0068	0.0092	0.0047	0.0047	0.0059	0.0058	0.0066	0.0067
Barium_T	0.0056	0.0059	0.0083	0.0082	0.010	0.013	0.0054	0.0055	0.0077	0.0078	0.010	0.010
Beryllium_T	0.000075	0.000076	0.000097	0.000092	0.000100	0.00010	0.000075	0.000076	0.000096	0.000091	0.000100	0.000100
Boron_D	0.0050	0.0050	0.0051	0.0053	0.0056	0.0067	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Boron_T	0.0050	0.0050	0.0051	0.0053	0.0056	0.0067	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Bromide	0.050	0.050	0.050	0.050	0.050	0.051	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium_D	0.0000038	0.0000050	0.0000054	0.0000063	0.0000080	0.000018	0.0000038	0.0000038	0.0000048	0.0000046	0.0000050	0.0000050
Cadmium_T	0.0000040	0.0000051	0.0000057	0.0000066	0.0000085	0.000018	0.0000038	0.0000038	0.0000050	0.0000047	0.0000050	0.0000050
Calcium_D	2.6	2.8	3.2	3.8	5.2	10	2.3	2.3	2.6	2.5	2.7	2.7
Chloride	0.25	0.25	0.26	0.27	0.29	0.32	0.25	0.25	0.25	0.25	0.25	0.25
Chromium_D	0.000050	0.000051	0.000052	0.000053	0.000055	0.000064	0.000050	0.000050	0.000051	0.000051	0.000051	0.000051
Chromium_D_Hex	0.000050	0.000051	0.000052	0.000053	0.000055	0.000064	0.000050	0.000050	0.000051	0.000051	0.000051	0.000051
Chromium_T	0.000054	0.000059	0.000079	0.000087	0.00013	0.00013	0.000051	0.000051	0.000058	0.000069	0.00011	0.00011
Cobalt_D	0.000076	0.000094	0.00011	0.00012	0.00014	0.00027	0.000075	0.000076	0.000098	0.000092	0.00010	0.00010
Cobalt_T	0.000080	0.000097	0.00011	0.00012	0.00014	0.00028	0.000075	0.000076	0.000098	0.000093	0.00010	0.00010
Copper_D	0.00028	0.00031	0.00034	0.00035	0.00043	0.00044	0.00028	0.00028	0.00033	0.00034	0.00042	0.00042
Copper_T	0.00030	0.00032	0.00050	0.00046	0.00052	0.00058	0.00028	0.00028	0.00048	0.00044	0.00050	0.00050
Cyanide_F	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Cyanide_T	0.00050	0.00052	0.00071	0.00068	0.00080	0.00085	0.00053	0.00053	0.00054	0.00055	0.00056	0.00058
Cyanide_WAD	0.00050	0.00050	0.00051	0.00051	0.00051	0.00051	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Fluoride	0.052	0.052	0.061	0.060	0.064	0.067	0.052	0.052	0.060	0.059	0.064	0.064
Hardness	9.1	9.7	11	11	12	17	8.4	8.5	9.6	9.5	10	10
Iron_D	0.050	0.052	0.075	0.073	0.10	0.10	0.049	0.051	0.075	0.073	0.10	0.10
Iron_T	0.13	0.13	0.16	0.17	0.22	0.22	0.13	0.13	0.16	0.16	0.21	0.21
Lead_D	0.000035	0.000038	0.000045	0.000043	0.000046	0.000058	0.000035	0.000035	0.000043	0.000042	0.000045	0.000045
Lead_T	0.000039	0.000045	0.000048	0.000049	0.000054	0.000074	0.000037	0.000037	0.000044	0.000042	0.000045	0.000045
Magnesium_D	0.66	0.74	0.83	0.90	1.1	1.8	0.62	0.63	0.73	0.72	0.79	0.79
Manganese_D	0.0032	0.0043	0.011	0.0098	0.012	0.022	0.0031	0.0031	0.0090	0.0081	0.012	0.012
Manganese_T	0.015	0.015	0.018	0.019	0.026	0.026	0.015	0.015	0.015	0.017	0.023	0.024
Mercury_D	.00000061	0.00000061	.00000062	.00000072	0.00000099	0.0000010	0.00000061	0.00000061	.00000061	.00000071	0.00000098	.00000100
Mercury_T	.00000070	0.00000070	.00000074	.00000082	0.0000010	0.0000010	0.00000070	0.00000070	.00000072	.00000081	0.0000010	0.0000010
Molybdenum_D	0.000044	0.000053	0.000096	0.00016	0.00030	0.00073	0.000042	0.000042	0.000050	0.000049	0.000052	0.000053
Molybdenum_T	0.000074	0.00010	0.00014	0.00020	0.00033	0.00078	0.000072	0.000072	0.000095	0.000091	0.00010	0.00010
N_Ammonia	0.0055	0.0083	0.025	0.022	0.027	0.075	0.0052	0.0052	0.019	0.016	0.025	0.025
N_Nitrate_Nitrite	0.027	0.036	0.088	0.098	0.14	0.48	0.025	0.025	0.056	0.056	0.087	0.087
N_Nitrite	0.0066	0.0077	0.015	0.014	0.015	0.024	0.0066	0.0069	0.014	0.013	0.015	0.015
Nickel_D	0.00020	0.00021	0.00026	0.00035	0.00054	0.0012	0.00020	0.00020	0.00020	0.00020	0.00021	0.00021
Nickel_T	0.00020	0.00022	0.00028	0.00037	0.00058	0.0012	0.00020	0.00020	0.00021	0.00021	0.00022	0.00022
Phosphorus_T	0.013	0.013	0.021	0.019	0.022	0.022	0.013	0.013	0.021	0.019	0.022	0.022
Potassium_D	0.54	0.64	0.73	0.89	1.2	2.5	0.52	0.52	0.60	0.60	0.65	0.65
Proton	000000082	0.000000086	.00000041	.00000040	0.00000063	.00000063	0.000000082	0.000000086	.00000042	.00000040	0.00000063	.00000063
Radium_226	0.0045	0.0046	0.0051	0.0053	0.0073	0.0074	0.0045	0.0045	0.0050	0.0052	0.0072	0.0073
Selenium_D	0.000038	0.000044	0.000050	0.000050	0.000053	0.000069	0.000038	0.000038	0.000048	0.000047	0.000050	0.000050
Selenium_T	0.000038	0.000044	0.000051	0.000051	0.000060	0.000070	0.000038	0.000038	0.000050	0.000048	0.000054	0.000055
Silicon_D	1.8	1.9	2.8	2.6	3.1	3.2	1.8	1.8	2.7	2.6	3.1	3.1
Silicon_T	2.0	2.1	2.8	2.7	3.1	3.2	2.0	2.0	2.7	2.7	3.1	3.1
Silver_D	0.0000050	0.0000050	0.0000050	0.0000051	0.0000052	0.0000055	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050
Silver_T	0.0000050	0.0000051	0.0000051	0.0000052	0.0000053	0.0000058	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050
Sodium_D	0.98	1.1	1.2	1.2	1.3	1.7	0.96	0.97	1.2	1.1	1.2	1.2
Sodium_T	1.0	1.1	1.3	1.3	1.4	1.8	0.99	1.00	1.2	1.2	1.3	1.3
Strontium_D	0.012	0.013	0.015	0.016	0.018	0.031	0.011	0.011	0.013	0.013	0.014	0.014
Strontium_T	0.012	0.013	0.016	0.016	0.019	0.032	0.011	0.011	0.014	0.014	0.015	0.015
Sulfate	1.5	1.7	3.1	4.9	9.2	23	0.92	0.93	1.3	1.2	1.5	1.6
Thallium_D	0.0000053	0.0000066	0.000047	0.000039	0.000050	0.000051	0.0000050	0.0000063	0.000047	0.000038	0.000050	0.000050
Thallium_T	0.0000053	0.0000067	0.000047	0.000039	0.000050	0.000051	0.0000050	0.0000063	0.000047	0.000038	0.000050	0.000050
TSS	1.4	2.5	5.2	7.9	15	36	1.0	1.0	1.9	2.0	3.3	3.3
Uranium_D	0.000035	0.000046	0.000056	0.000065	0.000085	0.00018	0.000034	0.000034	0.000047	0.000044	0.000050	0.000050
Uranium_T	0.000037	0.000048	0.000056	0.000066	0.000087	0.00018	0.000036	0.000036	0.000048	0.000045	0.000050	0.000050
Vanadium_T	0.00010	0.00010	0.00011	0.00011	0.00012	0.00016	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Zinc_D	0.00091	0.00092	0.0010	0.0010	0.0012	0.0013	0.00091	0.00091	0.00094	0.00098	0.0011	0.0011
Zinc_T	0.00092	0.00093	0.0010	0.0011	0.0013	0.0014	0.00091	0.00091	0.00094	0.00099	0.0011	0.0011
N_Ammonia_Un	0.0000038	0.0000040	0.0000066	0.000015	0.000041	0.000056	0.0000038	0.0000039	0.0000042	0.0000093	0.000031	0.000032

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Expected Case Scenario - Model Node QM03

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	2.4	2.4	3.4	3.3	4.0	4.1	2.3	2.3	3.4	3.3	4.0	4.0
Alkalinity_T	8.2	8.6	10	10.0	11	14	7.8	7.9	9.2	9.1	10	10
Aluminum_D	0.0068	0.0071	0.0087	0.0094	0.013	0.014	0.0068	0.0070	0.0087	0.0093	0.013	0.013
Aluminum_T	0.014	0.015	0.025	0.025	0.037	0.038	0.014	0.014	0.021	0.023	0.035	0.035
Antimony_D	0.000071	0.000100	0.00012	0.00015	0.00022	0.00052	0.000070	0.000071	0.000097	0.000091	0.00010	0.00010
Antimony_T	0.000071	0.000100	0.00012	0.00015	0.00022	0.00052	0.000070	0.000071	0.000097	0.000091	0.00010	0.00010
Arsenic_D	0.00013	0.00015	0.00025	0.00039	0.00073	0.0018	0.00012	0.00012	0.00014	0.00014	0.00014	0.00015
Arsenic_T	0.00013	0.00016	0.00028	0.00042	0.00079	0.0019	0.00012	0.00012	0.00014	0.00015	0.00018	0.00018
Barium_D	0.0051	0.0053	0.0065	0.0063	0.0068	0.0092	0.0047	0.0047	0.0059	0.0058	0.0067	0.0067
Barium_T	0.0056	0.0059	0.0083	0.0082	0.010	0.013	0.0054	0.0055	0.0077	0.0078	0.010	0.010
Beryllium_T	0.000075	0.000077	0.000097	0.000092	0.000100	0.00010	0.000075	0.000076	0.000096	0.000091	0.000100	0.000100
Boron_D	0.0050	0.0050	0.0051	0.0053	0.0056	0.0067	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Boron_T	0.0050	0.0050	0.0051	0.0053	0.0056	0.0067	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Bromide	0.050	0.050	0.050	0.050	0.050	0.051	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium_D	0.0000038	0.0000050	0.0000054	0.0000063	0.0000079	0.000017	0.0000038	0.0000038	0.0000048	0.0000046	0.0000050	0.0000050
Cadmium_T	0.0000040	0.0000051	0.0000057	0.0000066	0.0000085	0.000018	0.0000038	0.0000039	0.0000050	0.0000047	0.0000050	0.0000050
Calcium_D	2.6	2.8	3.2	3.9	5.2	10	2.3	2.3	2.6	2.6	2.7	2.8
Chloride	0.26	0.26	0.27	0.27	0.29	0.32	0.25	0.25	0.26	0.26	0.26	0.26
Chromium_D	0.000051	0.000051	0.000052	0.000053	0.000055	0.000065	0.000051	0.000051	0.000051	0.000051	0.000051	0.000051
Chromium_D_Hex	0.000051	0.000051	0.000052	0.000053	0.000055	0.000065	0.000051	0.000051	0.000051	0.000051	0.000051	0.000051
Chromium_T	0.000055	0.000060	0.000080	0.000087	0.00013	0.00013	0.000052	0.000052	0.000059	0.000070	0.00011	0.00011
Cobalt_D	0.000076	0.000094	0.00011	0.00012	0.00014	0.00027	0.000075	0.000076	0.000098	0.000092	0.00010	0.00010
Cobalt_T	0.000080	0.000097	0.00011	0.00012	0.00014	0.00028	0.000076	0.000076	0.000098	0.000093	0.00010	0.00010
Copper_D	0.00028	0.00031	0.00034	0.00036	0.00043	0.00044	0.00028	0.00028	0.00033	0.00034	0.00042	0.00042
Copper_T	0.00030	0.00032	0.00050	0.00046	0.00052	0.00058	0.00028	0.00029	0.00048	0.00044	0.00050	0.00050
Cyanide_F	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Cyanide_T	0.00050	0.00052	0.00071	0.00068	0.00080	0.00085	0.00053	0.00053	0.00054	0.00054	0.00056	0.00058
Cyanide_WAD	0.00050	0.00050	0.00051	0.00051	0.00051	0.00051	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Fluoride	0.052	0.053	0.061	0.060	0.064	0.067	0.052	0.052	0.060	0.059	0.064	0.064
Hardness	9.1	9.8	11	11	12	17	8.5	8.5	9.7	9.6	10	10
Iron_D	0.051	0.053	0.076	0.074	0.10	0.10	0.050	0.052	0.076	0.074	0.10	0.10
Iron_T	0.13	0.13	0.16	0.17	0.22	0.22	0.13	0.13	0.16	0.16	0.21	0.22
Lead_D	0.000035	0.000038	0.000045	0.000043	0.000046	0.000058	0.000035	0.000035	0.000043	0.000042	0.000045	0.000045
Lead_T	0.000039	0.000045	0.000048	0.000049	0.000054	0.000074	0.000037	0.000037	0.000044	0.000042	0.000045	0.000045
Magnesium_D	0.66	0.74	0.83	0.90	1.1	1.8	0.62	0.63	0.73	0.72	0.79	0.79
Manganese_D	0.0033	0.0045	0.011	0.0100	0.013	0.022	0.0032	0.0033	0.0091	0.0082	0.012	0.013
Manganese_T	0.015	0.015	0.018	0.019	0.026	0.026	0.015	0.015	0.016	0.017	0.023	0.024
Mercury_D	.00000061	0.00000061	.00000063	.00000072	0.00000099	0.0000010	0.00000061	0.00000061	.00000062	.00000071	0.00000099	.00000100
Mercury_T	.00000070	0.00000071	.00000075	.00000082	0.0000010	0.0000010	0.00000070	0.00000070	.00000073	.00000081	0.0000010	0.0000010
Molybdenum_D	0.000044	0.000053	0.000095	0.00016	0.00030	0.00072	0.000042	0.000042	0.000050	0.000049	0.000052	0.000053
Molybdenum_T	0.000074	0.00010	0.00014	0.00020	0.00033	0.00077	0.000072	0.000073	0.000095	0.000091	0.000100	0.00010
N_Ammonia	0.0057	0.0085	0.025	0.023	0.028	0.075	0.0053	0.0054	0.019	0.017	0.025	0.025
N_Nitrate_Nitrite	0.027	0.036	0.088	0.097	0.14	0.47	0.025	0.025	0.056	0.056	0.086	0.086
N_Nitrite	0.0066	0.0077	0.015	0.014	0.015	0.024	0.0066	0.0069	0.014	0.013	0.015	0.015
Nickel_D	0.00020	0.00021	0.00027	0.00035	0.00054	0.0012	0.00020	0.00020	0.00020	0.00021	0.00021	0.00021
Nickel_T	0.00021	0.00022	0.00029	0.00037	0.00058	0.0012	0.00020	0.00020	0.00021	0.00021	0.00022	0.00022
Phosphorus_T	0.013	0.013	0.021	0.019	0.022	0.022	0.013	0.013	0.021	0.019	0.022	0.022
Potassium_D	0.54	0.64	0.73	0.89	1.2	2.5	0.52	0.53	0.60	0.60	0.65	0.65
Proton	000000082	0.000000086	.00000041	.00000039	0.00000063	.00000063	0.000000082	0.000000086	.00000041	.00000040	0.00000063	.00000063
Radium_226	0.0045	0.0046	0.0051	0.0053	0.0073	0.0073	0.0045	0.0045	0.0050	0.0052	0.0072	0.0073
Selenium_D	0.000038	0.000044	0.000050	0.000050	0.000053	0.000069	0.000038	0.000038	0.000048	0.000047	0.000050	0.000050
Selenium_T	0.000038	0.000044	0.000051	0.000051	0.000059	0.000070	0.000038	0.000038	0.000050	0.000048	0.000054	0.000055
Silicon_D	1.8	1.9	2.8	2.6	3.1	3.2	1.8	1.8	2.7	2.6	3.1	3.1
Silicon_T	2.0	2.1	2.8	2.7	3.1	3.2	2.0	2.0	2.7	2.7	3.1	3.1
Silver_D	0.0000050	0.0000050	0.0000050	0.0000051	0.0000052	0.0000055	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050
Silver_T	0.0000050	0.0000051	0.0000051	0.0000052	0.0000053	0.0000058	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050
Sodium_D	0.98	1.1	1.2	1.2	1.3	1.7	0.96	0.97	1.2	1.1	1.2	1.2
Sodium_T	1.0	1.1	1.3	1.3	1.4	1.8	0.99	1.0	1.2	1.2	1.3	1.3
Strontium_D	0.012	0.013	0.015	0.016	0.018	0.031	0.011	0.011	0.013	0.013	0.014	0.014
Strontium_T	0.012	0.013	0.016	0.016	0.019	0.032	0.011	0.011	0.014	0.014	0.015	0.015
Sulfate	1.5	1.7	3.1	4.8	9.1	23	0.92	0.93	1.3	1.2	1.5	1.6
Thallium_D	0.0000055	0.0000068	0.000047	0.000039	0.000050	0.000051	0.0000053	0.0000066	0.000047	0.000038	0.000050	0.000050
Thallium_T	0.0000056	0.0000070	0.000047	0.000039	0.000050	0.000051	0.0000053	0.0000066	0.000047	0.000038	0.000050	0.000050
TSS	1.4	2.5	5.2	7.9	14	36	1.1	1.1	1.9	2.1	3.3	3.3
Uranium_D	0.000035	0.000046	0.000056	0.000064	0.000085	0.00017	0.000034	0.000034	0.000047	0.000044	0.000050	0.000050
Uranium_T	0.000037	0.000048	0.000056	0.000066	0.000087	0.00017	0.000036	0.000036	0.000048	0.000045	0.000050	0.000050
Vanadium_T	0.00010	0.00011	0.00011	0.00011	0.00012	0.00016	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Zinc_D	0.00092	0.00093	0.0010	0.0011	0.0012	0.0014	0.00091	0.00092	0.00094	0.00099	0.0011	0.0011
Zinc_T	0.00092	0.00094	0.0010	0.0011	0.0013	0.0014	0.00092	0.00092	0.00095	0.00099	0.0011	0.0011
N_Ammonia_Un	0.0000038	0.0000040	0.0000066	0.000015	0.000041	0.000056	0.0000038	0.0000039	0.0000043	0.0000094	0.000031	0.000032

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Expected Case Scenario - Model Node QM04

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	3.1	3.1	14	13	21	21	3.1	4.2	10	12	21	21
Alkalinity_T	82	83	110	110	140	140	83	83	140	120	140	140
Aluminum_D	0.0029	0.0038	0.0090	0.0084	0.013	0.013	0.0034	0.0043	0.038	0.027	0.044	0.048
Aluminum_T	0.0063	0.0073	0.012	0.012	0.017	0.017	0.0068	0.0091	0.20	0.12	0.20	0.20
Antimony_D	0.000082	0.00011	0.00035	0.00040	0.00082	0.0011	0.00011	0.00013	0.0019	0.0013	0.0024	0.0028
Antimony_T	0.000083	0.00011	0.00035	0.00040	0.00082	0.0011	0.00011	0.00013	0.0019	0.0013	0.0024	0.0028
Arsenic_D	0.00082	0.0010	0.0020	0.0023	0.0045	0.0065	0.0011	0.0012	0.011	0.0076	0.013	0.015
Arsenic_T	0.00082	0.0010	0.0021	0.0024	0.0045	0.0065	0.0011	0.0012	0.014	0.0093	0.017	0.018
Barium_D	0.043	0.045	0.060	0.060	0.073	0.076	0.044	0.048	0.069	0.064	0.072	0.074
Barium_T	0.044	0.046	0.061	0.061	0.074	0.077	0.045	0.049	0.070	0.066	0.073	0.075
Beryllium_T	0.000080	0.000081	0.000093	0.000091	0.000099	0.00010	0.000082	0.000082	0.00016	0.00013	0.00018	0.00019
Boron_D	0.0050	0.0051	0.0096	0.0099	0.015	0.018	0.0052	0.0053	0.019	0.015	0.020	0.022
Boron_T	0.0050	0.0051	0.011	0.011	0.017	0.020	0.0052	0.0053	0.019	0.016	0.021	0.023
Bromide	0.050	0.050	0.050	0.051	0.051	0.053	0.050	0.050	0.068	0.062	0.072	0.075
Cadmium_D	0.0000040	0.0000046	0.0000100	0.000012	0.000025	0.000041	0.0000064	0.0000083	0.00015	0.000099	0.00018	0.00021
Cadmium_T	0.0000040	0.0000046	0.0000100	0.000012	0.000025	0.000041	0.0000064	0.0000083	0.00017	0.00012	0.00021	0.00024
Calcium_D	77	80	100	100	120	130	79	85	160	140	170	190
Chloride	4.7	4.8	6.4	6.3	7.3	7.3	3.9	4.1	4.8	5.2	7.1	7.1
Chromium_D	0.000050	0.000050	0.000077	0.000079	0.00011	0.00013	0.000053	0.000055	0.00029	0.00021	0.00034	0.00038
Chromium_D_Hex	0.000050	0.000050	0.000077	0.000079	0.00011	0.00013	0.000053	0.000055	0.00029	0.00021	0.00034	0.00038
Chromium_T	0.000050	0.000052	0.00013	0.00011	0.00016	0.00018	0.000055	0.000057	0.0019	0.0012	0.0023	0.0025
Cobalt_D	0.000087	0.00012	0.00034	0.00040	0.00081	0.0011	0.00012	0.00016	0.0028	0.0019	0.0036	0.0041
Cobalt_T	0.000087	0.00012	0.00034	0.00040	0.00081	0.0011	0.00012	0.00016	0.0031	0.0021	0.0039	0.0044
Copper_D	0.00010	0.00020	0.00034	0.00036	0.00059	0.00067	0.00016	0.00025	0.0042	0.0031	0.0060	0.0068
Copper_T	0.00024	0.00028	0.00037	0.00041	0.00059	0.00067	0.00029	0.00032	0.0063	0.0042	0.0078	0.0088
Cyanide_F	0.00050	0.00051	0.00058	0.00057	0.00063	0.00067	0.00052	0.00053	0.0026	0.0019	0.0033	0.0036
Cyanide_T	0.00057	0.0031	0.013	0.014	0.029	0.037	0.0017	0.0025	0.0059	0.0053	0.0072	0.0082
Cyanide_WAD	0.00050	0.00057	0.00079	0.00085	0.0013	0.0016	0.00055	0.00057	0.0036	0.0025	0.0044	0.0051
Fluoride	0.029	0.032	0.045	0.045	0.055	0.060	0.030	0.041	0.13	0.10	0.15	0.17
Hardness	240	240	300	290	340	350	240	260	280	280	340	340
Iron_D	0.037	0.044	0.19	0.16	0.23	0.23	0.039	0.055	0.17	0.16	0.22	0.22
Iron_T	0.061	0.067	0.25	0.20	0.27	0.27	0.062	0.11	0.61	0.45	0.69	0.70
Lead_D	0.000037	0.000040	0.000047	0.000050	0.000065	0.000082	0.000042	0.000045	0.00034	0.00024	0.00041	0.00046
Lead_T	0.000037	0.000042	0.000052	0.000057	0.000086	0.000090	0.000043	0.000049	0.00093	0.00062	0.0011	0.0012
Magnesium_D	8.9	9.3	13	12	15	17	9.0	10	18	16	19	21
Manganese_D	0.044	0.049	0.67	0.55	0.90	0.90	0.053	0.16	1.1	0.90	1.2	1.3
Manganese_T	0.076	0.080	0.74	0.61	0.95	0.95	0.085	0.20	0.53	0.53	0.96	0.98
Mercury_D	.00000087	0.00000094	0.0000013	0.0000012	0.0000014	0.0000014	0.00000091	0.0000012	0.0000051	0.0000038	0.0000060	0.0000066
Mercury_T	0.0000011	0.0000012	0.0000023	0.0000020	0.0000025	0.0000025	0.0000011	0.0000014	0.0000057	0.0000044	0.0000064	0.0000071
Molybdenum_D	0.000041	0.000063	0.00062	0.00074	0.0018	0.0028	0.000081	0.00010	0.0026	0.0017	0.0033	0.0037
Molybdenum_T	0.000071	0.00011	0.00065	0.00078	0.0018	0.0028	0.00012	0.00014	0.0027	0.0018	0.0034	0.0038
N_Ammonia	0.026	0.052	0.27	0.21	0.31	0.38	0.027	0.032	0.28	0.26	0.35	0.41
N_Nitrate_Nitrite	0.025	0.028	0.070	0.11	0.23	0.73	0.025	0.026	0.087	0.066	0.10	0.11
N_Nitrite	0.0070	0.0073	0.014	0.014	0.021	0.032	0.0070	0.0070	0.013	0.012	0.016	0.016
Nickel_D	0.00041	0.00055	0.0012	0.0013	0.0026	0.0040	0.00075	0.00084	0.012	0.0079	0.014	0.016
Nickel_T	0.00043	0.00065	0.0012	0.0015	0.0028	0.0042	0.00076	0.00087	0.014	0.0092	0.017	0.019
Phosphorus_T	0.012	0.012	0.022	0.021	0.026	0.026	0.012	0.021	0.024	0.023	0.025	0.026
Potassium_D	4.6	5.1	7.2	7.6	11	13	5.0	5.8	30	21	35	39
Proton	000000050	0.000000050	.00000014	.00000013	0.00000020	.00000020	0.000000050	0.000000063	.00000012	.00000013	0.00000020	.00000020
Radium_226	0.0048	0.0049	0.0081	0.0074	0.0088	0.0088	0.0048	0.0063	0.014	0.011	0.015	0.016
Selenium_D	0.000040	0.000047	0.000069	0.000074	0.00012	0.00015	0.000045	0.000047	0.00027	0.00020	0.00033	0.00037
Selenium_T	0.000040	0.000047	0.000069	0.000074	0.00012	0.00015	0.000045	0.000047	0.00029	0.00021	0.00035	0.00039
Silicon_D	4.5	4.5	5.6	5.5	6.5	6.6	4.5	4.6	7.0	6.5	7.3	7.6
Silicon_T	4.6	4.6	5.8	5.7	6.8	6.9	4.6	4.7	7.1	6.6	7.4	7.7
Silver_D	0.0000050	0.0000050	0.0000053	0.0000054	0.0000060	0.0000067	0.0000051	0.0000052	0.000013	0.000010	0.000015	0.000016
Silver_T	0.0000050	0.0000050	0.0000053	0.0000054	0.0000060	0.0000067	0.0000051	0.0000052	0.000025	0.000018	0.000029	0.000032
Sodium_D	5.5	7.3	11	11	17	20	5.5	6.8	17	16	26	32
Sodium_T	5.8	7.5	11	12	18	21	5.8	7.0	17	16	26	33
Strontium_D	0.12	0.13	0.17	0.17	0.21	0.24	0.12	0.14	0.29	0.24	0.31	0.34
Strontium_T	0.12	0.13	0.17	0.17	0.21	0.24	0.12	0.15	0.29	0.24	0.31	0.34
Sulfate	150	160	210	220	270	300	150	190	420	340	460	500
Thallium_D	0.000032	0.000032	0.000042	0.000040	0.000045	0.000047	0.000032	0.000033	0.000054	0.000049	0.000057	0.000062
Thallium_T	0.000032	0.000032	0.000042	0.000040	0.000045	0.000047	0.000032	0.000033	0.000068	0.000057	0.000074	0.000079
TSS	1.0	2.0	23	25	55	100	14	16	530	350	650	720
Uranium_D	0.000033	0.000045	0.00013	0.00015	0.00033	0.00051	0.000061	0.000067	0.0012	0.00079	0.0015	0.0016
Uranium_T	0.000033	0.000045	0.00013	0.00015	0.00033	0.00051	0.000061	0.000067	0.0012	0.00080	0.0015	0.0016
Vanadium_T	0.00010	0.00010	0.00015	0.00016	0.00027	0.00029	0.00010	0.00011	0.0012	0.00082	0.0015	0.0016
Zinc_D	0.00065	0.00089	0.0011	0.0012	0.0018	0.0024	0.00078	0.0010	0.0072	0.0050	0.0086	0.0095
Zinc_T	0.0011	0.0014	0.0016	0.0017	0.0022	0.0028	0.0013	0.0015	0.0094	0.0066	0.011	0.012
N_Ammonia_Un	0.000025	0.000039	0.000050	0.00012	0.00044	0.00046	0.000026	0.000037	0.000054	0.00020	0.00061	0.00084

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Expected Case Scenario - Model Node QM06

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	2.3	2.4	3.5	3.3	4.0	4.2	2.3	2.4	3.5	3.3	4.0	4.1
Alkalinity_T	8.3	8.8	10	10	11	14	8.0	8.3	9.8	9.7	11	13
Aluminum_D	0.0068	0.0071	0.0087	0.0094	0.013	0.014	0.0068	0.0070	0.0088	0.0094	0.013	0.014
Aluminum_T	0.014	0.015	0.025	0.025	0.037	0.038	0.014	0.014	0.023	0.024	0.036	0.037
Antimony_D	0.000071	0.000100	0.00012	0.00015	0.00022	0.00052	0.000070	0.000080	0.00010	0.00010	0.00011	0.00016
Antimony_T	0.000071	0.000100	0.00012	0.00015	0.00022	0.00052	0.000070	0.000080	0.00010	0.00010	0.00011	0.00016
Arsenic_D	0.00013	0.00015	0.00025	0.00039	0.00073	0.0018	0.00012	0.00014	0.00019	0.00020	0.00026	0.00044
Arsenic_T	0.00014	0.00016	0.00028	0.00043	0.00079	0.0019	0.00013	0.00015	0.00020	0.00022	0.00032	0.00051
Barium_D	0.0051	0.0054	0.0065	0.0064	0.0069	0.0093	0.0048	0.0051	0.0063	0.0061	0.0070	0.0080
Barium_T	0.0057	0.0059	0.0084	0.0083	0.010	0.013	0.0055	0.0056	0.0081	0.0081	0.010	0.011
Beryllium_T	0.000075	0.000077	0.000097	0.000092	0.000100	0.00010	0.000075	0.000076	0.000097	0.000092	0.00010	0.00010
Boron_D	0.0050	0.0050	0.0051	0.0053	0.0056	0.0067	0.0050	0.0050	0.0051	0.0051	0.0051	0.0053
Boron_T	0.0050	0.0051	0.0051	0.0053	0.0056	0.0067	0.0050	0.0050	0.0051	0.0051	0.0051	0.0054
Bromide	0.050	0.050	0.050	0.050	0.050	0.051	0.050	0.050	0.050	0.050	0.050	0.051
Cadmium_D	0.0000038	0.0000050	0.0000054	0.0000063	0.0000079	0.000017	0.0000038	0.0000045	0.0000051	0.0000054	0.0000060	0.0000090
Cadmium_T	0.0000040	0.0000051	0.0000057	0.0000066	0.0000085	0.000018	0.0000038	0.0000046	0.0000054	0.0000056	0.0000068	0.0000097
Calcium_D	2.8	3.0	3.4	4.0	5.3	10	2.4	2.5	3.4	3.3	3.9	6.4
Chloride	0.27	0.27	0.28	0.28	0.30	0.34	0.26	0.26	0.28	0.28	0.29	0.34
Chromium_D	0.000051	0.000052	0.000052	0.000053	0.000055	0.000065	0.000051	0.000051	0.000052	0.000052	0.000053	0.000058
Chromium_D_Hex	0.000051	0.000052	0.000052	0.000053	0.000055	0.000065	0.000051	0.000051	0.000052	0.000052	0.000053	0.000058
Chromium_T	0.000056	0.000060	0.000081	0.000088	0.00013	0.00013	0.000053	0.000053	0.000064	0.000080	0.00011	0.00013
Cobalt_D	0.000076	0.000094	0.00011	0.00012	0.00014	0.00027	0.000076	0.000080	0.00010	0.00011	0.00012	0.00018
Cobalt_T	0.000080	0.000097	0.00011	0.00012	0.00014	0.00028	0.000076	0.000080	0.00010	0.00011	0.00012	0.00019
Copper_D	0.00028	0.00031	0.00034	0.00036	0.00043	0.00044	0.00028	0.00032	0.00035	0.00037	0.00045	0.00047
Copper_T	0.00030	0.00032	0.00050	0.00046	0.00052	0.00058	0.00029	0.00034	0.00050	0.00047	0.00053	0.00066
Cyanide_F	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00050	0.00051	0.00051	0.00053	0.00056
Cyanide_T	0.00050	0.00053	0.00073	0.00070	0.00085	0.00090	0.00055	0.00055	0.00057	0.00057	0.00060	0.00069
Cyanide_WAD	0.00050	0.00050	0.00051	0.00051	0.00051	0.00051	0.00050	0.00050	0.00052	0.00052	0.00053	0.00059
Fluoride	0.052	0.053	0.061	0.060	0.064	0.067	0.052	0.052	0.061	0.060	0.064	0.066
Hardness	9.5	10	11	11	12	17	8.8	9.0	11	11	12	16
Iron_D	0.051	0.053	0.077	0.075	0.10	0.10	0.051	0.052	0.077	0.074	0.10	0.10
Iron_T	0.13	0.13	0.16	0.17	0.22	0.22	0.13	0.13	0.16	0.17	0.22	0.22
Lead_D	0.000035	0.000038	0.000045	0.000043	0.000046	0.000058	0.000035	0.000037	0.000045	0.000043	0.000047	0.000053
Lead_T	0.000039	0.000045	0.000048	0.000049	0.000054	0.000074	0.000037	0.000038	0.000045	0.000047	0.000051	0.000070
Magnesium_D	0.67	0.75	0.85	0.92	1.1	1.8	0.63	0.67	0.81	0.81	0.88	1.2
Manganese_D	0.0034	0.0046	0.012	0.011	0.014	0.024	0.0034	0.0037	0.013	0.014	0.019	0.038
Manganese_T	0.017	0.017	0.019	0.020	0.026	0.027	0.016	0.017	0.018	0.020	0.024	0.026
Mercury_D	.00000061	0.00000061	.00000063	.00000072	0.00000100	0.0000010	0.00000061	0.00000061	.00000064	.00000074	0.00000100	0.0000010
Mercury_T	.00000071	0.00000071	.00000075	.00000082	0.0000010	0.0000010	0.00000071	0.00000071	.00000076	.00000084	0.0000011	0.0000011
Molybdenum_D	0.000044	0.000053	0.000095	0.00016	0.00030	0.00072	0.000042	0.000046	0.000061	0.000062	0.000081	0.00013
Molybdenum_T	0.000074	0.00010	0.00014	0.00020	0.00033	0.00077	0.000072	0.000086	0.00010	0.00010	0.00012	0.00018
N_Ammonia	0.0057	0.0089	0.025	0.023	0.028	0.075	0.0054	0.0059	0.020	0.018	0.027	0.033
N_Nitrate_Nitrite	0.027	0.036	0.088	0.097	0.14	0.47	0.025	0.025	0.056	0.056	0.086	0.087
N_Nitrite	0.0067	0.0077	0.015	0.013	0.015	0.024	0.0066	0.0069	0.014	0.013	0.015	0.015
Nickel_D	0.00021	0.00021	0.00027	0.00035	0.00054	0.0012	0.00021	0.00021	0.00026	0.00027	0.00034	0.00052
Nickel_T	0.00021	0.00022	0.00029	0.00037	0.00058	0.0012	0.00021	0.00021	0.00027	0.00028	0.00036	0.00057
Phosphorus_T	0.013	0.013	0.021	0.019	0.022	0.022	0.013	0.013	0.021	0.019	0.022	0.022
Potassium_D	0.55	0.65	0.74	0.90	1.2	2.5	0.53	0.57	0.77	0.75	0.86	1.4
Proton	000000082	0.000000086	.00000041	.00000039	0.00000063	.00000063	0.000000082	0.000000086	.00000041	.00000039	0.00000063	.00000063
Radium_226	0.0046	0.0046	0.0051	0.0053	0.0073	0.0073	0.0045	0.0046	0.0050	0.0053	0.0072	0.0073
Selenium_D	0.000038	0.000044	0.000050	0.000050	0.000053	0.000069	0.000038	0.000040	0.000050	0.000048	0.000051	0.000057
Selenium_T	0.000038	0.000044	0.000051	0.000051	0.000059	0.000070	0.000038	0.000040	0.000050	0.000049	0.000057	0.000057
Silicon_D	1.8	1.9	2.8	2.6	3.1	3.2	1.8	1.8	2.7	2.6	3.1	3.2
Silicon_T	2.0	2.1	2.8	2.7	3.1	3.2	2.0	2.0	2.8	2.7	3.1	3.2
Silver_D	0.0000050	0.0000050	0.0000050	0.0000051	0.0000052	0.0000055	0.0000050	0.0000050	0.0000050	0.0000050	0.0000051	0.0000052
Silver_T	0.0000050	0.0000051	0.0000051	0.0000052	0.0000053	0.0000058	0.0000050	0.0000050	0.0000051	0.0000051	0.0000052	0.0000056
Sodium_D	0.99	1.1	1.3	1.3	1.4	1.7	0.97	1.0	1.2	1.2	1.3	1.9
Sodium_T	1.0	1.1	1.3	1.3	1.4	1.8	1.00	1.1	1.3	1.3	1.4	2.0
Strontium_D	0.012	0.013	0.015	0.016	0.018	0.031	0.011	0.011	0.014	0.014	0.015	0.020
Strontium_T	0.012	0.014	0.016	0.017	0.019	0.032	0.011	0.012	0.015	0.015	0.016	0.021
Sulfate	1.8	2.1	3.4	5.1	9.4	23	1.2	1.2	3.3	3.3	5.2	12
Thallium_D	0.0000057	0.0000070	0.000047	0.000039	0.000050	0.000051	0.0000054	0.0000067	0.000047	0.000039	0.000050	0.000050
Thallium_T	0.0000057	0.0000071	0.000047	0.000039	0.000050	0.000051	0.0000054	0.0000067	0.000047	0.000039	0.000050	0.000050
TSS	1.4	2.5	5.2	7.9	14	36	1.1	1.1	3.5	4.8	8.4	15
Uranium_D	0.000035	0.000046	0.000056	0.000065	0.000085	0.00017	0.000034	0.000036	0.000050	0.000050	0.000057	0.000081
Uranium_T	0.000037	0.000048	0.000056	0.000066	0.000087	0.00018	0.000036	0.000039	0.000050	0.000051	0.000057	0.000081
Vanadium_T	0.00010	0.00011	0.00011	0.00011	0.00012	0.00016	0.00010	0.00010	0.00011	0.00011	0.00011	0.00013
Zinc_D	0.00092	0.00093	0.0010	0.0011	0.0012	0.0014	0.00092	0.00092	0.00097	0.0010	0.0012	0.0012
Zinc_T	0.00092	0.00094	0.0010	0.0011	0.0013	0.0014	0.00092	0.00092	0.00097	0.0010	0.0012	0.0012
N_Ammonia_Un	0.0000039	0.0000041	0.0000067	0.000015	0.000041	0.000056	0.0000038	0.0000040	0.0000048	0.000011	0.000032	0.000038

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Expected Case Scenario - QM29

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	2.3	2.4	3.9	3.8	4.8	4.9	2.3	2.4	3.9	3.8	4.8	4.9
Alkalinity_T	8.4	8.8	11	11	12	14	8.2	8.6	10	10	12	13
Aluminum_D	0.033	0.034	0.040	0.042	0.054	0.054	0.034	0.034	0.040	0.042	0.054	0.054
Aluminum_T	0.063	0.063	0.073	0.080	0.12	0.12	0.062	0.062	0.072	0.079	0.12	0.12
Antimony_D	0.000072	0.000097	0.00011	0.00013	0.00018	0.00041	0.000072	0.000073	0.000098	0.000096	0.00011	0.00014
Antimony_T	0.000072	0.000097	0.00011	0.00013	0.00018	0.00041	0.000072	0.000073	0.000098	0.000096	0.00011	0.00014
Arsenic_D	0.00015	0.00017	0.00024	0.00035	0.00059	0.0014	0.00014	0.00016	0.00020	0.00020	0.00024	0.00038
Arsenic_T	0.00016	0.00018	0.00027	0.00038	0.00065	0.0015	0.00015	0.00017	0.00021	0.00023	0.00030	0.00044
Barium_D	0.0057	0.0060	0.0071	0.0070	0.0077	0.0095	0.0054	0.0057	0.0070	0.0068	0.0078	0.0085
Barium_T	0.0063	0.0065	0.0086	0.0085	0.010	0.012	0.0061	0.0062	0.0084	0.0083	0.010	0.011
Beryllium_T	0.000072	0.000073	0.000095	0.000089	0.000098	0.00010	0.000072	0.000073	0.000095	0.000089	0.000098	0.000099
Boron_D	0.0050	0.0050	0.0051	0.0052	0.0055	0.0063	0.0050	0.0050	0.0051	0.0051	0.0051	0.0053
Boron_T	0.0050	0.0050	0.0051	0.0052	0.0055	0.0063	0.0050	0.0050	0.0051	0.0051	0.0051	0.0053
Bromide	0.050	0.050	0.050	0.050	0.050	0.051	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium_D	0.0000096	0.000011	0.000012	0.000013	0.000017	0.000021	0.0000096	0.0000098	0.000012	0.000012	0.000016	0.000018
Cadmium_T	0.000011	0.000012	0.000013	0.000014	0.000019	0.000022	0.000011	0.000011	0.000012	0.000013	0.000017	0.000019
Calcium_D	3.8	4.2	4.5	4.9	6.0	9.5	3.5	3.5	4.3	4.4	5.0	6.8
Chloride	0.49	0.49	0.56	0.55	0.59	0.64	0.48	0.48	0.56	0.55	0.60	0.63
Chromium_D	0.000066	0.000068	0.000078	0.000076	0.000082	0.000087	0.000066	0.000067	0.000077	0.000075	0.000080	0.000081
Chromium_D_Hex	0.000066	0.000068	0.000075	0.000074	0.000081	0.000084	0.000066	0.000067	0.000075	0.000074	0.000079	0.000081
Chromium_T	0.00012	0.00013	0.00014	0.00015	0.00017	0.00018	0.00012	0.00012	0.00013	0.00014	0.00016	0.00018
Cobalt_D	0.00032	0.00035	0.00047	0.00057	0.0012	0.0013	0.00032	0.00033	0.00047	0.00056	0.0012	0.0013
Cobalt_T	0.00042	0.00046	0.00050	0.00064	0.0014	0.0014	0.00042	0.00044	0.00049	0.00063	0.0014	0.0014
Copper_D	0.0013	0.0013	0.0015	0.0020	0.0047	0.0047	0.0013	0.0013	0.0015	0.0020	0.0047	0.0047
Copper_T	0.0015	0.0015	0.0018	0.0024	0.0055	0.0055	0.0015	0.0015	0.0018	0.0024	0.0055	0.0055
Cyanide_F	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00051	0.00052	0.00055
Cyanide_T	0.00050	0.00052	0.00067	0.00065	0.00076	0.00079	0.00053	0.00054	0.00055	0.00055	0.00057	0.00064
Cyanide_WAD	0.00050	0.00050	0.00050	0.00050	0.00051	0.00051	0.00050	0.00050	0.00051	0.00051	0.00053	0.00057
Fluoride	0.051	0.052	0.061	0.059	0.063	0.065	0.051	0.052	0.061	0.059	0.063	0.064
Hardness	13	14	15	15	17	20	13	13	15	15	16	19
Iron_D	0.12	0.12	0.18	0.17	0.19	0.19	0.12	0.12	0.18	0.17	0.19	0.19
Iron_T	0.29	0.29	0.32	0.32	0.35	0.35	0.29	0.29	0.32	0.32	0.35	0.35
Lead_D	0.000036	0.000038	0.000045	0.000043	0.000046	0.000055	0.000036	0.000038	0.000045	0.000043	0.000046	0.000051
Lead_T	0.000045	0.000046	0.000049	0.000054	0.000070	0.000072	0.000043	0.000045	0.000048	0.000052	0.000064	0.000071
Magnesium_D	0.91	0.98	1.0	1.1	1.2	1.8	0.89	0.89	1.0	1.0	1.1	1.3
Manganese_D	0.012	0.012	0.025	0.022	0.030	0.032	0.012	0.012	0.025	0.024	0.031	0.043
Manganese_T	0.028	0.029	0.030	0.032	0.039	0.041	0.028	0.029	0.030	0.032	0.038	0.041
Mercury_D	.00000066	0.00000066	.00000067	.00000079	0.0000011	0.0000011	0.00000066	0.00000066	.00000068	.00000081	0.0000011	0.0000012
Mercury_T	.00000082	0.00000083	.00000084	.00000097	0.0000013	0.0000013	0.00000082	0.00000084	.00000085	.00000098	0.0000013	0.0000014
Molybdenum_D	0.000045	0.000052	0.000086	0.00013	0.00023	0.00055	0.000044	0.000047	0.000058	0.000059	0.000076	0.00011
Molybdenum_T	0.000078	0.00010	0.00013	0.00017	0.00027	0.00060	0.000076	0.000086	0.00010	0.00010	0.00011	0.00016
N_Ammonia	0.0076	0.0095	0.028	0.026	0.037	0.072	0.0069	0.0075	0.024	0.023	0.036	0.041
N_Nitrate_Nitrite	0.026	0.034	0.087	0.087	0.12	0.37	0.025	0.025	0.058	0.057	0.087	0.087
N_Nitrite	0.0093	0.010	0.012	0.012	0.014	0.019	0.0093	0.0095	0.012	0.012	0.013	0.013
Nickel_D	0.024	0.024	0.027	0.030	0.047	0.047	0.024	0.024	0.027	0.030	0.047	0.047
Nickel_T	0.025	0.025	0.027	0.030	0.047	0.047	0.025	0.025	0.027	0.030	0.047	0.047
Phosphorus_T	0.013	0.014	0.020	0.019	0.021	0.021	0.013	0.014	0.020	0.019	0.021	0.021
Potassium_D	0.62	0.70	0.79	0.89	1.1	2.1	0.60	0.62	0.79	0.78	0.86	1.3
Proton	000000094	0.000000097	.00000036	.00000034	0.00000052	.00000052	0.000000094	0.000000097	.00000036	.00000034	0.00000052	.00000052
Radium_226	0.0045	0.0046	0.0050	0.0051	0.0065	0.0065	0.0045	0.0045	0.0049	0.0051	0.0064	0.0065
Selenium_D	0.000040	0.000042	0.000050	0.000048	0.000051	0.000064	0.000040	0.000041	0.000049	0.000047	0.000051	0.000055
Selenium_T	0.000041	0.000045	0.000051	0.000051	0.000058	0.000065	0.000040	0.000042	0.000050	0.000049	0.000055	0.000056
Silicon_D	2.0	2.0	2.8	2.8	3.3	3.4	2.0	2.0	2.8	2.7	3.3	3.4
Silicon_T	2.2	2.2	2.9	2.8	3.4	3.5	2.2	2.2	2.9	2.8	3.4	3.4
Silver_D	0.0000050	0.0000050	0.0000050	0.0000051	0.0000051	0.0000054	0.0000050	0.0000050	0.0000050	0.0000050	0.0000051	0.0000052
Silver_T	0.0000050	0.0000051	0.0000051	0.0000051	0.0000052	0.0000056	0.0000050	0.0000050	0.0000051	0.0000051	0.0000052	0.0000054
Sodium_D	1.1	1.2	1.4	1.4	1.5	1.8	1.1	1.1	1.4	1.3	1.5	1.9
Sodium_T	1.1	1.2	1.5	1.5	1.6	1.9	1.1	1.2	1.5	1.4	1.6	2.0
Strontium_D	0.014	0.015	0.017	0.018	0.019	0.029	0.013	0.014	0.017	0.016	0.018	0.021
Strontium_T	0.014	0.016	0.018	0.019	0.020	0.030	0.014	0.015	0.018	0.017	0.019	0.022
Sulfate	4.3	4.5	5.8	7.3	11	20	4.2	4.3	5.5	6.0	8.5	11
Thallium_D	0.000012	0.000013	0.000045	0.000037	0.000048	0.000049	0.000012	0.000013	0.000045	0.000037	0.000048	0.000048
Thallium_T	0.000013	0.000014	0.000045	0.000037	0.000048	0.000049	0.000012	0.000013	0.000045	0.000037	0.000048	0.000048
TSS	1.3	2.1	4.5	6.4	11	27	1.1	1.1	3.0	4.1	6.8	12
Uranium_D	0.000035	0.000045	0.000053	0.000059	0.000073	0.00014	0.000035	0.000035	0.000049	0.000048	0.000054	0.000072
Uranium_T	0.000038	0.000047	0.000054	0.000060	0.000075	0.00014	0.000038	0.000038	0.000049	0.000049	0.000054	0.000072
Vanadium_T	0.00010	0.00010	0.00011	0.00012	0.00014	0.00014	0.00010	0.00010	0.00010	0.00011	0.00013	0.00014
Zinc_D	0.0057	0.0058	0.0085	0.0078	0.0090	0.0091	0.0058	0.0058	0.0085	0.0078	0.0090	0.0090
Zinc_T	0.0058	0.0058	0.0085	0.0079	0.0091	0.0091	0.0058	0.0058	0.0085	0.0079	0.0090	0.0091
N_Ammonia_Un	0.0000055	0.0000056	0.0000077	0.000014	0.000034	0.000045	0.0000054	0.0000055	0.0000063	0.000011	0.000027	0.000031

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Expected Case Scenario - Model Node QM07 (Minton Lake)

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	4.5	4.6	4.9	4.9	5.3	5.4	4.6	4.8	5.2	5.2	5.7	5.9
Alkalinity_T	17	18	19	19	21	22	19	21	24	24	27	28
Aluminum_D	0.040	0.041	0.042	0.042	0.043	0.044	0.042	0.043	0.044	0.044	0.045	0.046
Aluminum_T	0.075	0.076	0.078	0.079	0.082	0.083	0.077	0.078	0.080	0.081	0.084	0.085
Antimony_D	0.000087	0.000096	0.00033	0.00032	0.00049	0.00054	0.00018	0.00019	0.00023	0.00023	0.00028	0.00032
Antimony_T	0.000087	0.000096	0.00033	0.00032	0.00049	0.00054	0.00018	0.00019	0.00023	0.00023	0.00028	0.00032
Arsenic_D	0.00056	0.00059	0.00098	0.0010	0.0015	0.0017	0.0011	0.0012	0.0017	0.0017	0.0022	0.0024
Arsenic_T	0.00059	0.00062	0.0010	0.0011	0.0016	0.0017	0.0011	0.0013	0.0018	0.0018	0.0022	0.0024
Barium_D	0.0072	0.0077	0.0086	0.0087	0.0097	0.010	0.0086	0.0096	0.011	0.011	0.013	0.014
Barium_T	0.0077	0.0082	0.0091	0.0091	0.010	0.011	0.0091	0.010	0.012	0.012	0.014	0.015
Beryllium_T	0.000087	0.000088	0.000090	0.000090	0.000092	0.000092	0.000092	0.000094	0.000098	0.000098	0.00010	0.00010
Boron_D	0.0059	0.0061	0.0067	0.0067	0.0073	0.0076	0.0064	0.0068	0.0074	0.0074	0.0080	0.0084
Boron_T	0.0075	0.0079	0.0088	0.0088	0.0097	0.010	0.0081	0.0086	0.0095	0.0095	0.010	0.011
Bromide	0.050	0.050	0.051	0.051	0.051	0.052	0.052	0.052	0.054	0.054	0.055	0.055
Cadmium_D	0.0000046	0.0000048	0.0000064	0.0000068	0.0000093	0.000010	0.0000097	0.000011	0.000019	0.000019	0.000025	0.000028
Cadmium_T	0.0000047	0.0000048	0.0000065	0.0000068	0.0000093	0.000010	0.0000097	0.000012	0.000019	0.000019	0.000025	0.000028
Calcium_D	6.2	6.6	8.5	8.7	11	12	10	12	17	17	22	24
Chloride	0.25	0.26	0.44	0.42	0.54	0.57	0.36	0.37	0.40	0.41	0.45	0.47
Chromium_D	0.00012	0.00012	0.00013	0.00013	0.00014	0.00014	0.00013	0.00013	0.00015	0.00015	0.00016	0.00016
Chromium_D_Hex	0.00012	0.00012	0.00013	0.00013	0.00014	0.00014	0.00013	0.00013	0.00015	0.00015	0.00016	0.00016
Chromium_T	0.00022	0.00023	0.00023	0.00023	0.00023	0.00023	0.00023	0.00024	0.00025	0.00025	0.00026	0.00026
Cobalt_D	0.000087	0.00011	0.00035	0.00034	0.00051	0.00056	0.00023	0.00025	0.00033	0.00034	0.00044	0.00049
Cobalt_T	0.000091	0.00012	0.00035	0.00034	0.00052	0.00057	0.00023	0.00025	0.00034	0.00034	0.00044	0.00049
Copper_D	0.00049	0.00052	0.00062	0.00061	0.00068	0.00071	0.00065	0.00067	0.00075	0.00076	0.00085	0.00092
Copper_T	0.00062	0.00067	0.00077	0.00076	0.00086	0.00090	0.00078	0.00081	0.00091	0.00091	0.0010	0.0011
Cyanide_F	0.00050	0.00051	0.00059	0.00058	0.00064	0.00066	0.00062	0.00063	0.00066	0.00066	0.00069	0.00072
Cyanide_T	0.00050	0.0024	0.019	0.017	0.028	0.031	0.0078	0.0087	0.012	0.012	0.016	0.017
Cyanide_WAD	0.00050	0.00054	0.00097	0.00091	0.0012	0.0012	0.00073	0.00076	0.00088	0.00088	0.00098	0.0010
Fluoride	0.038	0.039	0.043	0.043	0.047	0.049	0.043	0.043	0.047	0.047	0.051	0.053
Hardness	20	21	22	23	24	26	24	27	34	34	40	43
Iron_D	0.29	0.30	0.32	0.32	0.34	0.35	0.29	0.30	0.33	0.33	0.35	0.35
Iron_T	0.43	0.44	0.45	0.46	0.47	0.48	0.44	0.44	0.46	0.46	0.48	0.48
Lead_D	0.000052	0.000054	0.000060	0.000060	0.000065	0.000068	0.000068	0.000071	0.000081	0.000081	0.000091	0.000096
Lead_T	0.000085	0.000088	0.000095	0.000095	0.00010	0.00010	0.00010	0.00011	0.00012	0.00012	0.00013	0.00013
Magnesium_D	1.1	1.1	1.3	1.4	1.7	1.8	1.5	1.7	2.3	2.3	2.8	3.0
Manganese_D	0.033	0.036	0.045	0.045	0.053	0.056	0.077	0.084	0.10	0.10	0.12	0.13
Manganese_T	0.047	0.050	0.056	0.057	0.064	0.066	0.091	0.097	0.11	0.11	0.13	0.14
Mercury_D	0.0000018	0.0000019	0.0000019	0.0000019	0.0000020	0.0000020	0.0000021	0.0000021	0.0000022	0.0000022	0.0000022	0.0000023
Mercury_T	0.0000021	0.0000021	0.0000022	0.0000022	0.0000022	0.0000023	0.0000023	0.0000023	0.0000024	0.0000024	0.0000025	0.0000025
Molybdenum_D	0.000049	0.000056	0.00030	0.00032	0.00059	0.00066	0.00017	0.00018	0.00023	0.00024	0.00031	0.00034
Molybdenum_T	0.000091	0.000098	0.00035	0.00036	0.00063	0.00071	0.00021	0.00022	0.00027	0.00028	0.00035	0.00038
N_Ammonia	0.046	0.060	0.10	0.094	0.12	0.13	0.054	0.057	0.069	0.069	0.080	0.11
N_Nitrate_Nitrite	0.031	0.034	0.050	0.055	0.080	0.091	0.033	0.034	0.037	0.037	0.039	0.041
N_Nitrite	0.016	0.016	0.018	0.018	0.020	0.020	0.016	0.016	0.018	0.018	0.019	0.020
Nickel_D	0.00026	0.00028	0.00047	0.00050	0.00077	0.00086	0.00065	0.00079	0.0014	0.0014	0.0019	0.0021
Nickel_T	0.00039	0.00042	0.00061	0.00064	0.00091	0.0010	0.00079	0.00093	0.0015	0.0015	0.0020	0.0023
Phosphorus_T	0.024	0.025	0.025	0.025	0.026	0.026	0.025	0.026	0.026	0.026	0.027	0.027
Potassium_D	0.65	0.70	1.2	1.3	1.9	2.1	1.7	1.9	3.1	3.1	4.2	4.6
Proton	.00000029	0.00000029	.00000031	.00000031	0.00000034	.00000034	0.00000029	0.00000030	.00000032	.00000032	0.00000034	.00000035
Radium_226	0.0049	0.0049	0.0050	0.0050	0.0050	0.0050	0.0050	0.0051	0.0053	0.0053	0.0054	0.0055
Selenium_D	0.000048	0.000049	0.000070	0.000068	0.000084	0.000089	0.000060	0.000061	0.000067	0.000067	0.000075	0.000078
Selenium_T	0.000049	0.000051	0.000072	0.000070	0.000086	0.000091	0.000061	0.000063	0.000068	0.000069	0.000077	0.000080
Silicon_D	0.72	0.75	0.80	0.80	0.86	0.89	0.81	0.89	1.0	1.0	1.1	1.2
Silicon_T	0.82	0.84	0.89	0.89	0.94	0.96	0.91	0.98	1.1	1.1	1.2	1.3
Silver_D	0.0000050	0.0000051	0.0000052	0.0000052	0.0000054	0.0000055	0.0000054	0.0000055	0.0000059	0.0000059	0.0000063	0.0000065
Silver_T	0.0000050	0.0000051	0.0000052	0.0000052	0.0000054	0.0000055	0.0000054	0.0000055	0.0000059	0.0000059	0.0000063	0.0000065
Sodium_D	0.94	1.1	6.2	5.6	8.7	9.5	1.2	1.3	1.4	1.6	2.5	5.2
Sodium_T	0.96	1.1	6.2	5.6	8.7	9.5	1.2	1.3	1.4	1.7	2.5	5.2
Strontium_D	0.013	0.014	0.018	0.019	0.024	0.026	0.020	0.023	0.032	0.032	0.041	0.045
Strontium_T	0.014	0.014	0.019	0.019	0.024	0.026	0.021	0.024	0.033	0.033	0.041	0.045
Sulfate	0.43	1.1	18	17	31	35	17	18	29	30	42	47
Thallium_D	0.000038	0.000038	0.000039	0.000039	0.000040	0.000041	0.000039	0.000040	0.000042	0.000042	0.000043	0.000044
Thallium_T	0.000038	0.000038	0.000039	0.000039	0.000040	0.000041	0.000039	0.000040	0.000042	0.000042	0.000043	0.000044
TSS	3.7	4.1	8.2	9.1	16	17	15	20	40	40	58	65
Uranium_D	0.000042	0.000044	0.000069	0.000074	0.00011	0.00012	0.000079	0.000089	0.00014	0.00014	0.00018	0.00020
Uranium_T	0.000044	0.000045	0.000070	0.000075	0.00011	0.00012	0.000080	0.000091	0.00014	0.00014	0.00018	0.00020
Vanadium_T	0.00025	0.00026	0.00028	0.00028	0.00030	0.00031	0.00027	0.00027	0.00029	0.00029	0.00030	0.00031
Zinc_D	0.0018	0.0018	0.0019	0.0019	0.0021	0.0021	0.0020	0.0021	0.0024	0.0024	0.0027	0.0028
Zinc_T	0.0019	0.0020	0.0021	0.0021	0.0023	0.0023	0.0021	0.0023	0.0026	0.0026	0.0029	0.0029
N_Ammonia_Un	0.0000071	0.000011	0.000030	0.000083	0.00021	0.00027	0.0000083	0.0000095	0.000032	0.000061	0.00015	0.00022

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Expected Case Scenario - Model Node QM11

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	4.4	4.4	7.8	7.6	11	11	4.4	4.4	7.8	7.6	11	11
Alkalinity_T	13	13	26	24	31	31	13	13	26	24	31	31
Aluminum_D	0.054	0.054	0.066	0.064	0.067	0.067	0.054	0.054	0.066	0.064	0.067	0.067
Aluminum_T	0.087	0.087	0.13	0.12	0.13	0.13	0.087	0.087	0.13	0.12	0.13	0.13
Antimony_D	0.000080	0.000080	0.000092	0.000088	0.000093	0.000093	0.000080	0.000080	0.000092	0.000088	0.000093	0.000093
Antimony_T	0.000080	0.000080	0.000092	0.000088	0.000093	0.000093	0.000080	0.000080	0.000092	0.000088	0.000093	0.000093
Arsenic_D	0.00027	0.00027	0.00037	0.00035	0.00041	0.00041	0.00027	0.00027	0.00037	0.00035	0.00041	0.00041
Arsenic_T	0.00029	0.00029	0.00038	0.00037	0.00043	0.00043	0.00029	0.00029	0.00038	0.00037	0.00043	0.00043
Barium_D	0.0067	0.0067	0.010	0.0096	0.012	0.012	0.0067	0.0067	0.010	0.0096	0.012	0.012
Barium_T	0.0070	0.0070	0.011	0.010	0.013	0.013	0.0070	0.0070	0.011	0.010	0.013	0.013
Beryllium_T	0.000080	0.000080	0.000092	0.000088	0.000093	0.000093	0.000080	0.000080	0.000092	0.000088	0.000093	0.000093
Boron_D	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Boron_T	0.0050	0.0050	0.0085	0.0085	0.012	0.012	0.0050	0.0050	0.0085	0.0085	0.012	0.012
Bromide	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium_D	0.0000038	0.0000038	0.0000045	0.0000046	0.0000052	0.0000052	0.0000038	0.0000038	0.0000045	0.0000046	0.0000052	0.0000052
Cadmium_T	0.0000038	0.0000038	0.0000052	0.0000053	0.0000064	0.0000064	0.0000038	0.0000038	0.0000052	0.0000053	0.0000064	0.0000064
Calcium_D	4.8	4.8	7.7	7.3	9.0	9.0	4.8	4.8	7.7	7.3	9.0	9.0
Chloride	0.25	0.25	0.56	0.46	0.58	0.58	0.25	0.25	0.56	0.46	0.58	0.58
Chromium_D	0.00015	0.00015	0.00022	0.00021	0.00022	0.00022	0.00015	0.00015	0.00022	0.00021	0.00022	0.00022
Chromium_D_Hex	0.00015	0.00015	0.00022	0.00020	0.00022	0.00022	0.00015	0.00015	0.00022	0.00020	0.00022	0.00022
Chromium_T	0.00027	0.00027	0.00034	0.00032	0.00035	0.00035	0.00027	0.00027	0.00034	0.00032	0.00035	0.00035
Cobalt_D	0.000092	0.000092	0.00019	0.00017	0.00024	0.00024	0.000092	0.000092	0.00019	0.00017	0.00024	0.00024
Cobalt_T	0.00010	0.00010	0.00022	0.00020	0.00028	0.00028	0.00010	0.00010	0.00022	0.00020	0.00028	0.00028
Copper_D	0.00062	0.00062	0.00065	0.00074	0.0011	0.0011	0.00062	0.00062	0.00065	0.00074	0.0011	0.0011
Copper_T	0.00070	0.00070	0.00094	0.00095	0.0013	0.0013	0.00070	0.00070	0.00094	0.00095	0.0013	0.0013
Cyanide_F	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Cyanide_T	0.00050	0.00050	0.00056	0.00056	0.00062	0.00062	0.00050	0.00050	0.00056	0.00056	0.00062	0.00062
Cyanide_WAD	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Fluoride	0.043	0.043	0.053	0.050	0.053	0.053	0.043	0.043	0.053	0.050	0.053	0.053
Hardness	17	17	26	25	31	31	17	17	26	25	31	31
Iron_D	0.39	0.39	0.76	0.71	0.92	0.92	0.39	0.39	0.76	0.71	0.92	0.92
Iron_T	0.75	0.75	1.1	1.1	1.3	1.3	0.75	0.75	1.1	1.1	1.3	1.3
Lead_D	0.000041	0.000041	0.000041	0.000042	0.000048	0.000048	0.000041	0.000041	0.000041	0.000042	0.000048	0.000048
Lead_T	0.000066	0.000066	0.00011	0.000099	0.00012	0.00012	0.000066	0.000066	0.00011	0.000099	0.00012	0.00012
Magnesium_D	1.1	1.1	1.6	1.6	1.9	1.9	1.1	1.1	1.6	1.6	1.9	1.9
Manganese_D	0.033	0.033	0.091	0.083	0.12	0.12	0.033	0.033	0.091	0.083	0.12	0.12
Manganese_T	0.044	0.044	0.10	0.095	0.13	0.13	0.044	0.044	0.10	0.095	0.13	0.13
Mercury_D	0.0000015	0.0000015	0.0000015	0.0000018	0.0000023	0.0000023	0.0000015	0.0000015	0.0000015	0.0000018	0.0000023	0.0000023
Mercury_T	0.0000018	0.0000018	0.0000020	0.0000021	0.0000026	0.0000026	0.0000018	0.0000018	0.0000020	0.0000021	0.0000026	0.0000026
Molybdenum_D	0.00010	0.00010	0.00012	0.00012	0.00016	0.00016	0.00010	0.00010	0.00012	0.00012	0.00016	0.00016
Molybdenum_T	0.00010	0.00010	0.00012	0.00012	0.00017	0.00017	0.00010	0.00010	0.00012	0.00012	0.00017	0.00017
N_Ammonia	0.0080	0.0080	0.061	0.060	0.11	0.11	0.0080	0.0080	0.061	0.060	0.11	0.11
N_Nitrate_Nitrite	0.025	0.025	0.12	0.12	0.21	0.21	0.025	0.025	0.12	0.12	0.21	0.21
N_Nitrite	0.0010	0.0010	0.013	0.011	0.013	0.013	0.0010	0.0010	0.013	0.011	0.013	0.013
Nickel_D	0.00038	0.00038	0.00062	0.00065	0.0010	0.0010	0.00038	0.00038	0.00062	0.00065	0.0010	0.0010
Nickel_T	0.00059	0.00059	0.00075	0.00082	0.0013	0.0013	0.00059	0.00059	0.00075	0.00082	0.0013	0.0013
Phosphorus_T	0.024	0.024	0.034	0.033	0.039	0.039	0.024	0.024	0.034	0.033	0.039	0.039
Potassium_D	0.41	0.41	0.84	0.78	1.0	1.0	0.41	0.41	0.84	0.78	1.0	1.0
Proton	.00000020	0.00000020	.00000028	.00000027	0.00000032	.00000032	0.00000020	0.00000020	.00000028	.00000027	0.00000032	.00000032
Radium_226	0.0046	0.0046	0.0046	0.0048	0.0057	0.0057	0.0046	0.0046	0.0046	0.0048	0.0057	0.0057
Selenium_D	0.000040	0.000040	0.000048	0.000047	0.000050	0.000050	0.000040	0.000040	0.000048	0.000047	0.000050	0.000050
Selenium_T	0.000047	0.000047	0.000050	0.000050	0.000050	0.000050	0.000047	0.000047	0.000050	0.000050	0.000050	0.000050
Silicon_D	1.0	1.0	2.1	1.8	2.2	2.2	1.0	1.0	2.1	1.8	2.2	2.2
Silicon_T	1.2	1.2	2.1	1.9	2.2	2.2	1.2	1.2	2.1	1.9	2.2	2.2
Silver_D	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050
Silver_T	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050
Sodium_D	1.1	1.1	1.8	1.7	2.3	2.3	1.1	1.1	1.8	1.7	2.3	2.3
Sodium_T	1.1	1.1	1.8	1.8	2.3	2.3	1.1	1.1	1.8	1.8	2.3	2.3
Strontium_D	0.013	0.013	0.020	0.019	0.022	0.022	0.013	0.013	0.020	0.019	0.022	0.022
Strontium_T	0.014	0.014	0.021	0.019	0.023	0.023	0.014	0.014	0.021	0.019	0.023	0.023
Sulfate	0.38	0.38	0.72	0.70	0.92	0.92	0.38	0.38	0.72	0.70	0.92	0.92
Thallium_D	0.000032	0.000032	0.000042	0.000039	0.000044	0.000044	0.000032	0.000032	0.000042	0.000039	0.000044	0.000044
Thallium_T	0.000032	0.000032	0.000042	0.000039	0.000044	0.000044	0.000032	0.000032	0.000042	0.000039	0.000044	0.000044
TSS	1.0	1.0	3.8	3.2	4.0	4.0	1.0	1.0	3.8	3.2	4.0	4.0
Uranium_D	0.000038	0.000038	0.000046	0.000044	0.000046	0.000046	0.000038	0.000038	0.000046	0.000044	0.000046	0.000046
Uranium_T	0.000040	0.000040	0.000048	0.000046	0.000048	0.000048	0.000040	0.000040	0.000048	0.000046	0.000048	0.000048
Vanadium_T	0.00028	0.00028	0.00043	0.00039	0.00048	0.00048	0.00028	0.00028	0.00043	0.00039	0.00048	0.00048
Zinc_D	0.0019	0.0019	0.0023	0.0026	0.0042	0.0042	0.0019	0.0019	0.0023	0.0026	0.0042	0.0042
Zinc_T	0.0020	0.0020	0.0030	0.0031	0.0046	0.0046	0.0020	0.0020	0.0030	0.0031	0.0046	0.0046
N_Ammonia_Un	0.0000080	0.0000080	0.000017	0.000016	0.000019	0.000019	0.0000080	0.0000080	0.000017	0.000016	0.000019	0.000019

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Expected Case Scenario - Cockeram Lake

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	2.4	2.6	3.9	3.9	5.1	5.1	2.4	2.6	3.9	3.9	5.0	5.1
Alkalinity_T	8.7	9.3	11	11	13	13	8.5	9.0	11	11	13	13
Aluminum_D	0.034	0.038	0.041	0.042	0.050	0.054	0.035	0.038	0.041	0.042	0.050	0.054
Aluminum_T	0.065	0.065	0.077	0.080	0.10	0.12	0.064	0.064	0.077	0.080	0.10	0.12
Antimony_D	0.000073	0.000096	0.00011	0.00012	0.00016	0.00025	0.000073	0.000075	0.000096	0.000094	0.00011	0.00012
Antimony_T	0.000073	0.000096	0.00011	0.00012	0.00016	0.00025	0.000073	0.000075	0.000096	0.000094	0.00011	0.00012
Arsenic_D	0.00015	0.00017	0.00025	0.00031	0.00054	0.00073	0.00015	0.00016	0.00021	0.00020	0.00024	0.00028
Arsenic_T	0.00017	0.00019	0.00029	0.00035	0.00058	0.00076	0.00016	0.00018	0.00022	0.00023	0.00029	0.00032
Barium_D	0.0058	0.0060	0.0071	0.0070	0.0078	0.0084	0.0056	0.0057	0.0070	0.0069	0.0079	0.0082
Barium_T	0.0064	0.0065	0.0084	0.0084	0.010	0.011	0.0062	0.0063	0.0082	0.0082	0.010	0.010
Beryllium_T	0.000073	0.000075	0.000093	0.000089	0.000097	0.000098	0.000073	0.000074	0.000093	0.000089	0.000097	0.000098
Boron_D	0.0050	0.0050	0.0051	0.0052	0.0054	0.0056	0.0050	0.0050	0.0050	0.0050	0.0051	0.0051
Boron_T	0.0050	0.0051	0.0055	0.0054	0.0056	0.0060	0.0050	0.0050	0.0053	0.0053	0.0056	0.0057
Bromide	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium_D	0.0000093	0.000011	0.000011	0.000012	0.000016	0.000018	0.0000093	0.0000095	0.000011	0.000012	0.000015	0.000016
Cadmium_T	0.000011	0.000012	0.000012	0.000013	0.000017	0.000019	0.000011	0.000011	0.000012	0.000013	0.000017	0.000018
Calcium_D	3.9	4.4	4.7	4.9	5.8	6.3	3.6	3.6	4.3	4.5	5.1	5.5
Chloride	0.48	0.49	0.54	0.54	0.59	0.61	0.47	0.48	0.54	0.54	0.59	0.61
Chromium_D	0.000070	0.000073	0.000082	0.000079	0.000084	0.000085	0.000070	0.000072	0.000081	0.000079	0.000083	0.000083
Chromium_D_Hex	0.000070	0.000073	0.000079	0.000078	0.000082	0.000084	0.000070	0.000072	0.000079	0.000078	0.000081	0.000083
Chromium_T	0.00013	0.00014	0.00015	0.00015	0.00017	0.00018	0.00013	0.00013	0.00014	0.00015	0.00017	0.00018
Cobalt_D	0.00033	0.00036	0.00044	0.00054	0.00096	0.0011	0.00033	0.00034	0.00044	0.00053	0.00095	0.0011
Cobalt_T	0.00043	0.00046	0.00047	0.00061	0.0011	0.0013	0.00043	0.00044	0.00047	0.00060	0.0010	0.0013
Copper_D	0.0013	0.0013	0.0017	0.0020	0.0035	0.0044	0.0013	0.0013	0.0017	0.0020	0.0035	0.0044
Copper_T	0.0015	0.0015	0.0020	0.0024	0.0041	0.0051	0.0015	0.0015	0.0020	0.0024	0.0041	0.0051
Cyanide_F	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00051	0.00052	0.00053
Cyanide_T	0.00050	0.00052	0.00066	0.00064	0.00072	0.00076	0.00053	0.00054	0.00055	0.00055	0.00056	0.00059
Cyanide_WAD	0.00050	0.00050	0.00050	0.00050	0.00051	0.00051	0.00050	0.00050	0.00051	0.00051	0.00052	0.00054
Fluoride	0.051	0.054	0.059	0.059	0.063	0.063	0.051	0.054	0.059	0.059	0.063	0.063
Hardness	13	14	16	15	16	17	13	13	16	15	16	17
Iron_D	0.14	0.15	0.19	0.19	0.22	0.22	0.14	0.15	0.19	0.19	0.22	0.22
Iron_T	0.32	0.33	0.35	0.35	0.36	0.37	0.31	0.33	0.35	0.35	0.36	0.37
Lead_D	0.000036	0.000038	0.000043	0.000043	0.000046	0.000048	0.000036	0.000038	0.000044	0.000042	0.000046	0.000047
Lead_T	0.000046	0.000048	0.000052	0.000054	0.000064	0.000072	0.000044	0.000047	0.000051	0.000053	0.000062	0.000070
Magnesium_D	0.93	1.0	1.1	1.1	1.2	1.3	0.90	0.91	1.1	1.0	1.1	1.2
Manganese_D	0.012	0.013	0.027	0.024	0.030	0.030	0.012	0.014	0.027	0.025	0.032	0.037
Manganese_T	0.028	0.030	0.033	0.034	0.040	0.040	0.028	0.029	0.033	0.033	0.038	0.040
Mercury_D	.00000069	0.00000069	.00000071	.00000083	0.0000011	0.0000012	0.00000069	0.00000069	.00000073	.00000084	0.0000011	0.0000012
Mercury_T	.00000086	0.00000087	.00000088	0.0000010	0.0000013	0.0000014	0.00000086	0.00000088	.00000089	0.0000010	0.0000013	0.0000014
Molybdenum_D	0.000050	0.000055	0.000090	0.00012	0.00021	0.00027	0.000048	0.000050	0.000061	0.000060	0.000074	0.000082
Molybdenum_T	0.000082	0.00010	0.00013	0.00016	0.00025	0.00031	0.000081	0.000085	0.00010	0.00010	0.00011	0.00013
N_Ammonia	0.0078	0.010	0.027	0.026	0.040	0.052	0.0075	0.0087	0.022	0.024	0.039	0.041
N_Nitrate_Nitrite	0.027	0.035	0.081	0.081	0.12	0.19	0.025	0.025	0.055	0.058	0.091	0.091
N_Nitrite	0.0091	0.010	0.012	0.012	0.013	0.014	0.0090	0.0099	0.012	0.011	0.012	0.012
Nickel_D	0.023	0.023	0.027	0.029	0.038	0.044	0.023	0.023	0.027	0.029	0.038	0.044
Nickel_T	0.024	0.024	0.027	0.029	0.038	0.044	0.024	0.024	0.027	0.029	0.038	0.044
Phosphorus_T	0.014	0.016	0.019	0.019	0.022	0.022	0.014	0.016	0.019	0.019	0.022	0.022
Potassium_D	0.63	0.70	0.80	0.85	1.1	1.3	0.61	0.61	0.77	0.76	0.84	0.98
Proton	.00000010	0.00000013	.00000031	.00000032	0.00000050	.00000050	0.00000010	0.00000013	.00000031	.00000032	0.00000050	.00000050
Radium_226	0.0046	0.0047	0.0049	0.0051	0.0056	0.0063	0.0045	0.0046	0.0049	0.0051	0.0056	0.0063
Selenium_D	0.000041	0.000043	0.000048	0.000048	0.000051	0.000055	0.000041	0.000041	0.000047	0.000047	0.000051	0.000052
Selenium_T	0.000041	0.000045	0.000051	0.000050	0.000054	0.000057	0.000041	0.000043	0.000050	0.000049	0.000052	0.000054
Silicon_D	2.0	2.0	2.6	2.7	3.3	3.3	1.9	2.0	2.6	2.7	3.3	3.3
Silicon_T	2.2	2.2	2.7	2.8	3.3	3.4	2.1	2.2	2.7	2.8	3.3	3.3
Silver_D	0.0000050	0.0000050	0.0000050	0.0000050	0.0000051	0.0000051	0.0000050	0.0000050	0.0000050	0.0000050	0.0000051	0.0000051
Silver_T	0.0000050	0.0000050	0.0000051	0.0000051	0.0000052	0.0000053	0.0000050	0.0000050	0.0000051	0.0000051	0.0000051	0.0000052
Sodium_D	1.1	1.2	1.4	1.4	1.5	1.6	1.1	1.1	1.4	1.4	1.5	1.6
Sodium_T	1.2	1.2	1.4	1.4	1.6	1.7	1.1	1.2	1.4	1.4	1.6	1.7
Strontium_D	0.014	0.015	0.017	0.017	0.019	0.021	0.013	0.014	0.017	0.016	0.018	0.019
Strontium_T	0.014	0.016	0.018	0.018	0.020	0.022	0.014	0.015	0.018	0.017	0.019	0.020
Sulfate	4.1	4.4	6.2	6.6	9.7	11	4.1	4.1	5.3	5.6	7.7	8.3
Thallium_D	0.000016	0.000021	0.000044	0.000037	0.000047	0.000047	0.000016	0.000021	0.000044	0.000037	0.000047	0.000047
Thallium_T	0.000016	0.000021	0.000044	0.000037	0.000047	0.000048	0.000016	0.000021	0.000044	0.000037	0.000047	0.000047
TSS	1.3	2.3	4.9	5.6	10	12	1.2	1.2	3.0	3.8	6.3	8.9
Uranium_D	0.000036	0.000044	0.000053	0.000056	0.000069	0.000087	0.000035	0.000036	0.000048	0.000047	0.000053	0.000059
Uranium_T	0.000039	0.000047	0.000054	0.000057	0.000072	0.000088	0.000038	0.000039	0.000049	0.000048	0.000053	0.000060
Vanadium_T	0.00011	0.00012	0.00012	0.00012	0.00014	0.00014	0.00011	0.00011	0.00012	0.00012	0.00013	0.00014
Zinc_D	0.0057	0.0059	0.0082	0.0075	0.0085	0.0086	0.0057	0.0059	0.0082	0.0075	0.0085	0.0086
Zinc_T	0.0057	0.0063	0.0082	0.0076	0.0086	0.0086	0.0057	0.0063	0.0082	0.0076	0.0085	0.0086
N_Ammonia_Un	0.0000039	0.0000057	0.0000078	0.000015	0.000036	0.000052	0.0000039	0.0000057	0.0000064	0.000012	0.000027	0.000031

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Expected Case Scenario - Payne Lake

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	7.6	7.9	9.0	9.0	10	10	7.8	8.1	9.2	9.2	10	11
Alkalinity_T	9.8	11	12	12	14	14	12	12	14	14	15	16
Aluminum_D	0.037	0.038	0.040	0.041	0.044	0.044	0.038	0.039	0.041	0.041	0.044	0.046
Aluminum_T	0.056	0.057	0.059	0.059	0.061	0.062	0.058	0.058	0.059	0.060	0.062	0.063
Antimony_D	0.000076	0.00011	0.00091	0.00079	0.0012	0.0013	0.000094	0.000097	0.00010	0.00015	0.00026	0.00064
Antimony_T	0.000076	0.00011	0.00091	0.00079	0.0012	0.0013	0.000094	0.000097	0.00010	0.00015	0.00026	0.00064
Arsenic_D	0.00021	0.00026	0.00096	0.00090	0.0014	0.0015	0.00084	0.00087	0.0010	0.0011	0.0012	0.0014
Arsenic_T	0.00024	0.00029	0.00099	0.00093	0.0014	0.0015	0.00087	0.00090	0.0011	0.0011	0.0013	0.0015
Barium_D	0.0083	0.0090	0.010	0.010	0.012	0.012	0.0092	0.0094	0.010	0.010	0.011	0.012
Barium_T	0.0087	0.0094	0.011	0.011	0.012	0.012	0.0096	0.0099	0.011	0.011	0.012	0.012
Beryllium_T	0.000075	0.000076	0.000078	0.000078	0.000080	0.000080	0.000078	0.000078	0.000081	0.000081	0.000082	0.000084
Boron_D	0.0050	0.0050	0.0055	0.0055	0.0058	0.0059	0.0052	0.0052	0.0052	0.0052	0.0053	0.0055
Boron_T	0.0050	0.0050	0.0055	0.0055	0.0058	0.0059	0.0052	0.0052	0.0052	0.0052	0.0053	0.0055
Bromide	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.051	0.051	0.051	0.051
Cadmium_D	0.0000038	0.0000040	0.0000053	0.0000052	0.0000062	0.0000064	0.0000048	0.0000049	0.0000053	0.0000055	0.0000063	0.0000075
Cadmium_T	0.0000048	0.0000050	0.0000064	0.0000063	0.0000073	0.0000075	0.0000058	0.0000060	0.0000064	0.0000065	0.0000074	0.0000086
Calcium_D	3.9	4.5	7.6	7.2	9.3	9.8	5.4	5.7	6.3	6.5	7.5	9.1
Chloride	0.25	0.28	0.97	0.86	1.2	1.3	0.33	0.33	0.35	0.38	0.47	0.75
Chromium_D	0.00014	0.00014	0.00015	0.00015	0.00016	0.00017	0.00014	0.00015	0.00016	0.00016	0.00017	0.00017
Chromium_D_Hex	0.00014	0.00014	0.00015	0.00015	0.00016	0.00017	0.00014	0.00015	0.00016	0.00016	0.00017	0.00017
Chromium_T	0.00023	0.00023	0.00024	0.00024	0.00024	0.00024	0.00023	0.00023	0.00024	0.00024	0.00025	0.00025
Cobalt_D	0.00020	0.00030	0.0012	0.0010	0.0015	0.0016	0.00022	0.00023	0.00027	0.00030	0.00040	0.00086
Cobalt_T	0.00021	0.00031	0.0012	0.0010	0.0015	0.0016	0.00023	0.00024	0.00028	0.00031	0.00042	0.00088
Copper_D	0.00021	0.00026	0.00059	0.00055	0.00074	0.00077	0.00025	0.00026	0.00062	0.00052	0.00070	0.00075
Copper_T	0.00031	0.00038	0.00071	0.00066	0.00085	0.00088	0.00035	0.00038	0.00073	0.00063	0.00081	0.00086
Cyanide_F	0.00050	0.00051	0.00083	0.00078	0.00096	0.00098	0.00065	0.00065	0.00069	0.00072	0.00085	0.0011
Cyanide_T	0.00051	0.0082	0.071	0.063	0.099	0.10	0.014	0.014	0.018	0.018	0.022	0.025
Cyanide_WAD	0.00050	0.00063	0.0023	0.0020	0.0029	0.0031	0.00090	0.00092	0.0010	0.0010	0.0011	0.0012
Fluoride	0.031	0.033	0.044	0.042	0.050	0.052	0.033	0.033	0.035	0.036	0.038	0.046
Hardness	12	13	14	14	15	15	15	16	17	17	19	20
Iron_D	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Iron_T	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Lead_D	0.000036	0.000038	0.000044	0.000043	0.000047	0.000048	0.000047	0.000048	0.000051	0.000053	0.000059	0.000070
Lead_T	0.000067	0.000072	0.000079	0.000079	0.000085	0.000087	0.000079	0.000082	0.000088	0.000088	0.000095	0.00011
Magnesium_D	0.62	0.67	0.86	0.84	1.0	1.0	0.81	0.84	0.92	0.92	1.0	1.1
Manganese_D	0.061	0.065	0.081	0.081	0.096	0.10	0.12	0.13	0.15	0.16	0.19	0.24
Manganese_T	0.073	0.077	0.092	0.092	0.11	0.11	0.13	0.14	0.16	0.17	0.20	0.25
Mercury_D	0.0000015	0.0000015	0.0000017	0.0000016	0.0000017	0.0000018	0.0000017	0.0000018	0.0000018	0.0000019	0.0000020	0.0000023
Mercury_T	0.0000018	0.0000019	0.0000020	0.0000020	0.0000021	0.0000021	0.0000021	0.0000021	0.0000022	0.0000022	0.0000024	0.0000027
Molybdenum_D	0.000046	0.000066	0.00064	0.00057	0.00092	0.00098	0.000070	0.000074	0.000084	0.00012	0.00021	0.00050
Molybdenum_T	0.000057	0.000078	0.00065	0.00058	0.00093	0.00099	0.000081	0.000086	0.000096	0.00013	0.00022	0.00051
N_Ammonia	0.071	0.099	0.24	0.22	0.30	0.33	0.078	0.083	0.10	0.11	0.13	0.22
N_Nitrate_Nitrite	0.025	0.026	0.049	0.049	0.073	0.079	0.026	0.026	0.026	0.026	0.027	0.030
N_Nitrite	0.017	0.017	0.018	0.018	0.019	0.019	0.017	0.017	0.017	0.017	0.018	0.018
Nickel_D	0.00025	0.00027	0.00048	0.00045	0.00059	0.00063	0.00028	0.00029	0.00031	0.00032	0.00037	0.00051
Nickel_T	0.00029	0.00033	0.00053	0.00051	0.00066	0.00069	0.00033	0.00034	0.00037	0.00038	0.00043	0.00057
Phosphorus_T	0.022	0.022	0.023	0.023	0.023	0.023	0.022	0.022	0.023	0.023	0.024	0.024
Potassium_D	0.46	0.54	1.5	1.4	2.0	2.1	0.70	0.72	0.82	0.88	1.2	1.8
Proton	.00000068	0.00000070	.00000078	.00000078	0.00000087	.00000089	0.00000068	0.00000070	.00000078	.00000079	0.00000087	.00000089
Radium_226	0.0049	0.0049	0.0050	0.0050	0.0051	0.0051	0.0050	0.0050	0.0051	0.0051	0.0052	0.0052
Selenium_D	0.000041	0.000045	0.00011	0.00010	0.00014	0.00015	0.000042	0.000043	0.000044	0.000047	0.000057	0.000089
Selenium_T	0.000045	0.000048	0.00012	0.00011	0.00015	0.00015	0.000046	0.000046	0.000047	0.000050	0.000060	0.000093
Silicon_D	1.8	1.8	2.1	2.1	2.3	2.4	1.9	1.9	2.2	2.2	2.4	2.5
Silicon_T	1.9	2.0	2.2	2.2	2.5	2.6	2.0	2.0	2.3	2.3	2.6	2.6
Silver_D	0.0000050	0.0000050	0.0000053	0.0000053	0.0000055	0.0000055	0.0000052	0.0000052	0.0000052	0.0000052	0.0000053	0.0000055
Silver_T	0.0000050	0.0000050	0.0000053	0.0000053	0.0000055	0.0000055	0.0000052	0.0000052	0.0000052	0.0000052	0.0000053	0.0000055
Sodium_D	0.76	1.6	21	18	28	30	0.81	0.83	0.92	1.8	4.3	13
Sodium_T	0.84	1.6	21	18	28	30	0.89	0.91	1.0	1.9	4.4	13
Strontium_D	0.011	0.012	0.018	0.018	0.022	0.023	0.013	0.014	0.015	0.015	0.017	0.021
Strontium_T	0.011	0.013	0.019	0.018	0.023	0.024	0.014	0.015	0.016	0.016	0.018	0.022
Sulfate	0.18	2.6	57	49	79	84	3.7	3.8	5.1	7.7	16	41
Thallium_D	0.000022	0.000023	0.000025	0.000025	0.000027	0.000028	0.000023	0.000023	0.000026	0.000026	0.000028	0.000029
Thallium_T	0.000022	0.000023	0.000025	0.000025	0.000027	0.000028	0.000023	0.000023	0.000026	0.000026	0.000028	0.000029
TSS	5.4	5.9	7.4	7.3	8.8	9.4	5.6	5.8	6.5	6.5	7.1	7.5
Uranium_D	0.000024	0.000029	0.000054	0.000051	0.000069	0.000072	0.000030	0.000032	0.000036	0.000037	0.000045	0.000061
Uranium_T	0.000033	0.000037	0.000062	0.000059	0.000076	0.000079	0.000040	0.000041	0.000044	0.000045	0.000053	0.000068
Vanadium_T	0.00017	0.00018	0.00021	0.00020	0.00022	0.00023	0.00018	0.00019	0.00019	0.00020	0.00020	0.00022
Zinc_D	0.0017	0.0018	0.0020	0.0020	0.0021	0.0022	0.0018	0.0018	0.0020	0.0020	0.0021	0.0023
Zinc_T	0.0027	0.0028	0.0028	0.0028	0.0029	0.0029	0.0028	0.0028	0.0029	0.0029	0.0029	0.0030
N_Ammonia_Un	0.000012	0.000019	0.000056	0.00019	0.00050	0.00067	0.000013	0.000014	0.000051	0.000091	0.00022	0.00044

Notes:

Appendix C Water Quality Results For the Upper Case Scenario – Summary Statistics

Summary Statistics of the Updated Model Results (mg/L) for the Upper Case Scenario - Open Pit Discharge

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	na	na	na	na	na	na	1.9	9.9	10	10	10	10
Alkalinity_T	na	na	na	na	na	na	27	140	140	140	140	140
Aluminum_D	na	na	na	na	na	na	0.010	0.051	0.051	0.051	0.051	0.052
Aluminum_T	na	na	na	na	na	na	0.077	0.39	0.39	0.39	0.39	0.39
Antimony_D	na	na	na	na	na	na	0.00061	0.0027	0.0028	0.0028	0.0030	0.0031
Antimony_T	na	na	na	na	na	na	0.00061	0.0027	0.0028	0.0028	0.0030	0.0031
Arsenic_D	na	na	na	na	na	na	0.0030	0.015	0.015	0.016	0.016	0.016
Arsenic_T	na	na	na	na	na	na	0.0038	0.019	0.019	0.019	0.020	0.020
Barium_D	na	na	na	na	na	na	0.013	0.068	0.071	0.071	0.073	0.074
Barium_T	na	na	na	na	na	na	0.014	0.070	0.072	0.072	0.075	0.076
Beryllium_T	na	na	na	na	na	na	0.000036	0.00019	0.00019	0.00019	0.00020	0.00020
Boron_D	na	na	na	na	na	na	0.0043	0.022	0.023	0.023	0.023	0.023
Boron_T	na	na	na	na	na	na	0.0044	0.022	0.023	0.023	0.023	0.024
Bromide	na	na	na	na	na	na	0.015	0.075	0.076	0.076	0.077	0.078
Cadmium_D	na	na	na	na	na	na	0.000040	0.00020	0.00021	0.00021	0.00022	0.00023
Cadmium_T	na	na	na	na	na	na	0.000047	0.00024	0.00025	0.00025	0.00026	0.00026
Calcium_D	na	na	na	na	na	na	36	180	190	190	200	200
Chloride	na	na	na	na	na	na	0.78	3.8	3.8	3.8	3.9	4.0
Chromium_D	na	na	na	na	na	na	0.000074	0.00038	0.00039	0.00039	0.00040	0.00040
Chromium_D_Hex	na	na	na	na	na	na	0.000074	0.00038	0.00039	0.00039	0.00040	0.00040
Chromium_T	na	na	na	na	na	na	0.00053	0.0027	0.0027	0.0027	0.0027	0.0027
Cobalt_D	na	na	na	na	na	na	0.00087	0.0040	0.0041	0.0041	0.0043	0.0044
Cobalt_T	na	na	na	na	na	na	0.00093	0.0044	0.0045	0.0045	0.0046	0.0047
Copper_D	na	na	na	na	na	na	0.0014	0.0058	0.0069	0.0067	0.0073	0.0074
Copper_T	na	na	na	na	na	na	0.0017	0.0087	0.0092	0.0091	0.0096	0.0097
Cyanide_F	na	na	na	na	na	na	0.00075	0.0037	0.0038	0.0038	0.0038	0.0038
Cyanide_T	na	na	na	na	na	na	0.0014	0.0074	0.0083	0.0082	0.0090	0.0092
Cyanide_WAD	na	na	na	na	na	na	0.00086	0.0046	0.0051	0.0051	0.0056	0.0057
Fluoride	na	na	na	na	na	na	0.035	0.17	0.17	0.17	0.18	0.18
Hardness	na	na	na	na	na	na	51	260	270	270	280	280
Iron_D	na	na	na	na	na	na	0.033	0.17	0.17	0.17	0.17	0.17
Iron_T	na	na	na	na	na	na	0.15	0.76	0.77	0.77	0.78	0.78
Lead_D	na	na	na	na	na	na	0.000091	0.00046	0.00048	0.00048	0.00049	0.00050
Lead_T	na	na	na	na	na	na	0.00026	0.0013	0.0013	0.0013	0.0014	0.0014
Magnesium_D	na	na	na	na	na	na	3.8	19	20	20	21	21
Manganese_D	na	na	na	na	na	na	0.25	1.3	1.3	1.3	1.4	1.4
Manganese_T	na	na	na	na	na	na	0.073	0.37	0.39	0.39	0.41	0.41
Mercury_D	na	na	na	na	na	na	0.0000014	0.0000070	0.0000070	0.0000071	0.0000072	0.0000073
Mercury_T	na	na	na	na	na	na	0.0000014	0.0000073	0.0000074	0.0000074	0.0000076	0.0000077
Molybdenum_D	na	na	na	na	na	na	0.00079	0.0038	0.0038	0.0038	0.0039	0.0040
Molybdenum_T	na	na	na	na	na	na	0.00080	0.0038	0.0039	0.0039	0.0040	0.0041
N_Ammonia	na	na	na	na	na	na	0.085	0.32	0.36	0.36	0.41	0.43
N_Nitrate_Nitrite	na	na	na	na	na	na	0.023	0.11	0.12	0.12	0.12	0.12
N_Nitrite	na	na	na	na	na	na	0.0026	0.013	0.013	0.013	0.013	0.013
Nickel_D	na	na	na	na	na	na	0.0031	0.016	0.017	0.017	0.018	0.018
Nickel_T	na	na	na	na	na	na	0.0037	0.019	0.019	0.019	0.020	0.021
Phosphorus_T	na	na	na	na	na	na	0.0047	0.024	0.025	0.025	0.025	0.025
Potassium_D	na	na	na	na	na	na	7.5	38	40	40	41	42
Proton	na	na	na	na	na	na	0.000000023	0.00000012	.00000012	.00000012	0.00000012	.00000012
Radium_226	na	na	na	na	na	na	0.0033	0.017	0.017	0.017	0.017	0.017
Selenium_D	na	na	na	na	na	na	0.000079	0.00037	0.00038	0.00038	0.00039	0.00040
Selenium_T	na	na	na	na	na	na	0.000084	0.00040	0.00040	0.00040	0.00042	0.00042
Silicon_D	na	na	na	na	na	na	1.5	7.5	7.6	7.6	7.7	7.7
Silicon_T	na	na	na	na	na	na	1.5	7.6	7.7	7.7	7.8	7.8
Silver_D	na	na	na	na	na	na	0.0000032	0.000016	0.000017	0.000017	0.000017	0.000017
Silver_T	na	na	na	na	na	na	0.0000066	0.000034	0.000034	0.000034	0.000035	0.000035
Sodium_D	na	na	na	na	na	na	6.9	21	25	26	33	35
Sodium_T	na	na	na	na	na	na	7.0	21	26	26	33	35
Strontium_D	na	na	na	na	na	na	0.064	0.33	0.34	0.34	0.35	0.36
Strontium_T	na	na	na	na	na	na	0.065	0.33	0.34	0.34	0.36	0.36
Sulfate	na	na	na	na	na	na	100	510	510	510	520	520
Thallium_D	na	na	na	na	na	na	0.000012	0.000059	0.000061	0.000061	0.000063	0.000064
Thallium_T	na	na	na	na	na	na	0.000015	0.000078	0.000080	0.000080	0.000082	0.000083
TSS	na	na	na	na	na	na	150	750	760	760	780	790
Uranium_D	na	na	na	na	na	na	0.00032	0.0017	0.0017	0.0017	0.0018	0.0018
Uranium_T	na	na	na	na	na	na	0.00033	0.0017	0.0017	0.0017	0.0018	0.0018
Vanadium_T	na	na	na	na	na	na	0.00034	0.0017	0.0017	0.0017	0.0017	0.0017
Zinc_D	na	na	na	na	na	na	0.0019	0.0096	0.0099	0.0099	0.010	0.010
Zinc_T	na	na	na	na	na	na	0.0025	0.013	0.013	0.013	0.013	0.013
N_Ammonia_Un	na	na	na	na	na	na	0.000013	0.000051	0.00027	0.00032	0.00082	0.0010

Notes:

na denotes not applicable. The model results are not reported for the period when the water volume reached the lower bound (empty reservoir)

Summary Statistics of the Updated Model Results (mg/L) for the Upper Case Scenario - Satellite Pit Discharge

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	na	na	na	na	na	na	6.6	9.9	11	11	11	11
Alkalinity_T	na	na	na	na	na	na	93	140	150	150	160	160
Aluminum_D	na	na	na	na	na	na	0.021	0.034	0.035	0.035	0.037	0.038
Aluminum_T	na	na	na	na	na	na	0.21	0.36	0.37	0.37	0.37	0.37
Antimony_D	na	na	na	na	na	na	0.0015	0.0023	0.0024	0.0024	0.0026	0.0026
Antimony_T	na	na	na	na	na	na	0.0015	0.0023	0.0025	0.0025	0.0026	0.0026
Arsenic_D	na	na	na	na	na	na	0.0085	0.013	0.014	0.014	0.015	0.015
Arsenic_T	na	na	na	na	na	na	0.011	0.017	0.018	0.018	0.019	0.019
Barium_D	na	na	na	na	na	na	0.055	0.081	0.087	0.087	0.094	0.096
Barium_T	na	na	na	na	na	na	0.056	0.082	0.089	0.089	0.096	0.098
Beryllium_T	na	na	na	na	na	na	0.00013	0.00019	0.00020	0.00020	0.00022	0.00022
Boron_D	na	na	na	na	na	na	0.017	0.026	0.027	0.027	0.029	0.029
Boron_T	na	na	na	na	na	na	0.017	0.026	0.028	0.028	0.029	0.030
Bromide	na	na	na	na	na	na	0.055	0.085	0.089	0.089	0.094	0.096
Cadmium_D	na	na	na	na	na	na	0.00017	0.00026	0.00027	0.00027	0.00029	0.00029
Cadmium_T	na	na	na	na	na	na	0.00019	0.00030	0.00031	0.00031	0.00033	0.00033
Calcium_D	na	na	na	na	na	na	150	220	240	240	260	260
Chloride	na	na	na	na	na	na	2.8	3.8	4.2	4.3	4.8	4.9
Chromium_D	na	na	na	na	na	na	0.00028	0.00043	0.00046	0.00046	0.00048	0.00048
Chromium_D_Hex	na	na	na	na	na	na	0.00028	0.00043	0.00046	0.00046	0.00048	0.00048
Chromium_T	na	na	na	na	na	na	0.0016	0.0027	0.0028	0.0028	0.0028	0.0028
Cobalt_D	na	na	na	na	na	na	0.0027	0.0041	0.0044	0.0044	0.0046	0.0047
Cobalt_T	na	na	na	na	na	na	0.0029	0.0046	0.0048	0.0048	0.0051	0.0051
Copper_D	na	na	na	na	na	na	0.0014	0.0022	0.0023	0.0023	0.0024	0.0024
Copper_T	na	na	na	na	na	na	0.0023	0.0038	0.0039	0.0039	0.0040	0.0040
Cyanide_F	na	na	na	na	na	na	0.00048	0.00074	0.00078	0.00078	0.00082	0.00083
Cyanide_T	na	na	na	na	na	na	0.00045	0.00069	0.00073	0.00073	0.00078	0.00079
Cyanide_WAD	na	na	na	na	na	na	0.00045	0.00069	0.00073	0.00073	0.00078	0.00079
Fluoride	na	na	na	na	na	na	0.099	0.16	0.16	0.16	0.17	0.17
Hardness	na	na	na	na	na	na	220	320	350	350	380	390
Iron_D	na	na	na	na	na	na	0.11	0.16	0.17	0.17	0.19	0.19
Iron_T	na	na	na	na	na	na	0.42	0.70	0.71	0.71	0.73	0.73
Lead_D	na	na	na	na	na	na	0.00022	0.00034	0.00036	0.00036	0.00038	0.00039
Lead_T	na	na	na	na	na	na	0.00072	0.0012	0.0012	0.0012	0.0012	0.0013
Magnesium_D	na	na	na	na	na	na	16	24	26	26	28	28
Manganese_D	na	na	na	na	na	na	0.27	0.38	0.42	0.42	0.46	0.47
Manganese_T	na	na	na	na	na	na	0.30	0.43	0.47	0.47	0.52	0.53
Mercury_D	na	na	na	na	na	na	0.0000012	0.0000019	0.0000019	0.0000020	0.0000021	0.0000021
Mercury_T	na	na	na	na	na	na	0.0000015	0.0000023	0.0000024	0.0000024	0.0000026	0.0000026
Molybdenum_D	na	na	na	na	na	na	0.0023	0.0035	0.0037	0.0037	0.0039	0.0040
Molybdenum_T	na	na	na	na	na	na	0.0023	0.0036	0.0037	0.0037	0.0039	0.0040
N_Ammonia	na	na	na	na	na	na	0.092	0.13	0.14	0.14	0.16	0.16
N_Nitrate_Nitrite	na	na	na	na	na	na	0.075	0.12	0.13	0.13	0.13	0.13
N_Nitrite	na	na	na	na	na	na	0.0084	0.013	0.014	0.014	0.014	0.015
Nickel_D	na	na	na	na	na	na	0.014	0.021	0.023	0.023	0.024	0.024
Nickel_T	na	na	na	na	na	na	0.016	0.024	0.025	0.025	0.027	0.027
Phosphorus_T	na	na	na	na	na	na	0.016	0.024	0.025	0.025	0.027	0.028
Potassium_D	na	na	na	na	na	na	31	46	50	49	53	53
Proton	na	na	na	na	na	na	0.000000085	0.00000013	.00000014	.00000014	0.00000015	.00000015
Radium_226	na	na	na	na	na	na	0.010	0.017	0.017	0.017	0.017	0.018
Selenium_D	na	na	na	na	na	na	0.00025	0.00039	0.00041	0.00041	0.00044	0.00044
Selenium_T	na	na	na	na	na	na	0.00027	0.00042	0.00044	0.00044	0.00046	0.00047
Silicon_D	na	na	na	na	na	na	5.3	8.2	8.6	8.6	9.1	9.2
Silicon_T	na	na	na	na	na	na	5.3	8.3	8.7	8.7	9.2	9.3
Silver_D	na	na	na	na	na	na	0.000012	0.000018	0.000019	0.000019	0.000020	0.000021
Silver_T	na	na	na	na	na	na	0.000022	0.000036	0.000037	0.000037	0.000038	0.000038
Sodium_D	na	na	na	na	na	na	6.4	9.7	10	10	11	11
Sodium_T	na	na	na	na	na	na	6.5	9.8	10	10	11	11
Strontium_D	na	na	na	na	na	na	0.27	0.40	0.43	0.43	0.46	0.47
Strontium_T	na	na	na	na	na	na	0.27	0.40	0.43	0.43	0.46	0.47
Sulfate	na	na	na	na	na	na	390	570	620	620	660	680
Thallium_D	na	na	na	na	na	na	0.000045	0.000067	0.000072	0.000072	0.000077	0.000079
Thallium_T	na	na	na	na	na	na	0.000056	0.000087	0.000091	0.000091	0.000097	0.000098
TSS	na	na	na	na	na	na	570	930	960	960	990	1,000
Uranium_D	na	na	na	na	na	na	0.0013	0.0020	0.0021	0.0021	0.0022	0.0022
Uranium_T	na	na	na	na	na	na	0.0013	0.0020	0.0021	0.0021	0.0022	0.0022
Vanadium_T	na	na	na	na	na	na	0.00091	0.0016	0.0016	0.0016	0.0016	0.0016
Zinc_D	na	na	na	na	na	na	0.0070	0.011	0.012	0.012	0.012	0.012
Zinc_T	na	na	na	na	na	na	0.0088	0.014	0.015	0.015	0.015	0.015
N_Ammonia_Un	na	na	na	na	na	na	0.000020	0.000021	0.000052	0.00013	0.00033	0.00038

Notes:

na denotes not applicable. The model results are not reported for the period when the water volume reached the lower bound (empty reservoir)

Summary Statistics of the Updated Model Results (mg/L) for the Upper Case Scenario - Collection Pond Discharge

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	4.2	5.9	7.0	7.6	9.1	13	na	na	na	na	na	na
Alkalinity_T	78	84	110	120	180	210	na	na	na	na	na	na
Aluminum_D	0.0068	0.014	0.025	0.029	0.044	0.047	na	na	na	na	na	na
Aluminum_T	0.32	0.33	0.36	0.36	0.37	0.38	na	na	na	na	na	na
Antimony_D	0.000068	0.00039	0.0050	0.0061	0.014	0.022	na	na	na	na	na	na
Antimony_T	0.000077	0.00040	0.0050	0.0062	0.014	0.022	na	na	na	na	na	na
Arsenic_D	0.00054	0.0019	0.022	0.029	0.068	0.091	na	na	na	na	na	na
Arsenic_T	0.0021	0.0041	0.027	0.033	0.071	0.095	na	na	na	na	na	na
Barium_D	0.020	0.024	0.055	0.065	0.12	0.14	na	na	na	na	na	na
Barium_T	0.022	0.025	0.056	0.066	0.12	0.15	na	na	na	na	na	na
Beryllium_T	0.000062	0.000071	0.00012	0.00014	0.00024	0.00029	na	na	na	na	na	na
Boron_D	0.0055	0.0079	0.028	0.036	0.076	0.095	na	na	na	na	na	na
Boron_T	0.0055	0.0079	0.028	0.036	0.076	0.096	na	na	na	na	na	na
Bromide	0.043	0.053	0.063	0.069	0.094	0.10	na	na	na	na	na	na
Cadmium_D	0.0000052	0.000013	0.00015	0.00019	0.00043	0.00068	na	na	na	na	na	na
Cadmium_T	0.000022	0.000038	0.00019	0.00023	0.00047	0.00071	na	na	na	na	na	na
Calcium_D	37	48	130	160	330	390	na	na	na	na	na	na
Chloride	0.53	0.62	2.3	2.2	3.6	4.9	na	na	na	na	na	na
Chromium_D	0.000067	0.00012	0.00025	0.00031	0.00059	0.00077	na	na	na	na	na	na
Chromium_D_Hex	0.000067	0.00012	0.00025	0.00031	0.00059	0.00077	na	na	na	na	na	na
Chromium_T	0.0022	0.0024	0.0025	0.0026	0.0029	0.0031	na	na	na	na	na	na
Cobalt_D	0.00011	0.00027	0.0021	0.0028	0.0065	0.0089	na	na	na	na	na	na
Cobalt_T	0.00053	0.00070	0.0025	0.0032	0.0070	0.0094	na	na	na	na	na	na
Copper_D	0.00037	0.00097	0.0018	0.0020	0.0032	0.0035	na	na	na	na	na	na
Copper_T	0.0018	0.0025	0.0034	0.0035	0.0047	0.0051	na	na	na	na	na	na
Cyanide_F	0.00045	0.00054	0.00064	0.00064	0.00076	0.00082	na	na	na	na	na	na
Cyanide_T	0.00042	0.00050	0.00055	0.00058	0.00071	0.00076	na	na	na	na	na	na
Cyanide_WAD	0.00042	0.00050	0.00055	0.00058	0.00071	0.00076	na	na	na	na	na	na
Fluoride	0.036	0.062	0.10	0.12	0.20	0.23	na	na	na	na	na	na
Hardness	100	110	210	210	330	370	na	na	na	na	na	na
Iron_D	0.059	0.093	0.12	0.13	0.17	0.18	na	na	na	na	na	na
Iron_T	0.55	0.60	0.63	0.64	0.69	0.70	na	na	na	na	na	na
Lead_D	0.000043	0.000070	0.00022	0.00026	0.00053	0.00076	na	na	na	na	na	na
Lead_T	0.00046	0.00058	0.0011	0.0011	0.0014	0.0016	na	na	na	na	na	na
Magnesium_D	3.9	5.6	18	22	46	56	na	na	na	na	na	na
Manganese_D	0.066	0.089	0.20	0.23	0.42	0.56	na	na	na	na	na	na
Manganese_T	0.089	0.10	0.23	0.26	0.47	0.58	na	na	na	na	na	na
Mercury_D	0.0000011	0.0000014	0.0000017	0.0000018	0.0000023	0.0000026	na	na	na	na	na	na
Mercury_T	0.0000013	0.0000016	0.0000019	0.0000020	0.0000026	0.0000029	na	na	na	na	na	na
Molybdenum_D	0.00017	0.0010	0.0091	0.013	0.029	0.036	na	na	na	na	na	na
Molybdenum_T	0.00021	0.0010	0.0092	0.013	0.029	0.036	na	na	na	na	na	na
N_Ammonia	0.049	0.085	0.49	0.69	1.5	2.8	na	na	na	na	na	na
N_Nitrate_Nitrite	0.10	0.33	3.6	5.0	11	22	na	na	na	na	na	na
N_Nitrite	0.0099	0.017	0.089	0.12	0.26	0.50	na	na	na	na	na	na
Nickel_D	0.00054	0.0012	0.013	0.017	0.039	0.051	na	na	na	na	na	na
Nickel_T	0.0030	0.0038	0.016	0.020	0.042	0.054	na	na	na	na	na	na
Phosphorus_T	0.012	0.013	0.017	0.017	0.023	0.025	na	na	na	na	na	na
Potassium_D	2.4	5.0	27	35	78	100	na	na	na	na	na	na
Proton	000000058	0.000000082	000000098	.00000011	0.00000014	.00000018	na	na	na	na	na	na
Radium_226	0.0092	0.012	0.019	0.017	0.021	0.022	na	na	na	na	na	na
Selenium_D	0.000047	0.000078	0.00031	0.00040	0.00085	0.0011	na	na	na	na	na	na
Selenium_T	0.000058	0.000092	0.00034	0.00042	0.00087	0.0011	na	na	na	na	na	na
Silicon_D	4.7	5.5	6.7	7.2	9.6	11	na	na	na	na	na	na
Silicon_T	4.7	5.6	6.7	7.2	9.6	11	na	na	na	na	na	na
Silver_D	0.0000047	0.0000059	0.000011	0.000014	0.000025	0.000031	na	na	na	na	na	na
Silver_T	0.000014	0.000017	0.000030	0.000030	0.000042	0.000049	na	na	na	na	na	na
Sodium_D	5.5	6.3	9.9	12	20	23	na	na	na	na	na	na
Sodium_T	5.7	6.3	10	12	20	23	na	na	na	na	na	na
Strontium_D	0.075	0.11	0.29	0.37	0.76	0.93	na	na	na	na	na	na
Strontium_T	0.077	0.11	0.30	0.37	0.76	0.93	na	na	na	na	na	na
Sulfate	36	69	330	420	910	1,100	na	na	na	na	na	na
Thallium_D	0.000025	0.000028	0.000049	0.000056	0.000096	0.00011	na	na	na	na	na	na
Thallium_T	0.000032	0.000043	0.000070	0.000074	0.00011	0.00013	na	na	na	na	na	na
TSS	73	280	640	750	1,400	1,900	na	na	na	na	na	na
Uranium_D	0.000094	0.00038	0.0018	0.0025	0.0055	0.0068	na	na	na	na	na	na
Uranium_T	0.00010	0.00039	0.0019	0.0025	0.0055	0.0068	na	na	na	na	na	na
Vanadium_T	0.0012	0.0014	0.0018	0.0020	0.0028	0.0032	na	na	na	na	na	na
Zinc_D	0.0012	0.0026	0.0072	0.0087	0.017	0.024	na	na	na	na	na	na
Zinc_T	0.0030	0.0046	0.010	0.012	0.020	0.027	na	na	na	na	na	na
N_Ammonia_Un	0.0000077	0.000014	0.00021	0.00073	0.0025	0.0036	na	na	na	na	na	na

Notes:

na denotes not applicable. The model results are not reported for the period when the collection pond does not discharge

Summary Statistics of the Updated Model Results (mg/L) for the Upper Case Scenario - TMF Pond Water

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	2.5	4.1	5.2	5.3	6.5	8.6	15	15	16	16	16	17
Alkalinity_T	63	88	100	100	120	140	180	180	190	190	200	230
Aluminum_D	0.0062	0.11	0.13	0.13	0.15	0.16	0.10	0.10	0.11	0.12	0.15	0.20
Aluminum_T	0.011	0.20	0.20	0.20	0.20	0.20	0.11	0.12	0.20	0.18	0.20	0.20
Antimony_D	0.00011	0.032	0.063	0.057	0.068	0.070	0.0018	0.0018	0.0019	0.0040	0.0094	0.027
Antimony_T	0.00012	0.030	0.061	0.055	0.065	0.068	0.0018	0.0018	0.0019	0.0039	0.0091	0.026
Arsenic_D	0.0012	0.025	0.057	0.050	0.063	0.064	0.025	0.025	0.026	0.029	0.038	0.068
Arsenic_T	0.0012	0.026	0.057	0.050	0.063	0.065	0.025	0.025	0.026	0.030	0.038	0.069
Barium_D	0.062	0.085	0.090	0.090	0.096	0.099	0.083	0.083	0.085	0.086	0.091	0.11
Barium_T	0.064	0.088	0.093	0.092	0.099	0.10	0.084	0.085	0.086	0.088	0.093	0.11
Beryllium_T	0.000027	0.00010	0.00014	0.00015	0.00020	0.00024	0.00025	0.00026	0.00026	0.00027	0.00030	0.00040
Boron_D	0.0072	0.039	0.043	0.042	0.046	0.047	0.013	0.014	0.014	0.015	0.019	0.033
Boron_T	0.0075	0.041	0.045	0.045	0.048	0.049	0.014	0.014	0.014	0.016	0.020	0.034
Bromide	0.045	0.046	0.050	0.050	0.054	0.064	0.060	0.064	0.066	0.065	0.066	0.066
Cadmium_D	0.0000054	0.000073	0.000091	0.000089	0.00011	0.00011	0.000092	0.000093	0.000097	0.00010	0.00013	0.00020
Cadmium_T	0.0000054	0.000057	0.000075	0.000074	0.000093	0.000100	0.000092	0.000093	0.000097	0.00010	0.00013	0.00020
Calcium_D	110	240	260	250	270	270	150	160	160	170	180	250
Chloride	7.0	30	55	50	59	61	7.1	7.2	7.3	8.7	13	25
Chromium_D	0.000069	0.00011	0.00014	0.00014	0.00017	0.00018	0.00023	0.00023	0.00024	0.00025	0.00028	0.00039
Chromium_D_Hex	0.000069	0.00011	0.00014	0.00014	0.00017	0.00018	0.00023	0.00023	0.00024	0.00025	0.00028	0.00039
Chromium_T	0.000098	0.00060	0.00063	0.00062	0.00064	0.00065	0.00027	0.00027	0.00028	0.00030	0.00037	0.00060
Cobalt_D	0.00011	0.069	0.072	0.071	0.076	0.078	0.0010	0.0010	0.0011	0.0035	0.0096	0.030
Cobalt_T	0.00011	0.061	0.064	0.064	0.068	0.070	0.0010	0.0010	0.0011	0.0032	0.0087	0.027
Copper_D	0.00023	0.030	0.030	0.030	0.030	0.030	0.0034	0.0039	0.030	0.021	0.030	0.030
Copper_T	0.00033	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Cyanide_F	0.00067	0.014	0.025	0.023	0.027	0.028	0.013	0.014	0.014	0.016	0.020	0.035
Cyanide_T	0.00067	1.5	2.1	2.1	2.9	3.1	0.019	0.036	0.044	0.042	0.045	0.045
Cyanide_WAD	0.00067	0.097	0.13	0.13	0.17	0.18	0.011	0.022	0.027	0.025	0.027	0.027
Fluoride	0.047	0.50	0.95	0.85	1.00	1.0	0.19	0.20	0.20	0.24	0.34	0.67
Hardness	42	52	70	72	88	330	240	310	340	330	350	350
Iron_D	0.12	0.67	0.70	0.69	0.70	0.70	0.20	0.20	0.20	0.22	0.28	0.45
Iron_T	0.19	0.70	0.70	0.70	0.70	0.70	0.59	0.70	0.70	0.70	0.70	0.70
Lead_D	0.000050	0.00047	0.00050	0.00050	0.00054	0.00055	0.00098	0.00099	0.0010	0.0011	0.0013	0.0019
Lead_T	0.000068	0.0011	0.0012	0.0011	0.0012	0.0012	0.0010	0.0010	0.0011	0.0011	0.0014	0.0022
Magnesium_D	8.5	11	13	14	16	18	18	19	19	19	20	23
Manganese_D	0.10	0.16	0.20	0.20	0.25	0.37	5.1	5.2	5.4	5.6	6.3	8.8
Manganese_T	0.12	0.17	0.22	0.22	0.27	0.43	0.63	0.66	0.66	0.67	0.68	0.68
Mercury_D	0.0000015	0.000012	0.000016	0.000016	0.000020	0.000023	0.000025	0.000026	0.000027	0.000029	0.000034	0.000053
Mercury_T	0.0000021	0.000012	0.000016	0.000016	0.000020	0.000023	0.000026	0.000026	0.000027	0.000029	0.000035	0.000053
Molybdenum_D	0.000058	0.021	0.045	0.040	0.048	0.050	0.0025	0.0026	0.0027	0.0043	0.0085	0.022
Molybdenum_T	0.00011	0.022	0.048	0.043	0.051	0.052	0.0026	0.0026	0.0027	0.0044	0.0088	0.023
N_Ammonia	0.15	5.7	11	10	12	13	0.67	0.68	0.70	1.1	2.2	5.7
N_Nitrate_Nitrite	0.032	0.45	1.6	1.6	2.7	2.8	0.044	0.045	0.046	0.065	0.12	0.29
N_Nitrite	0.010	0.036	0.078	0.076	0.11	0.11	0.011	0.011	0.012	0.013	0.017	0.029
Nickel_D	0.00066	0.012	0.014	0.015	0.017	0.018	0.0031	0.0032	0.0033	0.0039	0.0057	0.012
Nickel_T	0.00075	0.012	0.014	0.015	0.017	0.018	0.0032	0.0033	0.0034	0.0040	0.0058	0.012
Phosphorus_T	0.014	0.023	0.030	0.029	0.032	0.034	0.044	0.044	0.045	0.046	0.049	0.059
Potassium_D	6.7	74	80	79	85	87	24	24	25	28	37	68
Proton	000000014	0.000000018	000000025	000000025	0.000000030	00000097	0.000000076	0.000000098	.00000011	.00000011	0.00000011	.00000011
Radium_226	0.0057	0.0060	0.0064	0.0065	0.0069	0.0087	0.0084	0.0092	0.0095	0.0094	0.0096	0.0096
Selenium_D	0.000054	0.0028	0.0055	0.0050	0.0059	0.0061	0.000099	0.00010	0.00011	0.00028	0.00074	0.0023
Selenium_T	0.000054	0.0028	0.0055	0.0050	0.0059	0.0061	0.000099	0.00010	0.00011	0.00028	0.00074	0.0023
Silicon_D	1.2	1.5	2.0	2.0	2.6	6.1	6.1	6.9	7.2	7.2	7.3	7.3
Silicon_T	1.3	1.5	2.0	2.1	2.6	6.3	6.2	7.1	7.4	7.3	7.5	7.5
Silver_D	0.0000064	0.000025	0.000029	0.000028	0.000033	0.000035	0.000014	0.000014	0.000014	0.000015	0.000019	0.000030
Silver_T	0.0000064	0.000017	0.000021	0.000021	0.000026	0.000028	0.000014	0.000014	0.000014	0.000015	0.000018	0.000027
Sodium_D	8.4	780	1,500	1,400	1,600	1,700	9.3	9.5	11	58	180	580
Sodium_T	8.7	790	1,500	1,400	1,600	1,700	9.7	9.8	11	58	180	580
Strontium_D	0.17	0.45	0.49	0.49	0.53	0.54	0.26	0.26	0.27	0.28	0.32	0.46
Strontium_T	0.18	0.46	0.50	0.50	0.54	0.55	0.27	0.27	0.27	0.29	0.33	0.47
Sulfate	220	2,200	4,300	3,900	4,600	4,700	330	340	340	480	820	2,000
Thallium_D	0.000013	0.000017	0.000022	0.000022	0.000028	0.000047	0.000069	0.000069	0.000070	0.000070	0.000071	0.000074
Thallium_T	0.000017	0.000022	0.000027	0.000027	0.000033	0.000047	0.000069	0.000069	0.000070	0.000070	0.000072	0.000076
TSS	8.2	14	46	40	59	69	1.2	6.9	9.2	8.6	9.4	9.4
Uranium_D	0.000049	0.0014	0.0017	0.0016	0.0019	0.0019	0.00063	0.00064	0.00066	0.00074	0.00098	0.0018
Uranium_T	0.000049	0.0016	0.0018	0.0018	0.0020	0.0021	0.00063	0.00064	0.00066	0.00075	0.00100	0.0018
Vanadium_T	0.00021	0.0011	0.0021	0.0019	0.0023	0.0023	0.00097	0.00098	0.0010	0.0011	0.0014	0.0024
Zinc_D	0.00100	0.0028	0.0038	0.0039	0.0052	0.0058	0.0059	0.0060	0.0062	0.0066	0.0077	0.011
Zinc_T	0.0017	0.0037	0.0047	0.0048	0.0061	0.0067	0.0066	0.0066	0.0069	0.0073	0.0084	0.012
N_Ammonia_Un	0.000023	0.0014	0.0023	0.0089	0.026	0.028	0.00011	0.00011	0.00059	0.00096	0.0019	0.012

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Upper Case Scenario - Model Node QM02

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	2.3	2.4	3.4	3.3	4.0	4.1	2.3	2.3	3.4	3.2	4.0	4.0
Alkalinity_T	8.1	8.6	10.0	9.9	11	14	7.8	7.9	9.1	9.1	10	10
Aluminum_D	0.0065	0.0068	0.0085	0.0091	0.013	0.013	0.0065	0.0067	0.0084	0.0090	0.013	0.013
Aluminum_T	0.014	0.014	0.025	0.025	0.037	0.037	0.013	0.013	0.021	0.023	0.034	0.035
Antimony_D	0.000071	0.000100	0.00012	0.00015	0.00022	0.00052	0.000070	0.000071	0.000097	0.000091	0.00010	0.00010
Antimony_T	0.000071	0.000100	0.00012	0.00015	0.00022	0.00052	0.000070	0.000071	0.000097	0.000091	0.00010	0.00010
Arsenic_D	0.00012	0.00015	0.00025	0.00039	0.00073	0.0018	0.00012	0.00012	0.00014	0.00014	0.00014	0.00014
Arsenic_T	0.00013	0.00016	0.00028	0.00043	0.00079	0.0019	0.00012	0.00012	0.00014	0.00015	0.00018	0.00018
Barium_D	0.0050	0.0053	0.0064	0.0063	0.0068	0.0092	0.0047	0.0047	0.0059	0.0058	0.0066	0.0067
Barium_T	0.0056	0.0059	0.0083	0.0082	0.010	0.013	0.0054	0.0055	0.0077	0.0078	0.010	0.010
Beryllium_T	0.000075	0.000076	0.000097	0.000092	0.000100	0.00010	0.000075	0.000076	0.000096	0.000091	0.000100	0.000100
Boron_D	0.0050	0.0050	0.0051	0.0053	0.0056	0.0067	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Boron_T	0.0050	0.0050	0.0051	0.0053	0.0056	0.0067	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Bromide	0.050	0.050	0.050	0.050	0.050	0.051	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium_D	0.0000038	0.0000050	0.0000054	0.0000063	0.0000080	0.000018	0.0000038	0.0000038	0.0000048	0.0000046	0.0000050	0.0000050
Cadmium_T	0.0000040	0.0000051	0.0000057	0.0000066	0.0000085	0.000018	0.0000038	0.0000038	0.0000050	0.0000047	0.0000050	0.0000050
Calcium_D	2.6	2.8	3.2	3.8	5.2	10	2.3	2.3	2.6	2.5	2.7	2.7
Chloride	0.25	0.25	0.26	0.27	0.29	0.32	0.25	0.25	0.25	0.25	0.25	0.25
Chromium_D	0.000050	0.000051	0.000052	0.000053	0.000055	0.000064	0.000050	0.000050	0.000051	0.000051	0.000051	0.000051
Chromium_D_Hex	0.000050	0.000051	0.000052	0.000053	0.000055	0.000064	0.000050	0.000050	0.000051	0.000051	0.000051	0.000051
Chromium_T	0.000054	0.000059	0.000079	0.000087	0.00013	0.00013	0.000051	0.000051	0.000058	0.000069	0.00011	0.00011
Cobalt_D	0.000076	0.000094	0.00011	0.00012	0.00014	0.00027	0.000075	0.000076	0.000098	0.000092	0.00010	0.00010
Cobalt_T	0.000080	0.000097	0.00011	0.00012	0.00014	0.00028	0.000075	0.000076	0.000098	0.000093	0.00010	0.00010
Copper_D	0.00028	0.00031	0.00034	0.00035	0.00043	0.00044	0.00028	0.00028	0.00033	0.00034	0.00042	0.00042
Copper_T	0.00030	0.00032	0.00050	0.00046	0.00052	0.00058	0.00028	0.00028	0.00048	0.00044	0.00050	0.00050
Cyanide_F	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Cyanide_T	0.00050	0.00052	0.00071	0.00068	0.00080	0.00085	0.00053	0.00053	0.00054	0.00055	0.00056	0.00058
Cyanide_WAD	0.00050	0.00050	0.00051	0.00051	0.00051	0.00051	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Fluoride	0.052	0.052	0.061	0.060	0.064	0.067	0.052	0.052	0.060	0.059	0.064	0.064
Hardness	9.1	9.7	11	11	12	17	8.4	8.5	9.6	9.5	10	10
Iron_D	0.050	0.052	0.075	0.073	0.10	0.10	0.049	0.051	0.075	0.073	0.10	0.10
Iron_T	0.13	0.13	0.16	0.17	0.22	0.22	0.13	0.13	0.16	0.16	0.21	0.21
Lead_D	0.000035	0.000038	0.000045	0.000043	0.000046	0.000058	0.000035	0.000035	0.000043	0.000042	0.000045	0.000045
Lead_T	0.000039	0.000045	0.000048	0.000049	0.000054	0.000074	0.000037	0.000037	0.000044	0.000042	0.000045	0.000045
Magnesium_D	0.66	0.74	0.83	0.90	1.1	1.8	0.62	0.63	0.73	0.72	0.79	0.79
Manganese_D	0.0032	0.0043	0.011	0.0098	0.012	0.022	0.0031	0.0031	0.0090	0.0081	0.012	0.012
Manganese_T	0.015	0.015	0.018	0.019	0.026	0.026	0.015	0.015	0.015	0.017	0.023	0.024
Mercury_D	.00000061	0.00000061	.00000062	.00000072	0.00000099	0.0000010	0.00000061	0.00000061	.00000061	.00000071	0.00000098	.00000100
Mercury_T	.00000070	0.00000070	.00000074	.00000082	0.0000010	0.0000010	0.00000070	0.00000070	.00000072	.00000081	0.0000010	0.0000010
Molybdenum_D	0.000044	0.000053	0.000096	0.00016	0.00030	0.00073	0.000042	0.000042	0.000050	0.000049	0.000052	0.000053
Molybdenum_T	0.000074	0.00010	0.00014	0.00020	0.00033	0.00078	0.000072	0.000072	0.000095	0.000091	0.00010	0.00010
N_Ammonia	0.0055	0.0083	0.025	0.022	0.027	0.075	0.0052	0.0052	0.019	0.016	0.025	0.025
N_Nitrate_Nitrite	0.027	0.036	0.088	0.098	0.14	0.48	0.025	0.025	0.056	0.056	0.087	0.087
N_Nitrite	0.0066	0.0077	0.015	0.014	0.015	0.024	0.0066	0.0069	0.014	0.013	0.015	0.015
Nickel_D	0.00020	0.00021	0.00026	0.00035	0.00054	0.0012	0.00020	0.00020	0.00020	0.00020	0.00021	0.00021
Nickel_T	0.00020	0.00022	0.00028	0.00037	0.00058	0.0012	0.00020	0.00020	0.00021	0.00021	0.00022	0.00022
Phosphorus_T	0.013	0.013	0.021	0.019	0.022	0.022	0.013	0.013	0.021	0.019	0.022	0.022
Potassium_D	0.54	0.64	0.73	0.89	1.2	2.5	0.52	0.52	0.60	0.60	0.65	0.65
Proton	000000082	0.000000086	.00000041	.00000040	0.00000063	.00000063	0.000000082	0.000000086	.00000042	.00000040	0.00000063	.00000063
Radium_226	0.0045	0.0046	0.0051	0.0053	0.0073	0.0074	0.0045	0.0045	0.0050	0.0052	0.0072	0.0073
Selenium_D	0.000038	0.000044	0.000050	0.000050	0.000053	0.000069	0.000038	0.000038	0.000048	0.000047	0.000050	0.000050
Selenium_T	0.000038	0.000044	0.000051	0.000051	0.000060	0.000070	0.000038	0.000038	0.000050	0.000048	0.000054	0.000055
Silicon_D	1.8	1.9	2.8	2.6	3.1	3.2	1.8	1.8	2.7	2.6	3.1	3.1
Silicon_T	2.0	2.1	2.8	2.7	3.1	3.2	2.0	2.0	2.7	2.7	3.1	3.1
Silver_D	0.0000050	0.0000050	0.0000050	0.0000051	0.0000052	0.0000055	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050
Silver_T	0.0000050	0.0000051	0.0000051	0.0000052	0.0000053	0.0000058	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050
Sodium_D	0.98	1.1	1.2	1.2	1.3	1.7	0.96	0.97	1.2	1.1	1.2	1.2
Sodium_T	1.0	1.1	1.3	1.3	1.4	1.8	0.99	1.00	1.2	1.2	1.3	1.3
Strontium_D	0.012	0.013	0.015	0.016	0.018	0.031	0.011	0.011	0.013	0.013	0.014	0.014
Strontium_T	0.012	0.013	0.016	0.016	0.019	0.032	0.011	0.011	0.014	0.014	0.015	0.015
Sulfate	1.5	1.7	3.1	4.9	9.2	23	0.92	0.93	1.3	1.2	1.5	1.6
Thallium_D	0.0000053	0.0000066	0.000047	0.000039	0.000050	0.000051	0.0000050	0.0000063	0.000047	0.000038	0.000050	0.000050
Thallium_T	0.0000053	0.0000067	0.000047	0.000039	0.000050	0.000051	0.0000050	0.0000063	0.000047	0.000038	0.000050	0.000050
TSS	1.4	2.5	5.2	7.9	15	36	1.0	1.0	1.9	2.0	3.3	3.3
Uranium_D	0.000035	0.000046	0.000056	0.000065	0.000085	0.00018	0.000034	0.000034	0.000047	0.000044	0.000050	0.000050
Uranium_T	0.000037	0.000048	0.000056	0.000066	0.000087	0.00018	0.000036	0.000036	0.000048	0.000045	0.000050	0.000050
Vanadium_T	0.00010	0.00010	0.00011	0.00011	0.00012	0.00016	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Zinc_D	0.00091	0.00092	0.0010	0.0010	0.0012	0.0013	0.00091	0.00091	0.00094	0.00098	0.0011	0.0011
Zinc_T	0.00092	0.00093	0.0010	0.0011	0.0013	0.0014	0.00091	0.00091	0.00094	0.00099	0.0011	0.0011
N_Ammonia_Un	0.0000038	0.0000040	0.0000066	0.000015	0.000041	0.000056	0.0000038	0.0000039	0.0000042	0.0000093	0.000031	0.000032

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Upper Case Scenario - Model Node QM03

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	2.4	2.4	3.4	3.3	4.0	4.1	2.3	2.3	3.4	3.3	4.0	4.0
Alkalinity_T	8.2	8.6	10	10.0	11	14	7.8	7.9	9.2	9.1	10	10
Aluminum_D	0.0068	0.0071	0.0087	0.0094	0.013	0.014	0.0068	0.0070	0.0087	0.0093	0.013	0.013
Aluminum_T	0.014	0.015	0.025	0.025	0.037	0.038	0.014	0.014	0.021	0.023	0.035	0.035
Antimony_D	0.000071	0.000100	0.00012	0.00015	0.00022	0.00052	0.000070	0.000071	0.000097	0.000091	0.00010	0.00010
Antimony_T	0.000071	0.000100	0.00012	0.00015	0.00022	0.00052	0.000070	0.000071	0.000097	0.000091	0.00010	0.00010
Arsenic_D	0.00013	0.00015	0.00025	0.00039	0.00073	0.0018	0.00012	0.00012	0.00014	0.00014	0.00014	0.00015
Arsenic_T	0.00013	0.00016	0.00028	0.00042	0.00079	0.0019	0.00012	0.00012	0.00014	0.00015	0.00018	0.00018
Barium_D	0.0051	0.0053	0.0065	0.0063	0.0068	0.0092	0.0047	0.0047	0.0059	0.0058	0.0067	0.0067
Barium_T	0.0056	0.0059	0.0083	0.0082	0.010	0.013	0.0054	0.0055	0.0077	0.0078	0.010	0.010
Beryllium_T	0.000075	0.000077	0.000097	0.000092	0.000100	0.00010	0.000075	0.000076	0.000096	0.000091	0.000100	0.000100
Boron_D	0.0050	0.0050	0.0051	0.0053	0.0056	0.0067	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Boron_T	0.0050	0.0050	0.0051	0.0053	0.0056	0.0067	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Bromide	0.050	0.050	0.050	0.050	0.050	0.051	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium_D	0.0000038	0.0000050	0.0000054	0.0000063	0.0000079	0.000017	0.0000038	0.0000038	0.0000048	0.0000046	0.0000050	0.0000050
Cadmium_T	0.0000040	0.0000051	0.0000057	0.0000066	0.0000085	0.000018	0.0000038	0.0000039	0.0000050	0.0000047	0.0000050	0.0000050
Calcium_D	2.6	2.8	3.2	3.9	5.2	10	2.3	2.3	2.6	2.6	2.7	2.8
Chloride	0.26	0.26	0.27	0.27	0.29	0.32	0.25	0.25	0.26	0.26	0.26	0.26
Chromium_D	0.000051	0.000051	0.000052	0.000053	0.000055	0.000065	0.000051	0.000051	0.000051	0.000051	0.000051	0.000051
Chromium_D_Hex	0.000051	0.000051	0.000052	0.000053	0.000055	0.000065	0.000051	0.000051	0.000051	0.000051	0.000051	0.000051
Chromium_T	0.000055	0.000060	0.000080	0.000087	0.00013	0.00013	0.000052	0.000052	0.000059	0.000070	0.00011	0.00011
Cobalt_D	0.000076	0.000094	0.00011	0.00012	0.00014	0.00027	0.000075	0.000076	0.000098	0.000092	0.00010	0.00010
Cobalt_T	0.000080	0.000097	0.00011	0.00012	0.00014	0.00028	0.000076	0.000076	0.000098	0.000093	0.00010	0.00010
Copper_D	0.00028	0.00031	0.00034	0.00036	0.00043	0.00044	0.00028	0.00028	0.00033	0.00034	0.00042	0.00042
Copper_T	0.00030	0.00032	0.00050	0.00046	0.00052	0.00058	0.00028	0.00029	0.00048	0.00044	0.00050	0.00050
Cyanide_F	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Cyanide_T	0.00050	0.00052	0.00071	0.00068	0.00080	0.00085	0.00053	0.00053	0.00054	0.00054	0.00056	0.00058
Cyanide_WAD	0.00050	0.00050	0.00051	0.00051	0.00051	0.00051	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Fluoride	0.052	0.053	0.061	0.060	0.064	0.067	0.052	0.052	0.060	0.059	0.064	0.064
Hardness	9.1	9.8	11	11	12	17	8.5	8.5	9.7	9.6	10	10
Iron_D	0.051	0.053	0.076	0.074	0.10	0.10	0.050	0.052	0.076	0.074	0.10	0.10
Iron_T	0.13	0.13	0.16	0.17	0.22	0.22	0.13	0.13	0.16	0.16	0.21	0.22
Lead_D	0.000035	0.000038	0.000045	0.000043	0.000046	0.000058	0.000035	0.000035	0.000043	0.000042	0.000045	0.000045
Lead_T	0.000039	0.000045	0.000048	0.000049	0.000054	0.000074	0.000037	0.000037	0.000044	0.000042	0.000045	0.000045
Magnesium_D	0.66	0.74	0.83	0.90	1.1	1.8	0.62	0.63	0.73	0.72	0.79	0.79
Manganese_D	0.0033	0.0045	0.011	0.0100	0.013	0.022	0.0032	0.0033	0.0091	0.0082	0.012	0.013
Manganese_T	0.015	0.015	0.018	0.019	0.026	0.026	0.015	0.015	0.016	0.017	0.023	0.024
Mercury_D	.00000061	0.00000061	.00000063	.00000072	0.00000099	0.0000010	0.00000061	0.00000061	.00000062	.00000071	0.00000099	.00000100
Mercury_T	.00000070	0.00000071	.00000075	.00000082	0.0000010	0.0000010	0.00000070	0.00000070	.00000073	.00000081	0.0000010	0.0000010
Molybdenum_D	0.000044	0.000053	0.000095	0.00016	0.00030	0.00072	0.000042	0.000042	0.000050	0.000049	0.000052	0.000053
Molybdenum_T	0.000074	0.00010	0.00014	0.00020	0.00033	0.00077	0.000072	0.000073	0.000095	0.000091	0.000100	0.00010
N_Ammonia	0.0057	0.0085	0.025	0.023	0.028	0.075	0.0053	0.0054	0.019	0.017	0.025	0.025
N_Nitrate_Nitrite	0.027	0.036	0.088	0.097	0.14	0.47	0.025	0.025	0.056	0.056	0.086	0.086
N_Nitrite	0.0066	0.0077	0.015	0.014	0.015	0.024	0.0066	0.0069	0.014	0.013	0.015	0.015
Nickel_D	0.00020	0.00021	0.00027	0.00035	0.00054	0.0012	0.00020	0.00020	0.00020	0.00021	0.00021	0.00021
Nickel_T	0.00021	0.00022	0.00029	0.00037	0.00058	0.0012	0.00020	0.00020	0.00021	0.00021	0.00022	0.00022
Phosphorus_T	0.013	0.013	0.021	0.019	0.022	0.022	0.013	0.013	0.021	0.019	0.022	0.022
Potassium_D	0.54	0.64	0.73	0.89	1.2	2.5	0.52	0.53	0.60	0.60	0.65	0.65
Proton	000000082	0.000000086	.00000041	.00000039	0.00000063	.00000063	0.000000082	0.000000086	.00000041	.00000040	0.00000063	.00000063
Radium_226	0.0045	0.0046	0.0051	0.0053	0.0073	0.0073	0.0045	0.0045	0.0050	0.0052	0.0072	0.0073
Selenium_D	0.000038	0.000044	0.000050	0.000050	0.000053	0.000069	0.000038	0.000038	0.000048	0.000047	0.000050	0.000050
Selenium_T	0.000038	0.000044	0.000051	0.000051	0.000059	0.000070	0.000038	0.000038	0.000050	0.000048	0.000054	0.000055
Silicon_D	1.8	1.9	2.8	2.6	3.1	3.2	1.8	1.8	2.7	2.6	3.1	3.1
Silicon_T	2.0	2.1	2.8	2.7	3.1	3.2	2.0	2.0	2.7	2.7	3.1	3.1
Silver_D	0.0000050	0.0000050	0.0000050	0.0000051	0.0000052	0.0000055	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050
Silver_T	0.0000050	0.0000051	0.0000051	0.0000052	0.0000053	0.0000058	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050
Sodium_D	0.98	1.1	1.2	1.2	1.3	1.7	0.96	0.97	1.2	1.1	1.2	1.2
Sodium_T	1.0	1.1	1.3	1.3	1.4	1.8	0.99	1.0	1.2	1.2	1.3	1.3
Strontium_D	0.012	0.013	0.015	0.016	0.018	0.031	0.011	0.011	0.013	0.013	0.014	0.014
Strontium_T	0.012	0.013	0.016	0.016	0.019	0.032	0.011	0.011	0.014	0.014	0.015	0.015
Sulfate	1.5	1.7	3.1	4.8	9.1	23	0.92	0.93	1.3	1.2	1.5	1.6
Thallium_D	0.0000055	0.0000068	0.000047	0.000039	0.000050	0.000051	0.0000053	0.0000066	0.000047	0.000038	0.000050	0.000050
Thallium_T	0.0000056	0.0000070	0.000047	0.000039	0.000050	0.000051	0.0000053	0.0000066	0.000047	0.000038	0.000050	0.000050
TSS	1.4	2.5	5.2	7.9	14	36	1.1	1.1	1.9	2.1	3.3	3.3
Uranium_D	0.000035	0.000046	0.000056	0.000064	0.000085	0.00017	0.000034	0.000034	0.000047	0.000044	0.000050	0.000050
Uranium_T	0.000037	0.000048	0.000056	0.000066	0.000087	0.00017	0.000036	0.000036	0.000048	0.000045	0.000050	0.000050
Vanadium_T	0.00010	0.00011	0.00011	0.00011	0.00012	0.00016	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Zinc_D	0.00092	0.00093	0.0010	0.0011	0.0012	0.0014	0.00091	0.00092	0.00094	0.00099	0.0011	0.0011
Zinc_T	0.00092	0.00094	0.0010	0.0011	0.0013	0.0014	0.00092	0.00092	0.00095	0.00099	0.0011	0.0011
N_Ammonia_Un	0.0000038	0.0000040	0.0000066	0.000015	0.000041	0.000056	0.0000038	0.0000039	0.0000043	0.0000094	0.000031	0.000032

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Upper Case Scenario - Model Node QM04

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	3.1	3.1	14	13	21	21	3.1	4.2	10	12	21	21
Alkalinity_T	82	83	110	110	140	140	83	83	140	120	140	140
Aluminum_D	0.0029	0.0038	0.0090	0.0084	0.013	0.013	0.0034	0.0043	0.038	0.027	0.044	0.048
Aluminum_T	0.0063	0.0073	0.012	0.012	0.017	0.017	0.0068	0.0091	0.20	0.12	0.20	0.20
Antimony_D	0.000082	0.00011	0.00035	0.00040	0.00082	0.0011	0.00011	0.00013	0.0019	0.0013	0.0024	0.0028
Antimony_T	0.000083	0.00011	0.00035	0.00040	0.00082	0.0011	0.00011	0.00013	0.0019	0.0013	0.0024	0.0028
Arsenic_D	0.00082	0.0010	0.0020	0.0023	0.0045	0.0065	0.0011	0.0012	0.011	0.0076	0.013	0.015
Arsenic_T	0.00082	0.0010	0.0021	0.0024	0.0045	0.0065	0.0011	0.0012	0.014	0.0093	0.017	0.018
Barium_D	0.043	0.045	0.060	0.060	0.073	0.076	0.044	0.048	0.069	0.064	0.072	0.074
Barium_T	0.044	0.046	0.061	0.061	0.074	0.077	0.045	0.049	0.070	0.066	0.073	0.075
Beryllium_T	0.000080	0.000081	0.000093	0.000091	0.000099	0.00010	0.000082	0.000082	0.00016	0.00013	0.00018	0.00019
Boron_D	0.0050	0.0051	0.0096	0.0099	0.015	0.018	0.0052	0.0053	0.019	0.015	0.020	0.022
Boron_T	0.0050	0.0051	0.011	0.011	0.017	0.020	0.0052	0.0053	0.019	0.016	0.021	0.023
Bromide	0.050	0.050	0.050	0.051	0.051	0.053	0.050	0.050	0.068	0.062	0.072	0.075
Cadmium_D	0.0000040	0.0000046	0.0000100	0.000012	0.000025	0.000041	0.0000064	0.0000083	0.00015	0.000099	0.00018	0.00021
Cadmium_T	0.0000040	0.0000046	0.0000100	0.000012	0.000025	0.000041	0.0000064	0.0000083	0.00017	0.00012	0.00021	0.00024
Calcium_D	77	80	100	100	120	130	79	85	160	140	170	190
Chloride	4.7	4.8	6.4	6.3	7.3	7.3	3.9	4.1	4.8	5.2	7.1	7.1
Chromium_D	0.000050	0.000050	0.000077	0.000079	0.00011	0.00013	0.000053	0.000055	0.00029	0.00021	0.00034	0.00038
Chromium_D_Hex	0.000050	0.000050	0.000077	0.000079	0.00011	0.00013	0.000053	0.000055	0.00029	0.00021	0.00034	0.00038
Chromium_T	0.000050	0.000052	0.00013	0.00011	0.00016	0.00018	0.000055	0.000057	0.0019	0.0012	0.0023	0.0025
Cobalt_D	0.000087	0.00012	0.00034	0.00040	0.00081	0.0011	0.00012	0.00016	0.0028	0.0019	0.0036	0.0041
Cobalt_T	0.000087	0.00012	0.00034	0.00040	0.00081	0.0011	0.00012	0.00016	0.0031	0.0021	0.0039	0.0044
Copper_D	0.00010	0.00020	0.00034	0.00036	0.00059	0.00067	0.00016	0.00025	0.0042	0.0031	0.0060	0.0068
Copper_T	0.00024	0.00028	0.00037	0.00041	0.00059	0.00067	0.00029	0.00032	0.0063	0.0042	0.0078	0.0088
Cyanide_F	0.00050	0.00051	0.00058	0.00057	0.00063	0.00067	0.00052	0.00053	0.0026	0.0019	0.0033	0.0036
Cyanide_T	0.00057	0.0031	0.013	0.014	0.029	0.037	0.0017	0.0025	0.0059	0.0053	0.0072	0.0082
Cyanide_WAD	0.00050	0.00057	0.00079	0.00085	0.0013	0.0016	0.00055	0.00057	0.0036	0.0025	0.0044	0.0051
Fluoride	0.029	0.032	0.045	0.045	0.055	0.060	0.030	0.041	0.13	0.10	0.15	0.17
Hardness	240	240	300	290	340	350	240	260	280	280	340	340
Iron_D	0.037	0.044	0.19	0.16	0.23	0.23	0.039	0.055	0.17	0.16	0.22	0.22
Iron_T	0.061	0.067	0.25	0.20	0.27	0.27	0.062	0.11	0.61	0.45	0.69	0.70
Lead_D	0.000037	0.000040	0.000047	0.000050	0.000065	0.000082	0.000042	0.000045	0.00034	0.00024	0.00041	0.00046
Lead_T	0.000037	0.000042	0.000052	0.000057	0.000086	0.000090	0.000043	0.000049	0.00093	0.00062	0.0011	0.0012
Magnesium_D	8.9	9.3	13	12	15	17	9.0	10	18	16	19	21
Manganese_D	0.044	0.049	0.67	0.55	0.90	0.90	0.053	0.16	1.1	0.90	1.2	1.3
Manganese_T	0.076	0.080	0.74	0.61	0.95	0.95	0.085	0.20	0.53	0.53	0.96	0.98
Mercury_D	.00000087	0.00000094	0.0000013	0.0000012	0.0000014	0.0000014	0.00000091	0.0000012	0.0000051	0.0000038	0.0000060	0.0000066
Mercury_T	0.0000011	0.0000012	0.0000023	0.0000020	0.0000025	0.0000025	0.0000011	0.0000014	0.0000057	0.0000044	0.0000064	0.0000071
Molybdenum_D	0.000041	0.000063	0.00062	0.00074	0.0018	0.0028	0.000081	0.00010	0.0026	0.0017	0.0033	0.0037
Molybdenum_T	0.000071	0.00011	0.00065	0.00078	0.0018	0.0028	0.00012	0.00014	0.0027	0.0018	0.0034	0.0038
N_Ammonia	0.026	0.052	0.27	0.21	0.31	0.38	0.027	0.032	0.28	0.26	0.35	0.41
N_Nitrate_Nitrite	0.025	0.028	0.070	0.11	0.23	0.73	0.025	0.026	0.087	0.066	0.10	0.11
N_Nitrite	0.0070	0.0073	0.014	0.014	0.021	0.032	0.0070	0.0070	0.013	0.012	0.016	0.016
Nickel_D	0.00041	0.00055	0.0012	0.0013	0.0026	0.0040	0.00075	0.00084	0.012	0.0079	0.014	0.016
Nickel_T	0.00043	0.00065	0.0012	0.0015	0.0028	0.0042	0.00076	0.00087	0.014	0.0092	0.017	0.019
Phosphorus_T	0.012	0.012	0.022	0.021	0.026	0.026	0.012	0.021	0.024	0.023	0.025	0.026
Potassium_D	4.6	5.1	7.2	7.6	11	13	5.0	5.8	30	21	35	39
Proton	000000050	0.000000050	.00000014	.00000013	0.00000020	.00000020	0.000000050	0.000000063	.00000012	.00000013	0.00000020	.00000020
Radium_226	0.0048	0.0049	0.0081	0.0074	0.0088	0.0088	0.0048	0.0063	0.014	0.011	0.015	0.016
Selenium_D	0.000040	0.000047	0.000069	0.000074	0.00012	0.00015	0.000045	0.000047	0.00027	0.00020	0.00033	0.00037
Selenium_T	0.000040	0.000047	0.000069	0.000074	0.00012	0.00015	0.000045	0.000047	0.00029	0.00021	0.00035	0.00039
Silicon_D	4.5	4.5	5.6	5.5	6.5	6.6	4.5	4.6	7.0	6.5	7.3	7.6
Silicon_T	4.6	4.6	5.8	5.7	6.8	6.9	4.6	4.7	7.1	6.6	7.4	7.7
Silver_D	0.0000050	0.0000050	0.0000053	0.0000054	0.0000060	0.0000067	0.0000051	0.0000052	0.000013	0.000010	0.000015	0.000016
Silver_T	0.0000050	0.0000050	0.0000053	0.0000054	0.0000060	0.0000067	0.0000051	0.0000052	0.000025	0.000018	0.000029	0.000032
Sodium_D	5.5	7.3	11	11	17	20	5.5	6.8	17	16	26	32
Sodium_T	5.8	7.5	11	12	18	21	5.8	7.0	17	16	26	33
Strontium_D	0.12	0.13	0.17	0.17	0.21	0.24	0.12	0.14	0.29	0.24	0.31	0.34
Strontium_T	0.12	0.13	0.17	0.17	0.21	0.24	0.12	0.15	0.29	0.24	0.31	0.34
Sulfate	150	160	210	220	270	300	150	190	420	340	460	500
Thallium_D	0.000032	0.000032	0.000042	0.000040	0.000045	0.000047	0.000032	0.000033	0.000054	0.000049	0.000057	0.000062
Thallium_T	0.000032	0.000032	0.000042	0.000040	0.000045	0.000047	0.000032	0.000033	0.000068	0.000057	0.000074	0.000079
TSS	1.0	2.0	23	25	55	100	14	16	530	350	650	720
Uranium_D	0.000033	0.000045	0.00013	0.00015	0.00033	0.00051	0.000061	0.000067	0.0012	0.00079	0.0015	0.0016
Uranium_T	0.000033	0.000045	0.00013	0.00015	0.00033	0.00051	0.000061	0.000067	0.0012	0.00080	0.0015	0.0016
Vanadium_T	0.00010	0.00010	0.00015	0.00016	0.00027	0.00029	0.00010	0.00011	0.0012	0.00082	0.0015	0.0016
Zinc_D	0.00065	0.00089	0.0011	0.0012	0.0018	0.0024	0.00078	0.0010	0.0072	0.0050	0.0086	0.0095
Zinc_T	0.0011	0.0014	0.0016	0.0017	0.0022	0.0028	0.0013	0.0015	0.0094	0.0066	0.011	0.012
N_Ammonia_Un	0.000025	0.000039	0.000050	0.00012	0.00044	0.00046	0.000026	0.000037	0.000054	0.00020	0.00061	0.00084

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Upper Case Scenario - Model Node QM06

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	2.3	2.4	3.5	3.3	4.0	4.2	2.3	2.4	3.5	3.3	4.0	4.1
Alkalinity_T	8.3	8.8	10	10	11	14	8.0	8.3	9.8	9.7	11	13
Aluminum_D	0.0068	0.0071	0.0087	0.0094	0.013	0.014	0.0068	0.0070	0.0088	0.0094	0.013	0.014
Aluminum_T	0.014	0.015	0.025	0.025	0.037	0.038	0.014	0.014	0.023	0.024	0.036	0.037
Antimony_D	0.000071	0.000100	0.00012	0.00015	0.00022	0.00052	0.000070	0.000080	0.00010	0.00010	0.00011	0.00016
Antimony_T	0.000071	0.000100	0.00012	0.00015	0.00022	0.00052	0.000070	0.000080	0.00010	0.00010	0.00011	0.00016
Arsenic_D	0.00013	0.00015	0.00025	0.00039	0.00073	0.0018	0.00012	0.00014	0.00019	0.00020	0.00026	0.00044
Arsenic_T	0.00014	0.00016	0.00028	0.00043	0.00079	0.0019	0.00013	0.00015	0.00020	0.00022	0.00032	0.00051
Barium_D	0.0051	0.0054	0.0065	0.0064	0.0069	0.0093	0.0048	0.0051	0.0063	0.0061	0.0070	0.0080
Barium_T	0.0057	0.0059	0.0084	0.0083	0.010	0.013	0.0055	0.0056	0.0081	0.0081	0.010	0.011
Beryllium_T	0.000075	0.000077	0.000097	0.000092	0.000100	0.00010	0.000075	0.000076	0.000097	0.000092	0.00010	0.00010
Boron_D	0.0050	0.0050	0.0051	0.0053	0.0056	0.0067	0.0050	0.0050	0.0051	0.0051	0.0051	0.0053
Boron_T	0.0050	0.0051	0.0051	0.0053	0.0056	0.0067	0.0050	0.0050	0.0051	0.0051	0.0051	0.0054
Bromide	0.050	0.050	0.050	0.050	0.050	0.051	0.050	0.050	0.050	0.050	0.050	0.051
Cadmium_D	0.0000038	0.0000050	0.0000054	0.0000063	0.0000079	0.000017	0.0000038	0.0000045	0.0000051	0.0000054	0.0000060	0.0000090
Cadmium_T	0.0000040	0.0000051	0.0000057	0.0000066	0.0000085	0.000018	0.0000038	0.0000046	0.0000054	0.0000056	0.0000068	0.0000097
Calcium_D	2.8	3.0	3.4	4.0	5.3	10	2.4	2.5	3.4	3.3	3.9	6.4
Chloride	0.27	0.27	0.28	0.28	0.30	0.34	0.26	0.26	0.28	0.28	0.29	0.34
Chromium_D	0.000051	0.000052	0.000052	0.000053	0.000055	0.000065	0.000051	0.000051	0.000052	0.000052	0.000053	0.000058
Chromium_D_Hex	0.000051	0.000052	0.000052	0.000053	0.000055	0.000065	0.000051	0.000051	0.000052	0.000052	0.000053	0.000058
Chromium_T	0.000056	0.000060	0.000081	0.000088	0.00013	0.00013	0.000053	0.000053	0.000064	0.000080	0.00011	0.00013
Cobalt_D	0.000076	0.000094	0.00011	0.00012	0.00014	0.00027	0.000076	0.000080	0.00010	0.00011	0.00012	0.00018
Cobalt_T	0.000080	0.000097	0.00011	0.00012	0.00014	0.00028	0.000076	0.000080	0.00010	0.00011	0.00012	0.00019
Copper_D	0.00028	0.00031	0.00034	0.00036	0.00043	0.00044	0.00028	0.00032	0.00035	0.00037	0.00045	0.00047
Copper_T	0.00030	0.00032	0.00050	0.00046	0.00052	0.00058	0.00029	0.00034	0.00050	0.00047	0.00053	0.00066
Cyanide_F	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00050	0.00050	0.00051	0.00051	0.00053	0.00056
Cyanide_T	0.00050	0.00053	0.00073	0.00070	0.00085	0.00090	0.00055	0.00055	0.00057	0.00057	0.00060	0.00069
Cyanide_WAD	0.00050	0.00050	0.00051	0.00051	0.00051	0.00051	0.00050	0.00050	0.00052	0.00052	0.00053	0.00059
Fluoride	0.052	0.053	0.061	0.060	0.064	0.067	0.052	0.052	0.061	0.060	0.064	0.066
Hardness	9.5	10	11	11	12	17	8.8	9.0	11	11	12	16
Iron_D	0.051	0.053	0.077	0.075	0.10	0.10	0.051	0.052	0.077	0.074	0.10	0.10
Iron_T	0.13	0.13	0.16	0.17	0.22	0.22	0.13	0.13	0.16	0.17	0.22	0.22
Lead_D	0.000035	0.000038	0.000045	0.000043	0.000046	0.000058	0.000035	0.000037	0.000045	0.000043	0.000047	0.000053
Lead_T	0.000039	0.000045	0.000048	0.000049	0.000054	0.000074	0.000037	0.000038	0.000045	0.000047	0.000051	0.000070
Magnesium_D	0.67	0.75	0.85	0.92	1.1	1.8	0.63	0.67	0.81	0.81	0.88	1.2
Manganese_D	0.0034	0.0046	0.012	0.011	0.014	0.024	0.0034	0.0037	0.013	0.014	0.019	0.038
Manganese_T	0.017	0.017	0.019	0.020	0.026	0.027	0.016	0.017	0.018	0.020	0.024	0.026
Mercury_D	.00000061	0.00000061	.00000063	.00000072	0.00000100	0.0000010	0.00000061	0.00000061	.00000064	.00000074	0.00000100	0.0000010
Mercury_T	.00000071	0.00000071	.00000075	.00000082	0.0000010	0.0000010	0.00000071	0.00000071	.00000076	.00000084	0.0000011	0.0000011
Molybdenum_D	0.000044	0.000053	0.000095	0.00016	0.00030	0.00072	0.000042	0.000046	0.000061	0.000062	0.000081	0.00013
Molybdenum_T	0.000074	0.00010	0.00014	0.00020	0.00033	0.00077	0.000072	0.000086	0.00010	0.00010	0.00012	0.00018
N_Ammonia	0.0057	0.0089	0.025	0.023	0.028	0.075	0.0054	0.0059	0.020	0.018	0.027	0.033
N_Nitrate_Nitrite	0.027	0.036	0.088	0.097	0.14	0.47	0.025	0.025	0.056	0.056	0.086	0.087
N_Nitrite	0.0067	0.0077	0.015	0.013	0.015	0.024	0.0066	0.0069	0.014	0.013	0.015	0.015
Nickel_D	0.00021	0.00021	0.00027	0.00035	0.00054	0.0012	0.00021	0.00021	0.00026	0.00027	0.00034	0.00052
Nickel_T	0.00021	0.00022	0.00029	0.00037	0.00058	0.0012	0.00021	0.00021	0.00027	0.00028	0.00036	0.00057
Phosphorus_T	0.013	0.013	0.021	0.019	0.022	0.022	0.013	0.013	0.021	0.019	0.022	0.022
Potassium_D	0.55	0.65	0.74	0.90	1.2	2.5	0.53	0.57	0.77	0.75	0.86	1.4
Proton	000000082	0.000000086	.00000041	.00000039	0.00000063	.00000063	0.000000082	0.000000086	.00000041	.00000039	0.00000063	.00000063
Radium_226	0.0046	0.0046	0.0051	0.0053	0.0073	0.0073	0.0045	0.0046	0.0050	0.0053	0.0072	0.0073
Selenium_D	0.000038	0.000044	0.000050	0.000050	0.000053	0.000069	0.000038	0.000040	0.000050	0.000048	0.000051	0.000057
Selenium_T	0.000038	0.000044	0.000051	0.000051	0.000059	0.000070	0.000038	0.000040	0.000050	0.000049	0.000057	0.000057
Silicon_D	1.8	1.9	2.8	2.6	3.1	3.2	1.8	1.8	2.7	2.6	3.1	3.2
Silicon_T	2.0	2.1	2.8	2.7	3.1	3.2	2.0	2.0	2.8	2.7	3.1	3.2
Silver_D	0.0000050	0.0000050	0.0000050	0.0000051	0.0000052	0.0000055	0.0000050	0.0000050	0.0000050	0.0000050	0.0000051	0.0000052
Silver_T	0.0000050	0.0000051	0.0000051	0.0000052	0.0000053	0.0000058	0.0000050	0.0000050	0.0000051	0.0000051	0.0000052	0.0000056
Sodium_D	0.99	1.1	1.3	1.3	1.4	1.7	0.97	1.0	1.2	1.2	1.3	1.9
Sodium_T	1.0	1.1	1.3	1.3	1.4	1.8	1.00	1.1	1.3	1.3	1.4	2.0
Strontium_D	0.012	0.013	0.015	0.016	0.018	0.031	0.011	0.011	0.014	0.014	0.015	0.020
Strontium_T	0.012	0.014	0.016	0.017	0.019	0.032	0.011	0.012	0.015	0.015	0.016	0.021
Sulfate	1.8	2.1	3.4	5.1	9.4	23	1.2	1.2	3.3	3.3	5.2	12
Thallium_D	0.0000057	0.0000070	0.000047	0.000039	0.000050	0.000051	0.0000054	0.0000067	0.000047	0.000039	0.000050	0.000050
Thallium_T	0.0000057	0.0000071	0.000047	0.000039	0.000050	0.000051	0.0000054	0.0000067	0.000047	0.000039	0.000050	0.000050
TSS	1.4	2.5	5.2	7.9	14	36	1.1	1.1	3.5	4.8	8.4	15
Uranium_D	0.000035	0.000046	0.000056	0.000065	0.000085	0.00017	0.000034	0.000036	0.000050	0.000050	0.000057	0.000081
Uranium_T	0.000037	0.000048	0.000056	0.000066	0.000087	0.00018	0.000036	0.000039	0.000050	0.000051	0.000057	0.000081
Vanadium_T	0.00010	0.00011	0.00011	0.00011	0.00012	0.00016	0.00010	0.00010	0.00011	0.00011	0.00011	0.00013
Zinc_D	0.00092	0.00093	0.0010	0.0011	0.0012	0.0014	0.00092	0.00092	0.00097	0.0010	0.0012	0.0012
Zinc_T	0.00092	0.00094	0.0010	0.0011	0.0013	0.0014	0.00092	0.00092	0.00097	0.0010	0.0012	0.0012
N_Ammonia_Un	0.0000039	0.0000041	0.0000067	0.000015	0.000041	0.000056	0.0000038	0.0000040	0.0000048	0.000011	0.000032	0.000038

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Upper Case Scenario - QM29

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	2.3	2.4	3.9	3.8	4.8	4.9	2.3	2.4	3.9	3.8	4.8	4.9
Alkalinity_T	8.4	8.8	11	11	12	14	8.2	8.6	10	10	12	13
Aluminum_D	0.033	0.034	0.040	0.042	0.054	0.054	0.034	0.034	0.040	0.042	0.054	0.054
Aluminum_T	0.063	0.063	0.073	0.080	0.12	0.12	0.062	0.062	0.072	0.079	0.12	0.12
Antimony_D	0.000072	0.000097	0.00011	0.00013	0.00018	0.00041	0.000072	0.000073	0.000098	0.000096	0.00011	0.00014
Antimony_T	0.000072	0.000097	0.00011	0.00013	0.00018	0.00041	0.000072	0.000073	0.000098	0.000096	0.00011	0.00014
Arsenic_D	0.00015	0.00017	0.00024	0.00035	0.00059	0.0014	0.00014	0.00016	0.00020	0.00020	0.00024	0.00038
Arsenic_T	0.00016	0.00018	0.00027	0.00038	0.00065	0.0015	0.00015	0.00017	0.00021	0.00023	0.00030	0.00044
Barium_D	0.0057	0.0060	0.0071	0.0070	0.0077	0.0095	0.0054	0.0057	0.0070	0.0068	0.0078	0.0085
Barium_T	0.0063	0.0065	0.0086	0.0085	0.010	0.012	0.0061	0.0062	0.0084	0.0083	0.010	0.011
Beryllium_T	0.000072	0.000073	0.000095	0.000089	0.000098	0.00010	0.000072	0.000073	0.000095	0.000089	0.000098	0.000099
Boron_D	0.0050	0.0050	0.0051	0.0052	0.0055	0.0063	0.0050	0.0050	0.0051	0.0051	0.0051	0.0053
Boron_T	0.0050	0.0050	0.0051	0.0052	0.0055	0.0063	0.0050	0.0050	0.0051	0.0051	0.0051	0.0053
Bromide	0.050	0.050	0.050	0.050	0.050	0.051	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium_D	0.0000096	0.000011	0.000012	0.000013	0.000017	0.000021	0.0000096	0.0000098	0.000012	0.000012	0.000016	0.000018
Cadmium_T	0.000011	0.000012	0.000013	0.000014	0.000019	0.000022	0.000011	0.000011	0.000012	0.000013	0.000017	0.000019
Calcium_D	3.8	4.2	4.5	4.9	6.0	9.5	3.5	3.5	4.3	4.4	5.0	6.8
Chloride	0.49	0.49	0.56	0.55	0.59	0.64	0.48	0.48	0.56	0.55	0.60	0.63
Chromium_D	0.000066	0.000068	0.000078	0.000076	0.000082	0.000087	0.000066	0.000067	0.000077	0.000075	0.000080	0.000081
Chromium_D_Hex	0.000066	0.000068	0.000075	0.000074	0.000081	0.000084	0.000066	0.000067	0.000075	0.000074	0.000079	0.000081
Chromium_T	0.00012	0.00013	0.00014	0.00015	0.00017	0.00018	0.00012	0.00012	0.00013	0.00014	0.00016	0.00018
Cobalt_D	0.00032	0.00035	0.00047	0.00057	0.0012	0.0013	0.00032	0.00033	0.00047	0.00056	0.0012	0.0013
Cobalt_T	0.00042	0.00046	0.00050	0.00064	0.0014	0.0014	0.00042	0.00044	0.00049	0.00063	0.0014	0.0014
Copper_D	0.0013	0.0013	0.0015	0.0020	0.0047	0.0047	0.0013	0.0013	0.0015	0.0020	0.0047	0.0047
Copper_T	0.0015	0.0015	0.0018	0.0024	0.0055	0.0055	0.0015	0.0015	0.0018	0.0024	0.0055	0.0055
Cyanide_F	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00051	0.00052	0.00055
Cyanide_T	0.00050	0.00052	0.00067	0.00065	0.00076	0.00079	0.00053	0.00054	0.00055	0.00055	0.00057	0.00064
Cyanide_WAD	0.00050	0.00050	0.00050	0.00050	0.00051	0.00051	0.00050	0.00050	0.00051	0.00051	0.00053	0.00057
Fluoride	0.051	0.052	0.061	0.059	0.063	0.065	0.051	0.052	0.061	0.059	0.063	0.064
Hardness	13	14	15	15	17	20	13	13	15	15	16	19
Iron_D	0.12	0.12	0.18	0.17	0.19	0.19	0.12	0.12	0.18	0.17	0.19	0.19
Iron_T	0.29	0.29	0.32	0.32	0.35	0.35	0.29	0.29	0.32	0.32	0.35	0.35
Lead_D	0.000036	0.000038	0.000045	0.000043	0.000046	0.000055	0.000036	0.000038	0.000045	0.000043	0.000046	0.000051
Lead_T	0.000045	0.000046	0.000049	0.000054	0.000070	0.000072	0.000043	0.000045	0.000048	0.000052	0.000064	0.000071
Magnesium_D	0.91	0.98	1.0	1.1	1.2	1.8	0.89	0.89	1.0	1.0	1.1	1.3
Manganese_D	0.012	0.012	0.025	0.022	0.030	0.032	0.012	0.012	0.025	0.024	0.031	0.043
Manganese_T	0.028	0.029	0.030	0.032	0.039	0.041	0.028	0.029	0.030	0.032	0.038	0.041
Mercury_D	.00000066	0.00000066	.00000067	.00000079	0.0000011	0.0000011	0.00000066	0.00000066	.00000068	.00000081	0.0000011	0.0000012
Mercury_T	.00000082	0.00000083	.00000084	.00000097	0.0000013	0.0000013	0.00000082	0.00000084	.00000085	.00000098	0.0000013	0.0000014
Molybdenum_D	0.000045	0.000052	0.000086	0.00013	0.00023	0.00055	0.000044	0.000047	0.000058	0.000059	0.000076	0.00011
Molybdenum_T	0.000078	0.00010	0.00013	0.00017	0.00027	0.00060	0.000076	0.000086	0.00010	0.00010	0.00011	0.00016
N_Ammonia	0.0076	0.0095	0.028	0.026	0.037	0.072	0.0069	0.0075	0.024	0.023	0.036	0.041
N_Nitrate_Nitrite	0.026	0.034	0.087	0.087	0.12	0.37	0.025	0.025	0.058	0.057	0.087	0.087
N_Nitrite	0.0093	0.010	0.012	0.012	0.014	0.019	0.0093	0.0095	0.012	0.012	0.013	0.013
Nickel_D	0.024	0.024	0.027	0.030	0.047	0.047	0.024	0.024	0.027	0.030	0.047	0.047
Nickel_T	0.025	0.025	0.027	0.030	0.047	0.047	0.025	0.025	0.027	0.030	0.047	0.047
Phosphorus_T	0.013	0.014	0.020	0.019	0.021	0.021	0.013	0.014	0.020	0.019	0.021	0.021
Potassium_D	0.62	0.70	0.79	0.89	1.1	2.1	0.60	0.62	0.79	0.78	0.86	1.3
Proton	000000094	0.000000097	.00000036	.00000034	0.00000052	.00000052	0.000000094	0.000000097	.00000036	.00000034	0.00000052	.00000052
Radium_226	0.0045	0.0046	0.0050	0.0051	0.0065	0.0065	0.0045	0.0045	0.0049	0.0051	0.0064	0.0065
Selenium_D	0.000040	0.000042	0.000050	0.000048	0.000051	0.000064	0.000040	0.000041	0.000049	0.000047	0.000051	0.000055
Selenium_T	0.000041	0.000045	0.000051	0.000051	0.000058	0.000065	0.000040	0.000042	0.000050	0.000049	0.000055	0.000056
Silicon_D	2.0	2.0	2.8	2.8	3.3	3.4	2.0	2.0	2.8	2.7	3.3	3.4
Silicon_T	2.2	2.2	2.9	2.8	3.4	3.5	2.2	2.2	2.9	2.8	3.4	3.4
Silver_D	0.0000050	0.0000050	0.0000050	0.0000051	0.0000051	0.0000054	0.0000050	0.0000050	0.0000050	0.0000050	0.0000051	0.0000052
Silver_T	0.0000050	0.0000051	0.0000051	0.0000051	0.0000052	0.0000056	0.0000050	0.0000050	0.0000051	0.0000051	0.0000052	0.0000054
Sodium_D	1.1	1.2	1.4	1.4	1.5	1.8	1.1	1.1	1.4	1.3	1.5	1.9
Sodium_T	1.1	1.2	1.5	1.5	1.6	1.9	1.1	1.2	1.5	1.4	1.6	2.0
Strontium_D	0.014	0.015	0.017	0.018	0.019	0.029	0.013	0.014	0.017	0.016	0.018	0.021
Strontium_T	0.014	0.016	0.018	0.019	0.020	0.030	0.014	0.015	0.018	0.017	0.019	0.022
Sulfate	4.3	4.5	5.8	7.3	11	20	4.2	4.3	5.5	6.0	8.5	11
Thallium_D	0.000012	0.000013	0.000045	0.000037	0.000048	0.000049	0.000012	0.000013	0.000045	0.000037	0.000048	0.000048
Thallium_T	0.000013	0.000014	0.000045	0.000037	0.000048	0.000049	0.000012	0.000013	0.000045	0.000037	0.000048	0.000048
TSS	1.3	2.1	4.5	6.4	11	27	1.1	1.1	3.0	4.1	6.8	12
Uranium_D	0.000035	0.000045	0.000053	0.000059	0.000073	0.00014	0.000035	0.000035	0.000049	0.000048	0.000054	0.000072
Uranium_T	0.000038	0.000047	0.000054	0.000060	0.000075	0.00014	0.000038	0.000038	0.000049	0.000049	0.000054	0.000072
Vanadium_T	0.00010	0.00010	0.00011	0.00012	0.00014	0.00014	0.00010	0.00010	0.00010	0.00011	0.00013	0.00014
Zinc_D	0.0057	0.0058	0.0085	0.0078	0.0090	0.0091	0.0058	0.0058	0.0085	0.0078	0.0090	0.0090
Zinc_T	0.0058	0.0058	0.0085	0.0079	0.0091	0.0091	0.0058	0.0058	0.0085	0.0079	0.0090	0.0091
N_Ammonia_Un	0.0000055	0.0000056	0.0000077	0.000014	0.000034	0.000045	0.0000054	0.0000055	0.0000063	0.000011	0.000027	0.000031

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Upper Case Scenario - Model Node QM07 (Minton Lake)

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	4.5	4.6	4.9	4.9	5.3	5.4	4.6	4.8	5.2	5.2	5.7	5.9
Alkalinity_T	17	18	19	19	21	22	19	21	24	24	27	28
Aluminum_D	0.040	0.041	0.042	0.042	0.043	0.044	0.042	0.043	0.044	0.044	0.045	0.046
Aluminum_T	0.075	0.076	0.078	0.079	0.082	0.083	0.077	0.078	0.080	0.081	0.084	0.085
Antimony_D	0.000087	0.000096	0.00033	0.00032	0.00049	0.00054	0.00018	0.00019	0.00023	0.00023	0.00028	0.00032
Antimony_T	0.000087	0.000096	0.00033	0.00032	0.00049	0.00054	0.00018	0.00019	0.00023	0.00023	0.00028	0.00032
Arsenic_D	0.00056	0.00059	0.00098	0.0010	0.0015	0.0017	0.0011	0.0012	0.0017	0.0017	0.0022	0.0024
Arsenic_T	0.00059	0.00062	0.0010	0.0011	0.0016	0.0017	0.0011	0.0013	0.0018	0.0018	0.0022	0.0024
Barium_D	0.0072	0.0077	0.0086	0.0087	0.0097	0.010	0.0086	0.0096	0.011	0.011	0.013	0.014
Barium_T	0.0077	0.0082	0.0091	0.0091	0.010	0.011	0.0091	0.010	0.012	0.012	0.014	0.015
Beryllium_T	0.000087	0.000088	0.000090	0.000090	0.000092	0.000092	0.000092	0.000094	0.000098	0.000098	0.00010	0.00010
Boron_D	0.0059	0.0061	0.0067	0.0067	0.0073	0.0076	0.0064	0.0068	0.0074	0.0074	0.0080	0.0084
Boron_T	0.0075	0.0079	0.0088	0.0088	0.0097	0.010	0.0081	0.0086	0.0095	0.0095	0.010	0.011
Bromide	0.050	0.050	0.051	0.051	0.051	0.052	0.052	0.052	0.054	0.054	0.055	0.055
Cadmium_D	0.0000046	0.0000048	0.0000064	0.0000068	0.0000093	0.000010	0.0000097	0.000011	0.000019	0.000019	0.000025	0.000028
Cadmium_T	0.0000047	0.0000048	0.0000065	0.0000068	0.0000093	0.000010	0.0000097	0.000012	0.000019	0.000019	0.000025	0.000028
Calcium_D	6.2	6.6	8.5	8.7	11	12	10	12	17	17	22	24
Chloride	0.25	0.26	0.44	0.42	0.54	0.57	0.36	0.37	0.40	0.41	0.45	0.47
Chromium_D	0.00012	0.00012	0.00013	0.00013	0.00014	0.00014	0.00013	0.00013	0.00015	0.00015	0.00016	0.00016
Chromium_D_Hex	0.00012	0.00012	0.00013	0.00013	0.00014	0.00014	0.00013	0.00013	0.00015	0.00015	0.00016	0.00016
Chromium_T	0.00022	0.00023	0.00023	0.00023	0.00023	0.00023	0.00023	0.00024	0.00025	0.00025	0.00026	0.00026
Cobalt_D	0.000087	0.00011	0.00035	0.00034	0.00051	0.00056	0.00023	0.00025	0.00033	0.00034	0.00044	0.00049
Cobalt_T	0.000091	0.00012	0.00035	0.00034	0.00052	0.00057	0.00023	0.00025	0.00034	0.00034	0.00044	0.00049
Copper_D	0.00049	0.00052	0.00062	0.00061	0.00068	0.00071	0.00065	0.00067	0.00075	0.00076	0.00085	0.00092
Copper_T	0.00062	0.00067	0.00077	0.00076	0.00086	0.00090	0.00078	0.00081	0.00091	0.00091	0.0010	0.0011
Cyanide_F	0.00050	0.00051	0.00059	0.00058	0.00064	0.00066	0.00062	0.00063	0.00066	0.00066	0.00069	0.00072
Cyanide_T	0.00050	0.0024	0.019	0.017	0.028	0.031	0.0078	0.0087	0.012	0.012	0.016	0.017
Cyanide_WAD	0.00050	0.00054	0.00097	0.00091	0.0012	0.0012	0.00073	0.00076	0.00088	0.00088	0.00098	0.0010
Fluoride	0.038	0.039	0.043	0.043	0.047	0.049	0.043	0.043	0.047	0.047	0.051	0.053
Hardness	20	21	22	23	24	26	24	27	34	34	40	43
Iron_D	0.29	0.30	0.32	0.32	0.34	0.35	0.29	0.30	0.33	0.33	0.35	0.35
Iron_T	0.43	0.44	0.45	0.46	0.47	0.48	0.44	0.44	0.46	0.46	0.48	0.48
Lead_D	0.000052	0.000054	0.000060	0.000060	0.000065	0.000068	0.000068	0.000071	0.000081	0.000081	0.000091	0.000096
Lead_T	0.000085	0.000088	0.000095	0.000095	0.00010	0.00010	0.00010	0.00011	0.00012	0.00012	0.00013	0.00013
Magnesium_D	1.1	1.1	1.3	1.4	1.7	1.8	1.5	1.7	2.3	2.3	2.8	3.0
Manganese_D	0.033	0.036	0.045	0.045	0.053	0.056	0.077	0.084	0.10	0.10	0.12	0.13
Manganese_T	0.047	0.050	0.056	0.057	0.064	0.066	0.091	0.097	0.11	0.11	0.13	0.14
Mercury_D	0.0000018	0.0000019	0.0000019	0.0000019	0.0000020	0.0000020	0.0000021	0.0000021	0.0000022	0.0000022	0.0000022	0.0000023
Mercury_T	0.0000021	0.0000021	0.0000022	0.0000022	0.0000022	0.0000023	0.0000023	0.0000023	0.0000024	0.0000024	0.0000025	0.0000025
Molybdenum_D	0.000049	0.000056	0.00030	0.00032	0.00059	0.00066	0.00017	0.00018	0.00023	0.00024	0.00031	0.00034
Molybdenum_T	0.000091	0.000098	0.00035	0.00036	0.00063	0.00071	0.00021	0.00022	0.00027	0.00028	0.00035	0.00038
N_Ammonia	0.046	0.060	0.10	0.094	0.12	0.13	0.054	0.057	0.069	0.069	0.080	0.11
N_Nitrate_Nitrite	0.031	0.034	0.050	0.055	0.080	0.091	0.033	0.034	0.037	0.037	0.039	0.041
N_Nitrite	0.016	0.016	0.018	0.018	0.020	0.020	0.016	0.016	0.018	0.018	0.019	0.020
Nickel_D	0.00026	0.00028	0.00047	0.00050	0.00077	0.00086	0.00065	0.00079	0.0014	0.0014	0.0019	0.0021
Nickel_T	0.00039	0.00042	0.00061	0.00064	0.00091	0.0010	0.00079	0.00093	0.0015	0.0015	0.0020	0.0023
Phosphorus_T	0.024	0.025	0.025	0.025	0.026	0.026	0.025	0.026	0.026	0.026	0.027	0.027
Potassium_D	0.65	0.70	1.2	1.3	1.9	2.1	1.7	1.9	3.1	3.1	4.2	4.6
Proton	.00000029	0.00000029	.00000031	.00000031	0.00000034	.00000034	0.00000029	0.00000030	.00000032	.00000032	0.00000034	.00000035
Radium_226	0.0049	0.0049	0.0050	0.0050	0.0050	0.0050	0.0050	0.0051	0.0053	0.0053	0.0054	0.0055
Selenium_D	0.000048	0.000049	0.000070	0.000068	0.000084	0.000089	0.000060	0.000061	0.000067	0.000067	0.000075	0.000078
Selenium_T	0.000049	0.000051	0.000072	0.000070	0.000086	0.000091	0.000061	0.000063	0.000068	0.000069	0.000077	0.000080
Silicon_D	0.72	0.75	0.80	0.80	0.86	0.89	0.81	0.89	1.0	1.0	1.1	1.2
Silicon_T	0.82	0.84	0.89	0.89	0.94	0.96	0.91	0.98	1.1	1.1	1.2	1.3
Silver_D	0.0000050	0.0000051	0.0000052	0.0000052	0.0000054	0.0000055	0.0000054	0.0000055	0.0000059	0.0000059	0.0000063	0.0000065
Silver_T	0.0000050	0.0000051	0.0000052	0.0000052	0.0000054	0.0000055	0.0000054	0.0000055	0.0000059	0.0000059	0.0000063	0.0000065
Sodium_D	0.94	1.1	6.2	5.6	8.7	9.5	1.2	1.3	1.4	1.6	2.5	5.2
Sodium_T	0.96	1.1	6.2	5.6	8.7	9.5	1.2	1.3	1.4	1.7	2.5	5.2
Strontium_D	0.013	0.014	0.018	0.019	0.024	0.026	0.020	0.023	0.032	0.032	0.041	0.045
Strontium_T	0.014	0.014	0.019	0.019	0.024	0.026	0.021	0.024	0.033	0.033	0.041	0.045
Sulfate	0.43	1.1	18	17	31	35	17	18	29	30	42	47
Thallium_D	0.000038	0.000038	0.000039	0.000039	0.000040	0.000041	0.000039	0.000040	0.000042	0.000042	0.000043	0.000044
Thallium_T	0.000038	0.000038	0.000039	0.000039	0.000040	0.000041	0.000039	0.000040	0.000042	0.000042	0.000043	0.000044
TSS	3.7	4.1	8.2	9.1	16	17	15	20	40	40	58	65
Uranium_D	0.000042	0.000044	0.000069	0.000074	0.00011	0.00012	0.000079	0.000089	0.00014	0.00014	0.00018	0.00020
Uranium_T	0.000044	0.000045	0.000070	0.000075	0.00011	0.00012	0.000080	0.000091	0.00014	0.00014	0.00018	0.00020
Vanadium_T	0.00025	0.00026	0.00028	0.00028	0.00030	0.00031	0.00027	0.00027	0.00029	0.00029	0.00030	0.00031
Zinc_D	0.0018	0.0018	0.0019	0.0019	0.0021	0.0021	0.0020	0.0021	0.0024	0.0024	0.0027	0.0028
Zinc_T	0.0019	0.0020	0.0021	0.0021	0.0023	0.0023	0.0021	0.0023	0.0026	0.0026	0.0029	0.0029
N_Ammonia_Un	0.0000071	0.000011	0.000030	0.000083	0.00021	0.00027	0.0000083	0.0000095	0.000032	0.000061	0.00015	0.00022

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Upper Case Scenario - Model Node QM11

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	4.4	4.4	7.8	7.6	11	11	4.4	4.4	7.8	7.6	11	11
Alkalinity_T	13	13	26	24	31	31	13	13	26	24	31	31
Aluminum_D	0.054	0.054	0.066	0.064	0.067	0.067	0.054	0.054	0.066	0.064	0.067	0.067
Aluminum_T	0.087	0.087	0.13	0.12	0.13	0.13	0.087	0.087	0.13	0.12	0.13	0.13
Antimony_D	0.000080	0.000080	0.000092	0.000088	0.000093	0.000093	0.000080	0.000080	0.000092	0.000088	0.000093	0.000093
Antimony_T	0.000080	0.000080	0.000092	0.000088	0.000093	0.000093	0.000080	0.000080	0.000092	0.000088	0.000093	0.000093
Arsenic_D	0.00027	0.00027	0.00037	0.00035	0.00041	0.00041	0.00027	0.00027	0.00037	0.00035	0.00041	0.00041
Arsenic_T	0.00029	0.00029	0.00038	0.00037	0.00043	0.00043	0.00029	0.00029	0.00038	0.00037	0.00043	0.00043
Barium_D	0.0067	0.0067	0.010	0.0096	0.012	0.012	0.0067	0.0067	0.010	0.0096	0.012	0.012
Barium_T	0.0070	0.0070	0.011	0.010	0.013	0.013	0.0070	0.0070	0.011	0.010	0.013	0.013
Beryllium_T	0.000080	0.000080	0.000092	0.000088	0.000093	0.000093	0.000080	0.000080	0.000092	0.000088	0.000093	0.000093
Boron_D	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
Boron_T	0.0050	0.0050	0.0085	0.0085	0.012	0.012	0.0050	0.0050	0.0085	0.0085	0.012	0.012
Bromide	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium_D	0.0000038	0.0000038	0.0000045	0.0000046	0.0000052	0.0000052	0.0000038	0.0000038	0.0000045	0.0000046	0.0000052	0.0000052
Cadmium_T	0.0000038	0.0000038	0.0000052	0.0000053	0.0000064	0.0000064	0.0000038	0.0000038	0.0000052	0.0000053	0.0000064	0.0000064
Calcium_D	4.8	4.8	7.7	7.3	9.0	9.0	4.8	4.8	7.7	7.3	9.0	9.0
Chloride	0.25	0.25	0.56	0.46	0.58	0.58	0.25	0.25	0.56	0.46	0.58	0.58
Chromium_D	0.00015	0.00015	0.00022	0.00021	0.00022	0.00022	0.00015	0.00015	0.00022	0.00021	0.00022	0.00022
Chromium_D_Hex	0.00015	0.00015	0.00022	0.00020	0.00022	0.00022	0.00015	0.00015	0.00022	0.00020	0.00022	0.00022
Chromium_T	0.00027	0.00027	0.00034	0.00032	0.00035	0.00035	0.00027	0.00027	0.00034	0.00032	0.00035	0.00035
Cobalt_D	0.000092	0.000092	0.00019	0.00017	0.00024	0.00024	0.000092	0.000092	0.00019	0.00017	0.00024	0.00024
Cobalt_T	0.00010	0.00010	0.00022	0.00020	0.00028	0.00028	0.00010	0.00010	0.00022	0.00020	0.00028	0.00028
Copper_D	0.00062	0.00062	0.00065	0.00074	0.0011	0.0011	0.00062	0.00062	0.00065	0.00074	0.0011	0.0011
Copper_T	0.00070	0.00070	0.00094	0.00095	0.0013	0.0013	0.00070	0.00070	0.00094	0.00095	0.0013	0.0013
Cyanide_F	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Cyanide_T	0.00050	0.00050	0.00056	0.00056	0.00062	0.00062	0.00050	0.00050	0.00056	0.00056	0.00062	0.00062
Cyanide_WAD	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Fluoride	0.043	0.043	0.053	0.050	0.053	0.053	0.043	0.043	0.053	0.050	0.053	0.053
Hardness	17	17	26	25	31	31	17	17	26	25	31	31
Iron_D	0.39	0.39	0.76	0.71	0.92	0.92	0.39	0.39	0.76	0.71	0.92	0.92
Iron_T	0.75	0.75	1.1	1.1	1.3	1.3	0.75	0.75	1.1	1.1	1.3	1.3
Lead_D	0.000041	0.000041	0.000041	0.000042	0.000048	0.000048	0.000041	0.000041	0.000041	0.000042	0.000048	0.000048
Lead_T	0.000066	0.000066	0.00011	0.000099	0.00012	0.00012	0.000066	0.000066	0.00011	0.000099	0.00012	0.00012
Magnesium_D	1.1	1.1	1.6	1.6	1.9	1.9	1.1	1.1	1.6	1.6	1.9	1.9
Manganese_D	0.033	0.033	0.091	0.083	0.12	0.12	0.033	0.033	0.091	0.083	0.12	0.12
Manganese_T	0.044	0.044	0.10	0.095	0.13	0.13	0.044	0.044	0.10	0.095	0.13	0.13
Mercury_D	0.0000015	0.0000015	0.0000015	0.0000018	0.0000023	0.0000023	0.0000015	0.0000015	0.0000015	0.0000018	0.0000023	0.0000023
Mercury_T	0.0000018	0.0000018	0.0000020	0.0000021	0.0000026	0.0000026	0.0000018	0.0000018	0.0000020	0.0000021	0.0000026	0.0000026
Molybdenum_D	0.00010	0.00010	0.00012	0.00012	0.00016	0.00016	0.00010	0.00010	0.00012	0.00012	0.00016	0.00016
Molybdenum_T	0.00010	0.00010	0.00012	0.00012	0.00017	0.00017	0.00010	0.00010	0.00012	0.00012	0.00017	0.00017
N_Ammonia	0.0080	0.0080	0.061	0.060	0.11	0.11	0.0080	0.0080	0.061	0.060	0.11	0.11
N_Nitrate_Nitrite	0.025	0.025	0.12	0.12	0.21	0.21	0.025	0.025	0.12	0.12	0.21	0.21
N_Nitrite	0.0010	0.0010	0.013	0.011	0.013	0.013	0.0010	0.0010	0.013	0.011	0.013	0.013
Nickel_D	0.00038	0.00038	0.00062	0.00065	0.0010	0.0010	0.00038	0.00038	0.00062	0.00065	0.0010	0.0010
Nickel_T	0.00059	0.00059	0.00075	0.00082	0.0013	0.0013	0.00059	0.00059	0.00075	0.00082	0.0013	0.0013
Phosphorus_T	0.024	0.024	0.034	0.033	0.039	0.039	0.024	0.024	0.034	0.033	0.039	0.039
Potassium_D	0.41	0.41	0.84	0.78	1.0	1.0	0.41	0.41	0.84	0.78	1.0	1.0
Proton	.00000020	0.00000020	.00000028	.00000027	0.00000032	.00000032	0.00000020	0.00000020	.00000028	.00000027	0.00000032	.00000032
Radium_226	0.0046	0.0046	0.0046	0.0048	0.0057	0.0057	0.0046	0.0046	0.0046	0.0048	0.0057	0.0057
Selenium_D	0.000040	0.000040	0.000048	0.000047	0.000050	0.000050	0.000040	0.000040	0.000048	0.000047	0.000050	0.000050
Selenium_T	0.000047	0.000047	0.000050	0.000050	0.000050	0.000050	0.000047	0.000047	0.000050	0.000050	0.000050	0.000050
Silicon_D	1.0	1.0	2.1	1.8	2.2	2.2	1.0	1.0	2.1	1.8	2.2	2.2
Silicon_T	1.2	1.2	2.1	1.9	2.2	2.2	1.2	1.2	2.1	1.9	2.2	2.2
Silver_D	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050
Silver_T	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050	0.0000050
Sodium_D	1.1	1.1	1.8	1.7	2.3	2.3	1.1	1.1	1.8	1.7	2.3	2.3
Sodium_T	1.1	1.1	1.8	1.8	2.3	2.3	1.1	1.1	1.8	1.8	2.3	2.3
Strontium_D	0.013	0.013	0.020	0.019	0.022	0.022	0.013	0.013	0.020	0.019	0.022	0.022
Strontium_T	0.014	0.014	0.021	0.019	0.023	0.023	0.014	0.014	0.021	0.019	0.023	0.023
Sulfate	0.38	0.38	0.72	0.70	0.92	0.92	0.38	0.38	0.72	0.70	0.92	0.92
Thallium_D	0.000032	0.000032	0.000042	0.000039	0.000044	0.000044	0.000032	0.000032	0.000042	0.000039	0.000044	0.000044
Thallium_T	0.000032	0.000032	0.000042	0.000039	0.000044	0.000044	0.000032	0.000032	0.000042	0.000039	0.000044	0.000044
TSS	1.0	1.0	3.8	3.2	4.0	4.0	1.0	1.0	3.8	3.2	4.0	4.0
Uranium_D	0.000038	0.000038	0.000046	0.000044	0.000046	0.000046	0.000038	0.000038	0.000046	0.000044	0.000046	0.000046
Uranium_T	0.000040	0.000040	0.000048	0.000046	0.000048	0.000048	0.000040	0.000040	0.000048	0.000046	0.000048	0.000048
Vanadium_T	0.00028	0.00028	0.00043	0.00039	0.00048	0.00048	0.00028	0.00028	0.00043	0.00039	0.00048	0.00048
Zinc_D	0.0019	0.0019	0.0023	0.0026	0.0042	0.0042	0.0019	0.0019	0.0023	0.0026	0.0042	0.0042
Zinc_T	0.0020	0.0020	0.0030	0.0031	0.0046	0.0046	0.0020	0.0020	0.0030	0.0031	0.0046	0.0046
N_Ammonia_Un	0.0000080	0.0000080	0.000017	0.000016	0.000019	0.000019	0.0000080	0.0000080	0.000017	0.000016	0.000019	0.000019

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Upper Case Scenario - Cockeram Lake

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	2.4	2.6	3.9	3.9	5.1	5.1	2.4	2.6	3.9	3.9	5.0	5.1
Alkalinity_T	8.7	9.3	11	11	13	13	8.5	9.0	11	11	13	13
Aluminum_D	0.034	0.038	0.041	0.042	0.050	0.054	0.035	0.038	0.041	0.042	0.050	0.054
Aluminum_T	0.065	0.065	0.077	0.080	0.10	0.12	0.064	0.064	0.077	0.080	0.10	0.12
Antimony_D	0.000073	0.000096	0.00011	0.00012	0.00016	0.00025	0.000073	0.000075	0.000096	0.000094	0.00011	0.00012
Antimony_T	0.000073	0.000096	0.00011	0.00012	0.00016	0.00025	0.000073	0.000075	0.000096	0.000094	0.00011	0.00012
Arsenic_D	0.00015	0.00017	0.00025	0.00031	0.00054	0.00073	0.00015	0.00016	0.00021	0.00020	0.00024	0.00028
Arsenic_T	0.00017	0.00019	0.00029	0.00035	0.00058	0.00076	0.00016	0.00018	0.00022	0.00023	0.00029	0.00032
Barium_D	0.0058	0.0060	0.0071	0.0070	0.0078	0.0084	0.0056	0.0057	0.0070	0.0069	0.0079	0.0082
Barium_T	0.0064	0.0065	0.0084	0.0084	0.010	0.011	0.0062	0.0063	0.0082	0.0082	0.010	0.010
Beryllium_T	0.000073	0.000075	0.000093	0.000089	0.000097	0.000098	0.000073	0.000074	0.000093	0.000089	0.000097	0.000098
Boron_D	0.0050	0.0050	0.0051	0.0052	0.0054	0.0056	0.0050	0.0050	0.0050	0.0050	0.0051	0.0051
Boron_T	0.0050	0.0051	0.0055	0.0054	0.0056	0.0060	0.0050	0.0050	0.0053	0.0053	0.0056	0.0057
Bromide	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Cadmium_D	0.0000093	0.000011	0.000011	0.000012	0.000016	0.000018	0.0000093	0.0000095	0.000011	0.000012	0.000015	0.000016
Cadmium_T	0.000011	0.000012	0.000012	0.000013	0.000017	0.000019	0.000011	0.000011	0.000012	0.000013	0.000017	0.000018
Calcium_D	3.9	4.4	4.7	4.9	5.8	6.3	3.6	3.6	4.3	4.5	5.1	5.5
Chloride	0.48	0.49	0.54	0.54	0.59	0.61	0.47	0.48	0.54	0.54	0.59	0.61
Chromium_D	0.000070	0.000073	0.000082	0.000079	0.000084	0.000085	0.000070	0.000072	0.000081	0.000079	0.000083	0.000083
Chromium_D_Hex	0.000070	0.000073	0.000079	0.000078	0.000082	0.000084	0.000070	0.000072	0.000079	0.000078	0.000081	0.000083
Chromium_T	0.00013	0.00014	0.00015	0.00015	0.00017	0.00018	0.00013	0.00013	0.00014	0.00015	0.00017	0.00018
Cobalt_D	0.00033	0.00036	0.00044	0.00054	0.00096	0.0011	0.00033	0.00034	0.00044	0.00053	0.00095	0.0011
Cobalt_T	0.00043	0.00046	0.00047	0.00061	0.0011	0.0013	0.00043	0.00044	0.00047	0.00060	0.0010	0.0013
Copper_D	0.0013	0.0013	0.0017	0.0020	0.0035	0.0044	0.0013	0.0013	0.0017	0.0020	0.0035	0.0044
Copper_T	0.0015	0.0015	0.0020	0.0024	0.0041	0.0051	0.0015	0.0015	0.0020	0.0024	0.0041	0.0051
Cyanide_F	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00051	0.00051	0.00052	0.00053
Cyanide_T	0.00050	0.00052	0.00066	0.00064	0.00072	0.00076	0.00053	0.00054	0.00055	0.00055	0.00056	0.00059
Cyanide_WAD	0.00050	0.00050	0.00050	0.00050	0.00051	0.00051	0.00050	0.00050	0.00051	0.00051	0.00052	0.00054
Fluoride	0.051	0.054	0.059	0.059	0.063	0.063	0.051	0.054	0.059	0.059	0.063	0.063
Hardness	13	14	16	15	16	17	13	13	16	15	16	17
Iron_D	0.14	0.15	0.19	0.19	0.22	0.22	0.14	0.15	0.19	0.19	0.22	0.22
Iron_T	0.32	0.33	0.35	0.35	0.36	0.37	0.31	0.33	0.35	0.35	0.36	0.37
Lead_D	0.000036	0.000038	0.000043	0.000043	0.000046	0.000048	0.000036	0.000038	0.000044	0.000042	0.000046	0.000047
Lead_T	0.000046	0.000048	0.000052	0.000054	0.000064	0.000072	0.000044	0.000047	0.000051	0.000053	0.000062	0.000070
Magnesium_D	0.93	1.0	1.1	1.1	1.2	1.3	0.90	0.91	1.1	1.0	1.1	1.2
Manganese_D	0.012	0.013	0.027	0.024	0.030	0.030	0.012	0.014	0.027	0.025	0.032	0.037
Manganese_T	0.028	0.030	0.033	0.034	0.040	0.040	0.028	0.029	0.033	0.033	0.038	0.040
Mercury_D	.00000069	0.00000069	.00000071	.00000083	0.0000011	0.0000012	0.00000069	0.00000069	.00000073	.00000084	0.0000011	0.0000012
Mercury_T	.00000086	0.00000087	.00000088	0.0000010	0.0000013	0.0000014	0.00000086	0.00000088	.00000089	0.0000010	0.0000013	0.0000014
Molybdenum_D	0.000050	0.000055	0.000090	0.00012	0.00021	0.00027	0.000048	0.000050	0.000061	0.000060	0.000074	0.000082
Molybdenum_T	0.000082	0.00010	0.00013	0.00016	0.00025	0.00031	0.000081	0.000085	0.00010	0.00010	0.00011	0.00013
N_Ammonia	0.0078	0.010	0.027	0.026	0.040	0.052	0.0075	0.0087	0.022	0.024	0.039	0.041
N_Nitrate_Nitrite	0.027	0.035	0.081	0.081	0.12	0.19	0.025	0.025	0.055	0.058	0.091	0.091
N_Nitrite	0.0091	0.010	0.012	0.012	0.013	0.014	0.0090	0.0099	0.012	0.011	0.012	0.012
Nickel_D	0.023	0.023	0.027	0.029	0.038	0.044	0.023	0.023	0.027	0.029	0.038	0.044
Nickel_T	0.024	0.024	0.027	0.029	0.038	0.044	0.024	0.024	0.027	0.029	0.038	0.044
Phosphorus_T	0.014	0.016	0.019	0.019	0.022	0.022	0.014	0.016	0.019	0.019	0.022	0.022
Potassium_D	0.63	0.70	0.80	0.85	1.1	1.3	0.61	0.61	0.77	0.76	0.84	0.98
Proton	.00000010	0.00000013	.00000031	.00000032	0.00000050	.00000050	0.00000010	0.00000013	.00000031	.00000032	0.00000050	.00000050
Radium_226	0.0046	0.0047	0.0049	0.0051	0.0056	0.0063	0.0045	0.0046	0.0049	0.0051	0.0056	0.0063
Selenium_D	0.000041	0.000043	0.000048	0.000048	0.000051	0.000055	0.000041	0.000041	0.000047	0.000047	0.000051	0.000052
Selenium_T	0.000041	0.000045	0.000051	0.000050	0.000054	0.000057	0.000041	0.000043	0.000050	0.000049	0.000052	0.000054
Silicon_D	2.0	2.0	2.6	2.7	3.3	3.3	1.9	2.0	2.6	2.7	3.3	3.3
Silicon_T	2.2	2.2	2.7	2.8	3.3	3.4	2.1	2.2	2.7	2.8	3.3	3.3
Silver_D	0.0000050	0.0000050	0.0000050	0.0000050	0.0000051	0.0000051	0.0000050	0.0000050	0.0000050	0.0000050	0.0000051	0.0000051
Silver_T	0.0000050	0.0000050	0.0000051	0.0000051	0.0000052	0.0000053	0.0000050	0.0000050	0.0000051	0.0000051	0.0000051	0.0000052
Sodium_D	1.1	1.2	1.4	1.4	1.5	1.6	1.1	1.1	1.4	1.4	1.5	1.6
Sodium_T	1.2	1.2	1.4	1.4	1.6	1.7	1.1	1.2	1.4	1.4	1.6	1.7
Strontium_D	0.014	0.015	0.017	0.017	0.019	0.021	0.013	0.014	0.017	0.016	0.018	0.019
Strontium_T	0.014	0.016	0.018	0.018	0.020	0.022	0.014	0.015	0.018	0.017	0.019	0.020
Sulfate	4.1	4.4	6.2	6.6	9.7	11	4.1	4.1	5.3	5.6	7.7	8.3
Thallium_D	0.000016	0.000021	0.000044	0.000037	0.000047	0.000047	0.000016	0.000021	0.000044	0.000037	0.000047	0.000047
Thallium_T	0.000016	0.000021	0.000044	0.000037	0.000047	0.000048	0.000016	0.000021	0.000044	0.000037	0.000047	0.000047
TSS	1.3	2.3	4.9	5.6	10	12	1.2	1.2	3.0	3.8	6.3	8.9
Uranium_D	0.000036	0.000044	0.000053	0.000056	0.000069	0.000087	0.000035	0.000036	0.000048	0.000047	0.000053	0.000059
Uranium_T	0.000039	0.000047	0.000054	0.000057	0.000072	0.000088	0.000038	0.000039	0.000049	0.000048	0.000053	0.000060
Vanadium_T	0.00011	0.00012	0.00012	0.00012	0.00014	0.00014	0.00011	0.00011	0.00012	0.00012	0.00013	0.00014
Zinc_D	0.0057	0.0059	0.0082	0.0075	0.0085	0.0086	0.0057	0.0059	0.0082	0.0075	0.0085	0.0086
Zinc_T	0.0057	0.0063	0.0082	0.0076	0.0086	0.0086	0.0057	0.0063	0.0082	0.0076	0.0085	0.0086
N_Ammonia_Un	0.0000039	0.0000057	0.0000078	0.000015	0.000036	0.000052	0.0000039	0.0000057	0.0000064	0.000012	0.000027	0.000031

Notes:

Summary Statistics of the Updated Model Results (mg/L) for the Upper Case Scenario - Payne Lake

Parameters	Operations (Mine Years 1 - 18)						Post-closure (Mine Years 24 - 100)					
	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum	Minimum	10th Percentile	Median	Mean	90th Percentile	Maximum
Acidity_T	7.6	7.9	9.0	9.0	10	10	7.8	8.1	9.2	9.2	10	11
Alkalinity_T	9.8	11	12	12	14	14	12	12	14	14	15	16
Aluminum_D	0.037	0.038	0.040	0.041	0.044	0.044	0.038	0.039	0.041	0.041	0.044	0.046
Aluminum_T	0.056	0.057	0.059	0.059	0.061	0.062	0.058	0.058	0.059	0.060	0.062	0.063
Antimony_D	0.000076	0.00011	0.00091	0.00079	0.0012	0.0013	0.000094	0.000097	0.00010	0.00015	0.00026	0.00064
Antimony_T	0.000076	0.00011	0.00091	0.00079	0.0012	0.0013	0.000094	0.000097	0.00010	0.00015	0.00026	0.00064
Arsenic_D	0.00021	0.00026	0.00096	0.00090	0.0014	0.0015	0.00084	0.00087	0.0010	0.0011	0.0012	0.0014
Arsenic_T	0.00024	0.00029	0.00099	0.00093	0.0014	0.0015	0.00087	0.00090	0.0011	0.0011	0.0013	0.0015
Barium_D	0.0083	0.0090	0.010	0.010	0.012	0.012	0.0092	0.0094	0.010	0.010	0.011	0.012
Barium_T	0.0087	0.0094	0.011	0.011	0.012	0.012	0.0096	0.0099	0.011	0.011	0.012	0.012
Beryllium_T	0.000075	0.000076	0.000078	0.000078	0.000080	0.000080	0.000078	0.000078	0.000081	0.000081	0.000082	0.000084
Boron_D	0.0050	0.0050	0.0055	0.0055	0.0058	0.0059	0.0052	0.0052	0.0052	0.0052	0.0053	0.0055
Boron_T	0.0050	0.0050	0.0055	0.0055	0.0058	0.0059	0.0052	0.0052	0.0052	0.0052	0.0053	0.0055
Bromide	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.051	0.051	0.051	0.051
Cadmium_D	0.0000038	0.0000040	0.0000053	0.0000052	0.0000062	0.0000064	0.0000048	0.0000049	0.0000053	0.0000055	0.0000063	0.0000075
Cadmium_T	0.0000048	0.0000050	0.0000064	0.0000063	0.0000073	0.0000075	0.0000058	0.0000060	0.0000064	0.0000065	0.0000074	0.0000086
Calcium_D	3.9	4.5	7.6	7.2	9.3	9.8	5.4	5.7	6.3	6.5	7.5	9.1
Chloride	0.25	0.28	0.97	0.86	1.2	1.3	0.33	0.33	0.35	0.38	0.47	0.75
Chromium_D	0.00014	0.00014	0.00015	0.00015	0.00016	0.00017	0.00014	0.00015	0.00016	0.00016	0.00017	0.00017
Chromium_D_Hex	0.00014	0.00014	0.00015	0.00015	0.00016	0.00017	0.00014	0.00015	0.00016	0.00016	0.00017	0.00017
Chromium_T	0.00023	0.00023	0.00024	0.00024	0.00024	0.00024	0.00023	0.00023	0.00024	0.00024	0.00025	0.00025
Cobalt_D	0.00020	0.00030	0.0012	0.0010	0.0015	0.0016	0.00022	0.00023	0.00027	0.00030	0.00040	0.00086
Cobalt_T	0.00021	0.00031	0.0012	0.0010	0.0015	0.0016	0.00023	0.00024	0.00028	0.00031	0.00042	0.00088
Copper_D	0.00021	0.00026	0.00059	0.00055	0.00074	0.00077	0.00025	0.00026	0.00062	0.00052	0.00070	0.00075
Copper_T	0.00031	0.00038	0.00071	0.00066	0.00085	0.00088	0.00035	0.00038	0.00073	0.00063	0.00081	0.00086
Cyanide_F	0.00050	0.00051	0.00083	0.00078	0.00096	0.00098	0.00065	0.00065	0.00069	0.00072	0.00085	0.0011
Cyanide_T	0.00051	0.0082	0.071	0.063	0.099	0.10	0.014	0.014	0.018	0.018	0.022	0.025
Cyanide_WAD	0.00050	0.00063	0.0023	0.0020	0.0029	0.0031	0.00090	0.00092	0.0010	0.0010	0.0011	0.0012
Fluoride	0.031	0.033	0.044	0.042	0.050	0.052	0.033	0.033	0.035	0.036	0.038	0.046
Hardness	12	13	14	14	15	15	15	16	17	17	19	20
Iron_D	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Iron_T	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Lead_D	0.000036	0.000038	0.000044	0.000043	0.000047	0.000048	0.000047	0.000048	0.000051	0.000053	0.000059	0.000070
Lead_T	0.000067	0.000072	0.000079	0.000079	0.000085	0.000087	0.000079	0.000082	0.000088	0.000088	0.000095	0.00011
Magnesium_D	0.62	0.67	0.86	0.84	1.0	1.0	0.81	0.84	0.92	0.92	1.0	1.1
Manganese_D	0.061	0.065	0.081	0.081	0.096	0.10	0.12	0.13	0.15	0.16	0.19	0.24
Manganese_T	0.073	0.077	0.092	0.092	0.11	0.11	0.13	0.14	0.16	0.17	0.20	0.25
Mercury_D	0.0000015	0.0000015	0.0000017	0.0000016	0.0000017	0.0000018	0.0000017	0.0000018	0.0000018	0.0000019	0.0000020	0.0000023
Mercury_T	0.0000018	0.0000019	0.0000020	0.0000020	0.0000021	0.0000021	0.0000021	0.0000021	0.0000022	0.0000022	0.0000024	0.0000027
Molybdenum_D	0.000046	0.000066	0.00064	0.00057	0.00092	0.00098	0.000070	0.000074	0.000084	0.00012	0.00021	0.00050
Molybdenum_T	0.000057	0.000078	0.00065	0.00058	0.00093	0.00099	0.000081	0.000086	0.000096	0.00013	0.00022	0.00051
N_Ammonia	0.071	0.099	0.24	0.22	0.30	0.33	0.078	0.083	0.10	0.11	0.13	0.22
N_Nitrate_Nitrite	0.025	0.026	0.049	0.049	0.073	0.079	0.026	0.026	0.026	0.026	0.027	0.030
N_Nitrite	0.017	0.017	0.018	0.018	0.019	0.019	0.017	0.017	0.017	0.017	0.018	0.018
Nickel_D	0.00025	0.00027	0.00048	0.00045	0.00059	0.00063	0.00028	0.00029	0.00031	0.00032	0.00037	0.00051
Nickel_T	0.00029	0.00033	0.00053	0.00051	0.00066	0.00069	0.00033	0.00034	0.00037	0.00038	0.00043	0.00057
Phosphorus_T	0.022	0.022	0.023	0.023	0.023	0.023	0.022	0.022	0.023	0.023	0.024	0.024
Potassium_D	0.46	0.54	1.5	1.4	2.0	2.1	0.70	0.72	0.82	0.88	1.2	1.8
Proton	.00000068	0.00000070	.00000078	.00000078	0.00000087	.00000089	0.00000068	0.00000070	.00000078	.00000079	0.00000087	.00000089
Radium_226	0.0049	0.0049	0.0050	0.0050	0.0051	0.0051	0.0050	0.0050	0.0051	0.0051	0.0052	0.0052
Selenium_D	0.000041	0.000045	0.00011	0.00010	0.00014	0.00015	0.000042	0.000043	0.000044	0.000047	0.000057	0.000089
Selenium_T	0.000045	0.000048	0.00012	0.00011	0.00015	0.00015	0.000046	0.000046	0.000047	0.000050	0.000060	0.000093
Silicon_D	1.8	1.8	2.1	2.1	2.3	2.4	1.9	1.9	2.2	2.2	2.4	2.5
Silicon_T	1.9	2.0	2.2	2.2	2.5	2.6	2.0	2.0	2.3	2.3	2.6	2.6
Silver_D	0.0000050	0.0000050	0.0000053	0.0000053	0.0000055	0.0000055	0.0000052	0.0000052	0.0000052	0.0000052	0.0000053	0.0000055
Silver_T	0.0000050	0.0000050	0.0000053	0.0000053	0.0000055	0.0000055	0.0000052	0.0000052	0.0000052	0.0000052	0.0000053	0.0000055
Sodium_D	0.76	1.6	21	18	28	30	0.81	0.83	0.92	1.8	4.3	13
Sodium_T	0.84	1.6	21	18	28	30	0.89	0.91	1.0	1.9	4.4	13
Strontium_D	0.011	0.012	0.018	0.018	0.022	0.023	0.013	0.014	0.015	0.015	0.017	0.021
Strontium_T	0.011	0.013	0.019	0.018	0.023	0.024	0.014	0.015	0.016	0.016	0.018	0.022
Sulfate	0.18	2.6	57	49	79	84	3.7	3.8	5.1	7.7	16	41
Thallium_D	0.000022	0.000023	0.000025	0.000025	0.000027	0.000028	0.000023	0.000023	0.000026	0.000026	0.000028	0.000029
Thallium_T	0.000022	0.000023	0.000025	0.000025	0.000027	0.000028	0.000023	0.000023	0.000026	0.000026	0.000028	0.000029
TSS	5.4	5.9	7.4	7.3	8.8	9.4	5.6	5.8	6.5	6.5	7.1	7.5
Uranium_D	0.000024	0.000029	0.000054	0.000051	0.000069	0.000072	0.000030	0.000032	0.000036	0.000037	0.000045	0.000061
Uranium_T	0.000033	0.000037	0.000062	0.000059	0.000076	0.000079	0.000040	0.000041	0.000044	0.000045	0.000053	0.000068
Vanadium_T	0.00017	0.00018	0.00021	0.00020	0.00022	0.00023	0.00018	0.00019	0.00019	0.00020	0.00020	0.00022
Zinc_D	0.0017	0.0018	0.0020	0.0020	0.0021	0.0022	0.0018	0.0018	0.0020	0.0020	0.0021	0.0023
Zinc_T	0.0027	0.0028	0.0028	0.0028	0.0029	0.0029	0.0028	0.0028	0.0029	0.0029	0.0029	0.0030
N_Ammonia_Un	0.000012	0.000019	0.000056	0.00019	0.00050	0.00067	0.000013	0.000014	0.000051	0.000091	0.00022	0.00044

Notes:

Appendix D Comparison of the Water Quality Results Between the Updated Model and the EIS Model For the Average Case

Concentration Ratio of the Updated Model Results to the EIS Model Results (Stantec 2021) for the Expected Case Scenario - Open Pit Discharge

Parameters	Construction				Operations				Closure				Post-closure			
	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max
Acidity_T	na	na	na	na	na	na	na	na	na	na	na	na	0.4	1.7	1.6	1.6
Alkalinity_T	na	na	na	na	na	na	na	na	na	na	na	na	0.3	1.4	1.5	1.4
Aluminum_D	na	na	na	na	na	na	na	na	na	na	na	na	0.2	0.8	0.8	0.8
Aluminum_T	na	na	na	na	na	na	na	na	na	na	na	na	0.4	1.2	1.2	1.1
Antimony_D	na	na	na	na	na	na	na	na	na	na	na	na	0.2	0.8	1.0	0.6
Antimony_T	na	na	na	na	na	na	na	na	na	na	na	na	0.2	0.9	1.0	0.6
Arsenic_D	na	na	na	na	na	na	na	na	na	na	na	na	0.2	0.5	0.6	0.3
Arsenic_T	na	na	na	na	na	na	na	na	na	na	na	na	0.2	0.7	0.8	0.5
Barium_D	na	na	na	na	na	na	na	na	na	na	na	na	0.3	1.3	1.3	1.4
Barium_T	na	na	na	na	na	na	na	na	na	na	na	na	0.3	1.3	1.3	1.4
Beryllium_T	na	na	na	na	na	na	na	na	na	na	na	na	0.3	1.1	1.2	1.2
Boron_D	na	na	na	na	na	na	na	na	na	na	na	na	0.2	1.1	1.2	0.8
Boron_T	na	na	na	na	na	na	na	na	na	na	na	na	0.2	1.1	1.2	0.8
Bromide	na	na	na	na	na	na	na	na	na	na	na	na	0.4	1.6	1.7	1.7
Cadmium_D	na	na	na	na	na	na	na	na	na	na	na	na	2.0	0.3	0.3	0.3
Cadmium_T	na	na	na	na	na	na	na	na	na	na	na	na	1.8	0.5	0.4	0.4
Calcium_D	na	na	na	na	na	na	na	na	na	na	na	na	0.3	1.2	1.3	1.3
Chloride	na	na	na	na	na	na	na	na	na	na	na	na	0.4	1.3	1.3	1.2
Chromium_D	na	na	na	na	na	na	na	na	na	na	na	na	0.4	1.4	1.4	1.4
Chromium_D_Hex	na	na	na	na	na	na	na	na	na	na	na	na	0.4	1.4	1.4	1.4
Chromium_T	na	na	na	na	na	na	na	na	na	na	na	na	0.4	1.3	1.2	1.1
Cobalt_D	na	na	na	na	na	na	na	na	na	na	na	na	0.3	0.9	1.0	0.9
Cobalt_T	na	na	na	na	na	na	na	na	na	na	na	na	0.3	0.9	1.0	1.0
Copper_D	na	na	na	na	na	na	na	na	na	na	na	na	0.4	0.6	0.7	0.7
Copper_T	na	na	na	na	na	na	na	na	na	na	na	na	0.3	0.6	0.7	0.4
Cyanide_F	na	na	na	na	na	na	na	na	na	na	na	na	0.4	1.1	1.2	1.1
Cyanide_T	na	na	na	na	na	na	na	na	na	na	na	na	0.1	0.3	0.4	0.2
Cyanide_WAD	na	na	na	na	na	na	na	na	na	na	na	na	0.2	0.7	0.8	0.8
Fluoride	na	na	na	na	na	na	na	na	na	na	na	na	0.3	1.3	1.5	1.3
Hardness	na	na	na	na	na	na	na	na	na	na	na	na	0.6	1.4	1.4	1.4
Iron_D	na	na	na	na	na	na	na	na	na	na	na	na	0.4	1.4	1.4	1.3
Iron_T	na	na	na	na	na	na	na	na	na	na	na	na	1.0	4.5	4.5	4.3
Lead_D	na	na	na	na	na	na	na	na	na	na	na	na	0.7	1.7	1.8	1.7
Lead_T	na	na	na	na	na	na	na	na	na	na	na	na	0.8	2.1	2.0	1.9
Magnesium_D	na	na	na	na	na	na	na	na	na	na	na	na	0.2	1.0	1.1	1.1
Manganese_D	na	na	na	na	na	na	na	na	na	na	na	na	2.0	1.4	1.3	1.3
Manganese_T	na	na	na	na	na	na	na	na	na	na	na	na	0.5	1.4	1.3	1.3
Mercury_D	na	na	na	na	na	na	na	na	na	na	na	na	0.4	1.0	1.1	1.1
Mercury_T	na	na	na	na	na	na	na	na	na	na	na	na	0.4	1.0	1.1	1.1
Molybdenum_D	na	na	na	na	na	na	na	na	na	na	na	na	0.2	0.8	1.1	0.4
Molybdenum_T	na	na	na	na	na	na	na	na	na	na	na	na	0.2	0.8	1.1	0.4
N_Ammonia	na	na	na	na	na	na	na	na	na	na	na	na	0.5	1.5	1.8	1.0
N_Nitrate_Nitrite	na	na	na	na	na	na	na	na	na	na	na	na	0.3	1.5	1.6	1.3
N_Nitrite	na	na	na	na	na	na	na	na	na	na	na	na	0.4	1.6	1.8	1.4
Nickel_D	na	na	na	na	na	na	na	na	na	na	na	na	0.2	0.9	1.0	1.0
Nickel_T	na	na	na	na	na	na	na	na	na	na	na	na	0.3	1.0	1.0	1.0
Phosphorus_T	na	na	na	na	na	na	na	na	na	na	na	na	0.4	1.6	1.6	1.7
Potassium_D	na	na	na	na	na	na	na	na	na	na	na	na	0.2	1.1	1.2	1.2
Radium_226	na	na	na	na	na	na	na	na	na	na	na	na	0.5	2.3	2.4	1.9
Selenium_D	na	na	na	na	na	na	na	na	na	na	na	na	0.2	0.9	1.0	0.8
Selenium_T	na	na	na	na	na	na	na	na	na	na	na	na	0.2	0.9	1.0	0.8
Silicon_D	na	na	na	na	na	na	na	na	na	na	na	na	0.3	1.5	1.6	1.4
Silicon_T	na	na	na	na	na	na	na	na	na	na	na	na	0.3	1.5	1.6	1.4
Silver_D	na	na	na	na	na	na	na	na	na	na	na	na	0.3	1.0	1.0	1.0
Silver_T	na	na	na	na	na	na	na	na	na	na	na	na	0.5	1.4	1.4	1.3
Sodium_D	na	na	na	na	na	na	na	na	na	na	na	na	0.4	0.7	0.9	0.5
Sodium_T	na	na	na	na	na	na	na	na	na	na	na	na	0.4	0.7	0.9	0.5
Strontium_D	na	na	na	na	na	na	na	na	na	na	na	na	0.2	1.2	1.3	1.2
Strontium_T	na	na	na	na	na	na	na	na	na	na	na	na	0.2	1.2	1.3	1.3
Sulfate	na	na	na	na	na	na	na	na	na	na	na	na	0.2	1.1	1.2	1.2
Thallium_D	na	na	na	na	na	na	na	na	na	na	na	na	0.3	1.3	1.4	1.4
Thallium_T	na	na	na	na	na	na	na	na	na	na	na	na	0.3	1.6	1.6	1.6
Uranium_D	na	na	na	na	na	na	na	na	na	na	na	na	0.2	1.1	1.3	0.9
Uranium_T	na	na	na	na	na	na	na	na	na	na	na	na	0.2	1.1	1.3	0.9
Vanadium_T	na	na	na	na	na	na	na	na	na	na	na	na	0.3	1.3	1.3	1.3
Zinc_D	na	na	na	na	na	na	na	na	na	na	na	na	0.6	1.3	1.3	1.3
Zinc_T	na	na	na	na	na	na	na	na	na	na	na	na	0.6	1.4	1.4	1.4

Notes:

	updated model concentration/EIS model concentration <0.5
	0.5 < updated model concentration/EIS model concentration <2
	updated model concentration/EIS model concentration >2

Concentration Ratio of the Updated Model Results to the EIS Model Results (Stantec 2021) for the Expected Case Scenario - Collection Pond Dischagre

Parameters	Construction				Operations				Closure				Post-closure			
	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max
Acidity_T	0.9	0.8	0.6	0.7	0.9	1.2	1.0	1.3	na	na	na	na	na	na	na	na
Alkalinity_T	0.8	1.0	1.0	0.9	1.0	1.4	1.2	1.9	na	na	na	na	na	na	na	na
Aluminum_D	0.5	0.6	0.5	0.6	0.5	1.2	1.0	1.3	na	na	na	na	na	na	na	na
Aluminum_T	0.0	0.0	0.0	0.0	7.2	2.2	1.9	1.0	na	na	na	na	na	na	na	na
Antimony_D	0.6	0.7	0.6	0.3	0.3	4.2	3.2	4.6	na	na	na	na	na	na	na	na
Antimony_T	0.3	0.4	0.4	0.3	0.3	4.2	3.2	4.7	na	na	na	na	na	na	na	na
Arsenic_D	0.9	0.8	0.8	0.5	0.5	3.3	2.3	3.6	na	na	na	na	na	na	na	na
Arsenic_T	0.1	0.1	0.1	0.0	1.0	3.0	2.2	3.6	na	na	na	na	na	na	na	na
Barium_D	1.1	1.3	1.3	1.0	1.0	1.9	1.5	2.4	na	na	na	na	na	na	na	na
Barium_T	1.1	1.3	1.3	1.0	1.0	1.9	1.5	2.4	na	na	na	na	na	na	na	na
Beryllium_T	0.6	1.0	1.1	1.1	1.0	1.8	1.5	2.5	na	na	na	na	na	na	na	na
Boron_D	0.9	0.8	0.7	0.7	0.8	2.2	1.6	2.8	na	na	na	na	na	na	na	na
Boron_T	0.9	0.8	0.7	0.7	0.7	2.2	1.6	2.7	na	na	na	na	na	na	na	na
Bromide	0.5	0.9	1.0	0.9	1.1	1.4	1.3	1.8	na	na	na	na	na	na	na	na
Cadmium_D	0.5	0.8	0.8	0.7	0.9	15.2	10.6	16.5	na	na	na	na	na	na	na	na
Cadmium_T	0.0	0.0	0.0	0.0	2.0	7.5	6.0	6.4	na	na	na	na	na	na	na	na
Calcium_D	1.0	1.3	1.3	1.0	1.0	2.2	1.7	2.7	na	na	na	na	na	na	na	na
Chloride	1.5	1.6	1.6	1.0	0.8	1.5	1.5	1.4	na	na	na	na	na	na	na	na
Chromium_D	0.5	0.6	0.6	0.7	0.7	2.1	1.7	4.1	na	na	na	na	na	na	na	na
Chromium_D_Hex	0.5	0.6	0.6	0.7	0.7	2.1	1.7	4.1	na	na	na	na	na	na	na	na
Chromium_T	0.1	0.0	0.0	0.0	7.1	2.3	2.0	1.2	na	na	na	na	na	na	na	na
Cobalt_D	0.5	0.6	0.6	0.7	0.6	6.6	4.8	10.9	na	na	na	na	na	na	na	na
Cobalt_T	0.1	0.2	0.2	0.2	1.9	5.1	3.9	8.3	na	na	na	na	na	na	na	na
Copper_D	0.5	0.4	0.4	0.5	0.5	1.2	1.2	1.7	na	na	na	na	na	na	na	na
Copper_T	0.1	0.2	0.2	0.3	1.1	1.5	1.5	1.7	na	na	na	na	na	na	na	na
Cyanide_F	0.5	0.9	1.0	0.9	1.0	1.2	1.2	1.3	na	na	na	na	na	na	na	na
Cyanide_T	0.5	1.0	1.0	1.0	1.1	1.2	1.2	1.4	na	na	na	na	na	na	na	na
Cyanide_WAD	0.5	1.0	1.0	1.0	1.1	1.2	1.2	1.4	na	na	na	na	na	na	na	na
Fluoride	0.5	0.7	0.8	0.8	0.7	1.4	1.2	2.1	na	na	na	na	na	na	na	na
Hardness	1.0	1.3	1.3	1.0	1.1	1.9	1.8	1.9	na	na	na	na	na	na	na	na
Iron_D	0.8	0.9	0.6	1.0	0.8	1.2	1.2	1.3	na	na	na	na	na	na	na	na
Iron_T	0.4	0.6	0.6	1.1	2.7	3.2	3.2	3.5	na	na	na	na	na	na	na	na
Lead_D	0.5	0.8	0.8	0.7	0.8	3.0	2.4	5.8	na	na	na	na	na	na	na	na
Lead_T	0.0	0.0	0.0	0.0	3.5	2.4	2.2	0.7	na	na	na	na	na	na	na	na
Magnesium_D	1.1	1.3	1.3	1.0	1.0	2.3	1.7	2.7	na	na	na	na	na	na	na	na
Manganese_D	1.1	1.0	0.7	0.8	1.0	1.7	1.4	1.8	na	na	na	na	na	na	na	na
Manganese_T	1.1	1.0	0.8	0.9	1.1	1.7	1.4	1.7	na	na	na	na	na	na	na	na
Mercury_D	0.5	0.9	0.9	0.8	0.9	1.2	1.2	1.5	na	na	na	na	na	na	na	na
Mercury_T	0.8	0.9	0.8	0.9	0.9	1.2	1.2	1.6	na	na	na	na	na	na	na	na
Molybdenum_D	0.4	0.3	0.2	0.4	0.2	2.8	1.9	3.0	na	na	na	na	na	na	na	na
Molybdenum_T	0.4	0.3	0.2	0.4	0.2	2.8	1.9	3.0	na	na	na	na	na	na	na	na
N_Ammonia	0.5	0.6	0.3	0.9	0.9	3.8	1.9	3.1	na	na	na	na	na	na	na	na
N_Nitrate_Nitrite	0.5	0.1	0.1	0.0	0.9	5.4	2.2	3.3	na	na	na	na	na	na	na	na
N_Nitrite	0.6	0.5	0.4	0.2	0.9	4.0	2.0	3.1	na	na	na	na	na	na	na	na
Nickel_D	0.5	0.7	0.7	0.5	0.5	3.4	2.4	3.8	na	na	na	na	na	na	na	na
Nickel_T	0.2	0.2	0.2	0.1	2.0	3.2	2.3	3.6	na	na	na	na	na	na	na	na
Phosphorus_T	0.8	1.2	1.1	1.2	1.1	1.3	1.3	1.5	na	na	na	na	na	na	na	na
Potassium_D	1.0	1.1	1.1	1.0	0.8	2.9	2.0	3.1	na	na	na	na	na	na	na	na
Radium_226	0.5	0.6	0.6	0.6	0.8	1.0	1.1	1.0	na	na	na	na	na	na	na	na
Selenium_D	0.5	0.7	0.7	0.7	0.7	2.3	1.7	2.9	na	na	na	na	na	na	na	na
Selenium_T	0.2	0.3	0.3	0.3	0.6	2.4	1.8	2.9	na	na	na	na	na	na	na	na
Silicon_D	0.6	0.9	0.9	0.8	1.0	1.2	1.1	1.5	na	na	na	na	na	na	na	na
Silicon_T	0.6	0.9	0.9	0.8	1.0	1.2	1.1	1.5	na	na	na	na	na	na	na	na
Silver_D	0.5	0.9	1.0	0.9	0.9	2.0	1.6	3.5	na	na	na	na	na	na	na	na
Silver_T	0.1	0.1	0.1	0.1	1.9	2.1	2.0	1.0	na	na	na	na	na	na	na	na
Sodium_D	0.7	1.0	1.0	0.9	1.0	1.6	1.3	2.2	na	na	na	na	na	na	na	na
Sodium_T	0.7	1.0	1.0	1.0	1.0	1.6	1.3	2.2	na	na	na	na	na	na	na	na
Strontium_D	0.9	1.2	1.2	1.0	0.9	2.3	1.7	2.7	na	na	na	na	na	na	na	na
Strontium_T	0.9	1.2	1.2	1.1	1.0	2.3	1.7	2.7	na	na	na	na	na	na	na	na
Sulfate	1.6	1.5	1.5	1.1	1.2	2.7	2.0	2.9	na	na	na	na	na	na	na	na
Thallium_D	0.8	1.1	1.1	1.2	1.0	1.7	1.5	2.4	na	na	na	na	na	na	na	na
Thallium_T	0.3	0.3	0.3	0.3	1.1	1.8	1.6	1.4	na	na	na	na	na	na	na	na
Uranium_D	0.4	0.3	0.3	0.5	0.3	2.3	1.6	2.8	na	na	na	na	na	na	na	na
Uranium_T	0.2	0.3	0.2	0.5	0.3	2.3	1.6	2.8	na	na	na	na	na	na	na	na
Vanadium_T	0.1	0.1	0.1	0.2	2.7	2.0	1.8	2.0	na	na	na	na	na	na	na	na
Zinc_D	0.5	0.6	0.5	0.6	0.6	2.8	2.3	6.3	na	na	na	na	na	na	na	na
Zinc_T	0.1	0.2	0.2	0.2	0.8	2.7	2.3	3.1	na	na	na	na	na	na	na	na

Notes:

	updated model concentration/EIS model concentration <0.5
	0.5 < updated model concentration/EIS model concentration <2
	updated model concentration/EIS model concentration >2

Concentration Ratio of the Updated Model Results to the EIS Model Results (Stantec 2021) for the Expected Case Scenario - TMF Pond

Parameters	Construction				Operations				Closure				Post-closure			
	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max
Acidity_T	na	na	na	na	2.0	1.6	1.6	1.1	1.6	1.7	1.7	1.7	2.7	2.5	2.6	1.7
Alkalinity_T	na	na	na	na	1.3	1.3	1.3	1.0	1.3	1.3	1.3	1.3	2.2	2.1	2.2	1.3
Aluminum_D	na	na	na	na	0.7	1.1	1.1	0.8	1.1	1.0	1.1	0.9	1.1	1.1	1.1	0.9
Aluminum_T	na	na	na	na	0.8	0.9	0.9	0.7	1.0	0.8	0.8	0.7	1.2	1.7	2.1	0.8
Antimony_D	na	na	na	na	0.4	1.0	1.2	0.5	0.9	1.1	1.0	1.2	0.6	0.7	0.6	0.9
Antimony_T	na	na	na	na	0.4	1.0	1.2	0.5	0.9	1.1	1.0	1.2	0.6	0.7	0.6	0.9
Arsenic_D	na	na	na	na	0.3	1.1	1.2	1.1	1.1	1.1	1.1	1.2	1.4	1.4	1.5	1.2
Arsenic_T	na	na	na	na	0.3	1.1	1.2	1.1	1.1	1.1	1.1	1.2	1.4	1.4	1.5	1.2
Barium_D	na	na	na	na	1.5	1.2	1.2	1.1	1.2	1.3	1.3	1.3	3.0	2.7	3.0	1.4
Barium_T	na	na	na	na	1.5	1.2	1.1	1.1	1.3	1.3	1.3	1.3	3.0	2.7	3.0	1.4
Beryllium_T	na	na	na	na	3.0	1.4	1.4	0.8	1.2	1.0	0.9	0.9	1.1	1.1	1.1	0.9
Boron_D	na	na	na	na	0.9	1.1	1.1	1.0	0.8	0.9	0.9	1.0	1.2	1.1	1.2	0.8
Boron_T	na	na	na	na	0.9	1.1	1.1	1.0	0.8	0.9	0.9	1.0	1.2	1.1	1.2	0.8
Bromide	na	na	na	na	6.3	2.2	2.3	1.3	3.4	3.3	3.3	3.0	6.1	6.3	6.6	4.2
Cadmium_D	na	na	na	na	0.7	1.4	1.4	1.2	1.5	1.8	1.8	1.9	2.3	2.3	2.3	2.0
Cadmium_T	na	na	na	na	0.7	1.4	1.5	1.2	1.5	1.9	1.8	2.0	2.3	2.3	2.3	2.0
Calcium_D	na	na	na	na	1.2	1.1	1.1	1.0	1.2	1.1	1.1	1.1	2.3	2.1	2.3	1.2
Chloride	na	na	na	na	0.7	1.1	1.3	0.5	1.3	1.3	1.3	1.3	6.5	3.3	6.4	1.3
Chromium_D	na	na	na	na	0.9	1.2	1.2	1.1	1.3	1.8	1.7	2.0	2.9	2.8	2.9	2.0
Chromium_D_Hex	na	na	na	na	0.9	1.2	1.2	1.1	1.3	1.8	1.7	2.0	2.9	2.8	2.9	2.0
Chromium_T	na	na	na	na	0.9	1.1	1.1	1.0	1.5	1.4	1.4	1.2	3.2	2.7	3.2	1.6
Cobalt_D	na	na	na	na	0.9	1.1	1.1	0.9	0.9	1.0	1.0	1.2	0.3	0.6	0.3	0.9
Cobalt_T	na	na	na	na	0.9	1.1	1.1	0.9	0.8	1.0	1.0	1.2	0.3	0.5	0.3	0.9
Copper_D	na	na	na	na	0.8	0.8	0.8	0.6	1.2	1.0	1.0	0.9	0.6	2.9	5.4	1.1
Copper_T	na	na	na	na	0.3	0.2	0.2	0.1	0.4	0.3	0.3	0.2	5.6	2.5	5.3	0.4
Cyanide_F	na	na	na	na	0.3	1.2	1.3	0.9	1.4	1.3	1.3	1.2	1.3	1.3	1.3	1.3
Cyanide_T	na	na	na	na	1.1	0.6	0.7	0.2	0.0	0.4	0.1	1.7	0.5	0.5	1.0	0.1
Cyanide_WAD	na	na	na	na	0.9	0.6	0.8	0.2	0.2	0.4	0.3	1.4	0.5	1.0	1.2	0.4
Fluoride	na	na	na	na	0.5	1.1	1.2	0.6	1.1	1.2	1.2	1.2	1.5	1.4	1.5	1.1
Hardness	na	na	na	na	6.7	3.4	3.5	4.1	3.9	5.3	5.4	5.8	5.8	6.5	6.6	6.6
Iron_D	na	na	na	na	1.8	3.5	3.5	3.5	2.3	2.7	2.6	3.3	1.0	1.1	1.0	2.3
Iron_T	na	na	na	na	2.6	3.5	3.5	3.5	3.5	3.5	3.5	3.5	2.9	3.5	3.5	3.5
Lead_D	na	na	na	na	0.8	1.1	1.1	0.9	1.2	2.7	2.7	3.5	5.1	4.9	5.2	3.6
Lead_T	na	na	na	na	0.9	1.1	1.1	1.0	1.4	2.0	2.0	2.4	5.2	4.6	5.3	2.8
Magnesium_D	na	na	na	na	1.4	1.2	1.1	1.1	1.0	1.1	1.1	1.1	2.2	2.0	2.2	1.1
Manganese_D	na	na	na	na	2.1	1.8	1.9	1.2	1.7	1.7	1.7	1.7	2.8	2.7	2.8	1.7
Manganese_T	na	na	na	na	2.3	1.9	1.9	1.3	1.8	1.8	1.8	1.8	2.9	2.8	3.0	1.9
Mercury_D	na	na	na	na	0.6	1.3	1.3	0.8	1.2	1.2	1.1	1.2	1.2	1.2	1.2	1.2
Mercury_T	na	na	na	na	0.7	1.3	1.3	0.8	1.2	1.2	1.1	1.2	1.2	1.2	1.2	1.2
Molybdenum_D	na	na	na	na	0.4	1.0	1.1	0.6	0.9	1.0	0.9	1.1	0.9	0.9	0.9	0.9
Molybdenum_T	na	na	na	na	0.4	1.0	1.1	0.6	0.9	1.0	0.9	1.1	0.9	0.9	0.9	0.9
N_Ammonia	na	na	na	na	8.6	1.3	1.5	0.6	1.6	1.6	1.6	1.6	2.8	2.1	2.8	1.6
N_Nitrate_Nitrite	na	na	na	na	0.2	1.6	1.5	1.1	0.9	0.9	0.9	1.0	2.9	1.6	2.8	0.9
N_Nitrite	na	na	na	na	0.6	1.3	1.3	0.8	1.3	1.2	1.2	1.2	6.6	3.8	6.6	1.3
Nickel_D	na	na	na	na	0.7	1.1	1.1	0.9	0.7	0.6	0.6	0.7	0.3	0.3	0.3	0.5
Nickel_T	na	na	na	na	0.7	1.1	1.1	0.9	0.7	0.6	0.6	0.7	0.3	0.4	0.3	0.5
Phosphorus_T	na	na	na	na	3.7	1.9	2.0	1.3	2.2	2.6	2.6	2.8	4.2	4.0	4.2	2.8
Potassium_D	na	na	na	na	0.8	1.1	1.1	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.8
Radium_226	na	na	na	na	1.3	1.1	1.2	0.8	2.0	1.8	1.9	1.6	6.1	6.0	6.7	2.7
Selenium_D	na	na	na	na	0.4	1.0	1.2	0.6	0.8	1.0	0.9	1.2	0.2	0.4	0.2	0.8
Selenium_T	na	na	na	na	0.4	1.0	1.2	0.6	0.8	1.0	0.9	1.2	0.2	0.4	0.2	0.8
Silicon_D	na	na	na	na	9.3	1.5	1.4	1.7	1.4	1.8	1.8	2.0	3.3	3.6	3.8	2.4
Silicon_T	na	na	na	na	9.0	1.5	1.4	1.7	1.4	1.8	1.8	2.0	3.4	3.7	3.9	2.4
Silver_D	na	na	na	na	0.8	1.2	1.2	0.9	1.1	0.8	0.8	0.7	0.6	0.6	0.6	0.6
Silver_T	na	na	na	na	0.9	1.3	1.3	0.8	1.2	0.7	0.7	0.6	0.6	0.6	0.6	0.6
Sodium_D	na	na	na	na	0.4	1.0	1.2	0.5	0.9	1.1	1.1	1.2	0.3	0.7	0.3	0.9
Sodium_T	na	na	na	na	0.4	1.0	1.2	0.5	0.9	1.1	1.1	1.2	0.3	0.7	0.3	0.9
Strontium_D	na	na	na	na	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.8	1.6	1.8	1.0
Strontium_T	na	na	na	na	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.1	1.8	1.6	1.8	1.0
Sulfate	na	na	na	na	0.5	1.0	1.2	0.5	1.0	1.1	1.1	1.2	1.5	1.3	1.5	1.0
Thallium_D	na	na	na	na	2.2	1.4	1.4	1.3	1.2	1.8	1.8	2.1	3.7	3.5	3.7	2.1
Thallium_T	na	na	na	na	1.6	1.4	1.3	1.2	1.2	1.7	1.7	2.0	3.7	3.5	3.7	2.0
Uranium_D	na	na	na	na	0.7	1.0	1.0	0.9	0.9	0.9	0.9	0.8	1.3	1.2	1.3	0.9
Uranium_T	na	na	na	na	0.7	1.0	1.0	0.9	0.9	0.9	0.9	0.9	1.3	1.2	1.3	0.9
Vanadium_T	na	na	na	na	0.6	1.1	1.1	0.7	1.4	1.4	1.4	1.3	3.2	2.8	3.2	1.7
Zinc_D	na	na	na	na	1.1	1.4	1.4	0.9	1.3	1.3	1.2	1.2	1.4	1.3	1.4	1.2
Zinc_T	na	na	na	na	1.0	1.4	1.4	0.9	1.3	1.3	1.3	1.3	1.5	1.5	1.5	1.3

Notes:

	updated model concentration/EIS model concentration <0.5
	0.5 < updated model concentration/EIS model concentration <2
	updated model concentration/EIS model concentration >2

Concentration Ratio of the Updated Model Results to the EIS Model Results (Stantec 2021) for the Expected Case Scenario - Model Node QM02

Parameters	Construction				Operations				Closure				Post-closure			
	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max
Acidity_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Alkalinity_T	1.0	1.0	1.0	1.1	1.0	1.1	1.1	1.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Aluminum_D	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Aluminum_T	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Antimony_D	1.0	1.0	1.0	1.0	1.0	1.6	1.2	5.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Antimony_T	1.0	1.0	1.0	1.0	1.0	1.6	1.2	5.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic_D	1.0	1.0	1.0	1.0	1.0	2.8	1.8	13.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic_T	1.0	1.0	1.0	1.0	1.1	2.9	2.0	10.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Barium_D	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Barium_T	1.0	1.0	1.0	1.1	1.0	1.1	1.1	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Beryllium_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Boron_D	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Boron_T	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Bromide	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cadmium_D	1.0	1.0	1.0	1.0	1.0	1.4	1.1	3.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cadmium_T	1.0	1.0	1.0	1.0	1.0	1.4	1.1	3.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Calcium_D	1.1	1.1	1.1	1.3	1.1	1.5	1.3	3.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Chloride	1.0	1.1	1.0	1.2	1.0	1.1	1.1	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Chromium_D	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Chromium_D_Hex	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Chromium_T	1.0	1.0	1.0	1.0	1.1	1.3	1.4	1.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cobalt_D	1.0	1.0	1.0	1.0	1.0	1.3	1.1	2.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cobalt_T	1.0	1.0	1.0	1.0	1.1	1.3	1.2	2.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Copper_D	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Copper_T	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cyanide_F	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cyanide_T	1.0	1.0	1.0	1.0	1.0	1.3	1.4	1.7	1.1	1.2	1.1	1.5	1.1	1.1	1.1	1.1
Cyanide_WAD	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Fluoride	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Hardness	1.1	1.1	1.1	1.2	1.1	1.2	1.1	1.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Iron_D	1.0	1.1	1.3	1.0	1.0	1.1	1.3	1.0	1.0	1.1	1.3	1.0	1.0	1.1	1.3	1.0
Iron_T	1.2	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.2	1.1	1.1	1.1
Lead_D	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead_T	1.0	1.0	1.0	1.0	1.0	1.2	1.1	1.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Magnesium_D	1.0	1.0	1.0	1.1	1.1	1.2	1.1	2.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Manganese_D	1.1	1.2	1.4	1.6	1.1	1.3	1.3	1.9	1.0	1.1	1.1	1.0	1.0	1.1	1.1	1.0
Manganese_T	1.1	1.1	1.2	1.1	1.1	1.2	1.2	1.1	1.1	1.0	1.0	1.0	1.1	1.0	1.0	1.0
Mercury_D	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Mercury_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Molybdenum_D	1.0	1.0	1.0	1.0	1.1	3.2	1.9	14.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Molybdenum_T	1.0	1.0	1.0	1.0	1.0	2.2	1.4	7.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
N_Ammonia	1.0	1.1	1.0	1.1	1.1	1.4	1.3	3.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0
N_Nitrate_Nitrite	1.0	1.0	1.0	1.0	1.1	1.7	1.6	5.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
N_Nitrite	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Nickel_D	1.0	1.0	1.0	1.0	1.0	1.7	1.3	5.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Nickel_T	1.0	1.0	1.0	1.0	1.0	1.8	1.4	5.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Phosphorus_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Potassium_D	1.0	1.0	1.0	1.1	1.0	1.5	1.2	3.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Radium_226	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Selenium_D	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Selenium_T	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Silicon_D	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Silicon_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Silver_D	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Silver_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sodium_D	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.4	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0
Sodium_T	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Strontium_D	1.0	1.0	1.0	1.1	1.1	1.2	1.1	2.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Strontium_T	1.0	1.0	1.0	1.1	1.1	1.2	1.1	2.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sulfate	1.4	1.4	1.2	2.0	1.7	3.9	2.5	15.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0
Thallium_D	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Thallium_T	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Uranium_D	1.0	1.0	1.0	1.0	1.0	1.5	1.2	3.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Uranium_T	1.0	1.0	1.0	1.0	1.0	1.5	1.2	3.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Vanadium_T	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Zinc_D	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Zinc_T	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Notes:

	updated model concentration/EIS model concentration <0.5
	0.5 < updated model concentration/EIS model concentration <2
	updated model concentration/EIS model concentration >2

Concentration Ratio of the Updated Model Results to the EIS Model Results (Stantec 2021) for the Expected Case Scenario - Model Node QM04

Parameters	Construction				Operations				Closure				Post-closure			
	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max
Acidity_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.6	1.5	1.0
Alkalinity_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.2	1.4	0.6
Aluminum_D	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.4	1.2	1.1	1.3	1.3	0.6	0.7	0.6
Aluminum_T	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.2	1.2	1.1	1.1	1.2	1.2	0.8	1.2	1.0
Antimony_D	1.0	1.0	1.0	1.0	1.0	4.8	4.1	12.8	2.3	4.1	3.3	10.4	1.6	0.6	0.7	0.4
Antimony_T	1.0	1.0	1.0	1.0	1.0	4.6	4.1	10.8	2.3	4.0	3.4	8.8	1.6	0.6	0.7	0.4
Arsenic_D	1.0	1.0	1.0	1.0	1.0	2.5	2.0	6.3	1.5	1.9	1.6	4.6	1.5	0.6	0.8	0.2
Arsenic_T	1.0	1.0	1.0	1.0	1.0	2.4	2.0	6.3	1.6	1.9	1.6	4.6	1.6	0.8	1.0	0.3
Barium_D	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.1	1.2	1.2	1.3	0.4
Barium_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.1	1.2	1.2	1.3	0.4
Beryllium_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.1	1.0	0.9	0.9	0.5
Boron_D	1.0	1.0	1.0	1.0	1.0	1.2	1.1	1.5	1.0	1.1	1.1	1.3	1.1	0.9	0.9	0.3
Boron_T	1.0	1.0	1.0	1.0	1.0	1.2	1.1	1.4	1.0	1.1	1.1	1.3	1.1	0.9	0.9	0.3
Bromide	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.3	1.3	1.3	0.6
Cadmium_D	1.0	1.0	1.0	1.0	1.0	3.0	2.2	9.5	1.8	3.6	2.9	7.5	1.9	0.5	0.7	0.1
Cadmium_T	1.0	1.0	1.0	1.0	1.0	3.0	2.2	9.5	1.8	3.6	2.9	7.5	1.9	0.7	1.1	0.1
Calcium_D	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.2	1.0	1.1	1.1	1.1	1.0	1.0	0.9	0.3
Chloride	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.4	1.4	1.0
Chromium_D	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.5	1.1	1.2	1.2	1.4	1.1	0.9	1.1	0.3
Chromium_D_Hex	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.5	1.1	1.2	1.2	1.4	1.1	0.9	1.1	0.3
Chromium_T	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.3	1.2	1.1	1.1	1.2	1.1	0.8	1.1	1.1
Cobalt_D	1.0	1.0	1.0	1.0	1.1	4.8	3.7	12.6	2.6	5.1	4.1	10.6	1.8	0.6	0.7	0.3
Cobalt_T	1.0	1.0	1.0	1.0	1.1	4.8	3.7	12.6	2.6	5.1	4.1	10.6	1.8	0.6	0.7	0.3
Copper_D	1.0	1.0	1.0	1.0	1.1	1.5	1.3	2.0	2.4	1.7	1.5	2.0	2.5	0.8	0.9	0.3
Copper_T	1.0	1.0	1.0	1.0	1.0	1.4	1.3	2.0	1.5	1.6	1.5	2.0	1.5	0.8	1.1	0.5
Cyanide_F	1.0	1.0	1.0	1.0	1.0	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.1	0.8	0.8	1.0
Cyanide_T	1.0	1.0	1.0	1.0	1.1	28.8	26.8	70.9	7.0	12.1	10.4	18.6	4.6	0.3	0.4	0.2
Cyanide_WAD	1.0	1.0	1.0	1.0	1.0	1.7	1.6	2.8	1.2	1.4	1.3	2.0	1.3	0.5	0.5	0.5
Fluoride	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.4	1.1	1.2	1.1	1.3	1.1	0.9	1.1	0.5
Hardness	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.4	1.3	1.3	0.5
Iron_D	1.0	1.1	1.0	1.1	1.0	1.1	1.1	1.2	1.1	1.1	1.0	1.1	1.1	1.2	1.4	1.1
Iron_T	1.0	1.2	1.2	1.3	1.0	1.2	1.2	1.4	1.0	1.2	1.2	1.3	1.0	2.6	3.4	3.5
Lead_D	1.0	1.0	1.0	1.0	1.0	1.3	1.1	2.0	1.3	1.4	1.3	1.8	1.3	1.0	1.1	0.4
Lead_T	1.0	1.0	1.0	1.0	1.0	1.2	1.3	1.1	1.3	1.3	1.4	1.1	1.3	1.3	1.7	1.1
Magnesium_D	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.3	1.0	1.1	1.0	1.2	1.0	0.9	0.8	0.3
Manganese_D	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.1	1.5	1.5	0.9
Manganese_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.1	1.4	1.6	0.9
Mercury_D	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.1	1.1	0.8	0.8	1.0
Mercury_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.0	1.1	1.1	0.8	0.8	1.0
Molybdenum_D	1.0	1.0	1.0	1.0	1.0	16.8	12.6	59.6	3.5	8.1	5.2	41.4	2.5	0.6	0.7	0.4
Molybdenum_T	1.0	1.0	1.0	1.0	1.0	9.3	6.9	30.2	2.7	4.7	3.1	21.1	2.1	0.6	0.7	0.4
N_Ammonia	1.0	1.0	1.0	1.0	1.0	1.2	1.1	1.5	1.8	1.2	1.1	1.2	1.2	1.2	1.3	1.1
N_Nitrate_Nitrite	1.0	1.0	1.0	1.0	1.0	4.4	2.8	29.1	1.0	1.2	1.1	1.4	1.0	1.0	1.2	0.4
N_Nitrite	1.0	1.0	1.0	1.0	1.0	1.2	1.1	2.0	1.0	1.0	1.0	1.0	1.0	1.4	1.6	0.8
Nickel_D	1.0	1.0	1.0	1.0	1.0	2.7	2.2	7.3	2.0	2.8	2.2	5.6	2.0	0.6	0.6	0.2
Nickel_T	1.0	1.0	1.0	1.0	1.0	2.4	1.8	6.0	1.9	2.4	2.0	4.7	1.9	0.6	0.7	0.2
Phosphorus_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.3	1.5	0.9
Potassium_D	1.0	1.0	1.0	1.0	1.0	1.3	1.2	2.0	1.1	1.3	1.2	1.7	1.1	0.7	0.7	0.3
Radium_226	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.9	1.4
Selenium_D	1.0	1.0	1.0	1.0	1.0	1.7	1.5	3.1	1.4	1.6	1.4	2.6	1.2	0.6	0.7	0.3
Selenium_T	1.0	1.0	1.0	1.0	1.0	1.7	1.5	3.1	1.4	1.6	1.4	2.6	1.2	0.6	0.7	0.4
Silicon_D	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.3	1.4	0.6
Silicon_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.3	1.4	0.6
Silver_D	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.4	1.0	1.1	1.1	1.3	1.0	0.7	0.8	0.3
Silver_T	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.4	1.0	1.1	1.1	1.3	1.0	0.9	1.2	0.6
Sodium_D	1.0	1.0	1.0	1.0	1.0	1.6	1.5	2.4	1.3	1.5	1.4	2.2	1.0	0.6	0.7	0.5
Sodium_T	1.0	1.0	1.0	1.0	1.0	1.5	1.4	2.4	1.3	1.5	1.4	2.2	1.0	0.6	0.7	0.5
Strontium_D	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.3	1.0	1.1	1.1	1.2	1.0	0.9	0.9	0.3
Strontium_T	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.3	1.0	1.1	1.1	1.2	1.0	0.9	0.9	0.3
Sulfate	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.4	1.1	1.1	1.1	1.3	0.9	0.8	0.8	0.3
Thallium_D	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.1	1.1	1.1	0.4
Thallium_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.1	1.2	1.3	0.5
Uranium_D	1.0	1.0	1.0	1.0	1.0	4.0	3.0	12.1	2.1	3.1	2.3	8.3	2.1	0.7	0.8	0.3
Uranium_T	1.0	1.0	1.0	1.0	1.0	4.0	3.0	11.9	2.1	3.1	2.3	8.1	2.1	0.7	0.8	0.3
Vanadium_T	1.0	1.0	1.0	1.0	1.0	1.3	1.5	1.2	1.1	1.1	1.3	1.0	1.1	0.9	1.2	1.3
Zinc_D	1.0	1.0	1.0	1.0	1.0	1.3	1.1	2.3	1.3	1.4	1.3	2.0	1.3	0.8	0.9	0.3
Zinc_T	1.0	1.0	1.0	1.0	1.0	1.2	1.0	1.9	1.2	1.3	1.2	1.7	1.2	0.9	1.1	0.4

Notes:

	updated model concentration/EIS model concentration <0.5
	0.5 < updated model concentration/EIS model concentration <2
	updated model concentration/EIS model concentration >2

Concentration Ratio of the Updated Model Results to the EIS Model Results (Stantec 2021) for the Expected Case Scenario - Minton Lake

Parameters	Construction				Operations				Closure				Post-closure			
	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max
Acidity_T	1.3	1.4	1.3	1.5	1.3	1.4	1.3	1.5	1.4	1.4	1.4	1.5	1.4	1.4	1.4	1.5
Alkalinity_T	0.9	1.0	0.9	1.0	0.9	1.0	0.9	1.3	1.2	1.2	1.2	1.3	1.2	1.1	1.1	1.1
Aluminum_D	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.1
Aluminum_T	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9
Antimony_D	1.1	1.0	1.0	1.0	1.1	5.0	4.0	11.6	5.5	7.6	7.1	11.2	2.9	1.3	1.2	1.2
Antimony_T	1.1	1.0	1.0	1.0	1.1	5.0	4.0	11.6	5.5	7.6	7.1	11.2	2.9	1.3	1.2	1.3
Arsenic_D	1.2	1.2	1.2	1.2	1.2	3.6	2.0	9.9	3.8	5.4	4.7	9.5	3.6	1.8	1.8	1.1
Arsenic_T	1.1	1.1	1.1	1.1	1.2	3.4	1.9	9.2	3.6	5.1	4.4	8.8	3.5	1.7	1.7	1.1
Barium_D	1.2	1.2	1.2	1.3	1.1	1.5	1.3	2.3	1.7	1.9	1.9	2.3	1.7	1.4	1.4	1.1
Barium_T	1.1	1.2	1.2	1.3	1.1	1.4	1.3	2.1	1.7	1.8	1.8	2.1	1.7	1.4	1.3	1.1
Beryllium_T	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.0
Boron_D	1.1	1.1	1.1	1.2	1.1	1.4	1.2	2.0	1.4	1.6	1.5	2.0	1.4	1.2	1.2	1.0
Boron_T	1.3	1.5	1.5	1.6	1.4	1.7	1.6	2.4	1.6	1.9	1.9	2.4	1.6	1.5	1.4	1.3
Bromide	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.0	1.1	1.0	1.0	1.0
Cadmium_D	1.0	1.0	1.0	1.0	1.0	2.4	1.4	6.3	4.6	5.2	5.2	6.1	4.5	1.0	1.0	0.6
Cadmium_T	1.0	1.0	1.0	1.0	1.0	2.4	1.4	6.3	4.6	5.2	5.2	6.1	4.5	1.0	1.0	0.6
Calcium_D	0.9	0.9	0.9	0.9	0.8	1.5	1.1	3.3	2.4	2.8	2.7	3.3	2.4	1.2	1.1	0.7
Chloride	1.0	0.9	0.9	0.9	0.9	1.6	1.6	2.3	1.9	2.1	2.1	2.3	1.7	1.6	1.6	1.7
Chromium_D	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.4	1.3	1.4	1.3	1.4	1.3	1.1	1.1	1.0
Chromium_D_Hex	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.4	1.3	1.4	1.3	1.4	1.3	1.1	1.1	1.0
Chromium_T	1.1	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.1	1.2	1.0	1.0	0.9
Cobalt_D	0.9	0.9	0.9	0.9	0.9	4.2	3.5	9.4	6.0	7.4	7.5	9.2	3.8	1.1	1.1	0.9
Cobalt_T	0.9	0.9	0.9	0.9	0.9	4.1	3.4	9.1	5.9	7.2	7.3	9.0	3.7	1.1	1.0	0.9
Copper_D	0.9	0.9	0.9	0.9	0.9	1.1	1.1	1.4	1.5	1.5	1.4	1.4	1.2	1.2	1.2	1.1
Copper_T	1.1	1.1	1.1	1.1	1.0	1.3	1.2	1.6	1.6	1.6	1.6	1.6	1.3	1.3	1.3	1.2
Cyanide_F	1.0	1.0	1.0	0.9	1.0	1.1	1.1	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Cyanide_T	1.0	1.0	1.0	1.0	1.0	35.8	36.8	68.5	20.4	30.5	24.6	62.9	20.6	17.9	35.2	12.3
Cyanide_WAD	1.0	1.0	1.0	1.0	1.0	1.8	1.9	2.6	1.6	1.8	1.7	2.4	1.6	1.9	2.0	1.8
Fluoride	1.1	1.1	1.0	1.1	1.0	1.2	1.1	1.5	1.4	1.4	1.4	1.5	1.3	1.1	1.1	1.1
Hardness	0.9	0.9	0.9	0.9	0.8	1.0	0.9	1.4	1.3	1.4	1.4	1.4	1.4	1.2	1.2	1.0
Iron_D	1.4	1.6	1.6	1.7	1.4	1.6	1.6	1.8	1.5	1.6	1.6	1.8	1.5	1.6	1.7	1.8
Iron_T	2.1	2.2	2.2	2.3	2.1	2.3	2.3	2.4	2.2	2.3	2.3	2.4	2.2	2.3	2.3	2.4
Lead_D	0.8	0.9	0.9	0.9	0.8	1.0	0.9	1.3	1.3	1.3	1.3	1.3	1.4	1.1	1.0	0.8
Lead_T	0.8	0.9	0.9	0.9	0.8	1.0	0.9	1.1	1.1	1.1	1.1	1.1	1.2	1.0	1.0	0.8
Magnesium_D	1.0	1.1	1.1	1.1	1.0	1.7	1.2	3.6	2.2	2.6	2.5	3.5	2.2	1.1	1.1	0.7
Manganese_D	2.2	2.7	2.7	3.2	2.1	2.7	2.8	3.7	3.2	3.5	3.5	3.7	3.3	2.6	2.5	2.1
Manganese_T	1.5	1.7	1.7	2.0	1.5	1.8	1.8	2.4	2.0	2.2	2.2	2.4	2.0	1.9	1.8	1.7
Mercury_D	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.1
Mercury_T	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.1
Molybdenum_D	0.5	0.4	0.4	0.4	0.4	4.9	2.2	15.6	3.7	7.4	5.9	15.2	2.2	1.0	0.9	0.9
Molybdenum_T	0.6	0.6	0.6	0.6	0.6	4.2	2.0	12.9	3.1	6.1	4.9	12.5	2.0	1.0	0.9	0.9
N_Ammonia	2.3	2.8	2.8	3.3	2.3	4.6	4.8	6.4	4.9	5.7	5.8	6.4	3.1	3.3	3.4	4.6
N_Nitrate_Nitrite	1.0	1.0	1.0	1.0	1.0	1.8	1.7	2.7	1.2	1.3	1.3	1.4	1.2	1.1	1.1	1.0
N_Nitrite	1.3	1.4	1.4	1.6	1.4	1.5	1.5	1.7	1.4	1.5	1.5	1.6	1.4	1.5	1.5	1.6
Nickel_D	1.0	1.0	1.0	1.1	1.0	3.5	1.7	10.6	6.0	7.6	7.5	10.3	5.8	1.0	0.9	0.5
Nickel_T	1.1	1.1	1.1	1.1	1.1	2.9	1.6	7.9	4.8	5.7	5.6	7.7	4.6	1.0	0.9	0.5
Phosphorus_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Potassium_D	1.0	1.0	1.0	1.0	0.9	3.1	1.7	8.4	5.4	6.5	6.4	8.2	5.2	1.2	1.1	0.7
Radium_226	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Selenium_D	1.0	1.0	1.0	0.9	1.0	1.6	1.4	2.6	1.8	2.1	2.0	2.6	1.4	1.0	1.0	1.0
Selenium_T	1.0	0.9	1.0	0.9	1.0	1.5	1.4	2.5	1.8	2.0	2.0	2.5	1.4	1.0	1.0	1.0
Silicon_D	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.9	0.8	0.9	0.9	0.9	0.9	0.8	0.8	0.8
Silicon_T	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8
Silver_D	1.0	1.0	1.0	0.9	1.0	1.1	1.0	1.2	1.2	1.2	1.2	1.2	1.2	1.0	1.0	0.9
Silver_T	1.0	1.0	1.0	0.9	1.0	1.1	1.0	1.2	1.2	1.2	1.2	1.2	1.2	1.0	1.0	0.9
Sodium_D	0.8	0.8	0.8	0.8	0.8	4.5	4.6	8.4	5.1	6.6	6.6	8.4	1.1	1.2	1.0	3.0
Sodium_T	0.8	0.8	0.8	0.8	0.8	4.4	4.6	8.3	5.1	6.5	6.5	8.3	1.1	1.2	1.0	3.0
Strontium_D	0.9	0.9	0.9	0.9	0.8	1.6	1.1	3.6	2.2	2.7	2.6	3.5	2.2	1.2	1.1	0.7
Strontium_T	0.9	0.9	0.9	0.9	0.8	1.6	1.1	3.5	2.2	2.6	2.5	3.5	2.2	1.1	1.1	0.7
Sulfate	0.4	0.4	0.4	0.4	0.4	22.3	14.2	63.0	42.0	50.9	50.6	61.7	32.6	1.3	1.2	0.8
Thallium_D	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.0
Thallium_T	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.0
Uranium_D	0.6	0.5	0.5	0.5	0.5	1.6	0.8	4.5	2.0	2.8	2.5	4.3	1.9	0.9	0.8	0.6
Uranium_T	0.6	0.5	0.5	0.5	0.5	1.5	0.8	4.4	2.0	2.8	2.5	4.3	1.9	0.9	0.8	0.6
Vanadium_T	0.8	0.8	0.8	0.8	0.8	0.9	0.9	1.1	0.9	1.0	1.0	1.1	0.9	0.9	0.9	0.9
Zinc_D	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.4	1.4	1.4	1.4	1.4	1.4	1.0	1.0	0.8
Zinc_T	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.3	1.3	1.3	1.3	1.3	1.3	1.0	1.0	0.8

Notes:

	updated model concentration/EIS model concentration <0.5
	0.5 < updated model concentration/EIS model concentration <2
	updated model concentration/EIS model concentration >2

Concentration Ratio of the Updated Model Results to the EIS Model Results (Stantec 2021) for the Expected Case Scenario - Cockeram Lake

Parameters	Construction				Operations				Closure				Post-closure			
	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max
Acidity_T	0.9	1.0	1.0	1.1	0.9	1.0	1.0	1.1	0.9	1.0	1.0	1.1	0.9	1.0	1.0	1.1
Alkalinity_T	0.9	1.0	1.0	1.0	0.9	1.0	1.0	1.1	0.9	1.0	1.0	1.0	0.9	1.0	1.0	1.1
Aluminum_D	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
Aluminum_T	1.0	0.9	0.9	1.0	1.0	1.0	0.9	1.1	1.0	0.9	0.9	1.0	1.0	0.9	0.9	1.0
Antimony_D	1.0	1.0	1.1	1.0	1.0	1.3	1.2	2.4	1.0	1.0	1.1	1.1	1.0	1.0	1.0	1.0
Antimony_T	1.0	1.0	1.1	1.0	1.0	1.3	1.2	2.4	1.0	1.0	1.1	1.1	1.0	1.0	1.0	1.0
Arsenic_D	0.9	1.0	1.0	1.0	0.9	1.5	1.2	2.9	0.9	1.0	1.0	0.9	0.9	0.9	0.9	0.9
Arsenic_T	0.9	0.9	0.9	0.9	0.9	1.5	1.3	2.7	0.9	1.0	1.0	0.9	0.9	0.9	0.9	1.0
Barium_D	1.0	1.0	1.0	1.1	1.0	1.0	1.1	1.1	0.9	1.0	1.0	1.1	0.9	1.0	1.0	1.1
Barium_T	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1
Beryllium_T	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0
Boron_D	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Boron_T	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1
Bromide	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cadmium_D	1.5	1.7	1.7	1.8	1.5	1.8	1.8	2.0	1.5	1.7	1.7	1.8	1.5	1.6	1.7	1.7
Cadmium_T	1.6	1.6	1.6	1.8	1.6	1.8	1.7	2.0	1.6	1.7	1.7	1.8	1.6	1.6	1.6	1.8
Calcium_D	0.9	1.0	1.0	1.0	0.9	1.1	1.0	1.3	0.9	1.0	1.0	1.0	0.9	0.9	0.9	1.0
Chloride	0.9	1.0	1.0	1.1	0.9	1.0	1.0	1.1	0.9	1.0	1.0	1.1	0.9	1.0	1.0	1.1
Chromium_D	1.1	1.2	1.3	1.2	1.1	1.2	1.3	1.3	1.1	1.2	1.3	1.2	1.1	1.2	1.3	1.2
Chromium_D_Hex	1.1	1.2	1.2	1.2	1.1	1.2	1.3	1.3	1.1	1.2	1.2	1.2	1.1	1.2	1.2	1.2
Chromium_T	1.0	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	1.0	1.0	0.9	0.9	1.0
Cobalt_D	1.7	2.1	2.0	2.6	1.7	2.1	2.0	2.6	1.7	2.1	2.0	2.6	1.7	2.0	1.9	2.5
Cobalt_T	1.9	2.0	1.9	2.5	1.9	2.1	1.9	2.5	1.9	2.0	1.9	2.5	1.9	2.0	1.7	2.4
Copper_D	1.0	0.9	0.8	1.1	1.0	0.9	0.9	1.1	1.0	0.9	0.9	1.1	1.0	0.9	0.9	1.1
Copper_T	1.0	0.9	0.8	1.1	1.0	0.9	0.9	1.1	1.0	0.9	0.9	1.1	1.0	0.9	0.9	1.1
Cyanide_F	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cyanide_T	1.0	1.0	1.0	1.0	1.0	1.3	1.3	1.5	1.1	1.1	1.1	1.3	1.1	0.9	0.9	0.8
Cyanide_WAD	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Fluoride	0.9	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0
Hardness	0.9	1.0	1.0	1.1	0.9	1.0	1.0	1.1	0.9	1.0	1.0	1.0	0.9	1.0	1.0	1.0
Iron_D	1.0	1.2	1.2	1.2	1.0	1.2	1.2	1.2	1.0	1.2	1.2	1.2	1.0	1.2	1.2	1.2
Iron_T	1.6	1.7	1.8	1.8	1.6	1.7	1.8	1.8	1.6	1.7	1.8	1.8	1.6	1.7	1.8	1.8
Lead_D	1.1	1.2	1.2	1.2	1.1	1.2	1.2	1.3	1.1	1.2	1.2	1.2	1.1	1.2	1.2	1.2
Lead_T	1.0	1.1	1.0	1.3	1.1	1.2	1.2	1.5	1.1	1.2	1.1	1.4	1.1	1.2	1.1	1.4
Magnesium_D	0.9	1.0	1.0	1.0	0.9	1.0	1.0	1.2	0.9	1.0	1.0	1.0	0.9	0.9	1.0	1.0
Manganese_D	1.2	1.5	1.6	1.6	1.2	1.4	1.6	1.5	1.2	1.4	1.6	1.4	1.2	1.4	1.5	1.4
Manganese_T	1.5	1.8	1.8	2.0	1.5	1.7	1.7	2.0	1.5	1.7	1.7	1.9	1.5	1.7	1.6	1.9
Mercury_D	1.0	0.9	0.8	1.0	1.0	0.9	0.8	1.0	1.0	0.9	0.8	1.0	1.0	0.9	0.8	1.0
Mercury_T	1.0	0.9	0.9	1.0	1.0	0.9	0.9	1.0	1.0	0.9	0.9	1.0	1.0	0.9	0.9	1.0
Molybdenum_D	0.9	0.9	1.0	1.0	0.9	1.7	1.3	3.0	0.9	1.0	1.0	0.9	0.9	0.9	0.9	0.9
Molybdenum_T	0.9	1.0	1.0	1.0	0.9	1.5	1.2	2.5	0.9	1.0	1.0	1.0	0.9	0.9	0.9	1.0
N_Ammonia	0.8	1.1	1.0	1.1	0.9	1.2	1.3	1.5	0.9	1.1	1.0	1.1	0.8	1.1	1.0	1.1
N_Nitrate_Nitrite	0.9	1.0	1.0	1.1	1.0	1.4	1.4	2.1	0.9	1.0	1.0	1.1	0.9	1.0	1.0	1.1
N_Nitrite	1.1	1.1	1.2	1.1	1.1	1.2	1.2	1.2	1.1	1.2	1.2	1.1	1.1	1.2	1.2	1.1
Nickel_D	1.1	1.0	0.9	1.0	1.1	1.0	0.9	1.0	1.1	1.0	0.9	1.0	1.1	1.0	0.9	1.0
Nickel_T	1.1	1.0	0.9	1.0	1.1	1.0	0.9	1.0	1.1	1.0	0.9	1.0	1.1	1.0	0.9	1.0
Phosphorus_T	0.8	1.0	1.0	1.0	0.8	1.0	1.0	1.0	0.8	1.0	1.0	1.0	0.8	1.0	1.0	1.0
Potassium_D	1.0	1.0	1.0	1.1	1.0	1.2	1.1	1.6	1.0	1.0	1.0	1.0	1.0	0.9	0.9	1.0
Radium_226	1.0	1.0	1.0	1.2	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.2	1.0	1.0	1.0	1.2
Selenium_D	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Selenium_T	0.9	1.0	1.0	1.1	0.9	1.0	1.0	1.1	0.9	1.0	1.0	1.1	0.9	1.0	1.0	1.1
Silicon_D	1.0	1.1	1.0	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.0	1.1	1.0	1.1	1.1	1.1
Silicon_T	1.0	1.1	1.0	1.1	1.0	1.1	1.0	1.1	1.0	1.1	1.0	1.1	1.0	1.1	1.0	1.1
Silver_D	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Silver_T	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sodium_D	0.9	1.0	1.0	1.0	0.9	1.0	1.1	1.1	1.0	1.0	1.0	1.1	0.9	1.0	1.0	1.0
Sodium_T	0.9	1.0	1.0	1.0	0.9	1.0	1.0	1.1	0.9	1.0	1.0	1.1	0.9	1.0	1.0	1.0
Strontium_D	0.9	1.0	1.0	1.1	0.9	1.1	1.1	1.3	0.9	1.0	1.0	1.0	0.9	1.0	1.0	1.1
Strontium_T	0.9	1.0	1.0	1.1	0.9	1.1	1.1	1.2	0.9	1.0	1.0	1.0	0.9	1.0	1.0	1.1
Sulfate	1.1	1.1	1.0	1.2	1.1	1.3	1.2	1.8	1.1	1.0	0.9	1.1	1.1	0.9	0.8	1.0
Thallium_D	0.7	1.1	1.2	1.1	0.7	1.1	1.2	1.1	0.7	1.1	1.2	1.1	0.7	1.0	1.2	1.1
Thallium_T	0.7	1.0	1.2	1.1	0.7	1.1	1.2	1.1	0.7	1.1	1.2	1.1	0.7	1.0	1.2	1.1
Uranium_D	1.0	1.0	1.0	1.0	0.9	1.2	1.1	1.6	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.1
Uranium_T	1.0	1.0	1.0	1.0	0.9	1.2	1.1	1.6	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.1
Vanadium_T	0.9	0.9	0.9	1.0	0.9	1.0	1.0	1.0	0.9	0.9	0.9	1.0	0.9	0.9	0.9	1.0
Zinc_D	0.9	1.0	1.1	0.9	0.9	1.0	1.1	0.9	0.9	1.0	1.1	0.9	0.9	1.0	1.1	0.9
Zinc_T	0.9	1.0	1.1	0.9	0.9	1.0	1.1	0.9	0.9	1.0	1.1	0.9	0.9	1.0	1.1	0.9

Notes:

	updated model concentration/EIS model concentration <0.5
	0.5 < updated model concentration/EIS model concentration <2
	updated model concentration/EIS model concentration >2

Concentration Ratio of the Updated Model Results to the EIS Model Results (Stantec 2021) for the Expected Case Scenario - Payne Lake

Parameters	Construction				Operations				Closure				Post-closure			
	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median	Max
Acidity_T	2.5	0.8	0.8	0.5	2.5	0.8	0.8	0.5	2.5	0.8	0.8	0.5	2.6	0.8	0.8	0.5
Alkalinity_T	1.9	0.8	0.8	0.6	1.9	0.9	0.9	0.7	2.3	1.0	1.0	0.8	2.3	1.0	1.0	0.8
Aluminum_D	1.6	0.9	0.9	0.7	1.6	0.9	0.9	0.7	1.7	0.9	0.9	0.7	1.6	0.9	0.9	0.7
Aluminum_T	1.6	0.9	0.8	0.8	1.6	1.0	0.8	0.8	1.7	1.0	0.8	0.9	1.6	1.0	0.8	0.9
Antimony_D	1.5	1.0	0.9	0.9	1.5	10.0	10.8	14.8	11.7	10.7	9.7	13.2	1.9	1.7	1.2	5.8
Antimony_T	1.5	1.0	0.9	0.9	1.5	10.0	10.8	14.8	11.7	10.7	9.7	13.2	1.9	1.7	1.2	5.9
Arsenic_D	1.7	0.9	0.9	0.7	1.8	3.7	3.9	4.6	10.0	5.3	5.0	4.4	7.6	4.1	3.9	3.9
Arsenic_T	1.4	0.9	0.9	0.8	1.4	3.5	3.6	4.6	7.2	4.9	4.7	4.3	5.5	3.8	3.7	3.8
Barium_D	2.3	0.8	0.8	0.6	2.3	0.9	0.9	0.7	2.7	1.0	0.9	0.7	2.5	0.9	0.9	0.7
Barium_T	2.2	0.8	0.8	0.6	2.2	0.9	0.9	0.7	2.5	1.0	1.0	0.7	2.4	0.9	0.9	0.7
Beryllium_T	1.5	1.0	0.9	0.9	1.5	1.0	0.9	0.9	1.5	1.0	0.9	0.9	1.5	1.0	0.9	0.9
Boron_D	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.1
Boron_T	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.1
Bromide	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cadmium_D	1.5	1.0	0.9	0.9	1.5	1.3	1.2	1.4	2.2	1.5	1.4	1.6	1.9	1.3	1.2	1.6
Cadmium_T	1.9	1.0	1.1	0.6	1.9	1.3	1.4	0.8	2.5	1.5	1.6	0.8	2.3	1.3	1.4	0.9
Calcium_D	1.6	0.9	0.9	0.7	1.6	1.5	1.6	1.4	3.2	1.8	1.7	1.3	2.3	1.3	1.3	1.3
Chloride	1.0	1.0	1.0	1.0	1.0	3.4	3.9	5.1	2.8	3.6	3.6	4.7	1.3	1.5	1.4	2.8
Chromium_D	1.5	0.9	0.9	0.7	1.5	0.9	0.9	0.7	1.5	0.9	0.9	0.7	1.5	0.9	0.9	0.7
Chromium_D_Hex	1.5	0.9	0.9	0.7	1.5	0.9	0.9	0.7	1.5	0.9	0.9	0.7	1.5	0.9	0.9	0.7
Chromium_T	1.4	0.9	0.8	0.8	1.4	0.9	0.8	0.8	1.4	0.9	0.8	0.8	1.5	0.9	0.8	0.8
Cobalt_D	3.5	0.8	0.8	0.5	4.0	3.9	4.4	3.5	15.0	4.2	4.0	3.3	4.4	1.1	1.0	1.8
Cobalt_T	3.7	0.8	0.8	0.5	4.2	3.7	4.1	3.3	15.3	3.9	3.8	3.0	4.6	1.1	1.0	1.7
Copper_D	2.1	1.0	1.1	0.7	2.1	2.6	3.1	2.3	6.8	3.4	3.7	2.2	2.6	2.3	3.0	2.1
Copper_T	1.2	1.0	1.2	0.6	1.3	2.0	2.6	1.5	3.2	2.5	3.0	1.5	1.4	1.8	2.5	1.4
Cyanide_F	1.0	1.0	1.0	1.0	1.0	1.6	1.7	2.0	1.9	2.0	2.0	2.1	1.3	1.4	1.3	2.1
Cyanide_T	1.0	1.0	1.0	1.0	1.0	125.0	141.2	208.0	44.0	78.0	61.2	181.8	30.8	27.3	33.2	16.5
Cyanide_WAD	1.0	1.0	1.0	1.0	1.0	4.0	4.5	6.1	2.3	3.0	2.7	4.8	1.9	2.0	2.0	2.1
Fluoride	1.5	0.9	0.9	0.8	1.6	1.2	1.2	1.2	2.1	1.3	1.2	1.2	1.6	1.0	0.9	1.1
Hardness	1.6	0.9	0.9	0.7	1.6	0.9	0.9	0.7	1.8	1.0	1.0	0.8	2.0	1.2	1.1	0.9
Iron_D	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Iron_T	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Lead_D	1.4	1.0	0.9	0.9	1.5	1.1	1.1	1.1	1.8	1.4	1.3	1.4	1.9	1.3	1.2	1.5
Lead_T	1.5	1.1	1.6	0.6	1.5	1.1	1.8	0.7	1.6	1.3	2.0	0.8	1.7	1.2	1.9	0.8
Magnesium_D	1.5	0.9	0.9	0.7	1.5	1.1	1.1	1.0	2.2	1.3	1.3	1.1	2.1	1.2	1.2	1.1
Manganese_D	17.1	0.7	0.7	0.5	17.5	0.8	0.8	0.5	18.6	0.8	0.8	0.5	19.3	0.8	0.8	0.5
Manganese_T	6.0	0.8	0.8	0.5	6.1	0.8	0.8	0.5	6.4	0.8	0.8	0.5	6.6	0.8	0.8	0.5
Mercury_D	1.2	1.0	1.1	0.9	1.2	1.1	1.2	1.0	1.5	1.4	1.4	1.3	1.5	1.3	1.3	1.3
Mercury_T	1.5	1.0	0.9	1.0	1.5	1.1	1.0	1.1	1.8	1.3	1.2	1.3	1.7	1.2	1.1	1.3
Molybdenum_D	1.7	0.9	0.8	0.7	1.9	10.9	11.3	13.4	17.9	12.2	10.8	11.8	2.9	2.1	1.4	5.6
Molybdenum_T	2.1	0.9	0.8	0.8	2.3	9.3	8.5	12.0	18.4	10.4	8.1	10.6	3.4	1.9	1.2	5.2
N_Ammonia	13.8	0.7	0.7	0.5	14.2	1.8	2.0	1.4	35.0	2.0	1.9	1.3	15.6	0.9	0.8	0.9
N_Nitrate_Nitrite	1.0	1.0	1.0	1.0	1.0	2.0	2.0	3.1	1.2	1.3	1.3	1.5	1.0	1.0	1.0	1.2
N_Nitrite	1.3	1.0	1.0	0.8	1.3	1.1	1.0	0.9	1.3	1.0	1.0	0.8	1.3	1.0	1.0	0.8
Nickel_D	1.2	0.9	0.9	0.8	1.2	1.6	1.7	1.8	2.2	1.8	1.8	1.7	1.4	1.1	1.1	1.4
Nickel_T	1.5	0.9	0.8	0.8	1.5	1.5	1.4	1.6	2.4	1.6	1.4	1.5	1.6	1.1	0.9	1.2
Phosphorus_T	1.3	0.9	0.9	0.8	1.3	1.0	0.9	0.8	1.3	1.0	0.9	0.8	1.3	1.0	0.9	0.9
Potassium_D	1.2	0.9	0.9	0.8	1.2	2.8	3.1	3.5	4.1	3.5	3.5	3.2	2.0	1.7	1.6	2.6
Radium_226	1.1	1.0	0.9	0.9	1.1	1.0	0.9	0.9	1.1	1.0	0.9	0.9	1.1	1.0	1.0	0.9
Selenium_D	1.6	1.0	0.9	0.9	1.7	2.4	2.4	3.0	3.3	2.5	2.3	2.7	1.7	1.1	0.9	1.7
Selenium_T	1.1	1.0	1.0	0.9	1.1	2.3	2.5	3.0	2.1	2.4	2.3	2.8	1.1	1.1	1.0	1.8
Silicon_D	3.1	0.8	0.8	0.6	3.2	0.8	0.8	0.6	3.2	0.8	0.8	0.6	3.3	0.8	0.8	0.6
Silicon_T	2.9	0.8	0.8	0.6	2.9	0.8	0.8	0.6	2.9	0.8	0.8	0.6	3.0	0.8	0.8	0.6
Silver_D	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.1
Silver_T	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.1
Sodium_D	1.5	0.9	0.9	0.7	1.6	21.2	24.1	26.9	25.3	22.2	20.8	24.1	1.7	2.0	1.0	8.4
Sodium_T	1.3	0.9	0.9	0.7	1.4	19.4	22.7	24.8	20.3	20.3	19.5	22.2	1.5	1.9	1.1	7.9
Strontium_D	1.7	0.9	0.8	0.7	1.7	1.3	1.3	1.2	2.9	1.5	1.4	1.1	2.2	1.1	1.1	1.1
Strontium_T	1.7	0.9	0.9	0.7	1.7	1.3	1.3	1.2	2.8	1.4	1.4	1.1	2.1	1.1	1.1	1.0
Sulfate	1.2	0.9	0.9	0.8	1.2	246.7	290.8	345.4	241.3	271.8	266.2	307.9	27.6	21.7	19.9	28.0
Thallium_D	4.5	0.9	0.7	0.7	4.5	0.9	0.7	0.7	4.5	0.9	0.7	0.7	4.6	1.0	0.7	0.7
Thallium_T	4.5	0.9	0.7	0.7	4.5	0.9	0.7	0.7	4.5	0.9	0.7	0.7	4.6	1.0	0.7	0.7
Uranium_D	4.6	0.9	0.7	0.7	4.8	1.8	1.4	1.7	10.1	2.0	1.5	1.5	6.1	1.3	0.9	1.4
Uranium_T	1.5	1.0	0.9	0.8	1.5	1.6	1.6	1.8	2.7	1.8	1.6	1.6	1.8	1.2	1.1	1.5
Vanadium_T	1.7	1.0	0.9	0.8	1.7	1.1	1.0	1.0	2.0	1.1	1.1	1.0	1.8	1.0	1.0	1.0
Zinc_D	1.6	0.9	0.9	0.7	1.6	0.9	0.9	0.7	1.6	0.9	0.9	0.7	1.6	0.9	0.9	0.7
Zinc_T	1.7	1.0	0.9	0.8	1.7	1.0	0.9	0.9	1.7	1.0	0.9	0.9	1.7	1.0	0.9	0.9

Notes:

	updated model concentration/EIS model concentration <0.5
	0.5 < updated model concentration/EIS model concentration <2
	updated model concentration/EIS model concentration >2

Appendix G Surface Water Quality Figures

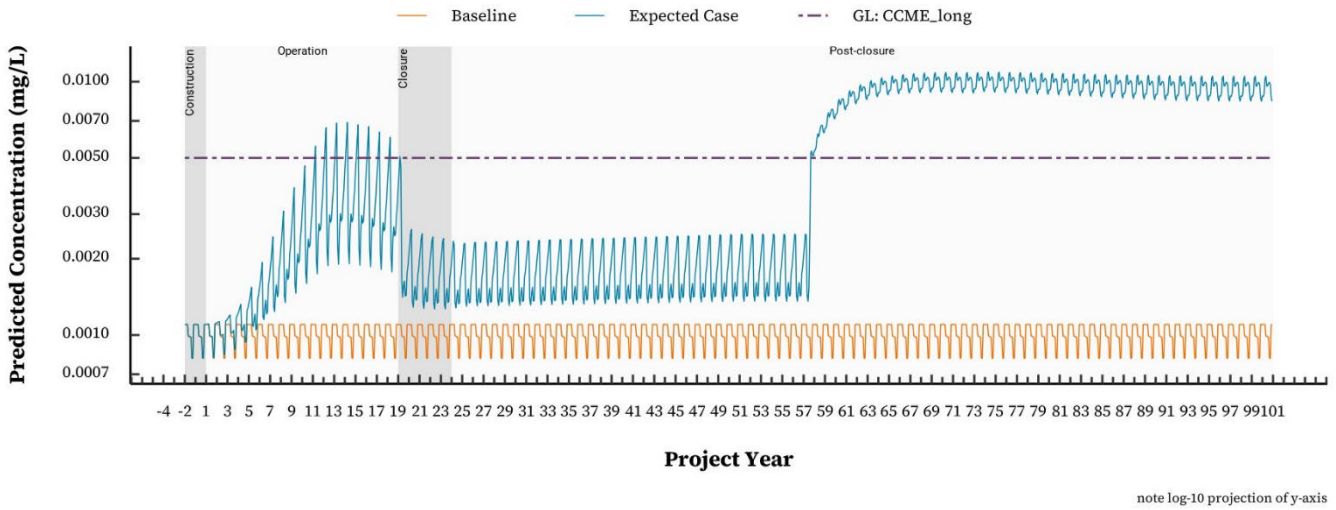


Figure G-1 Predicted Project vs. Baseline Concentrations of Total Arsenic in Tributary KEE3-B1 for the Expected Case Scenario

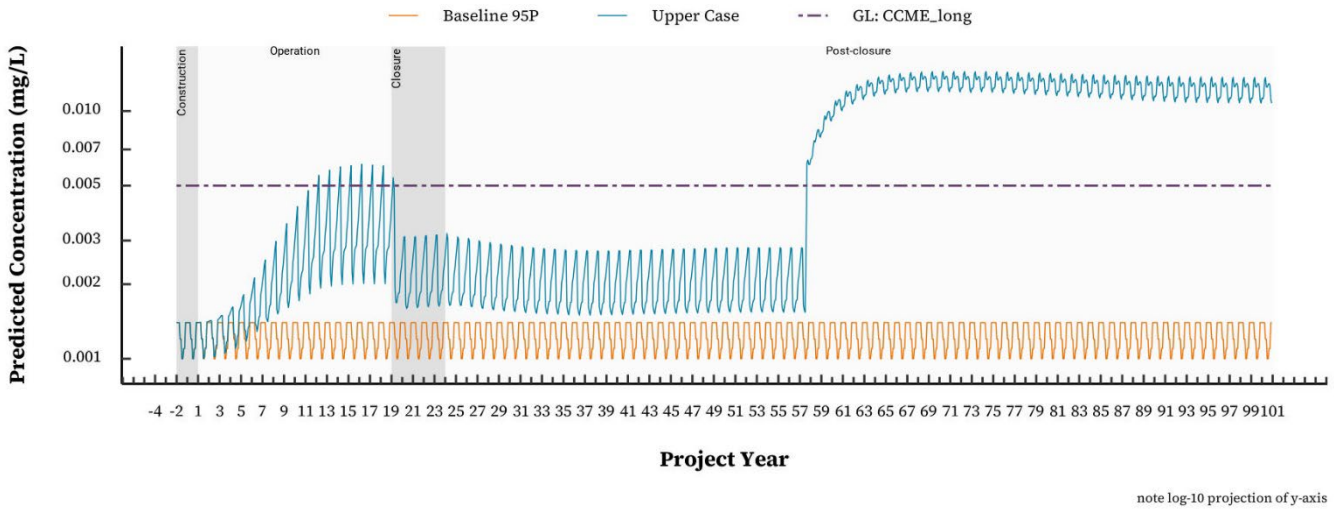


Figure G-2 Predicted Project vs. Baseline Concentrations of Total Arsenic in Tributary KEE3-B1 for the Upper-Case Scenario

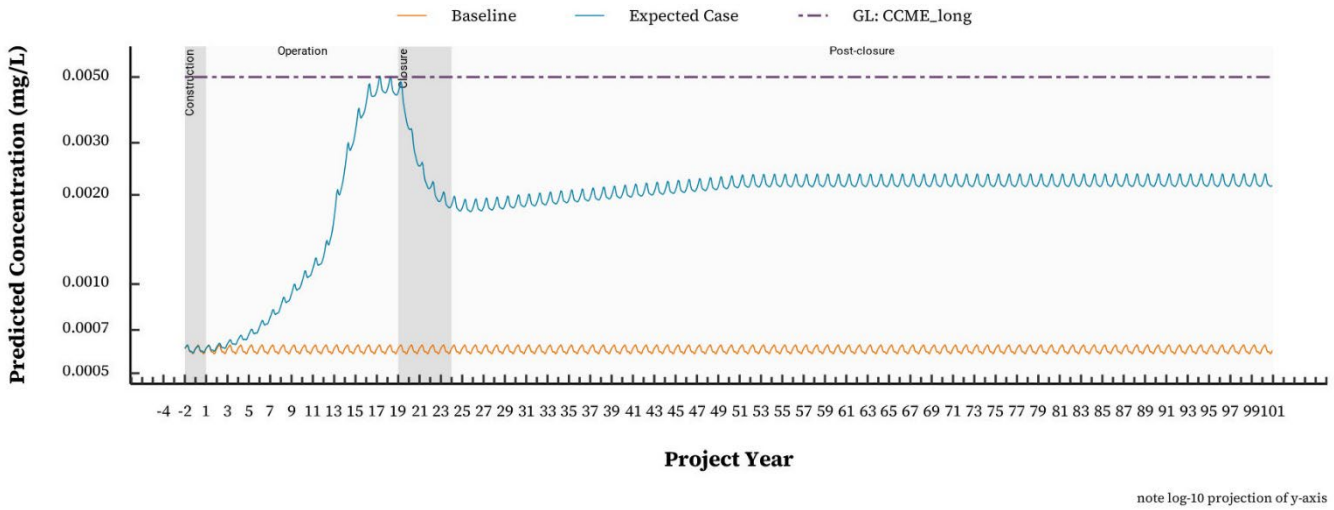


Figure G-3 Predicted Project vs. Baseline Concentrations of Total Arsenic in Minton Lake for the Expected Case Scenario

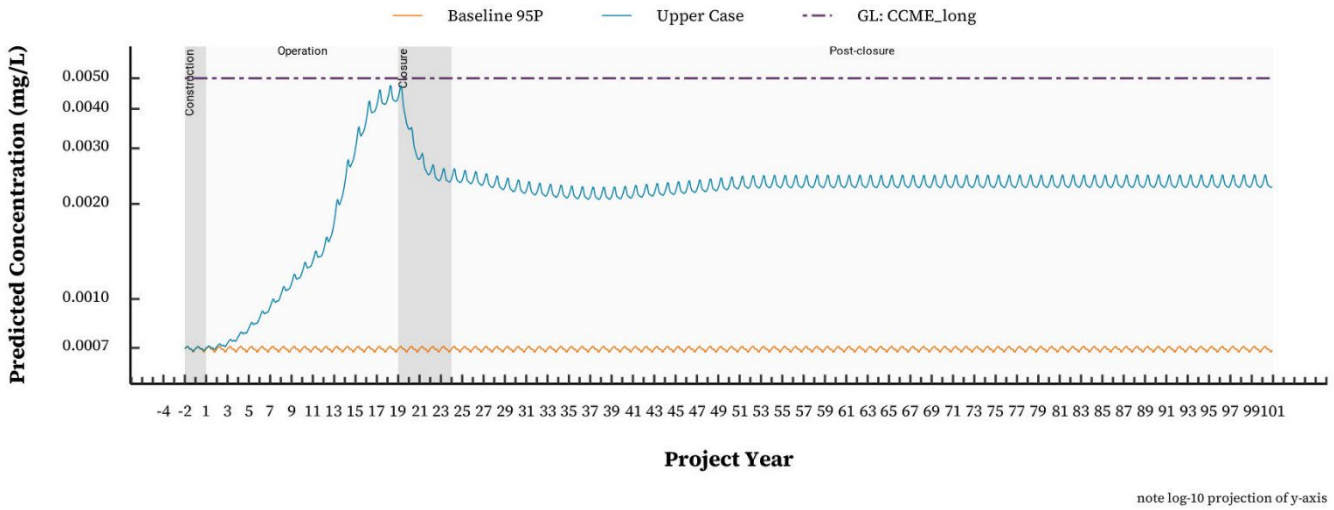


Figure G-4 Predicted Project vs. Baseline Concentrations of Total Arsenic in Minton Lake for the Upper-Case Scenario

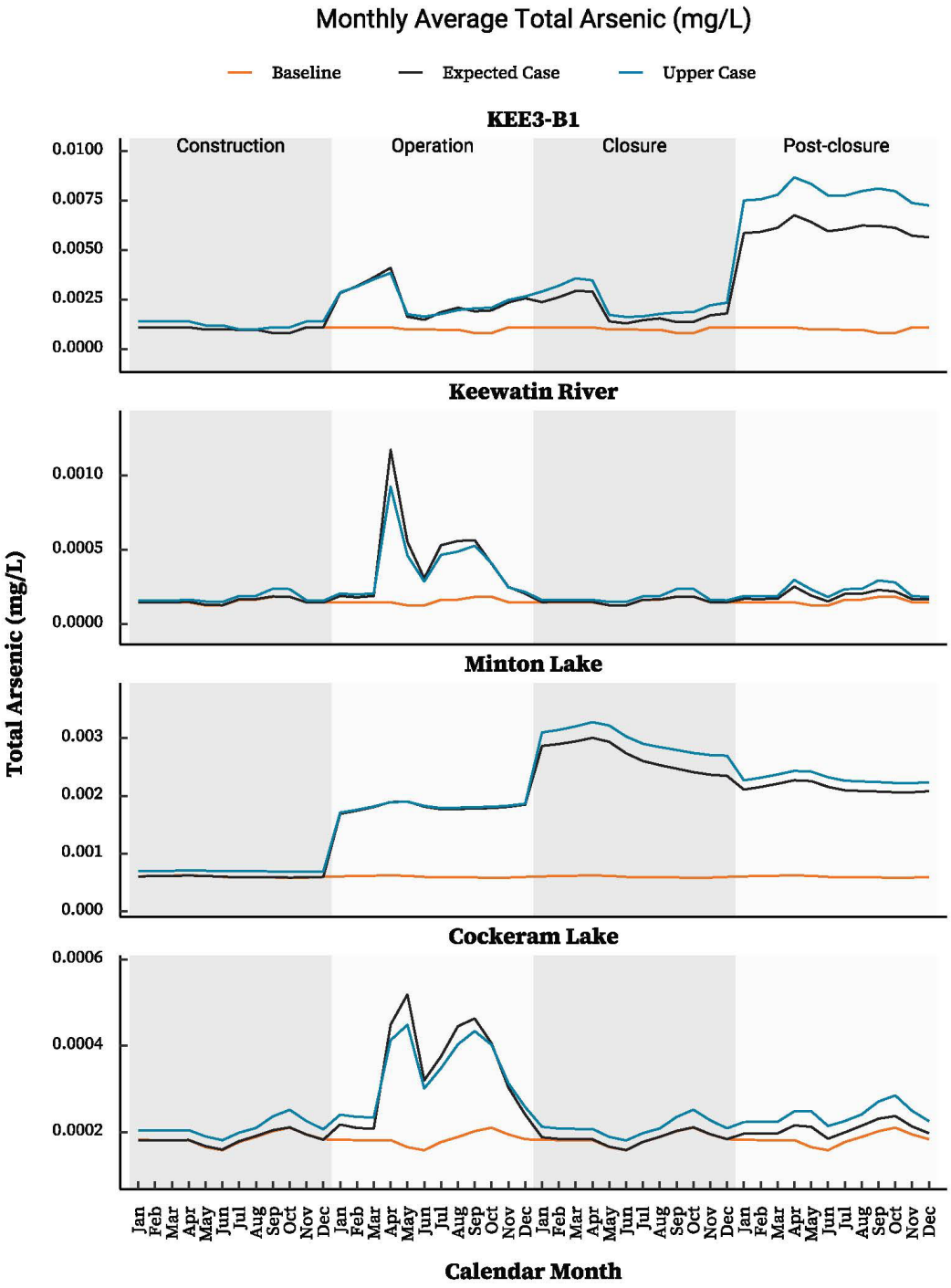


Figure G-5 Predicted Monthly Mean Total Arsenic Concentrations in Tributary KEE3-B1, Minton Lake, the Keewatin River (QM06), and Cockeram Lake (QM08) during Construction, Operation, Closure, and Post-Closure Phases

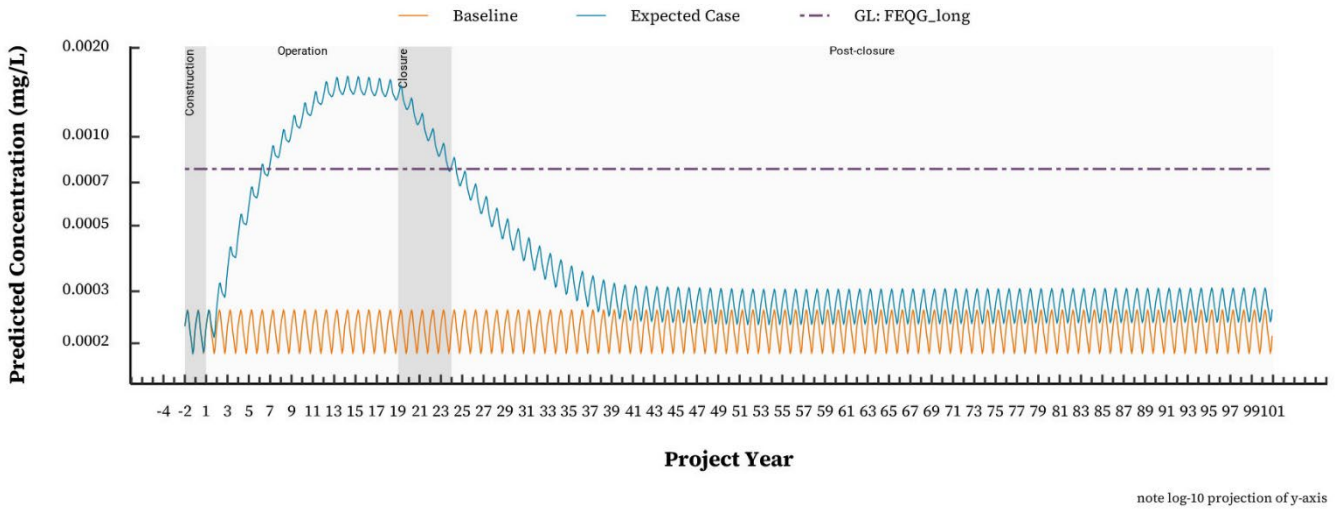


Figure G-6 Predicted Project vs. Baseline Concentrations of Total Cobalt in Tributary KEE3-PAY1 for the Expected Case Scenario

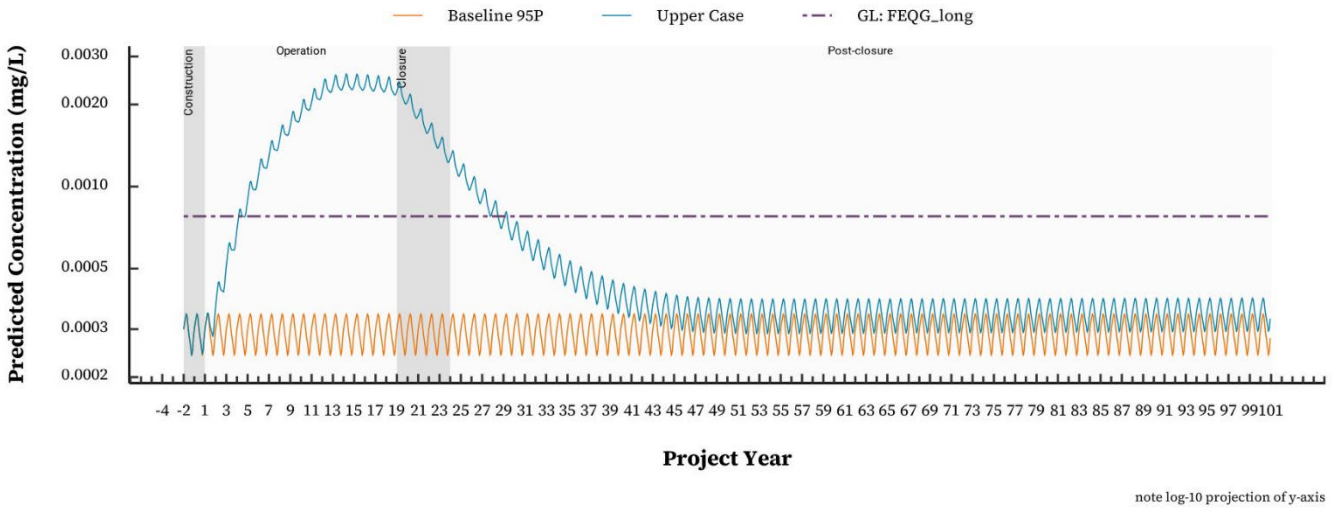


Figure G-7 Predicted Project vs. Baseline Concentrations of Total Cobalt in Tributary KEE3-PAY1 for the Upper-Case Scenario

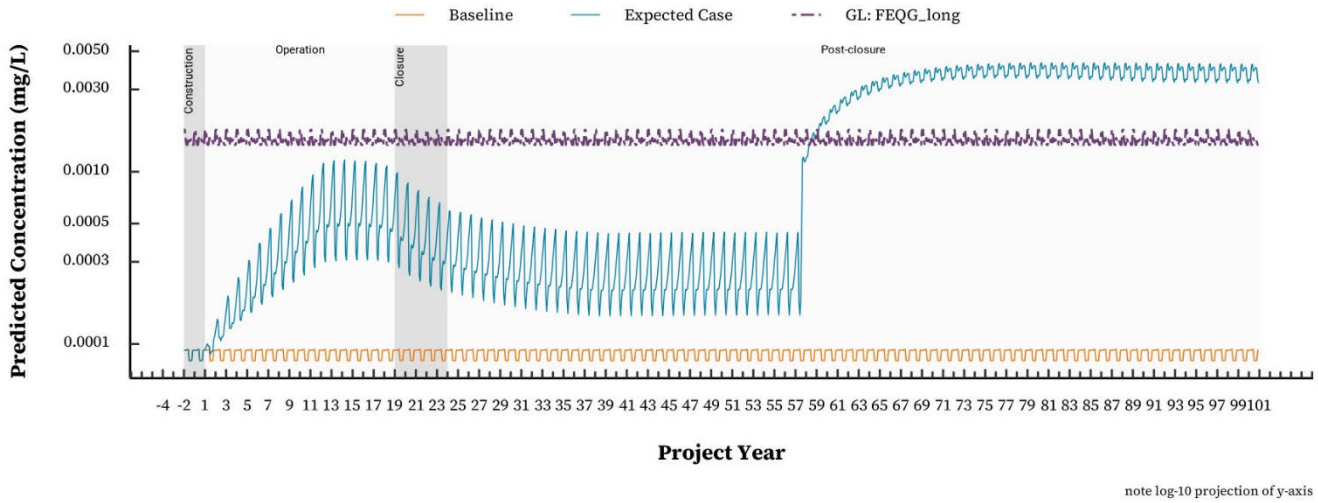


Figure G-8 Predicted Project vs. Baseline Concentrations of Total Cobalt in Tributary KEE3-B1 for the Expected Case Scenario

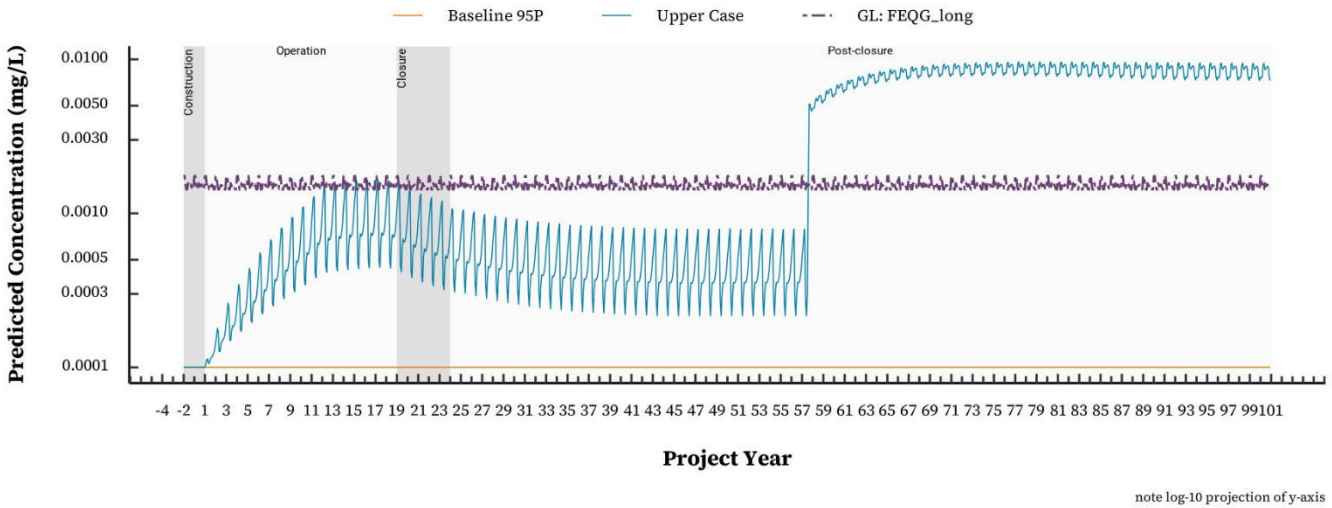


Figure G-9 Predicted Project vs. Baseline Concentrations of Total Cobalt in Tributary KEE3-B1 for the Upper-Case Scenario

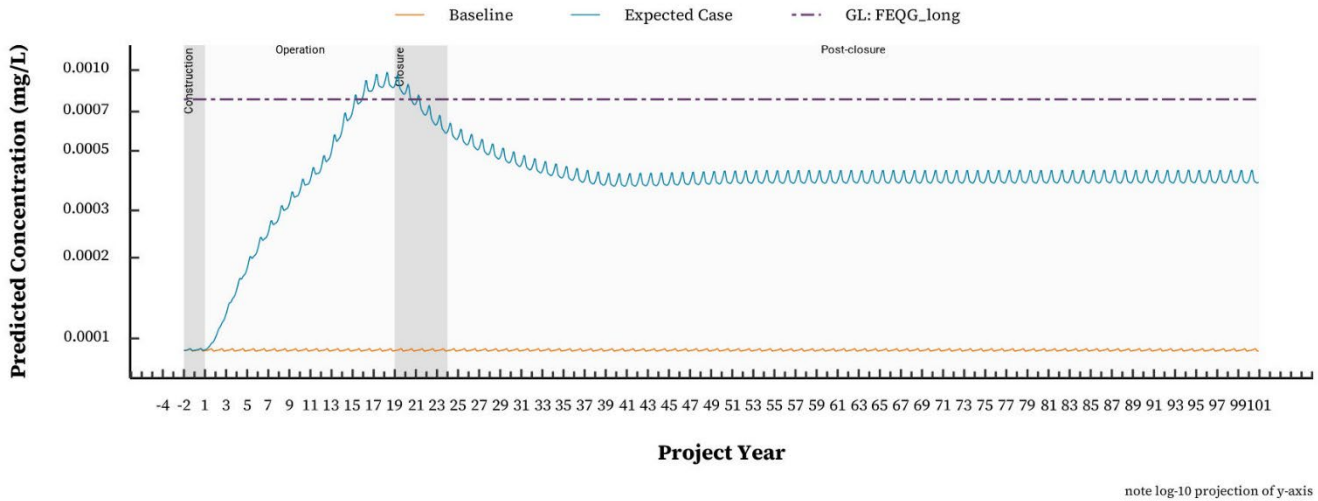


Figure G-10 Predicted Project vs. Baseline Concentrations of Total Cobalt in Minton Lake for the Expected Case Scenario

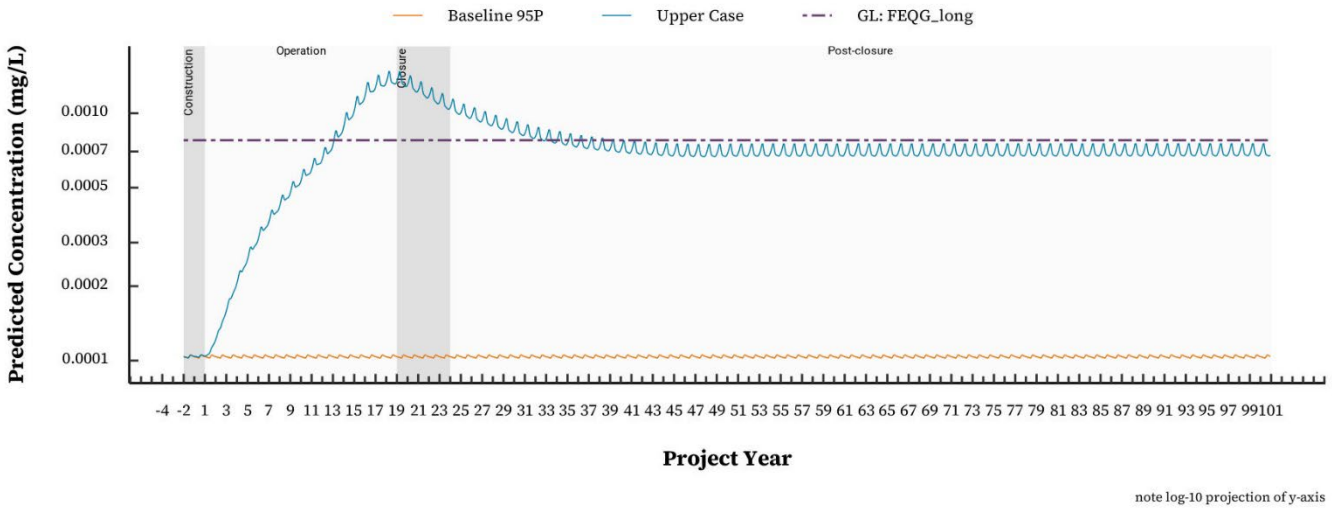


Figure G-11 Predicted Project vs. Baseline Concentrations of Total Cobalt in Minton Lake for the Upper-Case Scenario

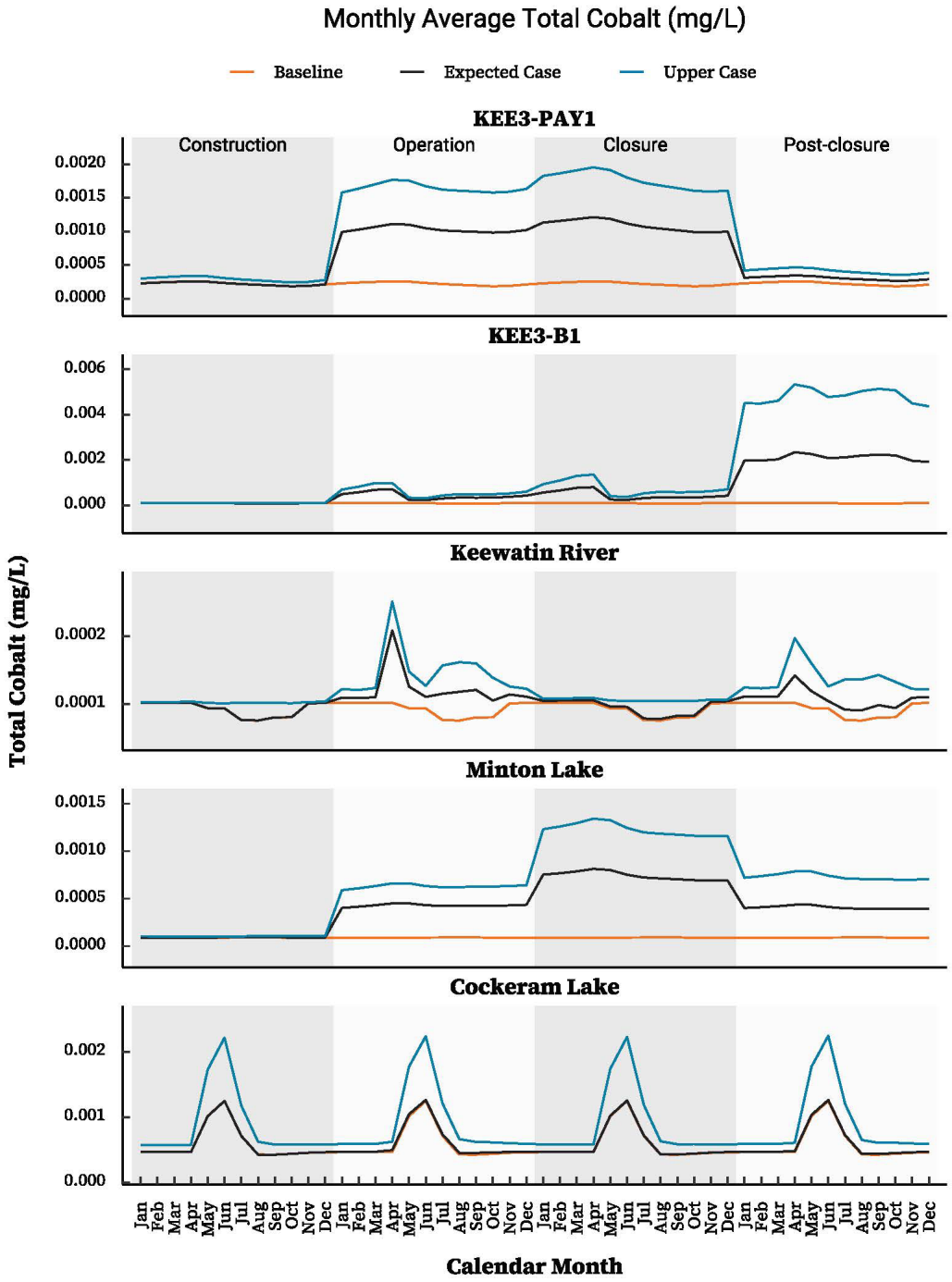


Figure G-12 Predicted Monthly Mean Total Cobalt Concentrations in Tributary KEE3-PAY1, Tributary KEE3-B1, Minton Lake, the Keewatin River (QM06), and Cockeram Lake (QM08) in Construction, Operation, Closure, and Post-Closure

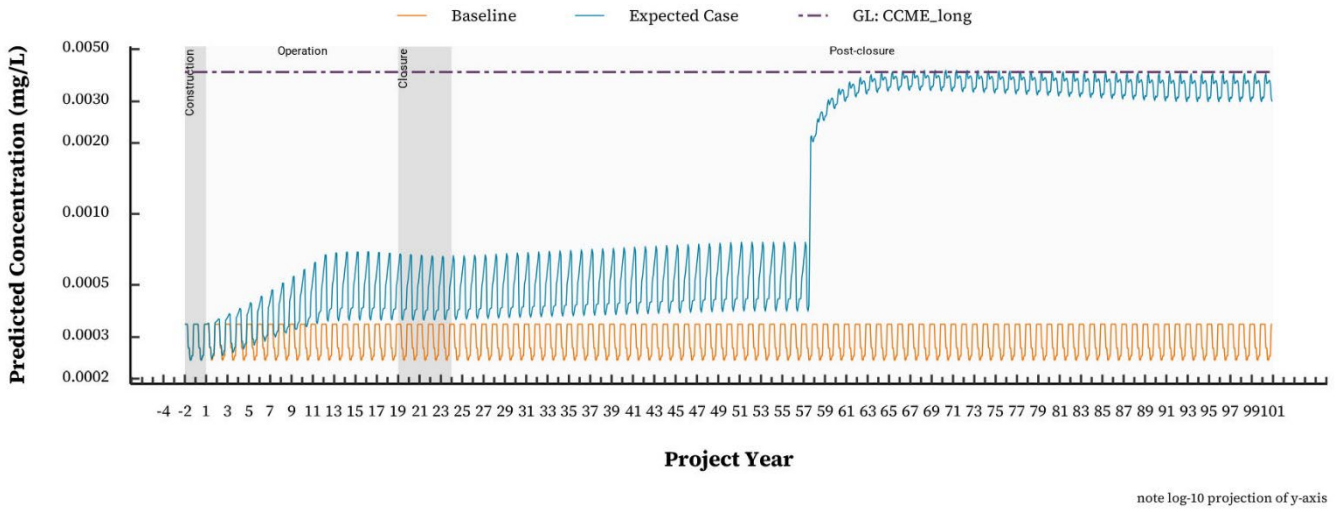


Figure G-13 Predicted Project vs. Baseline Concentrations of Total Copper in Tributary KEE3-B1 for the Expected Case Scenario

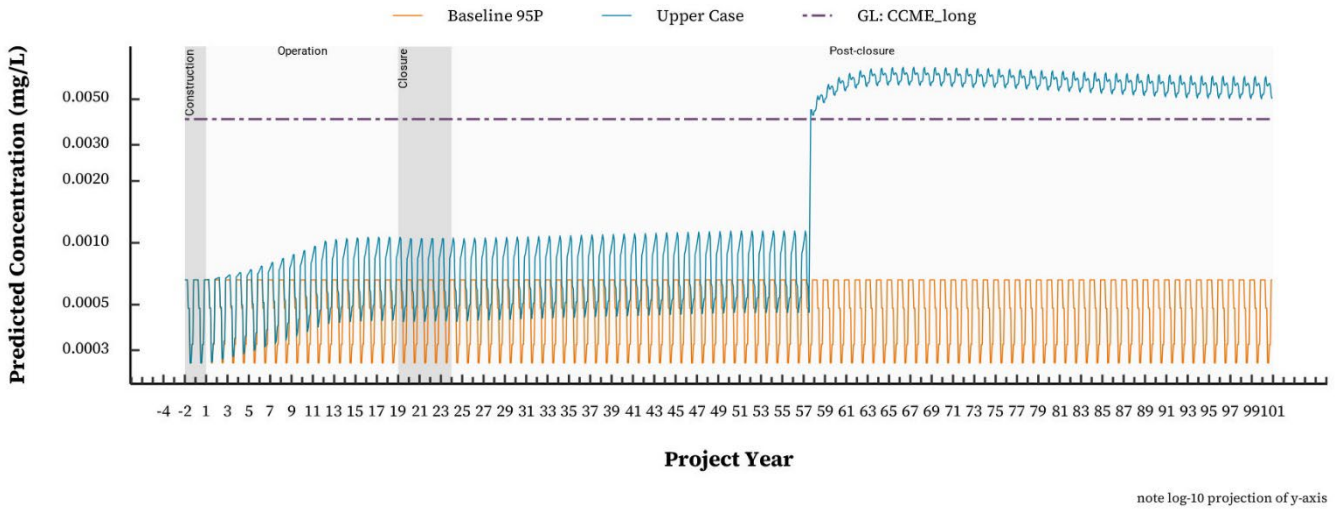


Figure G-14 Predicted Project vs. Baseline Concentrations of Total Copper in Tributary KEE3-B1 for the Upper-Case Scenario

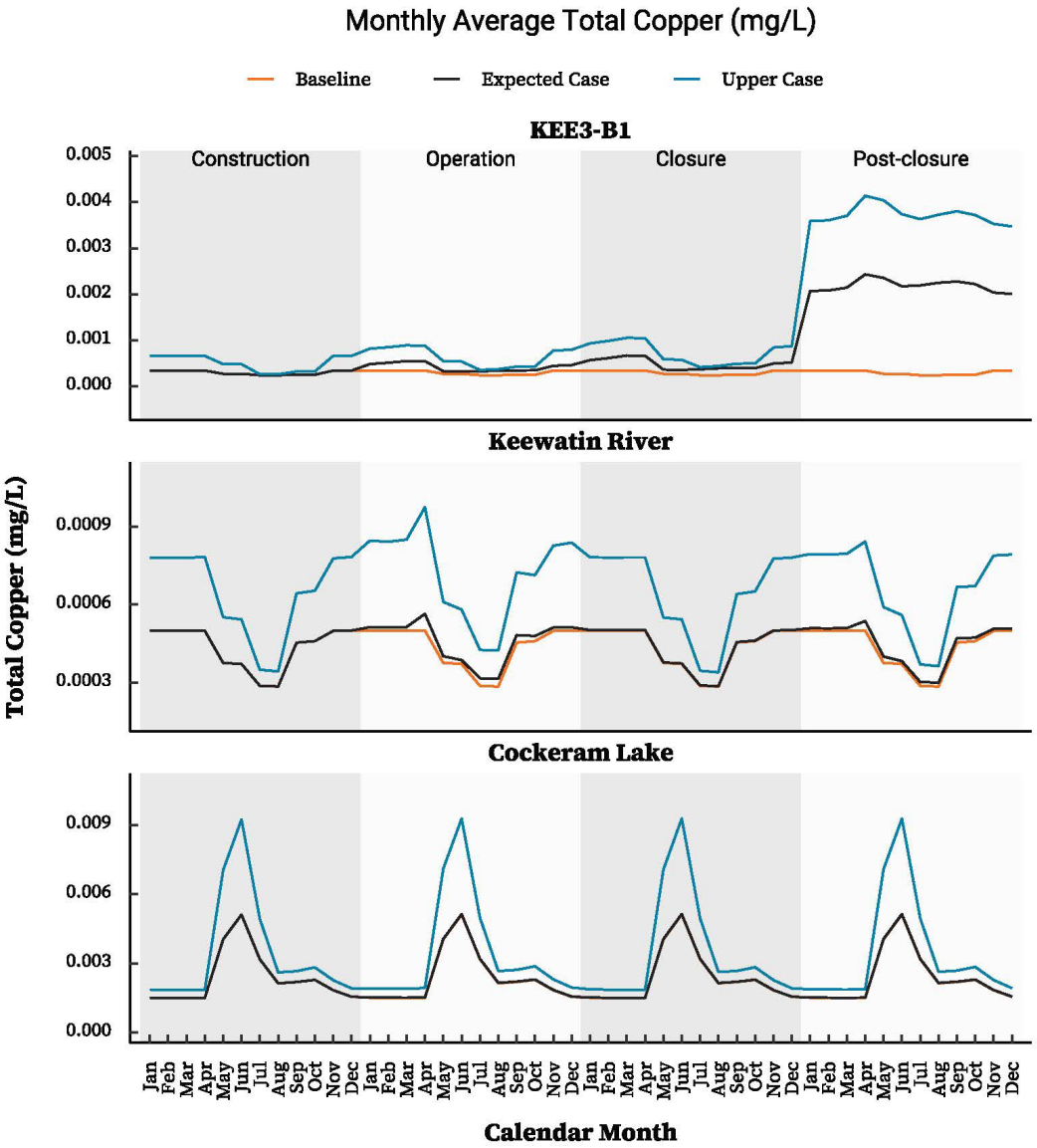


Figure G-15 Predicted Monthly Mean Total Copper Concentrations in Tributary KEE3-B1, the Keewatin River (QM06), and Cockeram Lake (QM08) in Construction, Operation, Closure, and Post-Closure

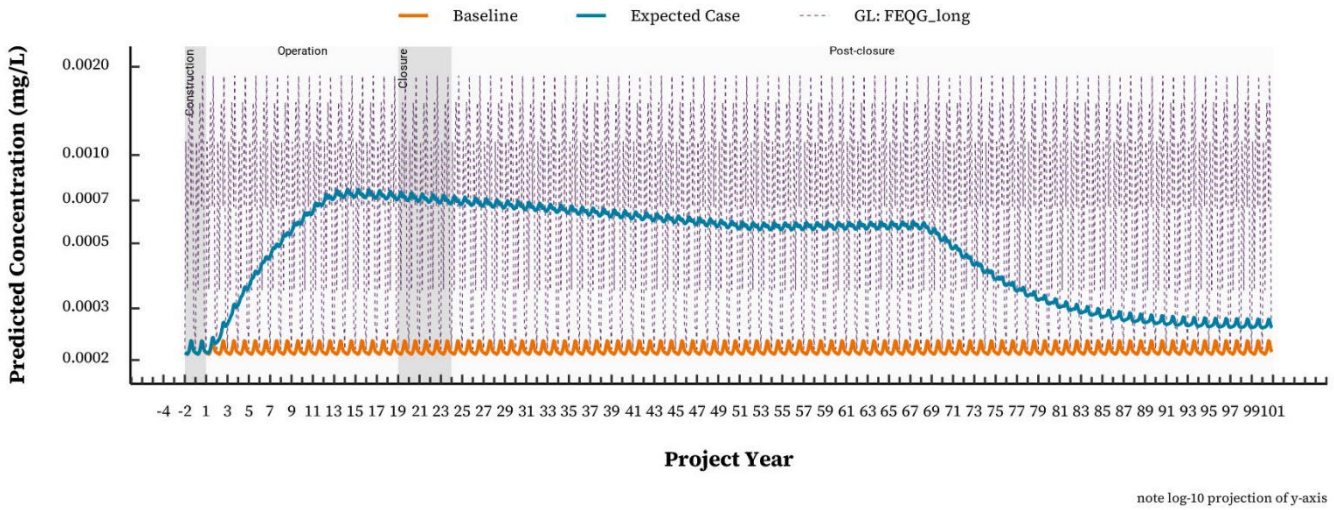


Figure G-16 Predicted Project vs. Baseline Concentrations of Dissolved Copper in Tributary KEE3-PAY1 for the Expected Case Scenario

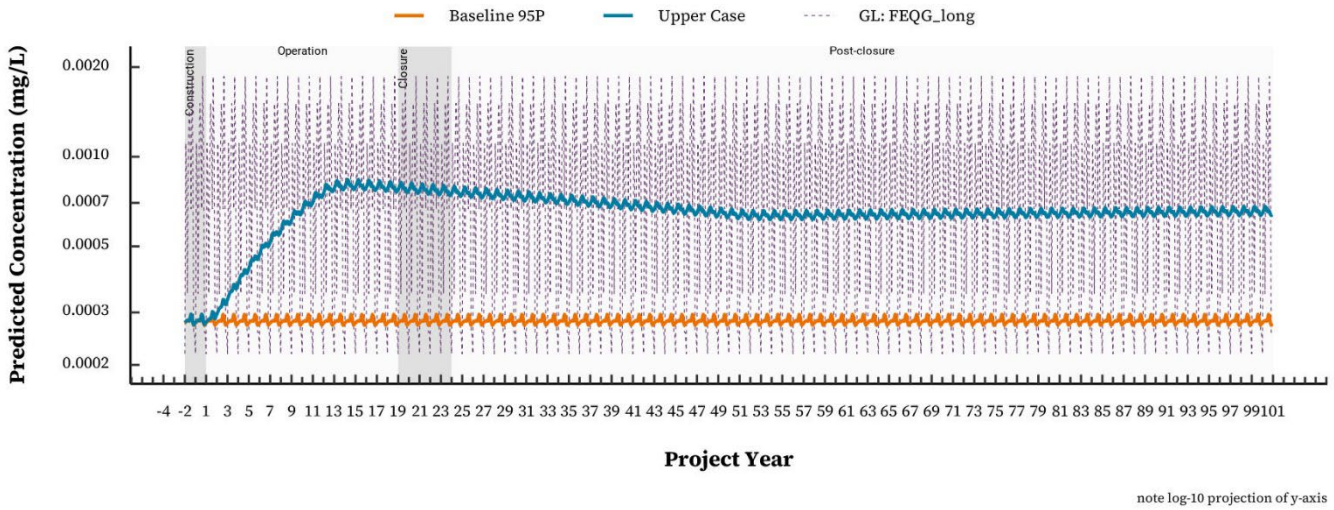


Figure G-17 Predicted Project vs. Baseline Concentrations of Dissolved Copper in Tributary KEE3-PAY1 for the Upper-Case Scenario

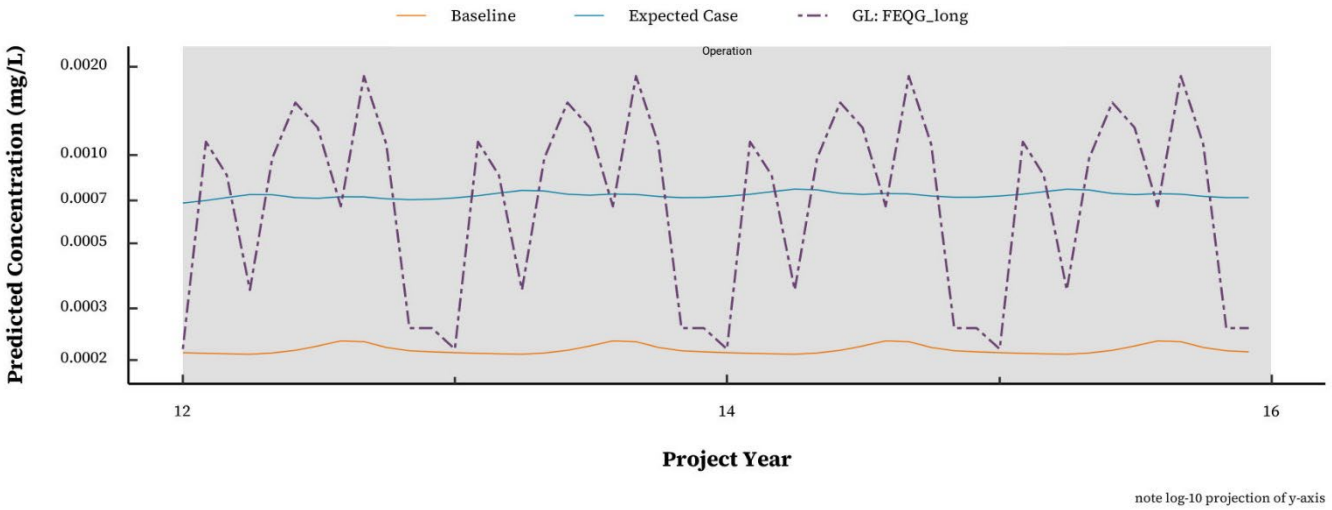


Figure G-18 Predicted Project vs. Baseline Concentrations of Dissolved Copper in Tributary KEE3-PAY1 in Operations for the Expected Case Scenario

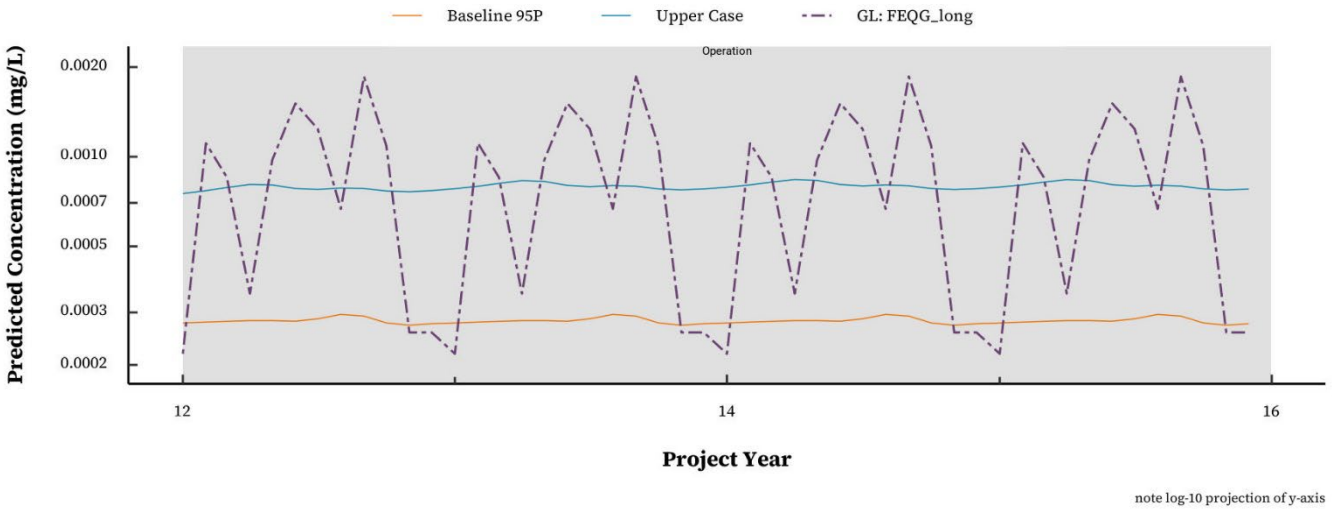


Figure G-19 Predicted Project vs. Baseline Concentrations of Dissolved Copper in Tributary KEE3-PAY1 in Operations for the Upper-Case Scenario

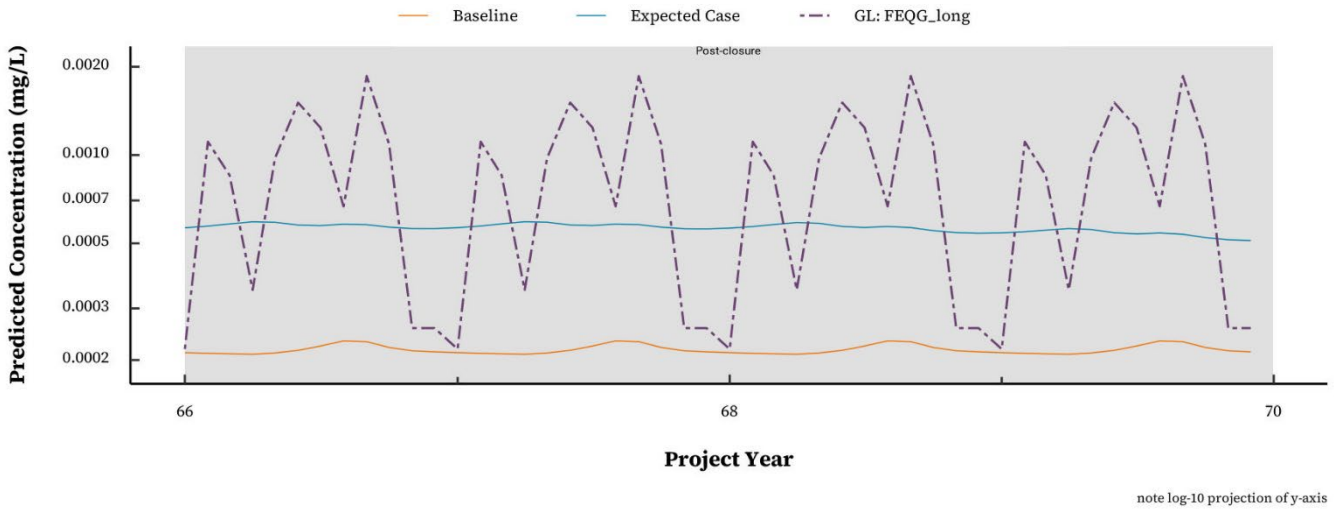


Figure G-20 Predicted Project vs. Baseline Concentrations of Dissolved Copper in Tributary KEE3-PAY1 in Early Post-Closure for the Expected Case Scenario

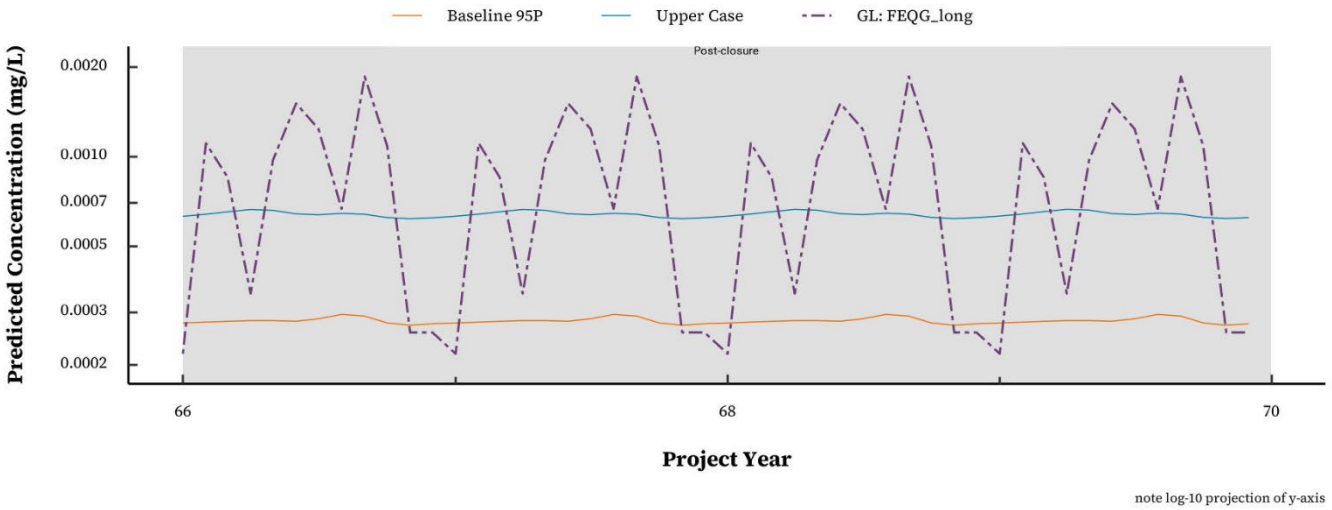


Figure G-21 Predicted Project vs. Baseline Concentrations of Dissolved Copper in Tributary KEE3-PAY1 in Early Post-Closure for the Upper-Case Scenario

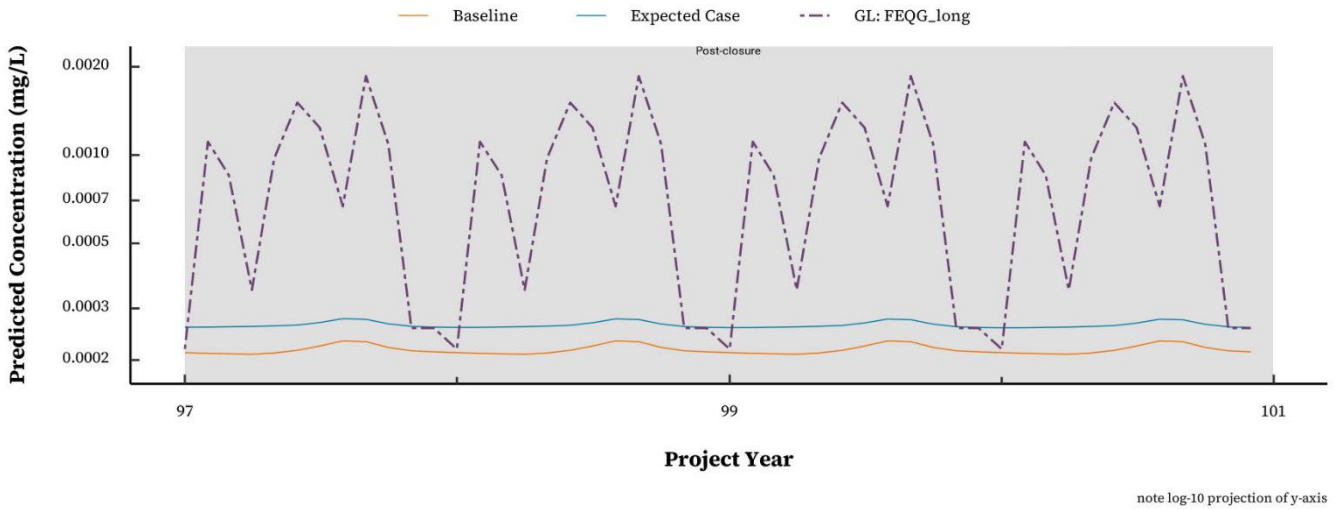


Figure G-22 Predicted Project vs. Baseline Concentrations of Dissolved Copper in Tributary KEE3-PAY1 in Late Post-Closure for the Expected Case Scenario

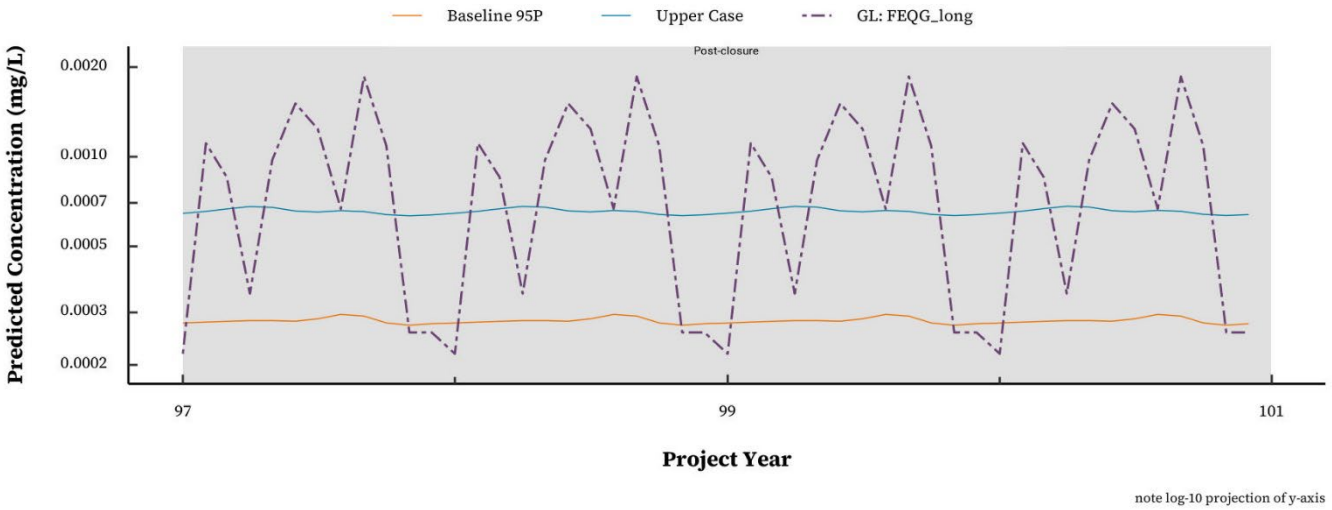


Figure G-23 Predicted Project vs. Baseline Concentrations of Dissolved Copper in Tributary KEE3-PAY1 in Late Post-Closure for the Upper-Case Scenario

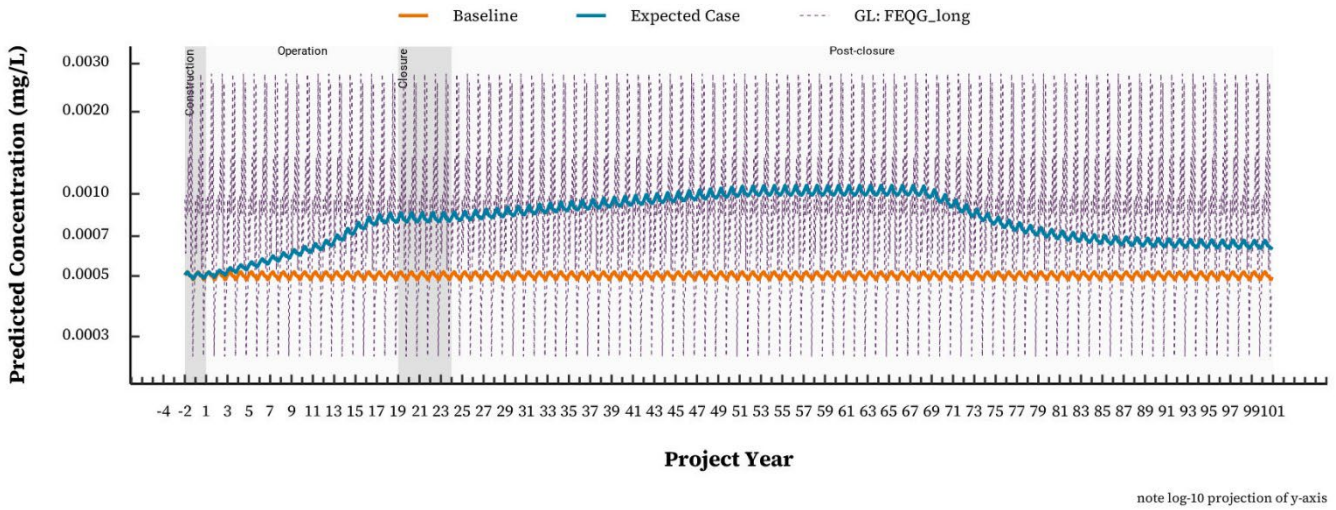


Figure G-24 Predicted Project vs. Baseline Concentrations of Dissolved Copper in Minton Lake for the Expected Case Scenario

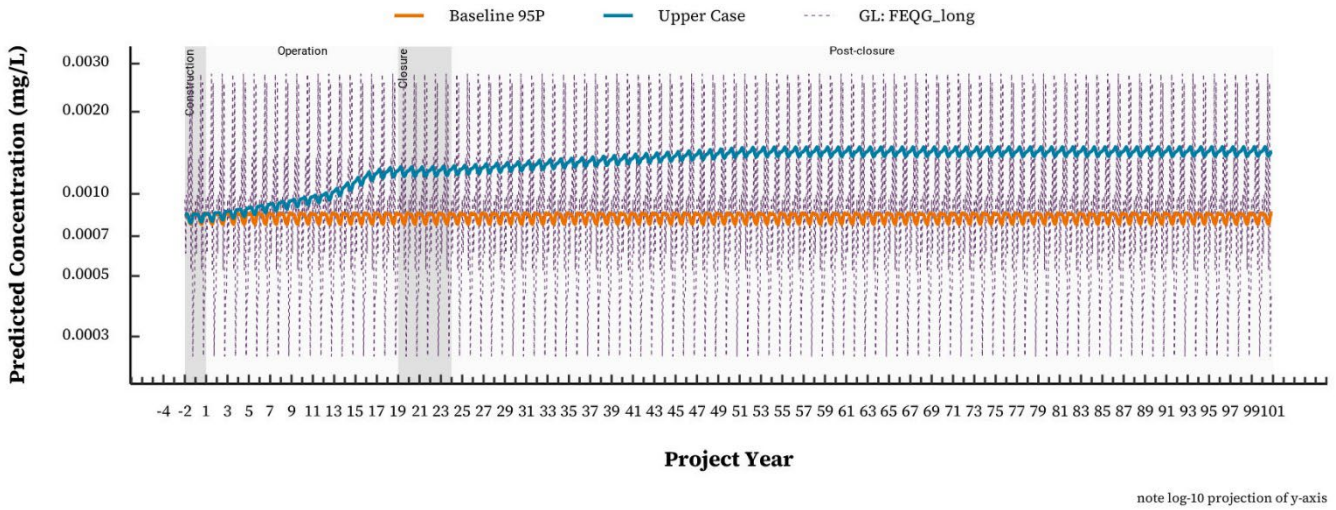


Figure G-25 Predicted Project vs. Baseline Concentrations of Dissolved Copper in Minton Lake for the Upper-Case Scenario

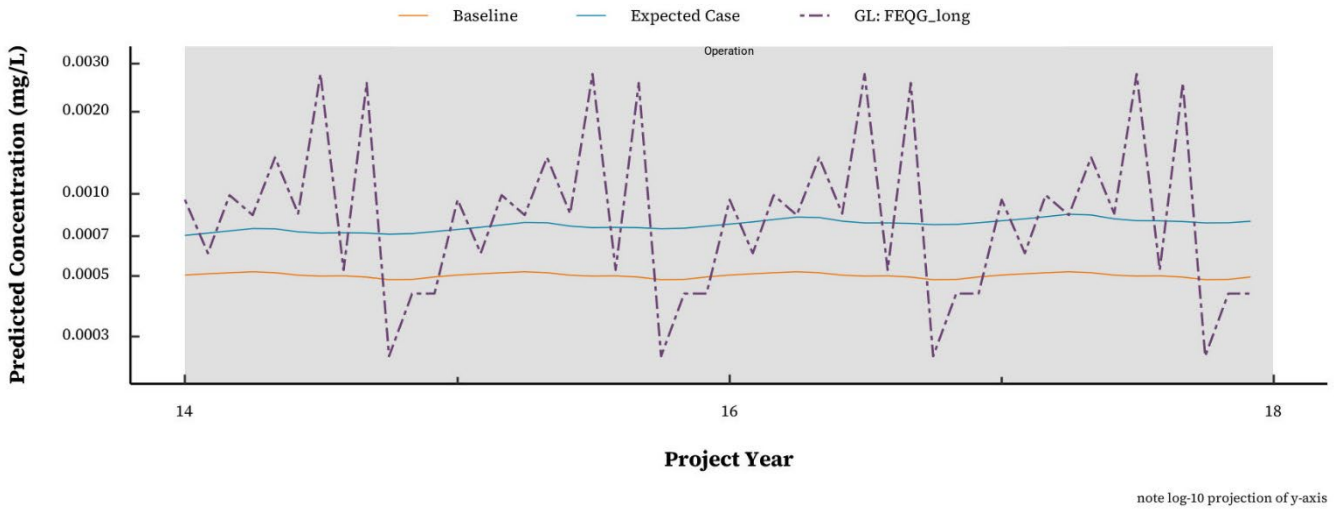


Figure G-26 Predicted Project vs. Baseline Concentrations of Dissolved Copper in Minton Lake in Operations for the Expected Case Scenario

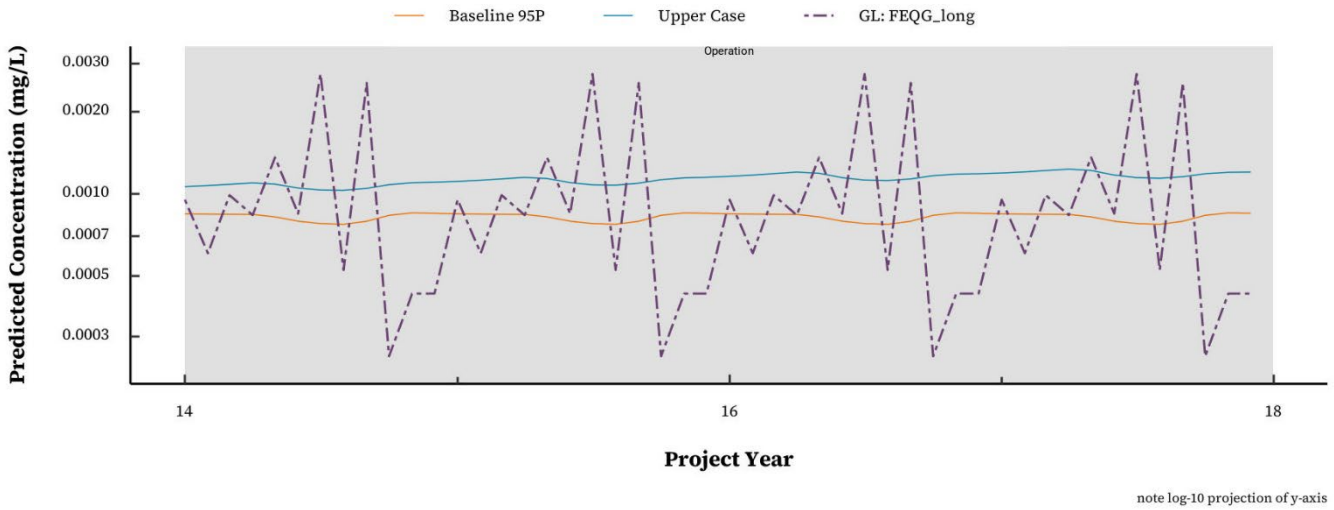


Figure G-27 Predicted Project vs. Baseline Concentrations of Dissolved Copper in Minton Lake in Operations for the Upper-Case Scenario

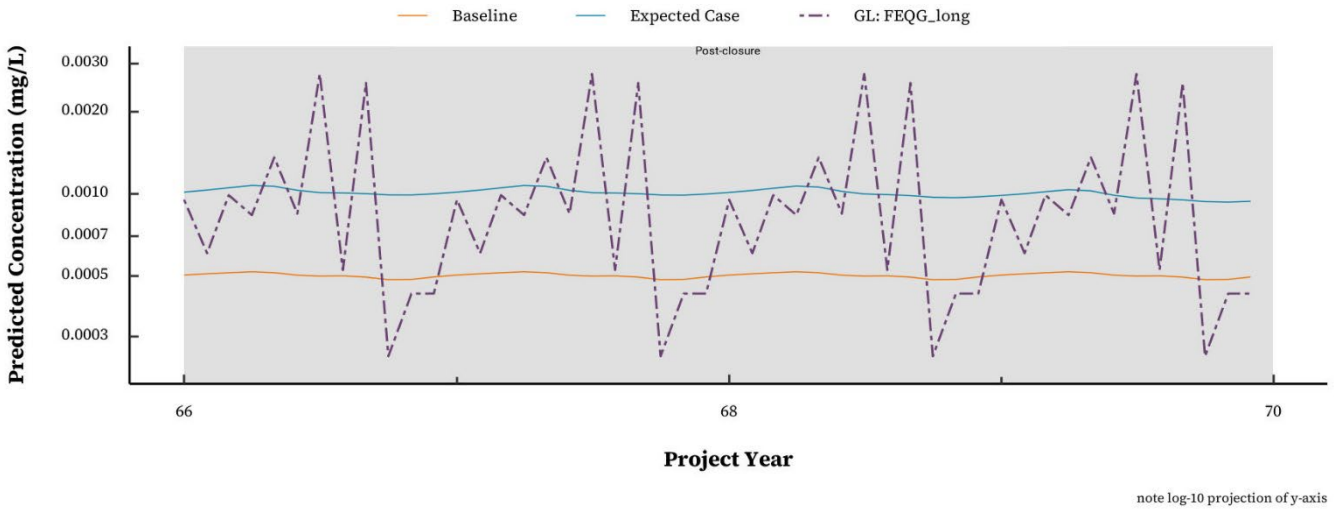


Figure G-28 Predicted Project vs. Baseline Concentrations of Dissolved Copper in Minton Lake in Early Post-Closure for the Expected Case Scenario

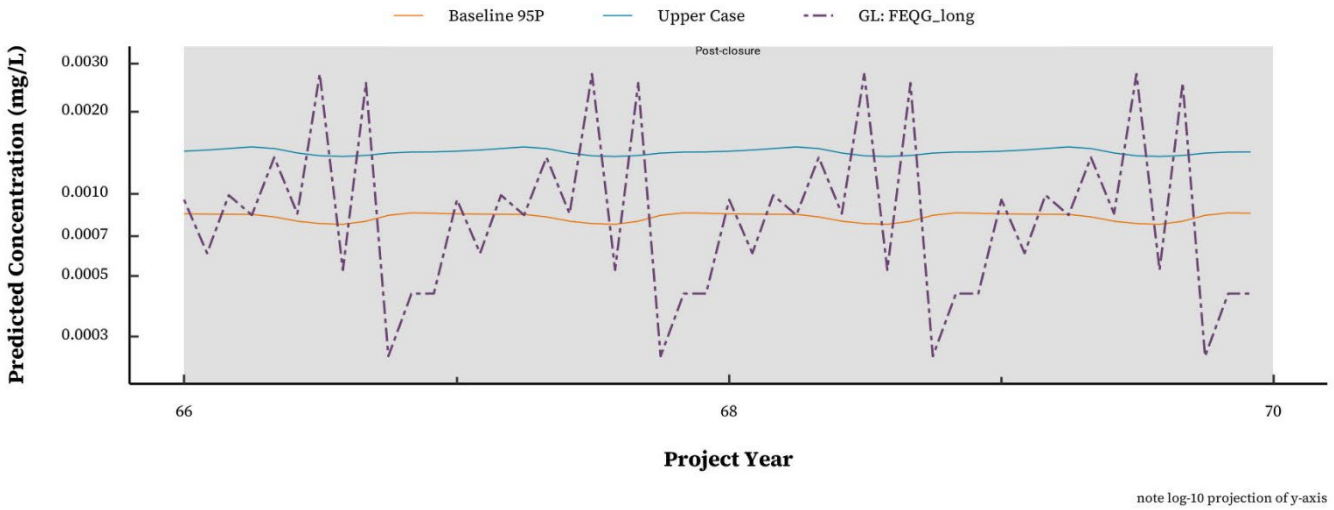


Figure G-29 Predicted Project vs. Baseline Concentrations of Dissolved Copper in Minton Lake in Early Post-Closure for the Upper-Case Scenario

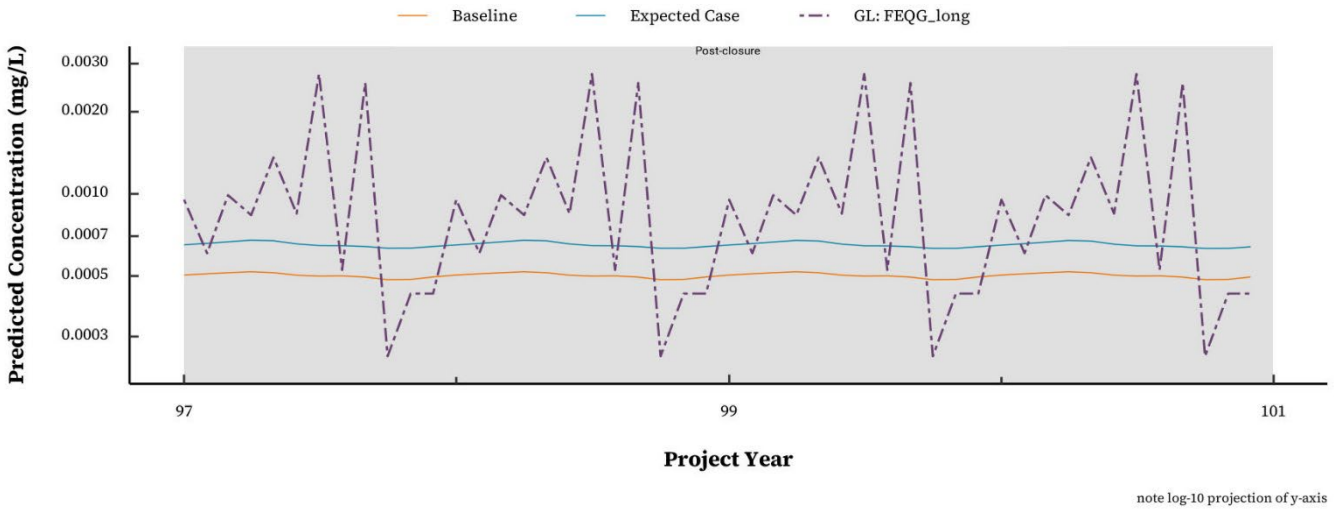


Figure G-30 Predicted Project vs. Baseline Concentrations of Dissolved Copper in Minton Lake in Late Post-Closure for the Expected Case Scenario

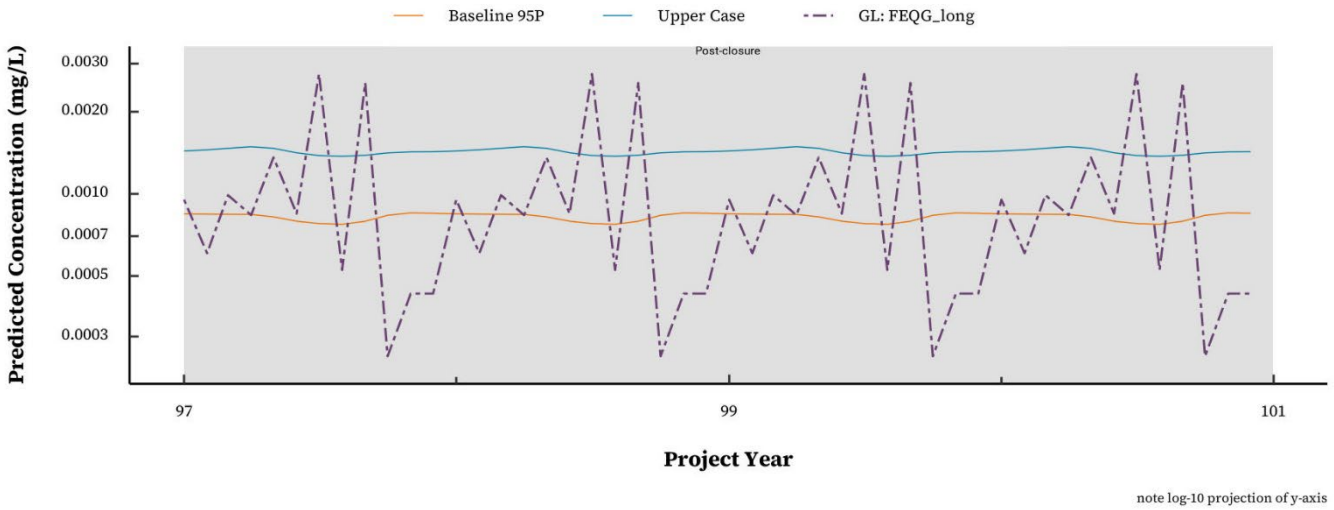


Figure G-31 Predicted Project vs. Baseline Concentrations of Dissolved Copper in Minton Lake in Late Post-Closure for the Upper-Case Scenario

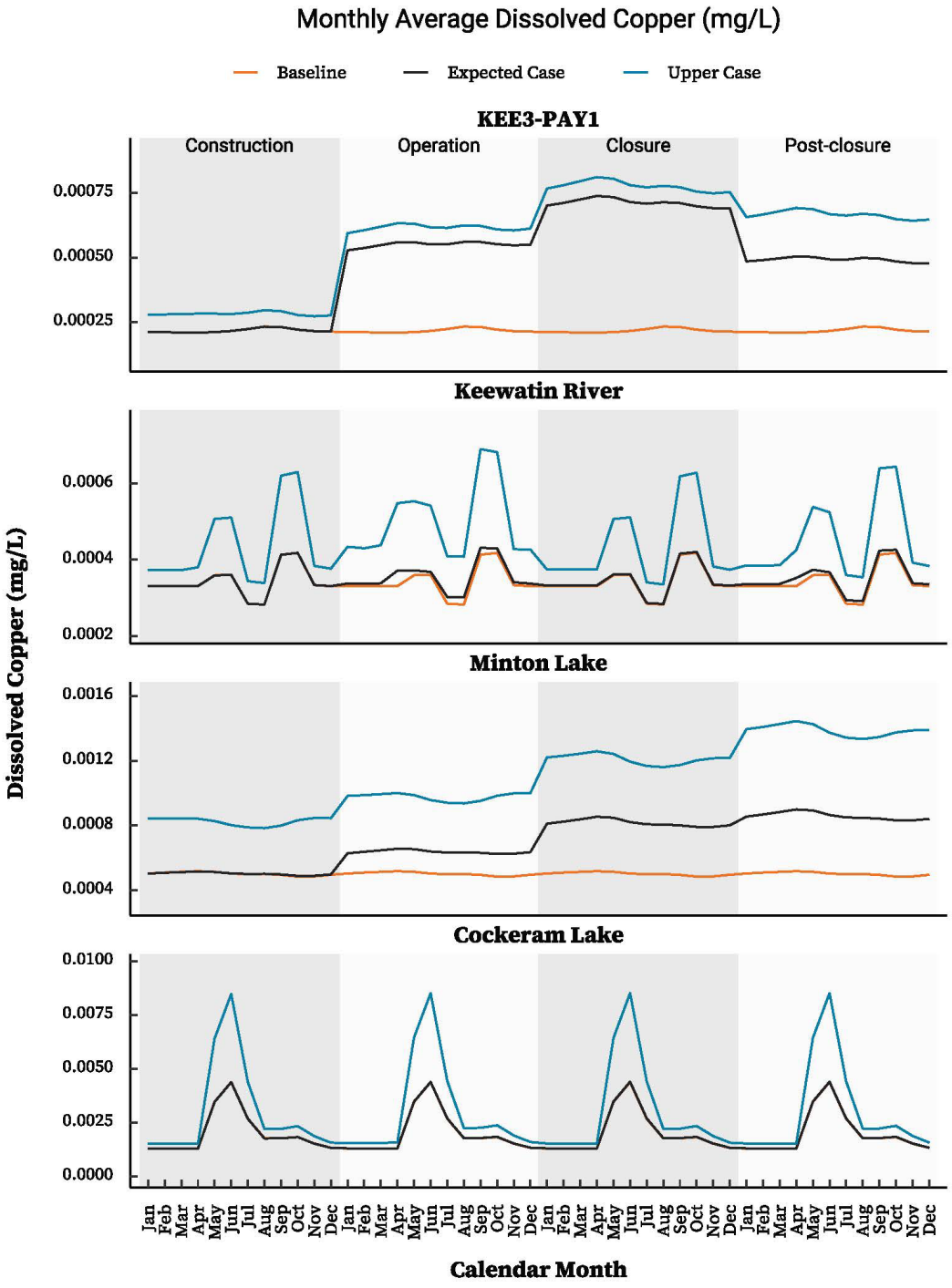


Figure G-32 Predicted Monthly Mean Dissolved Copper Concentrations in Tributary KEE3-PAY1, the Keewatin River (QM06), Minton Lake, and Cockeram Lake (QM08) in Construction, Operation, Closure, and Post-Closure

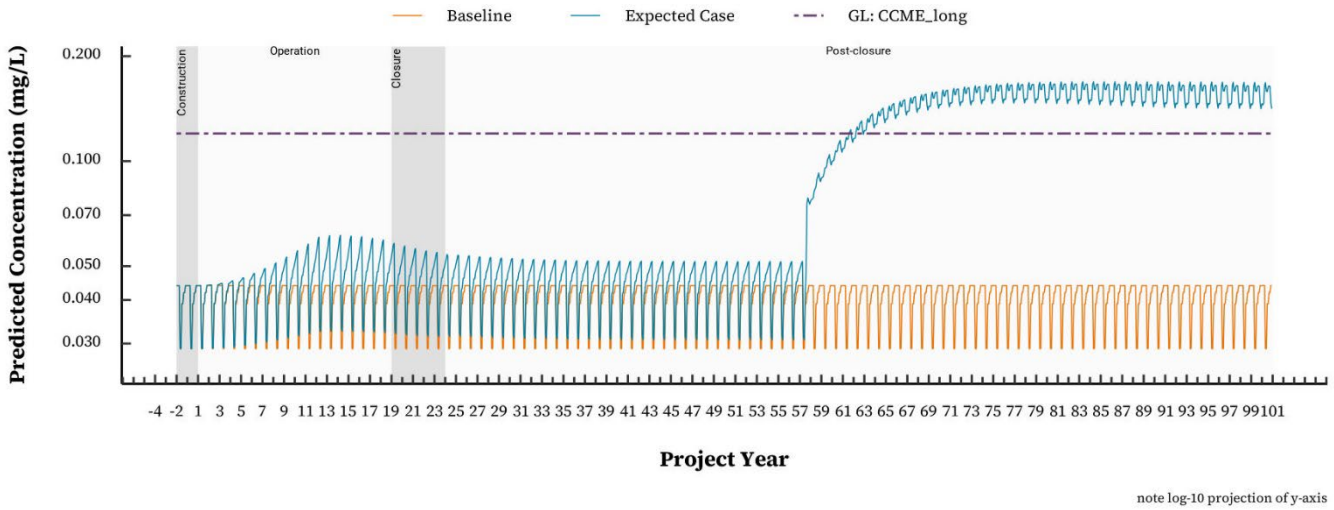


Figure G-33 Predicted Project vs. Baseline Concentrations of Fluoride in Tributary KEE3-B1 for the Expected Case Scenario

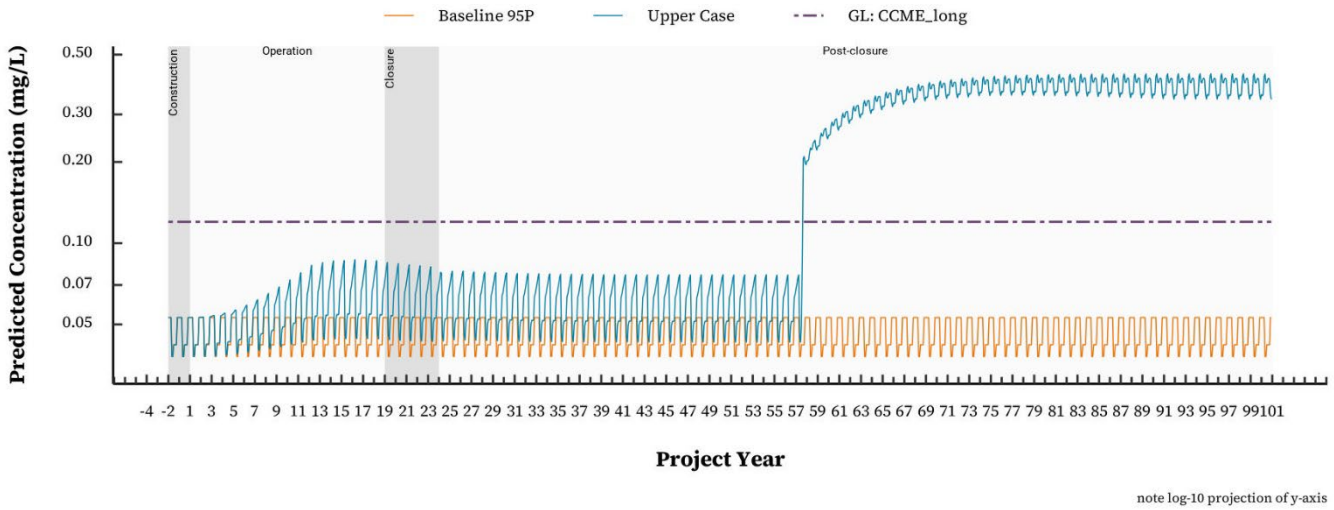


Figure G-34 Predicted Project vs. Baseline Concentrations of Fluoride in Tributary KEE3-B1 for the Upper-Case Scenario

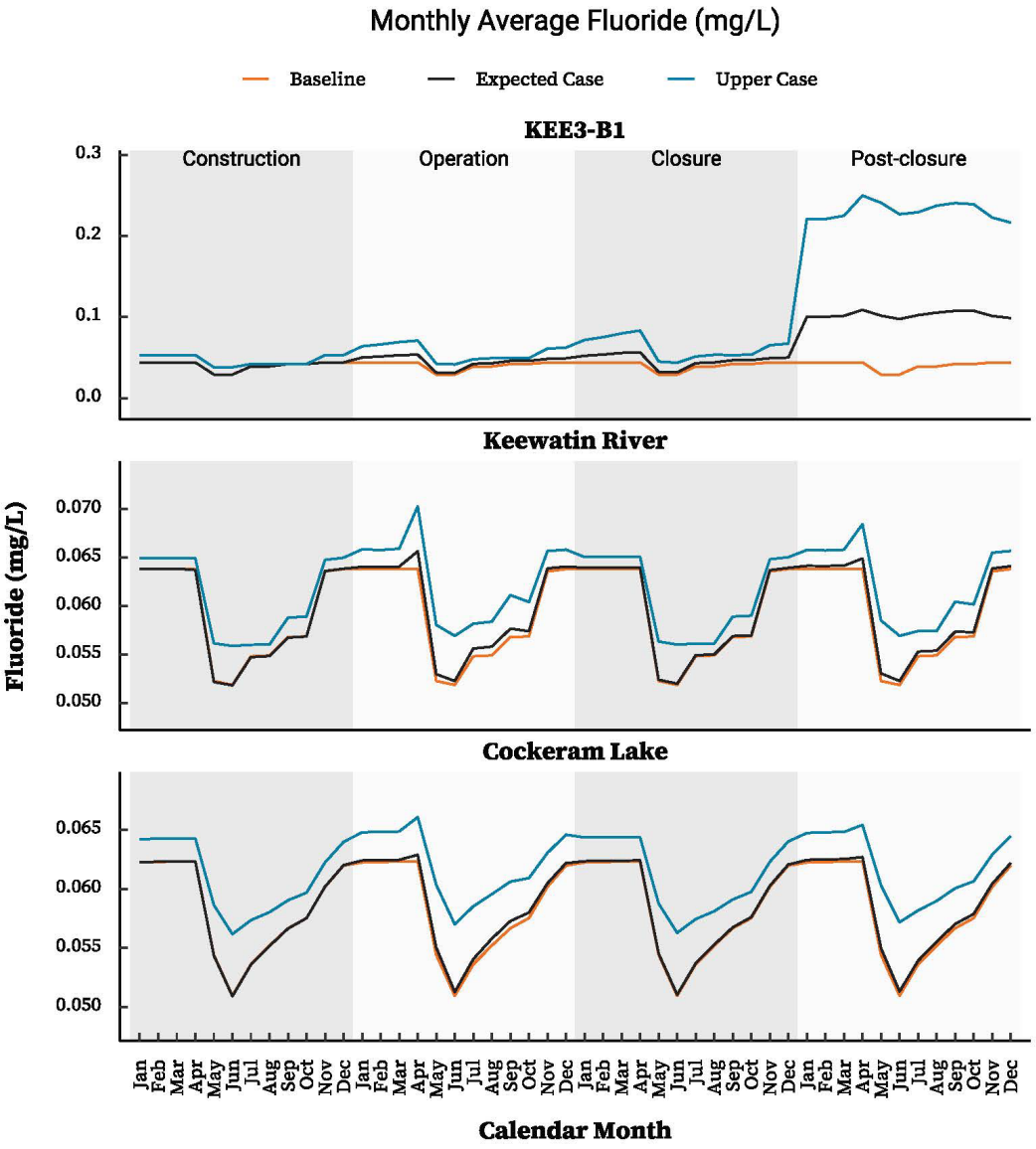


Figure G-35 Predicted Monthly Mean Fluoride Concentrations in Tributary KEE3-B1, the Keewatin River (QM06), and Cockeram Lake (QM08) in Construction, Operation, Closure, and Post-Closure

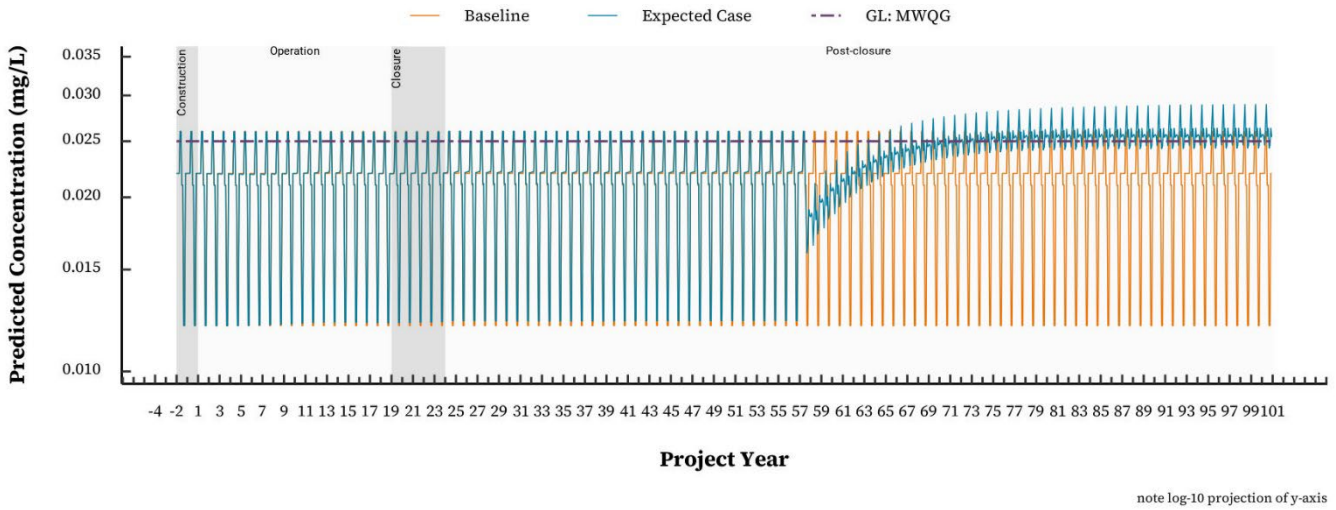


Figure G-36 Predicted Project vs. Baseline Concentrations of Total Phosphorus in Tributary KEE3-B1 for the Expected Case Scenario

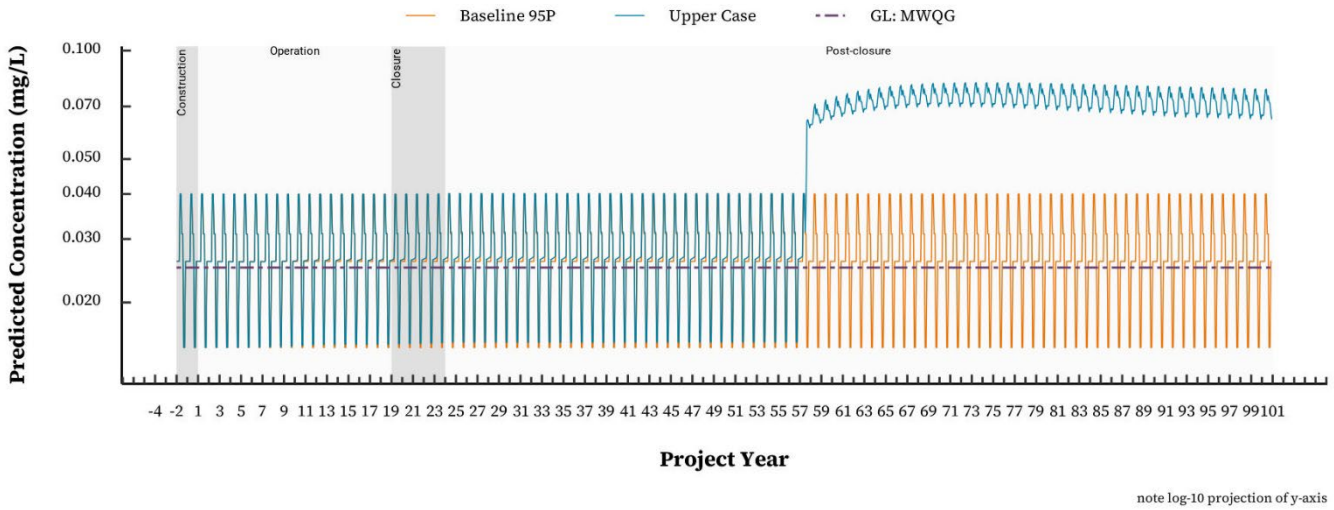


Figure G-37 Predicted Project vs. Baseline Concentrations of Total Phosphorus in Tributary KEE3-B1 for the Upper-Case Scenario

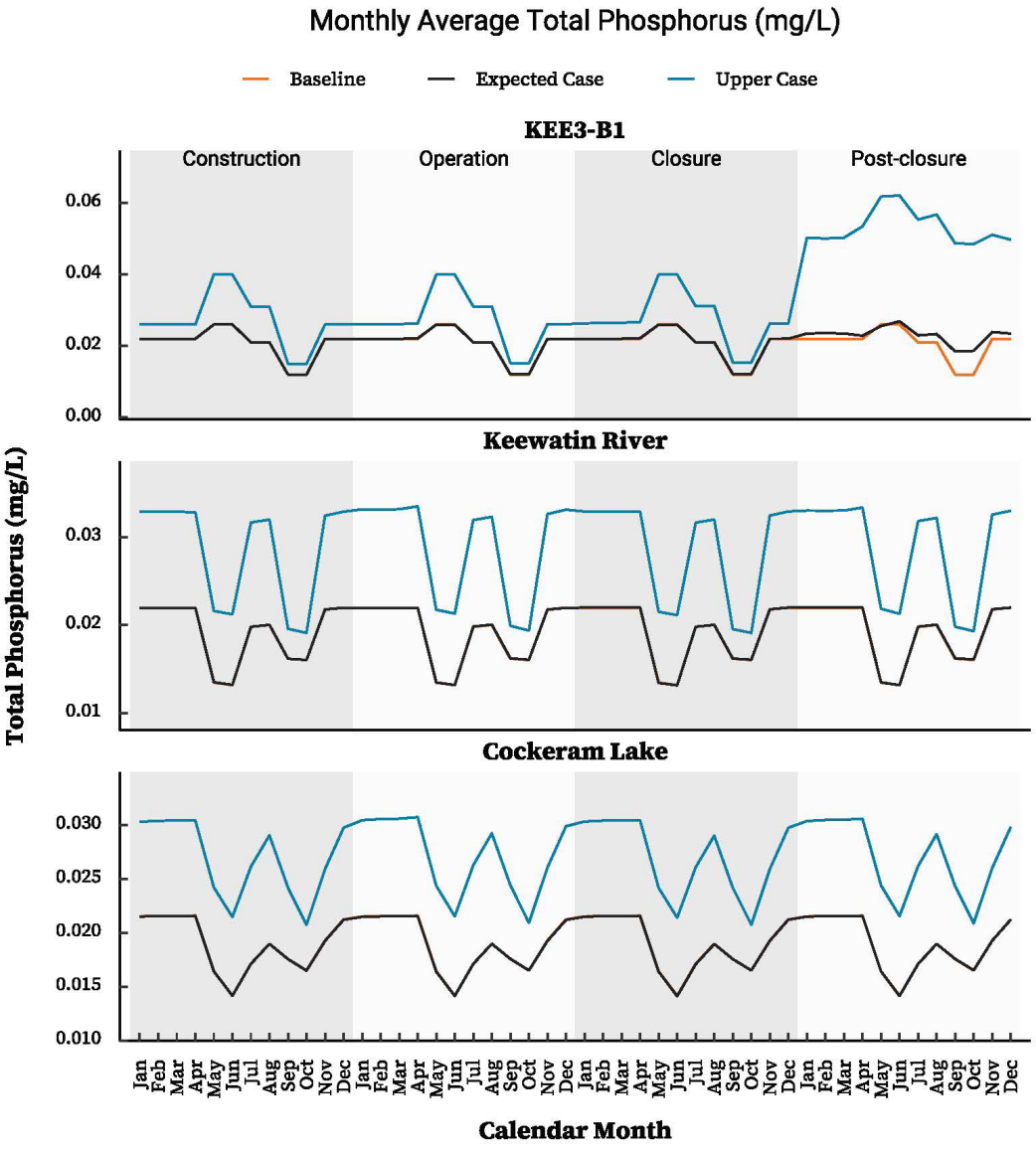


Figure G-38 Predicted Monthly Mean Total Phosphorus Concentrations in Tributary KEE3-B1, the Keewatin River (QM06), and Cockeram Lake (QM08) in Construction, Operation, Closure, and Post-Closure