Volume 1 -
Project Description

Project Description

for the

Pine Point Project

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VERSION HISTORY

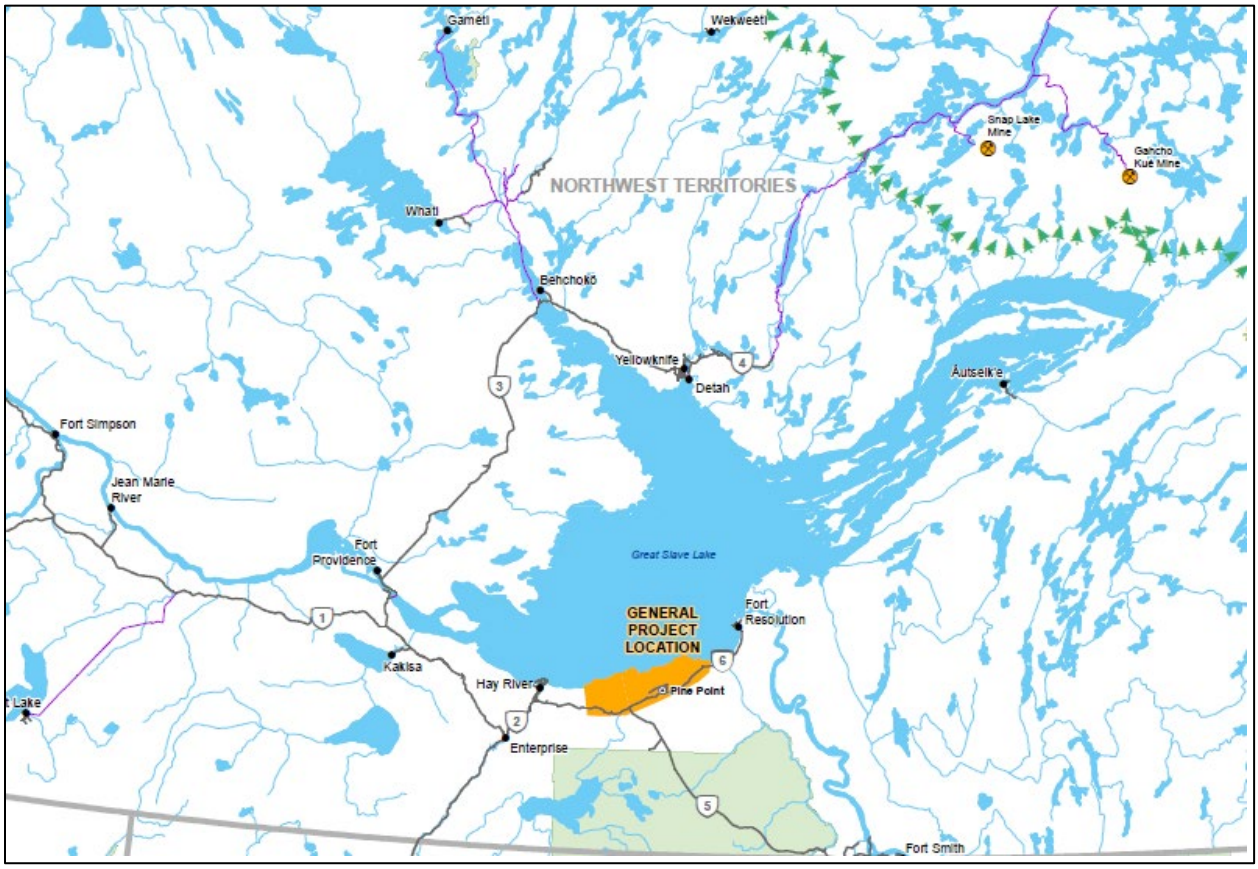
Revision #	Section(s) Revised	Description of Revision	Prepared by	Issue Date
0	-	All	Pine Point Mining Limited	15 December 2020

PLAIN LANGUAGE SUMMARY

This document is a plain language summary of the Project Description for the Pine Point Project. It is much shorter than the Project Description and covers only some of the topics. Readers should read the full Project Description if they are interested in more details about this information.

Overview

Pine Point Mining Limited (PPML) is proposing to build the Pine Point Project (Project), a zinc and lead mine, in the Northwest Territories (NWT), 175 kilometres (km) south of Yellowknife, 42 km east of Hay River and 53 km southwest of Fort Resolution. The property where the mine will be built is a “brownfield” site, meaning that the land has been used historically for mining activities.



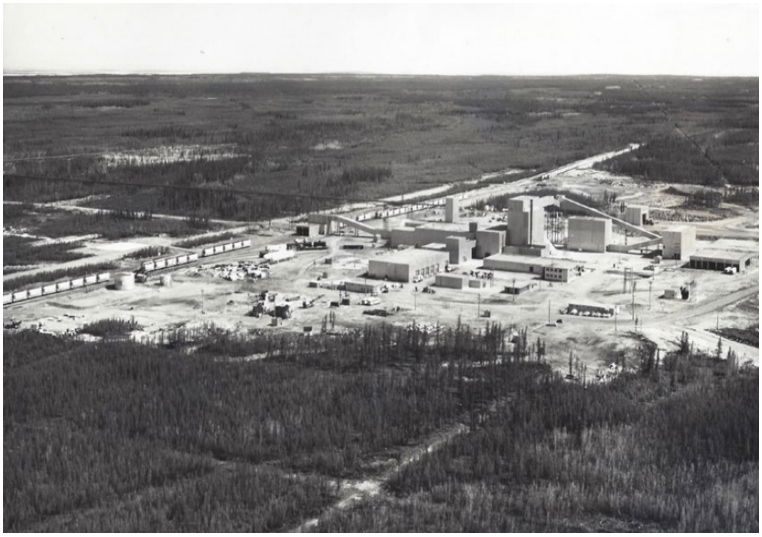
Zinc and lead will be mined using open-pit and underground mining methods. A process plant, camp, and other facilities will be built to support the mining operation. In total, about 40 million tonnes of rock containing zinc and lead will be mined for the Project. Zinc and lead will be sold to smelters, mainly in North America and Asia.

Developer

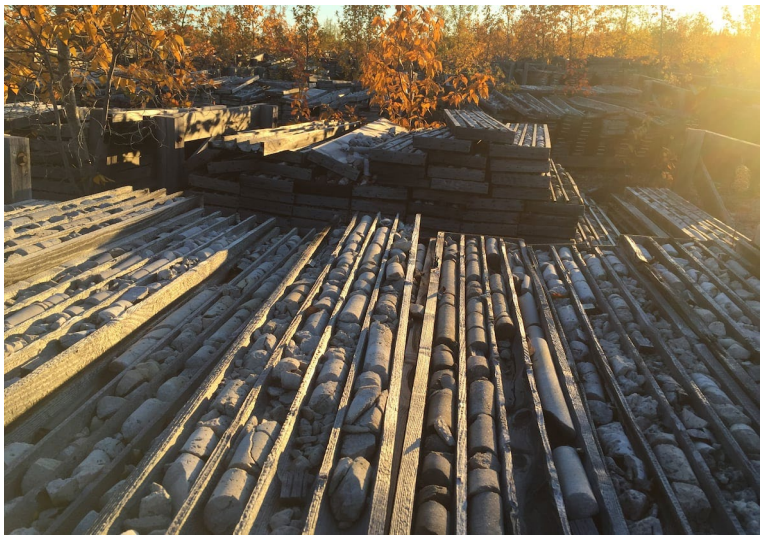
PPML is owned by Osisko Metals Limited (Osisko). Osisko is a Canadian exploration and mining company that focuses on mining of zinc.

Historical Mining at Pine Point

Zinc and lead were first discovered at Pine Point in 1898 by prospectors heading to the Klondike gold rush. Following several years of exploration, Cominco Ltd. (Cominco) built and operated a mine at the Pine Point property between 1964 and 1988. About 50 open pits and some of the facilities used by Cominco remain on the property.



Exploration at Pine Point continued throughout the 1990s and 2000s by Tamerlane Ventures Inc., Darnley Bay Resources Ltd., and PPML. Osisko bought PPML in 2018 with the purpose of developing a new mine at the property.



Project Schedule

To develop the Project, PPML must first obtain a number of permits and licences from the governments of Canada and the NWT. An environmental assessment of the Project is also required. This process will take about two years.

Construction for the Project is expected to begin in 2023 and will take about a year and a half to complete. During the construction period, the mine facilities will be built, and the site will be prepared for mining. Mining will take about 10 to 15 years and will begin in about 2024. The operation period will include mining the open pits and underground mines and processing the mined rock at the processing plant.

Once mining is finished, in about 2037, closure and reclamation will take place. Closure and reclamation activities will take about 15 years. More information about this topic can be found in the "Closure and Reclamation" section below.

Nearby Communities

The mine site is located on the traditional territories of the Deninu Kué First Nation, the K'atl'odeeche First Nation, and the Northwest Territories Métis Nation. The communities closest to the mine are the Deninu Kųé First Nation, the K'atl'odeeche First Nation, Hay River Métis, Fort Resolution Métis, and Fort Smith Métis.

Engagement

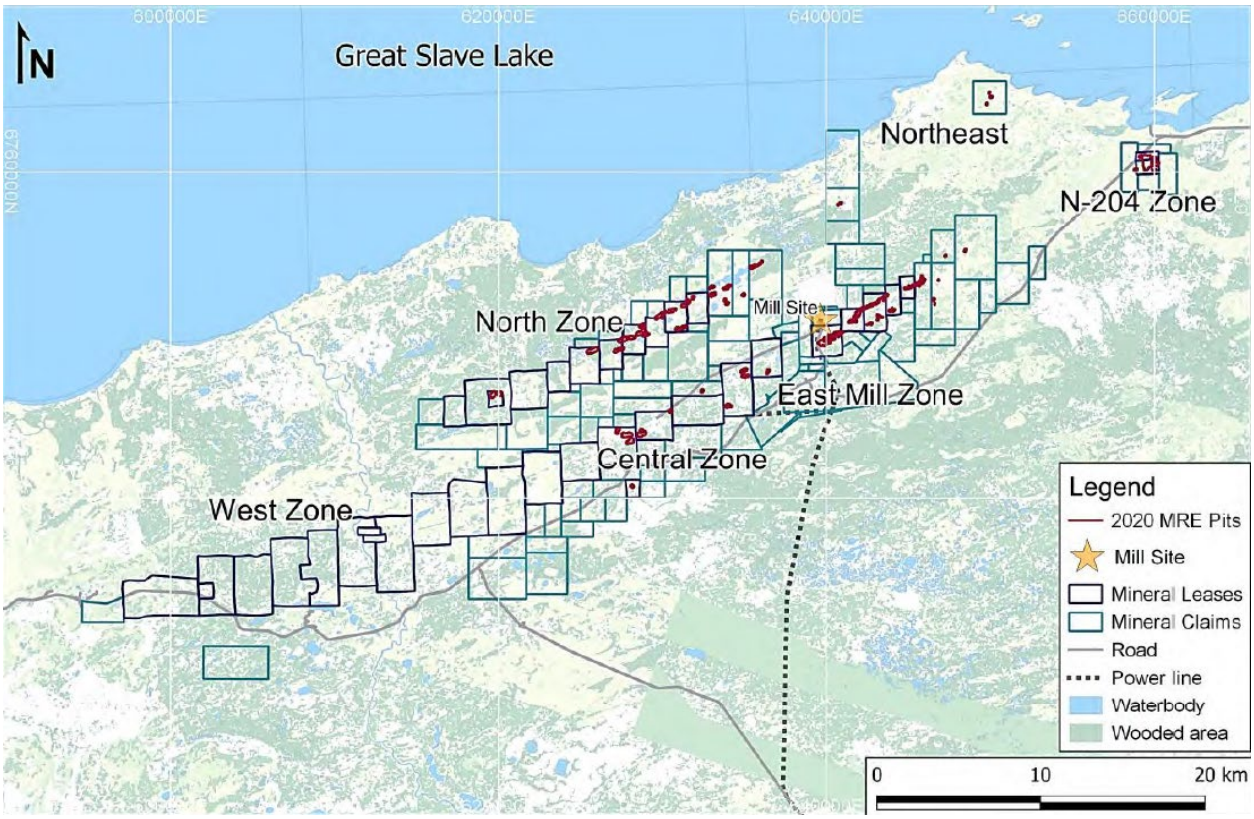
PPML has engaged with affected communities about the details of the Project. During engagement, comments, concerns, and insights provided by community members were recorded and considered in the Project design.

To accompany the Project Description, PPML has prepared an engagement plan framework for the Project. The purpose of the engagement plan is to explain how PPML will continue to engage with affected communities and other interested parties. The engagement plan can be found in a document called the "Engagement and Collaboration Framework" in Volume 2.

Mining

There are about 60 zinc-lead deposits at the Pine Point property. Deposits are locations where there are concentrations of lead or zinc minerals. Most of the lead and zinc will be mined from open pits. However, some of it is deeper in the ground and will be removed using underground mining.

Open pits are mainly located on the east side of the property in the "East Mill Zone", shown on the map below. Underground mines are located in the "West Zone" and "Central Zone".



Rock containing lead and zinc will be mined using excavators or shovels and haul trucks.

Processing

A new processing plant will be built to process the mined rock. Haul trucks will move the rock from the open pits and underground mines to the plant. The processing plant will crush the rock and concentrate the zinc and lead into a final product that can be sold to smelters.

Waste Management

Some of the rock removed from the open pits and underground mines is not useable. This rock is called “waste rock”. Some of the waste rock will be used for construction purposes, such as to build roads. The rest of it will be stored in piles or in open pits. Tailings, which are the leftover materials from processing, will also be stored in open pits.

Using existing open pits for storing waste rock or tailings will reduce the need for new land disturbances at the site.

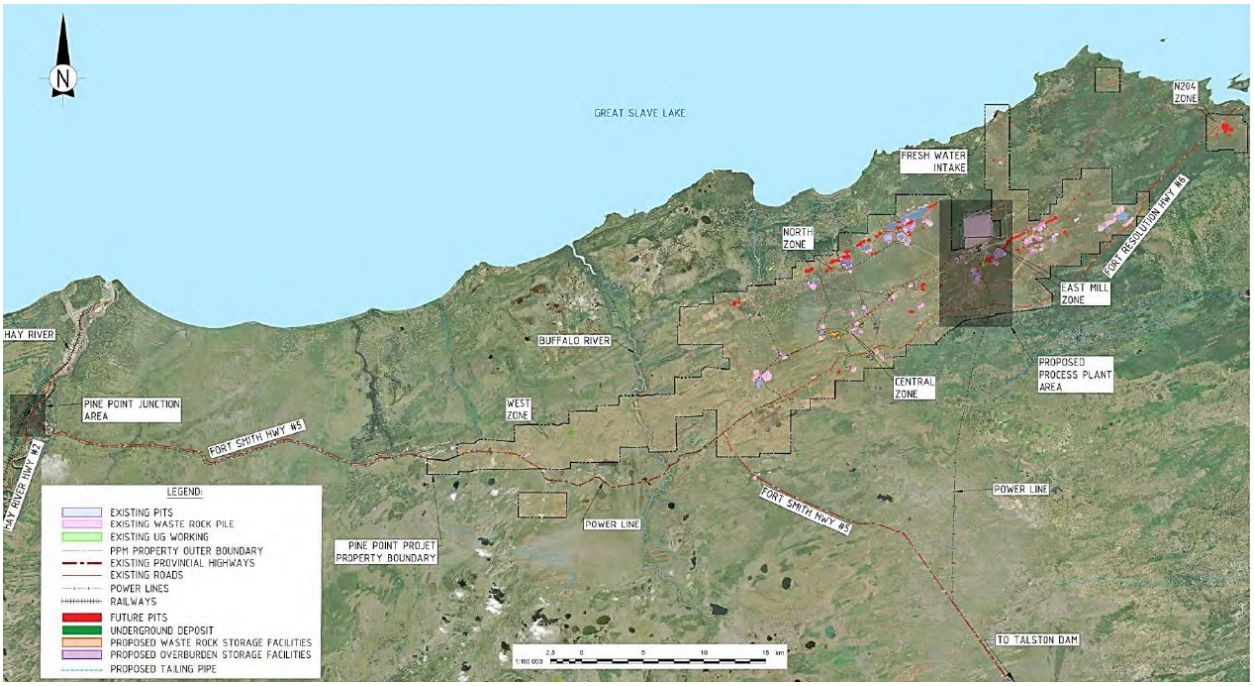
Water Management

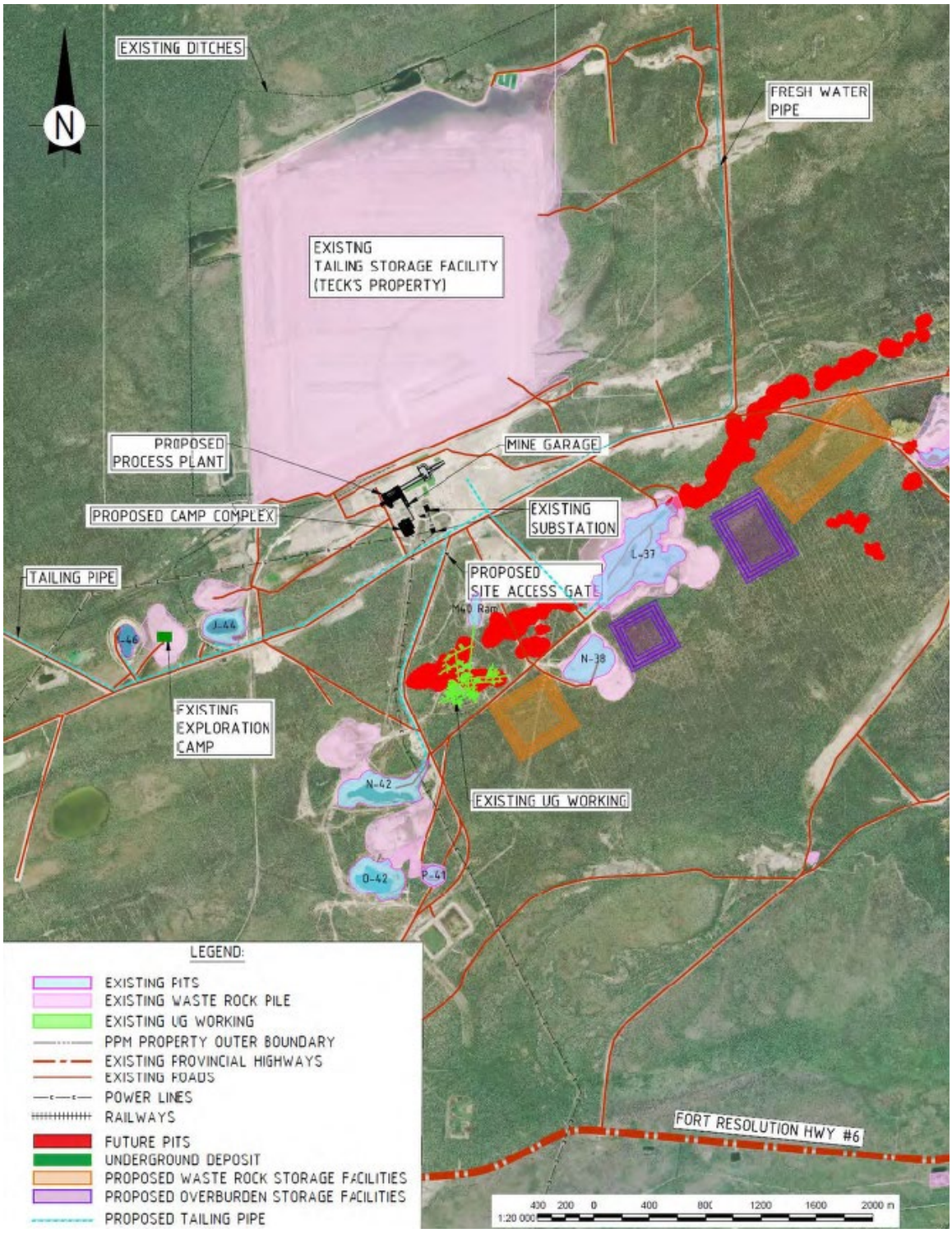
An important part of the mining operation will be the management of water on site. The goal for water management will be to prevent water from flowing into areas where it could become contaminated and by collecting and managing rainfall and runoff within the mine site area. Water that flows into the open pits and underground mines will be pumped into existing open pits or injected deep into the ground.

Water will be used at the processing plant, in the camp, and at other facilities. Water for drinking, showers, and cooking will come from Great Slave Lake. Water for processing and other uses may come from nearby open pits, storage lagoons, or maybe Great Slave Lake.

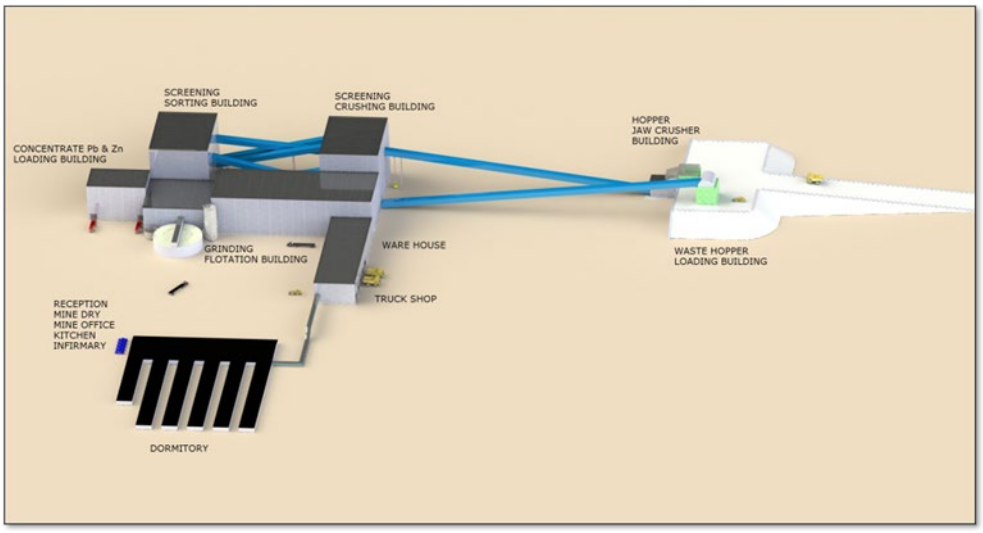
Buildings and Infrastructure

New buildings and infrastructure will be needed to support the mining operation. A gate house will be built at the mine entrance, along with fencing and a parking area. Other facilities will include maintenance buildings and a warehouse. A laydown area will be built to store equipment and supplies.



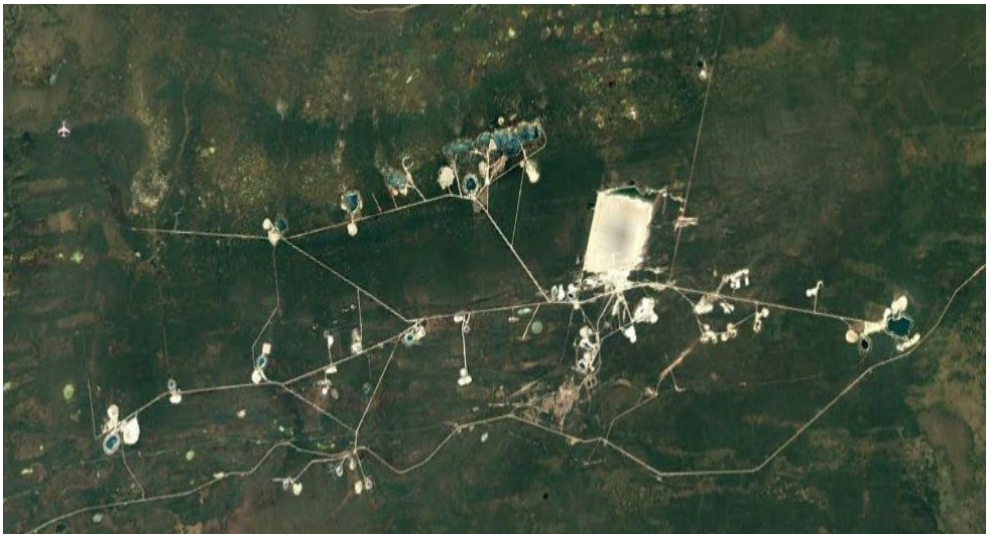


The new processing plant will be built at the same location as the historical Cominco mill site. Some of the infrastructure that was leftover by Comino will be used for the new plant, including the water storage ponds and the open pits that are close by.



Workers will stay in a camp that will be large enough for about 500 people during construction and for about 250 people during operation. The camp will have washroom and shower facilities, dining and kitchen areas, and a gymnasium and fitness room. An office and dry will be built next to the camp.

Over 100 km of roads built by Cominco remain on the property and provide good access throughout the mine site. These roads will be used for the Project as much as possible. Some of these roads may need to be upgraded so they are safe to use and some new roads may be needed for the Project.



Power for the mine will come from the Northwest Territories Power Corporation, who own and operate the Taltson Hydro Dam, and the mine site will also generate its own power from natural gas, with diesel as a back-up.

Explosives will be used during mining to help break the rock into smaller pieces so it can be more easily removed. Explosives will be transported to the mine site by truck and will be stored in special buildings on or storage pads away from other buildings and facilities.

The mining operation will use different types of chemicals and fuels, including diesel, gasoline, engine oil, antifreeze, and propane. Chemicals and fuels will be stored in a secure area that will be designed to catch hazardous materials if they leak or spill.

Jobs and Opportunities

The Project will be good for the economy of the NWT. It will operate for several years after the closure of some of the other mines in the NWT and will provide a continued source of jobs for nearby communities. During construction, there will be about 280 people employed at the mine, with a peak of about 500. About 460 people (two shifts of 230 on rotation) will be needed during mine operations.

The Project has entered into “Collaboration Agreements” with the Deninu Kųę First Nation and the Northwest Territories Métis Nation, and an “Exploration Agreement” with K'atl'odeeche First Nation. These agreements are aimed at providing jobs and business opportunities for these communities, as well as training and education opportunities.

Closure and Reclamation

Once mining is finished, closure and reclamation will occur. The mine facilities will be dismantled and taken away or disposed of in open pits. Brownfield areas, previously used for mining, and used by the Project will be returned to their current state. “Greenfield” areas that are not affected by historical mining activity will be returned to a sustainable and healthy environment that is similar to the current state. The closed mine site will be monitored until the site meets regulatory requirements.

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ABBREVIATIONS

Abbreviation	Definition
ABA	Acid Base Accounting
AEMP	Aquatic Effects Monitoring Program
AMC	AMC Mining Consultants Canada
ARD	acid rock drainage
ATV	all-terrain vehicle
$CaCO_3$	calcium carbonate
CNG	compressed natural gas
Cominco	Cominco Ltd.
DMS	Dense Media Separation
EA	Environmental Assessment
ESR	Excavation Support Ratio
GNWT	Government of the Northwest Territories
HDPE	high density polyethylene
HNO_3	nitric acid
HTD	hydrothermal dolomitization
HVAC	heating, ventilation, and air conditioning
ICP-MS	inductively coupled plasma mass spectrometry
ID	identification
ITK	Indigenous Traditional Knowledge
km	kilometre
LOM	Life of Mine
ML	metal leaching
MPA	maximum potential acidity
MRE	Mineral Resource Estimate
MVEIRB	Mackenzie Valley Environmental Impact Review Board
MVLWB	Mackenzie Valley Land and Water Board
MW	megawatt
NAG	net-acid generation
non-PAG	non-potentially acid generating
NP	neutralization potential
NPR	neutralization potential ratio
NSR	gross revenue
NTPC	Northwest Territories Power Corporation
NWT	Northwest Territories
OB	overburden
Osisko Metals	Osisko Metals Incorporated

Abbreviation	Definition
PAG	potentially acid-generating
PEA	Preliminary Economic Assessment
PPML	Pine Point Mining Limited
Project	Pine Point Project
PRS	Pressure Reduction System
QXRD	quantitative X-ray diffraction
RMR	rock mass ratio
SEMP	Socio-economic Management Plan
SFE	Shake Flask Extraction
SOR	Statutory Orders and Regulations of Canada
Tamerlane	Tamerlane Ventures Inc.
TDA	tailings disposal area
TEDV	typical element distribution values
WR	waste rock
WRSF	waste rock storage facility
XRF	X-Ray Fluorescence
XRT	X-Ray Transmission
ZnEq	zinc equivalent

UNITS OF MEASURE

Units of Measure	Definition
ha	hectare
hp	horsepower
km	kilometre
kv	kilovolt
kw	kilowatt
kwh	kilowatt hour
m	metre
m/s	metres per second
m^3	cubic metre
m^3/d	cubic metres per day
m^3/h	cubic metres per hour
Mlb	million imperial pounds
mm	millimetre
Mm^3	million cubic metres
Mt	million tonnes

Units of Measure	Definition
MW	megawatt
t	tonne
t/m^3	tonnes per cubic metre
tpd	tonnes per day
V	volt

1 PROJECT OVERVIEW

1.1 General Project Information

1.1.1 Project Title

Pine Point Project

1.1.2 Name and Address of the Developer

Pine Point Mining Limited (PPML; Table 1-1) is the sole proponent for the Pine Point Project (the Project). PPML is a 100% owned subsidiary of Osisko Metals Incorporated (Osisko Metals).

Table 1-1: Name and Contact Information of Applicant

Name of Applicant	Pine Point Mining Limited
Address	1100 Avenue des Canadiens-de-Montréal, Suite 300
City	Montreal
Province	Québec
Postal Code	H3B 2S2
Telephone	514-513 6710
Chief Operating Officer and President	Jeff Hussey

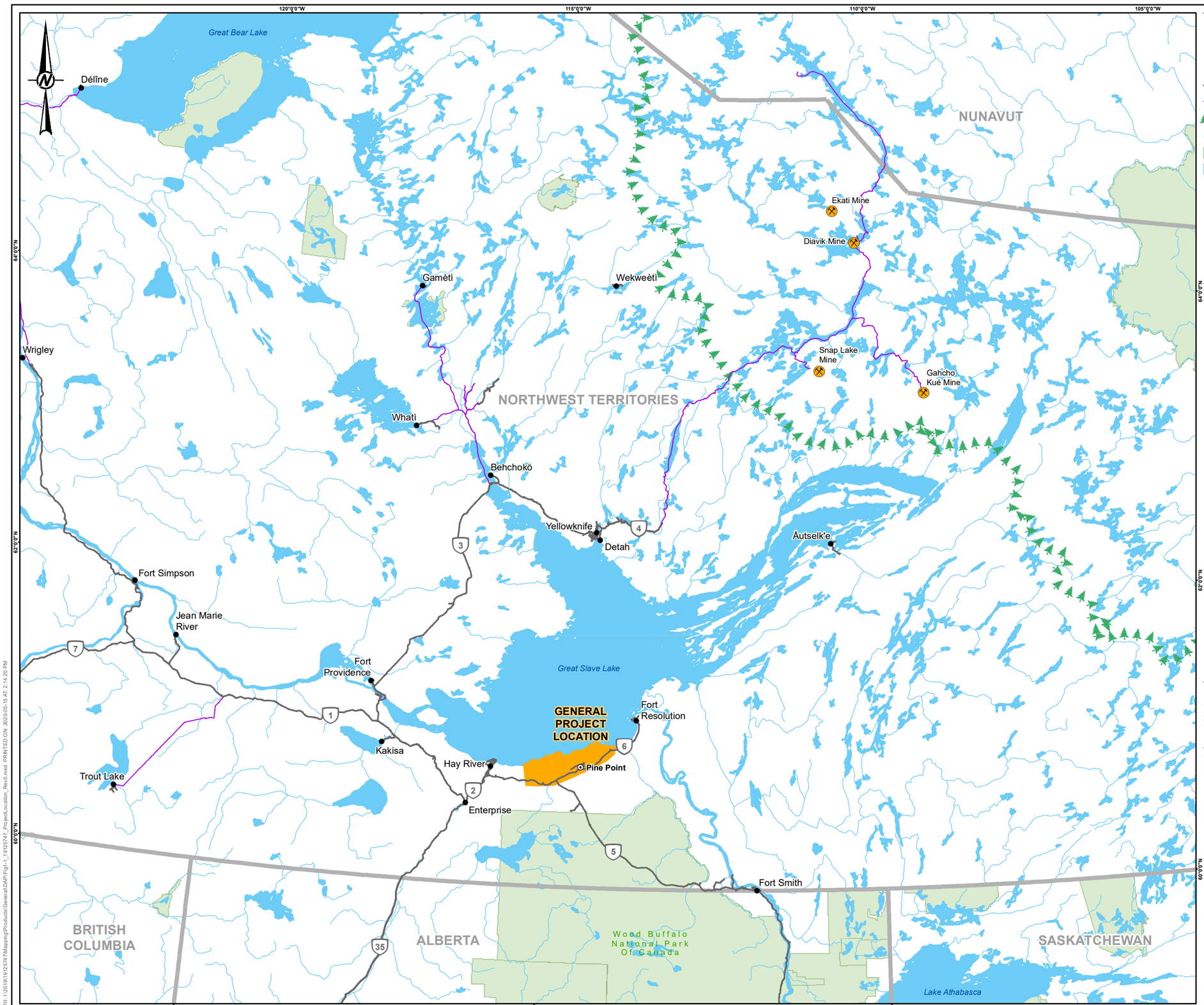
1.1.3 Project Type

Pine Point is a brownfield site and the location of the former Pine Point Mine managed by Cominco Ltd. (Cominco), operated between 1964 and 1988. The Project is currently composed of approximately 72 deposits of which 58 deposits are included in the 2020 Mineral Resource Estimate totaling approximately 52.4 Million tonnes (Mt) of mineralized material grading 4.64% zinc and 1.83% lead (6.47% Zinc Equivalent [ZnEq]) containing approximately 5.3 billion pounds of zinc and 2.1 billion pounds of lead in-situ. A total of 39.1 Mt of combined mineralized material is planned to be mined for the Project using open pit and underground mining methods. The planned processing capacity is 6,000 tonnes per day (tpd) ramping up to 11,250 tpd with an associated mine life of 10 years or longer following a Preliminary Economic Assessment (PEA) with considerable resource expansion and exploration potential.

The Project will consist of open pit and underground mining for zinc and lead, construction and operation of a processing plant (or “concentrator”) that will include pre-concentration facilities, storage and management of processed mineralized material and waste materials, water management, construction and operation of ancillary support facilities including a camp for workers and the transportation of zinc and lead concentrates to global markets.

1.1.4 Project Location

The Pine Point Project is located in the South Slave Mining District, south of Great Slave Lake in the Northwest Territories (NWT), approximately 175 km directly south of Yellowknife, 75 km east of Hay River, and 53 km southwest of Fort Resolution (Figure 1-1). It is located on a brownfield site resulting from Cominco’s historical mining and milling operations and includes the area of the former town of Pine Point and associated working accommodations.



LEGEND

- FORMER PINE POINT TOWN SITE
- POPULATED PLACE
- EXISTING MINE
- ALL-SEASON ROAD
- WINTER ROAD
- TREELINE
- WATERCOURSE
- PARK/PROTECTED AREA
- WATERBODY
- GENERAL PROJECT LOCATION

0 50 100

1:3,000,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS AND PROTECTED AREAS OBTAINED FROM CONSERVATION AREAS REPORTING AND TRACKING SYSTEM (CARTS), CANADIAN COUNCIL ON ECOLOGICAL AREAS, 2017.

PROJECTION: ALBERS CONIC EQUAL AREA

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
LOCATION OF PROJECT

CONSULTANT
GOLDER

YYYY-MM-DD	2020-05-15
DESIGNED	DC
PREPARED	BW
REVIEWED	LY
APPROVED	LY

PROJECT NO.	PHASE	REV.	FIGURE
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The mineral claims and mining leases that comprise the Project currently encompass a total of 46,553 ha including 106 mineral claims, 40 mining leases and four surface leases. The closest major transportation hubs are Hay River, Yellowknife, and Edmonton. Access to the Project is presently via all-weather Highways 5 and 6. Table 1-2 provides the coordinates for the proposed Project.

Table 1-2: Approximate Project Coordinates

Extent	Coordinates (degrees, minutes, seconds)
Minimum latitude	60°43'5.16"N
Maximum latitude	60°57'12.6"N
Minimum longitude	115°13'9.84"N
Maximum longitude	114°2'25.08"W
Map Sheets	NTS 85B 11, 14, 15 and 16

The Project is within the South Slave Region, and the traditional territories of the Akaitcho Dene First Nations, K'atl'odeeche First Nation, and the Northwest Territories Métis Nation. Of the Akaitcho Dene First Nation member nations, the Deninu Kųę First Nation is in close proximity to the Project. The Hay River Métis Council and the Fort Resolution Métis Council have been engaged under the Northwest Territories Métis Nation. The Project is also within the eastern extent of the Interim Measures areas for the Dehcho First Nations of which the K'atl'odeeche First Nation is a member. Currently the land claims in the area remain unsettled. Lands are managed by the Government of the Northwest Territories (GNWT), except for the historical railbed between Hay River and Pine Point, which remains federally managed land. Outside of the Project claims and leases, there is a surrounding Land Withdrawal Order (South Slave Region) for surface and subsurface rights (R-058-2014 under the *Northwest Territories Lands Act*).

1.1.5 Project Timeline

A conceptual Project timeline for the permitting, construction, and operational stages is presented in Table 1-3 below.

Table 1-3: Pine Point Project Schedule

Activity	Start	End
Feasibility Study	Q3 2020	Q3 2022
Environmental Assessment	Q4 2020	Q2 2022
Permitting	Q3 2022	Q3 2023
Confirmation and Exploration Field Program	Q1 2021	Q3 2023
Construction	Q3 2023	Q4 2024
Production (Operations)	Q4 2024	Q4 2037
Closure and Reclamation (excluding progressive closure activities)	Q4 2037	Q4 2042
Transition	Q4 2037	Q4 2039
Active Care	Q4 2039	Q4 2042
Passive Care	Q4 2042	Approx. 2052

1.2 Purpose of the Project

1.2.1 Objective

A PEA was completed by PPML and made publicly available[1] on July 30, 2020. The PEA was based on the NI 43-101 Mineral Resource Estimate listed in Table 1-4 The NI 43-101 PEA report was prepared by experienced and qualified independent consultants using recognized engineering standards. The results of the study indicate that the proposed Project has technical and financial merit using the base case assumptions. The results are considered sufficiently reliable to guide PPML's management in a decision to advance to the next phase of the Project development: that being the initiation of a feasibility study, which anticipates potentially redeveloping the former Pine Point mine site to produce concentrates of zinc and lead for shipment to independent smelters worldwide.

The concentrates produced from the mine (zinc and lead) are to be sold to smelters for use in industrial applications. Zinc is used for galvanization (60%), die-casting alloys (14%), brass castings (10%), paints, rubber, and other products, while lead is used, for example, in car batteries, pigments, ammunition, and lead crystal glass.

Table 1-4: Pine Point Indicated and Inferred Mineral Resources Estimate

Method	Zone	Cut-off Grade (ZnEq%)	Indicated Mineral Resources				Inferred Mineral Resources			
			Tonnage (kt)	ZnEq (%)	Pb (%)	Zn (%)	Tonnage (kt)	ZnEq (%)	Pb (%)	Zn (%)
Pit Constrained Mineral Resources	Central	1.85	1,700	7.31	1.71	5.61	3,200	7.89	2.02	5.86
	East Mill	1.85	6,000	5.38	1.39	4.00	3,800	5.05	1.02	4.03
	North	1.90	5,300	6.98	2.12	4.86	10,800	5.70	1.64	4.06
	N204	2.05	-	-	-	-	9,400	4.58	0.99	3.59
Underground Mineral Resources	Central	5.00	-	-	-	-	2,300	7.38	1.58	5.80
	West	5.00	-	-	-	-	8,200	11.04	3.78	7.25
Total Pit Constrained		**1.85 - 2.05**	**12,900**	**6.29**	**1.73**	**4.56**	**27,200**	**5.48**	**1.37**	**4.11**
Total Underground		**5.00**	-	-	-	-	**10,500**	**10.23**	**3.30**	**6.93**
	Total Combined		**12,900**	**6.29**	**1.73**	**4.56**	**37,600**	**6.80**	**1.91**	**4.89**

1.2.2 Need for the Development

PPML expects to begin production at Pine Point in 2024 and continue until 2034 based on the current Mineral Resource Estimate. The Project will benefit the NWT workforce and provide commercial opportunities in the region, especially the South Slave.

The Project will commence production in the year prior to the current forecasted closure of Diavik Diamond Mine (2025) (Rio Tinto 2020). The Gahcho Kué Diamond Mine is expected to cease operations around 2029 after 12 years of operations (De Beers 2020). The closure dates for these two mines will be influenced by their mine plans. The Ekati Diamond Mine is currently scheduled for closure in 2034 (Dominion 2020) after completion of the Jay and Misery Underground projects.

[1] Posted to SEDAR – System of Electronic Data Analysis And Retrieval, www.sedar.com

The Jay project was delayed in 2018 and is currently expected to recommence in 2021 (CBC 2018). The Jay project, if it proceeds, has an estimated mine life of 11 years.

The Project is anticipated to span the closure of both the Diavik and Gahcho Kué mines and will provide substantial continued employment opportunities for the workforce of the NWT with skill sets applicable to open-pit mining and underground mining operations, such as heavy equipment operators and maintenance personnel.

The Project will take advantage of the proximity of the Taltson Hydroelectric facility and use the available power, supplemented by onsite diesel and compressed natural gas generators.

1.2.3 Economic Projections

The following summarizes key outcomes as determined from the updated Mineral Resource Estimate (MRE) and PEA Study:

- pit constrained Indicated Mineral Resources[2] of 12.9 Mt grading 1.73% Pb and 4.56% Zn
- underground and pit constrained Inferred Mineral Resources[3] of 37.6 Mt grading 1.91% Pb and 4.89% Zn
- production of 3,279 million pounds (Mlb) of zinc and 1,438 Mlb of lead over a 10-year mine life from 39.1 Mt of mineral inventory, with an average diluted grade of 1.79% Pb and 4.38% Zn (6.17% ZnEq)
- Life of Mine (LOM) lead and zinc concentrate grades of 63% and 59%, respectively; LOM lead and zinc recoveries of 92.8% and 86.7%, respectively
- gross revenue (NSR) of $4.44 billion
- initial capital costs of $556 million, including a $71 million contingency. Sustaining capital costs of $410.9 million. Reclamation and closure costs of $62.8 million
- LOM operating costs of $1.76 billion, with federal, territorial mining taxes of $528.8 million
- average of approximately 280 workers during the construction period (peak of 500) and approximately 456 employees, staff and labour (local and fly-in-fly-out), will be required during operations
- process plant commissioning in Q1 2025; full commercial production by Q4 2025

As Project planning advances and the understanding of the associated workforce requirements evolves, information related to procurement strategies, taxation and royalty revenues, and economic predictions (i.e., Gross Domestic Product) will become available.

PPML has entered into two separate Collaboration Agreements regarding the Project with the Deninu Kųé First Nation and the Northwest Territories Métis Nation. These parties have entered into the agreements to promote a cooperative and mutually respectful relationship governing the

[2] An Indicated Mineral Resource is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics can be estimated with a level of confidence sufficient to allow the appropriate application of technical and economic parameters, to support mine planning and evaluation of the economic viability of the deposit.

[3] An Inferred Mineral Resource is that part of a Mineral Resource for which quantity and grade or quality can be estimated on the basis of geological evidence and limited sampling and reasonably assumed, but not verified, geological and grade continuity.

proposed exploration and development activities in the Pine Point area. The agreements reflect the intention to work with each Indigenous community regarding education and training, employment, business and contracting opportunities, information sharing, site visits, and broad outlines of topics for future agreements.

1.3 Project History

1.3.1 Site History

The first Pine Point lead-zinc deposit was discovered in 1898 by prospectors heading to the Klondike gold rush. Cominco Ltd. (Cominco) began exploration at Pine Point in 1929, with test-pitting, drilling, and shaft sinking. In 1948, Cominco began major exploration work and by the early 1960s had advanced the project to construction, which included a railroad, hydroelectric dam, and a town where up to 2,000 people could live.

Cominco commenced large-scale mine production in 1964 based on 21.5 million tonnes averaging 7.2% zinc and 4% lead. The mine eventually ramped up to a production rate of 10,000 tpd. The Pine Point Mine was an assemblage of open pits and underground deposits, distributed along a 70 km trend. Cominco operated the Pine Point Mine between 1964 and 1988 (Figure 1-2, Photo 1), producing 64 Mt grading 7.0% zinc and 3.1% lead from the 52 deposits mined. Fifty deposits were mined by open pit and two using underground mining methods. This historical production illustrates that the mine was composed of several small deposits rather than a single deposit or a few large deposits. The historical deposits mined varied between a minimum of 49,000 tonnes (X-17) to a maximum of 17,500,000 tonnes (X-15), with an average of 1,300,000 tonnes per deposit. Grades during the Cominco era ranged from 4% to 21% Zn + Pb, with an average of 9.9% Zn + Pb combined. The Cominco concentrator eventually processed mineralization at a level of 10,000 tonnes per day (tpd) (Figure 1-2, Photo 2).

Photo 1: Example of one of Cominco's open-pit mines at Pine Point –1960s

Photo 2: Pine Point Process Plant Site looking West Southwest from 1960s

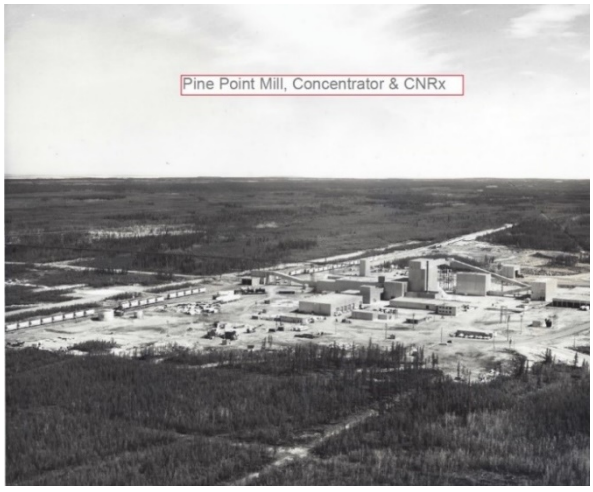


Figure 1-2: Historical Pine Point Mine Photos

Source: Photos courtesy of John Jewitt.

During the same period, Western Mines (later known as Westmin Resources Ltd.), acquired claims west of Cominco's project and mainly west of the Buffalo River. The exploration program was referred to as “The Great Slave Reef Project”. This project was a joint venture of Westmin, controlled by Boliden of Sweden, DuPont Exploration Canada, and Phillip Brothers. Drilling programs conducted between 1975 and 1981 outlined seven additional lead-zinc deposits on the Great Slave Reef Project. Westmin drilled 885 holes totalling 154,816 m from 1975 to 1981.

High operating costs related to the town of Pine Point, high power consumption for mine dewatering, and the acquisition of the Red Dog deposit with nearly double the average grades and better mining characteristics, are some of the reasons that may have prompted Cominco to close its Pine Point mining operation in 1988. Processing of stockpiled material continued until 1988. Reclamation of the mine site was completed in 1991 and included removal of the concentrator, townsite, and railroad.

By August 2001, all of Cominco’s and Westmin claims and mining leases had expired. Prospective parts of the district were staked a few years later by Ross Burns on behalf of the Kent-Burns Group (later Karst Investments LLC).

In 2004, the claims were optioned by Tamerlane Ventures Inc. (Tamerlane), who then acquired 100% interest in 2006. Tamerlane did extensive work including the compilation of historical data, exploration drilling, geophysical surveys, geological interpretation, and multiple mining studies including the Pine Point Pilot Project.

Environmental baseline studies were also conducted by EBA Engineering Consultants Ltd. in 2005 and 2006 and included water quality and stream assessment, vegetation/ecosystem studies, a rare plant survey, wildlife surveys, and a water quality sampling program.

After Tamerlane declared bankruptcy in 2013, limited work continued nonetheless, including targeted underground and open-pit mine plan development that was published in economic studies and Technical Reports.

Avalon Rare Metals, who was developing the Nechalacho rare earth elements project at Thor Lake during that period, considered building a hydrometallurgical plant at the historical Pine Point Mine site. Their plan included the disposal of tailings in the historical mined-out pits. They obtained the approval from the Mackenzie Valley Environmental Impact Review Board (MVEIRB) following an environmental assessment but did not pursue this plan.

Darnley Bay Resources Ltd. acquired the Pine Point assets from Tamerlane in 2016 and changed the company name to Pine Point Mining Limited (PPML) in 2017. They continued with exploration and published two Technical Reports in 2017, including a phased approach for the mine development plan.

In February 2018, Osisko Metals acquired PPML and became sole owner of the Project.

1.3.1.1 Existing Disturbances

All the past mining and exploration activities described in Section 1.3.1 have resulted in existing disturbance being present over a large portion of the area of the Project (i.e., brownfield site). Subsequent to the discovery of lead and zinc at Pine Point and the first exploration efforts in in 1929, the area has seen extensive exploration and mining up to 1988. Following the closure of

the mines in 1988, only small scale, and very localized, exploration has occurred. Surface disturbances documented herein are extensive and largely related to activities prior to 1988.

The disturbance is related to the presence of existing bush roads, cutlines, historic railbed, waste rock piles, and backfilled and mined pits (Figure 1-3 to Figure 1-7). As a result of past mining activities and the brownfield nature of the site, existing conditions do not necessarily reflect historical background conditions (i.e., before any industrial development occurred). Rather, existing conditions represent the outcome of historical and current environmental and socio-economic pressures or factors that have shaped the observed condition of biophysical, social, economic, and cultural components of the surrounding environment.

Photo 1: View of existing open pit N42 at the historical Pine Point Mine site.

Photo 2: View of existing open pit L37 at the historical Pine Point Mine site.

Photo 3: View of existing haul road at the historical Pine Point Mine site.

Photo 4: View of one of many existing roads at the historical Pine Point Mine site.

Figure 1-3: Current Photos of the Historical Pine Point Mine Site

In 2018 and 2019, PPML surveyed the area in the vicinity the Project with LiDAR airborne surveys. This system provides the ability to image the ground surface with vegetation removed at a precision of 0.5 m or better and with the ability to show where the ground surface has been disturbed under the current vegetation. Additionally, GNWT high resolution air photos from 2016-2018 were compiled to provide current photographic documentation of the area of the Project and current state of vegetation (Figure 1-4).

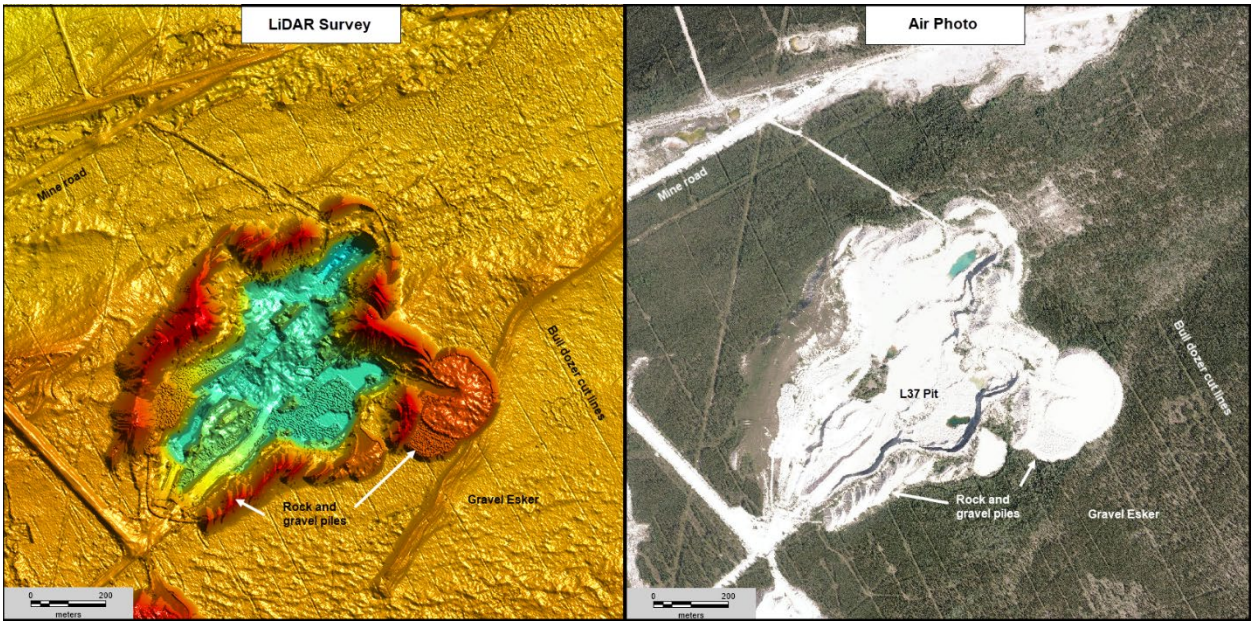


Figure 1-4: Comparison of LiDAR and Air Photo Imagery of the Historical Pine Point Mine Site

Analyses of these data indicate that the main sources of disturbance include the following:

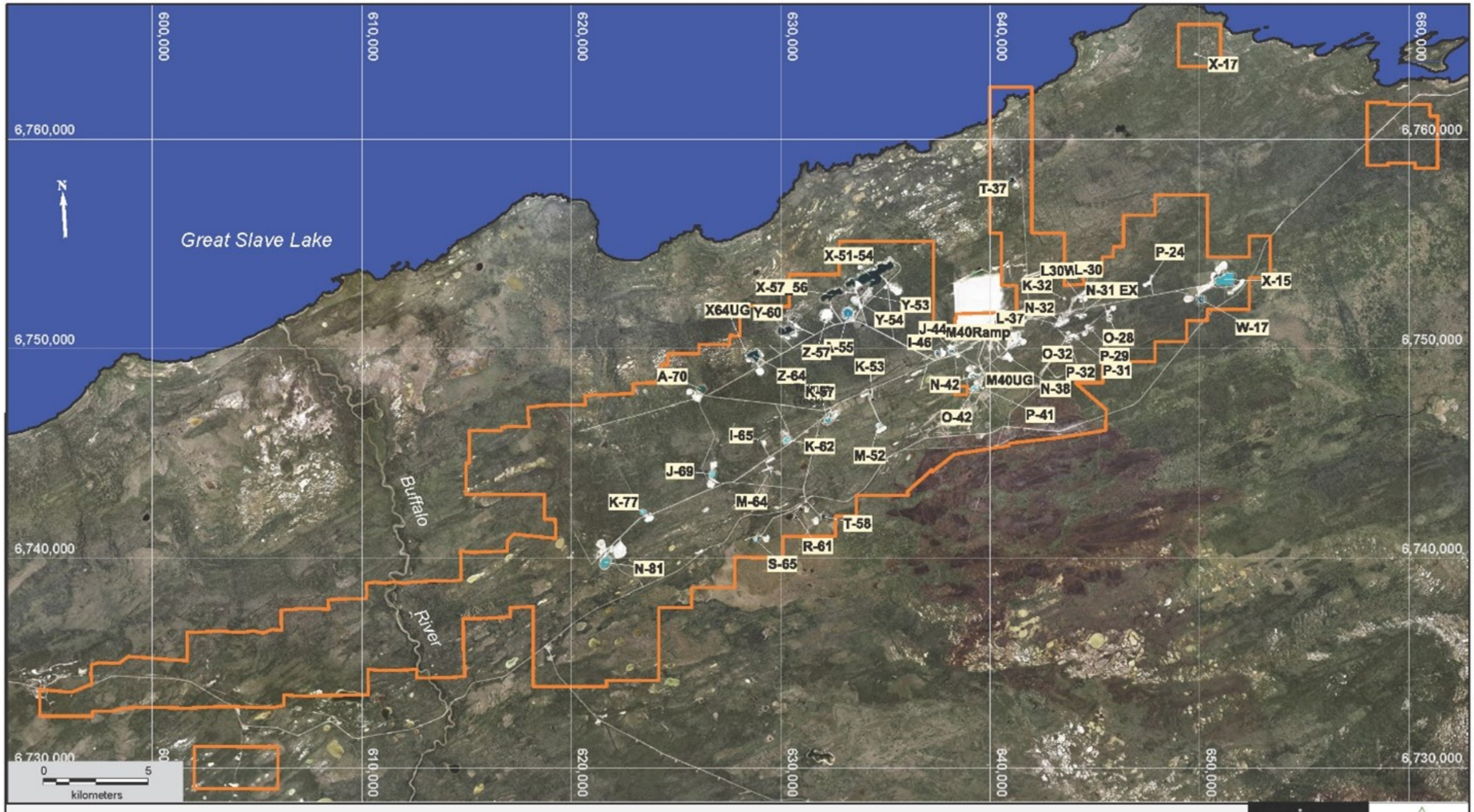
- open pits
- rock and gravel piles
- clearings and gravel pits related to mining, drill hole pads, townsite, tailings facility, core graveyard, former mill site, areas of high concentrations of drill holes, highway gravel pits
- drainage ditches
- haul roads and related mining access, bush roads, railroad right-of-way, power line, bulldozer cut lines, and highway

The area of existing disturbance is estimated in Table 1-5. Approximately 18.2% of the mineral permit area (claims and leases area) has been disturbed from the historical mining activity.

Table 1-5: Estimates of Existing Disturbance within the Mineral Permit Area (Claims and Leases Area) for the Project

Disturbance Type	Area Disturbed within Mineral Permit Area (km^2)	Percentage of Disturbance within Mineral Permit Area (%)
Open pits	5.4	1.2
Rock and gravel piles	15.5	3.3
Mine roads	6.3	1.4
Mine drainage ditches	2.7	0.6
Other disturbed areas	28.2	6.1
Cut lines	20.4	4.4
Pads	0.3	0.1
Bush roads	0.6	0.1
Railroad	0.5	0.1
Power line	1.8	0.4
Highway	2.6	0.6
Total	**84.3**	**18.2**

The mineral permit area is shown in Figure 1-5 and is calculated to be 462.2 km^2.



PPML Mineral Permits

Mineral permits: boundary

Historical Mine Name

N-81

OSISKO METALS

PINE POINT MINING LIMITED

Pine Point Project

High Resolution Air Photo

LiDAR and Orthophoto Date

NAD83 (CSRS) UTM Zone 11 | Nov 2020

Figure 1-5

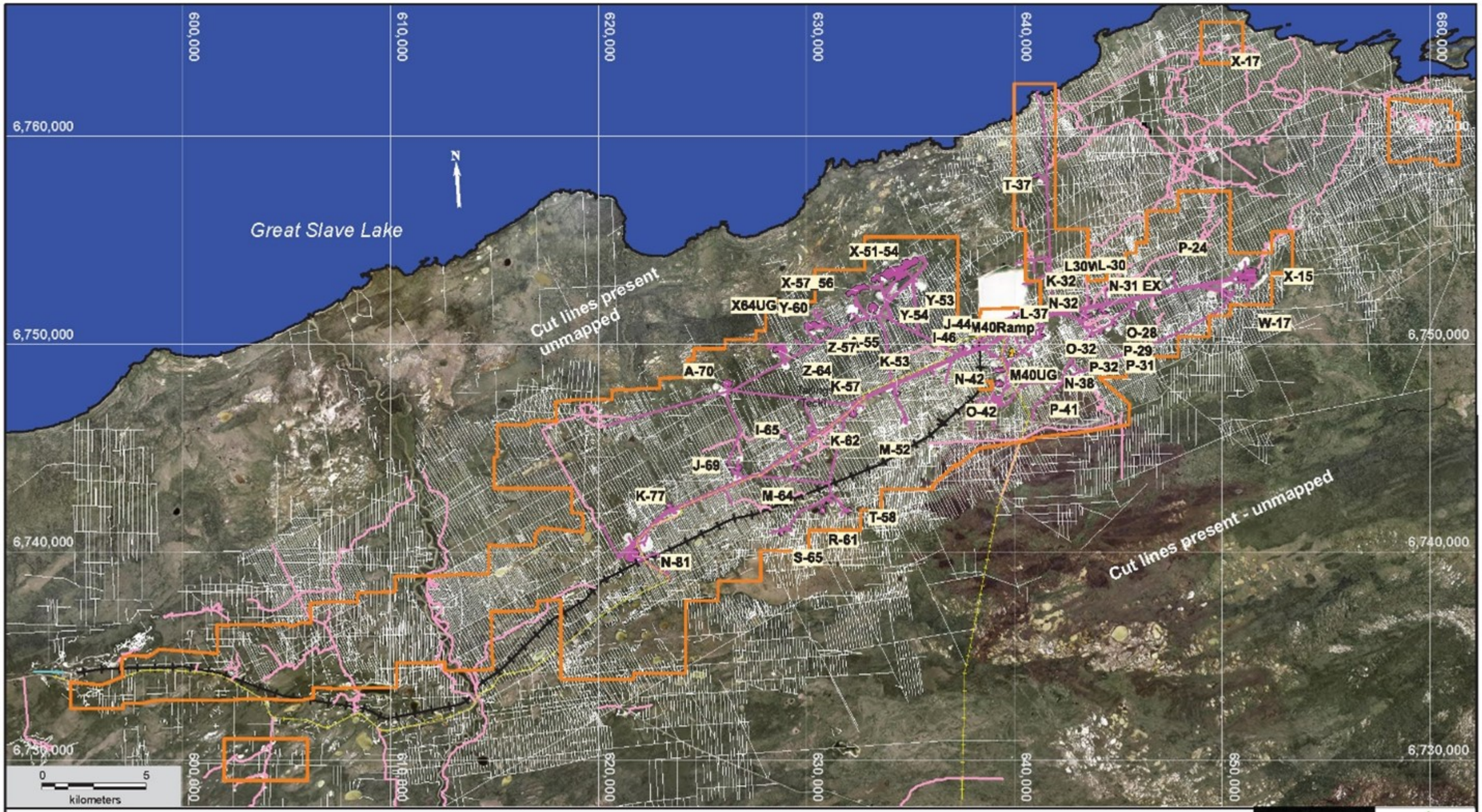
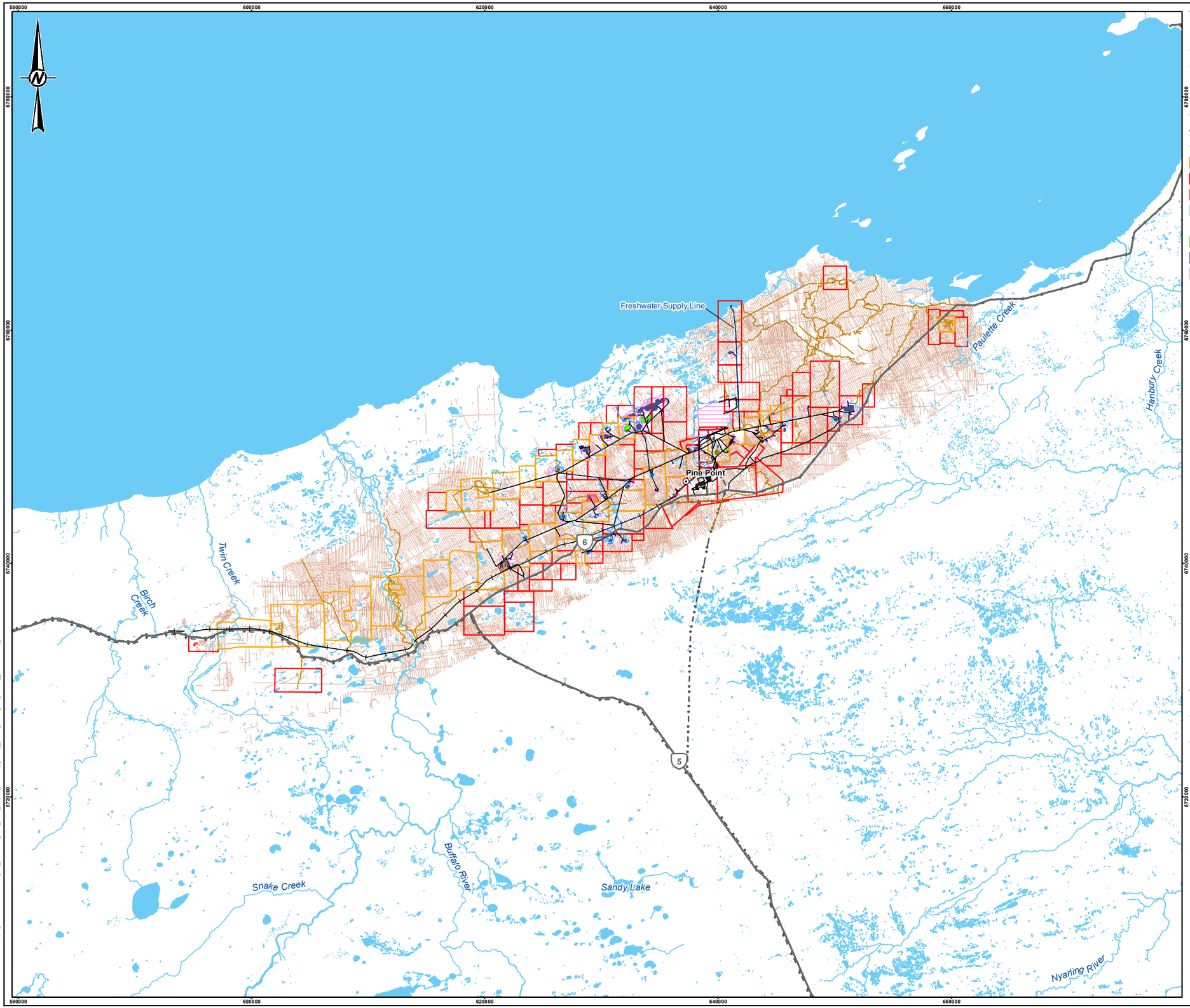

600,000
610,000
620,000
630,000
640,000
660,000
6,760,000
6,750,000
6,740,000
6,730,000
N
Great Slave Lake
Cut lines present unmapped
X-17
T-37
X-51-54
X-57_56
X64UG
Y-60
Y-53
Y-54
L30
L-30
K-32
N-31 EX
P-24
X-15
N-32
L-37
J-44
M40Ramp
I-46
O-28
W-17
Z-57
-55
K-53
O-32
P-29
P-32
P-31
A-70
Z-64
K-57
N-42
M40UG
N-38
O-42
P-41
I-65
K-62
M-52
J-69
K-77
M-64
T-58
R-61
S-65
N-81
Cut lines present - unmapped
0
5
kilometers
Survey Lines
Bulldozer cut lines (1955 - 1988)
PPML Mineral Permits
Mineral rights boundary.
Rail road bed
Primary mine haulage roads
Bush roads - drill, geophysics access
Powerline
Historical Open Pits
Historical underground mine.
N-81
Historical Mine Name
OSISKO METALS
PINE POINT MINING LIMITED
Pine Point Project
Historical Survey Lines - Regional
LiDAR and Orthophoto Date
NAD83 (CSRS) UTM Zone 11
Nov 2020

Figure 1-6



LEGEND

- FORMER PINE POINT TOWN SITE
- BUSH ROAD
- CUTLINE
- DRAINAGE DITCH
- HISTORIC RAILBED
- HIGHWAY
- TRANSMISSION LINE
- WATERCOURSE
- ACTIVE MINERAL LEASE
- ACTIVE MINERAL CLAIM
- CUTBLOCK
- WATERBODY

PINE POINT EXISTING MINING DISTURBANCE

- BACKFILLED PIT
- MINED PIT
- WASTE PILE

0 5 10
1:325,000 KILOMETRES

REFERENCE(S)

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PROJECTION: UTM ZONE 11N DATUM: NAD83

CLIENT
PINE POINT MINING LTD.

PROJECT
PINE POINT PROJECT

TITLE
PINE POINT PROJECT BOUNDARY, MINING LEASE AREAS, AND EXISTING DISTURBANCES

CONSULTANT
GOLDER

YYYY-MM-DD	2020-11-05
DESIGNED	JV
PREPARED	MM/PMT
REVIEWED	DP
APPROVED	DP

PROJECT NO.	CONTROL	REV.	FIGURE
19125747		0	1-7

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0 25mm

PATH: I:\2019\19125747\Mapping\Products\General\Fig1-3_19125747_Pine_Point_Project_Boundary_Mining_Lease_Areas_and_Existing_Disturbances_Rev0.mxd PRINTED ON: 2020-11-05 AT: 3:01:55 PM

1.3.2 Regulatory History

In June of 2006, Tamerlane applied to the Mackenzie Valley Land and Water Board (MVLWB) for a Land Use Permit (MV2006C0014) and Type B Water Licence (MV2006L2-0003) for the Pine Point Pilot Project. The proposed Pine Point Pilot Project included the construction and operation of an underground mining operation to extract and initially process a 1 Mt sample from a lead and zinc deposit at Tamerlane's R-190 project, east of Hay River. The proposed development involved building an underground test mine, extracting 1 Mt of lead/zinc mineralization, concentrating and separating the zinc and lead from the mineralized material, and then transporting the concentrate on Highway 5 to a load-out transfer facility south of Hay River where it would be shipped to international markets by rail.

Tamerlane was notified on June 28, 2006 that the development had been referred to the environmental assessment process. The MVEIRB then conducted an environmental assessment on Tamerlane's Pine Point Pilot Project test mine.

In February 2008, MVEIRB determined that if Tamerlane implemented the commitments listed in Appendix B of MVEIRB's Report of Environmental Assessment and Reasons for Decision, the proposed Pine Point Pilot Project test mine would not likely have any significant adverse impact on the environment or be a cause of significant public concern, and that the development should therefore proceed to the regulatory phase of approvals. No Measures were made by MVEIRB, but 11 Suggestions were provided (Appendix C of the MVEIRB Report of Environmental Assessment). The project did not begin construction at that time and in 2016 the Tamerlane assets were acquired by Darnley Bay Resources.

A history of recent exploration and associated permits and licences at the Pine Point site is provided in Table 1-6.

Table 1-6: History of Recent Exploration and Associated Permits and Licences at the Pine Point Site

Permit or Licence	Type	Owner	Activity	Status
MV2020L2-0008	Type B Water Licence	PPML	Confirmation drilling program activities	Active, expires October 8, 2022
MV2018L2-0003	Type B Water Licence	PPML	Confirmation drilling program activities	Expired
MV2018C0005	Type A Land Use Permit	PPML	Confirmation drilling program activities	Active, expires September 19, 2022
MV2017C0024 (amendment of MV2016C0023)	Type A Land Use Permit	Darnley Bay Resources Ltd.	Additional mineral exploration activities	Active, expires July 19, 2022
MV2016C0023 (renewal of MV2008C0023)	Type A Land Use Permit	Tamerlane Ventures Inc.	Drill exploration and confirmation holes	Expired
MV2012X0001	Type A Land Use Permit	Borealis Geopower	Drilling activities	Expired
MV2011C0015	Type B Water Licence	Tamerlane Ventures Inc.	Construction and operation of a lead/zinc pilot project	Expired

Table 1-6: History of Recent Exploration and Associated Permits and Licences at the Pine Point Site

Permit or Licence	Type	Owner	Activity	Status
MV2008C0023	Type A Land Use Permit	Tamerlane Ventures Inc.	Exploration activities	Expired
MV2006L2-0003	Type A Water Licence	Tamerlane Ventures Inc.	Pine Point Pilot Project	Expired
MV2006C0014	Type A Land Use Permit	Tamerlane Ventures Inc.	Construction and operation of a lead/zinc pilot project	Expired
MV2001C0084	Type A Land Use Permit	Tamerlane Ventures Inc.	Exploration and development work, including drilling	Expired

1.3.2.1 Jurisdiction

The environmental assessment process and issuance of a Land Use Permit and Water Licence for mining and milling is regulated under the *Mackenzie Valley Resource Management Act*. The *Fisheries Act*, the NWT *Lands Act* and NWT *Waters Act* also apply, as do a number of other federal and territorial regulatory instruments (Section 1.4).

1.4 Project Authorizations

PPML holds the necessary mineral leases and mineral claims that provide the fundamental mineral and mining rights for the Project. PPML controls a semi-contiguous group of 40 mineral leases and 106 mineral claims covering 46,553.48 ha in the area of the Project (Figure 1-7).

PPML has two surface leases in the R190 deposit area that were acquired in 2010 to cover the proposed mine site and a settling pond envisioned in the Tamerlane 2007 feasibility study (Figure 1-7).

The Project is not in an area of the NWT with an identified land use plan (GNWT 2020). In the southeastern NWT, the GNWT and the Government of Canada are working with the Akaitcho Dene First Nations and the Northwest Territories Métis Nation to develop an approach to land use planning that could concurrently inform negotiations for future land and resource agreements (GNWT 2019). The Project is located within the range of boreal caribou (*Rangifer tarandus caribou*); boreal caribou in the NWT are all considered part of the same population (NT1; Government of Canada and GNWT 2019). The Project will consider boreal caribou and other species at risk in planning, construction, and operations through the Wildlife Protection Plan. A Wildlife Protection Plan framework has been developed to support the submission of the Environmental Assessment (EA) Initiation Package (Section 3.9.8).

PPML currently holds a Type B Land Use Permit under authorization MV2017C0024, a Type B Water Licence (MV2020L2-0008) and a Type A Land Use Permit (MV2018C0005) from the MVLWB for drilling program activities. New applications are being submitted to the MVLWB to undertake the follow-up program recommended in the Preliminary Economic Assessment. The new applications will be for a Type A Water licence and Type A Land Use Permit to undertake this recommended follow-up work, which referred to as the Confirmation and Exploration

Program. This program includes continued work to further advance the Project design: diamond drilling for exploration, delineation, and geotechnical studies; shallow pitting to test soil strength; sampling of mineralized rock for metallurgical testing; pit water sampling to test for metallurgical processing purposes; and testing of the groundwater pumping rates and re-injection of groundwater via drillholes and deposition into pits. When approved, any existing licenses will no longer be required.

PPML will require a Type A Water Licence and Type A Land Use Permit for the Project following the Environmental Assessment process. The main licences, permits, and authorizations that are expected to be required for the Project are listed in Table 1-7.

Table 1-7: Authorizations, Permits, and Licenses Required for the Project

Authorization, Permit, or Licence	Act and/or Regulation	Permitting Board, Agency, or Organization
Type A Land Use Permit (for mine construction and operation)	*Mackenzie Valley Land Use Regulations*	MVLWB
Type A Water Licence (for Mining and Milling)	*Waters Act*/Regulations *Mackenzie Valley Resource Management Act*	MVLWB
Land Use Permit (for routine operation and maintenance)	*Mackenzie Valley Land Use Regulations*	MVLWB
Quarry Permit	*Quarrying Regulations* *Northwest Territories Lands Act*/Regulations *Northwest Territories Land Use Regulations*	GNWT-Lands
Explosives Permit	*Explosives Act*/*Explosive Regulations, 2013* *Explosives Use Act*/Regulations	Natural Resources Canada Workers' Safety and Compensation Commission
Approval to transport dangerous goods	*Transportation of Dangerous Goods Act*/Regulations	Transport Canada
Permit to Burn and Fire Preparedness Plan	*Forest Protection Act*	GNWT- Environment and Natural Resources
Fisheries Act Review / Authorization	*Fisheries Act*	Fisheries and Oceans Canada
Minor Works Order	*Canadian Navigable Waters Act*	Transport Canada
Schedule 2 Listing for Tailings Impoundment Areas	*Metal and Diamond Mining Effluent Regulations*	Environment and Climate Change Canada Fisheries and Oceans Canada
NWT Research Licence	*Scientists Act*	Aurora Research Institute
Wildlife Research Permit	*Wildlife Act*	GNWT - Environment and Natural Resources
Wildlife Management and Monitoring Plan approval	*Wildlife Act* (if the Project triggers Section 95 of the Act)	GNWT- Environment and Natural Resources
Archaeology Permit	*Archaeological Sites Act*/Regulations	GNWT- Education, Culture and Employment
Waste Disposal Approval (for any off-site waste disposal)	*Mackenzie Valley Land Use Regulations*	List land use permits for off-site disposal facilities

1.5 Description of the Developer

PPML is a 100% owned subsidiary to Osisko Metals Incorporated, which is a Canadian exploration and development company creating value with a focus on zinc mineral assets. Osisko Metals controls Canada's two premier zinc mining districts including its flagship Pine Point Project, located in the NWT, with an Inferred and Indicated Mineral Resource listed in Table 1-4.

Osisko Metal's vision is to become a leading base metal mining company in Canada. PPML and the development of the Pine Point Project are a key part of its strategy.

The Code of Ethics (Appendix A), which PPML adheres to, provides basic guidelines setting forth the ethical behavior expected from every employee. Through the Code of Ethics, PPML is committed to conducting its business in a manner that protects the environment, preserves resources and ensures sustainable development. It is continuously seeking to improve its environmental performance, in keeping with applicable law, regulations, and guidelines. Each employee is expected to be alert to environmental issues and has a responsibility to work in an environmentally responsible manner.

PPML is also committed to conducting its business responsibly with the communities in the areas where it operates, and to making a positive contribution to the well-being and development of those communities. Every employee shall reflect this commitment in their everyday dealings, and respect the different cultures and the dignity and rights of individuals in all countries where the Corporation carries out its activities.

1.6 Indigenous Traditional Knowledge, Engagement and Collaboration

1.6.1 Indigenous Traditional Knowledge

Previous studies related to Indigenous Traditional Knowledge (ITK) and traditional land and resource uses in the vicinity of the Project include ITK studies for the communities of Fort Resolution (Deninu Kųé First Nation and Fort Resolution Métis Council; Swisher 2006a) and Hay River (Hay River Métis Council and Northwest Territories Métis Nation; Swisher 2006b), and an ITK assessment for the Hay River Reserve (K'atl'odeeche First Nation; Eagle Eye Concepts 2007). These studies were conducted for Tamerlane Ventures Inc.'s Pine Point Pilot Project as part of the EA process. Information from these studies was incorporated into the baseline studies currently underway in support of the Project's environmental assessment.

Community members from Deninu Kųé First Nation, Fort Resolution Métis, and Hay River Métis have extensive familial roots in the South Slave Region and indicated that they or their family frequented the Project or broader general area (Swisher 2006a,b). Some community members began to use the area after the highway was built in the 1960s, but others have been using the area since the 1920s, which was accessed in the winter by dog team and during the summer by boat or overland by cutlines (Swisher 2006a). Hay River Métis community members indicated their historical use of the area ranges from 26 years to many generations (Swisher 2006b).

The area in the vicinity of the Project is used by the Deninu Kųé First Nation, Fort Resolution Métis, and Hay River Métis for hunting, trapping, medical plant and berry gathering, collecting firewood and also for employment activities associated with the Tamerlane 2005 Drill Program (Swisher 2006a,b). Some community members considered both groundwater and surface water in the area to be poor quality, because it is alkaline and sulphurous, and not fit for consumption (Swisher 2006a,b). Although Deninu Kųé First Nation, Fort Resolution Métis, and Hay River Métis

community members did not specifically know of anyone living in the vicinity of the Project, they had observed evidence of old prospector and hunting cabins, and it was noted that people historically used the area seasonally to hunt, and historical cabins existed (Swisher 2006a,b). Community members stated they have walked or travelled through the area or larger region in recent years, including actively snowmobiling in the South Great Slave region for traditional and work-related activities (Swisher 2006a,b).

K'atl'odeeche First Nation community members reported use of the area for hunting and harvesting resources and the community has strong economic ties with the land (Eagle Eye Concepts 2007). Caribou, moose, and waterfowl (e.g., ducks and geese) are hunted for sustenance. Elék'eh is a muskeg area on the south shore of Great Slave Lake and east of Buffalo River, and supports beaver, muskrat, and other wildlife, and is an important waterfowl nesting area. Specific moose harvesting sites were identified along the southern shore of Great Slave Lake, High Point, Birch Creek, and Twin Creek. Hunting also occurs along the Buffalo River (Eagle Eye Concepts 2007). The K'atl'odeeche First Nation also recognize themselves as stewards of their traditional lands and waters and are responsible for their protection for future generations (Eagle Eye Concepts 2007).

PPML is currently engaging with communities on the environmental assessment process regarding their preferred approach to collecting and presenting ITK. Community-specific studies undertaken as part of the baseline scope of work will be incorporated into future assessment work in consultation with communities.

1.6.2 Engagement

PPML undertook engagement from 2018 onwards and presented details of the proposed Project. During engagement, comments, concerns, and insights provided by community members were recorded and considered in Project design and in the EA Initiation Package. Table 1-8 provides a list of topics raised and how PPML has incorporated them into the design or addressed them.

The Engagement Log submitted with the Engagement and Collaboration Plan provides additional details of communication. While early consultation (prior to 2019) was focused on exploration, PPML took the approach to assume that these early concerns would also apply to the Project.

Table 1-8: Synthesis of Engagement and Considerations in Project Design and Planning

Concern	Meeting	Consideration/Accommodation
Indigenous communities need to be provided advanced notice of Project opportunities and requirements. Employment and contracting opportunities need to be kept local as much as possible	K'atl'odeeche First Nation Meeting (08/25/2020) Deninu Kųé First Nation Meeting (09/09/2020) NWT Métis Nation Meeting (08/31/ 2020)	PPML will work with communities as the Project evolves to communicate economic opportunities and associated requirements, and to facilitate the accessibility of such opportunities to Indigenous candidates and companies.
The Project must consider how to protect workers from public health risks like COVID-19	Deninu Kųé First Nation Meeting (09/09/ 2020)	PPML will follow applicable government protocols in terms of workforce management and health risk mitigation.
Will the Project result in the remediation of previously used industrial sites or the rail bed?	Deninu Kųé First Nation Meeting (09/09/ 2020)	The remediation of these sites is a responsibility of the Federal government.

Table 1-8: Synthesis of Engagement and Considerations in Project Design and Planning

Concern	Meeting	Consideration/Accommodation
Do not use water from Great Slave Lake for the processing plant	K'atl'odeeche First Nation Meeting (08/25/2020)	PPML will limit the use of water from Great Slave Lake for the processing plant by recycling water and using water from existing pits.
Concerns over legacy issues from the previous mining operation and current conditions at the site	All public meetings up to end of 2019	Work with the Government of Canada to clearly outline approach to legacy issues for PPML.
Local jobs, local workers, subcontracting opportunities	Fort Resolution Open Meeting (11/29/2017) Hay River Open Meeting (11/30/2017) Hay River Reserve (1/21/2017)	Entered into Collaboration and Exploration agreements (July 2019) to advance employment and business opportunities.
Use of existing pits for waste rock disposal	Fort Resolution Open Meeting (11/29/2017) Hay River Open Meeting (11/30/2017)	PPML will use existing open pits for waste rock, where feasible.
Surface discharge of groundwater is of concern	Fort Resolution Open Meeting (11/29/2017)	PPML does not plan to discharge any groundwater unless it meets effluent quality criteria.
Do not use Sulphur Creek as a receiving site for withdrawn groundwater	Fort Resolution Open Meeting (11/29/2017)	The Project Description does not plan for discharge to Sulphur Creek.
Caribou over-winter months near the Buffalo River in unmined lands	Fort Resolution Open Meeting (11/29/2017)	Mining proposed near the Buffalo River is limited and effects on wildlife will be managed through the Wildlife Management and Monitoring Plan.
Consider using the old Cominco system for freshwater supply from Lake to Camp	Fort Resolution Open Meeting (11/29/2017) Hay River Open Meeting (11/30/2017)	PPML has agreed to consider this point.
Use existing infrastructure	Hay River Open Meeting (11/30/2017)	PPML has designed the Project to use the existing footprint and existing infrastructure where feasible, including existing open pits.
Get into production as soon as possible. This area needs the jobs and revenue	Hay River Open Meeting (11/30/2017)	PPML has developed an aggressive schedule to meet the global zinc demand.
Conduct water quality monitoring to ensure impacts are mitigated	Hay River Open Meeting (11/30/2017)	PPML will develop a water quality monitoring program. Water quality monitoring is currently ongoing.

2 GEOLOGICAL, GEOCHEMICAL, AND GEOTECHNICAL SETTING

2.1 Geology

2.1.1 Regional Geology

The Pine Point deposits are located on the southern shore of Great Slave Lake (Figure 2-1). They form a 70 km long southwest-northeast-trending belt between Hay River and Fort Resolution in southern NWT. The area lies on the eastern margin of what is defined regionally as the Western Canada Sedimentary Basin. The Pine Point deposits exhibit all the geological, mineralogical, and geochemical attributes of Carbonate Hosted Zinc-Lead deposits.

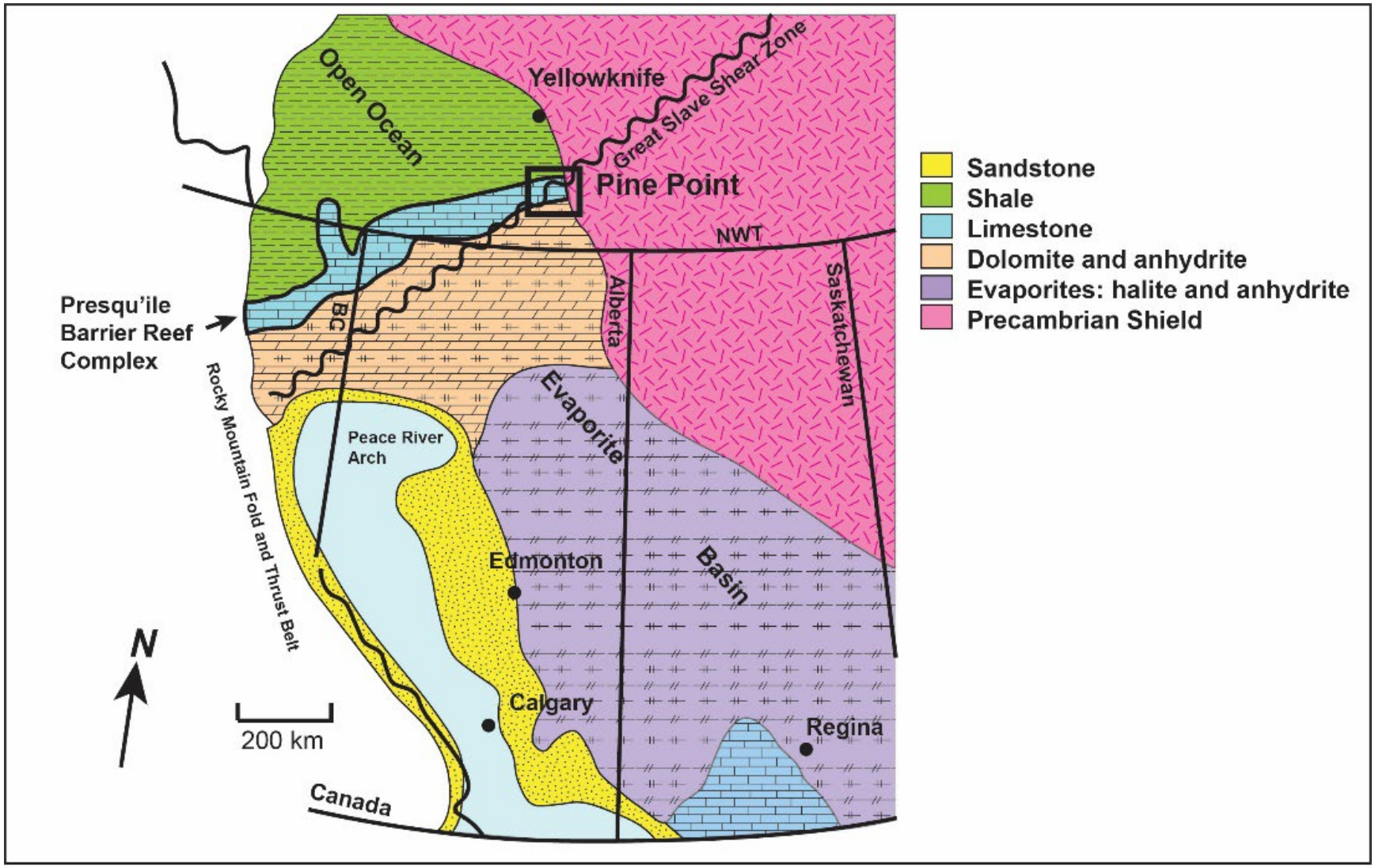


Figure 2-1: Regional Geological Setting of Pine Point

2.1.2 Project Site Geology

The Project is composed of several deposits of variable size and depth and spread across the 72 km long property. The Project is underlain by carbonate rocks and lesser shale units, which dip from 1 to 5 degrees to the southwest. These rocks are bounded to the north by marine shale and to the southeast by interbedded evaporites and carbonate rocks (Figure 2-2; Table 2-1). The entire area is covered by glacial till ranging between 10 and 40 m thick.

Table 2-1: Description of Formations and Related Rock Types

Formation Name	Marker Horizon	Protolith	Notes
Hay River (+ 15 m)		Shale	Deeper marine platform
Slave Point (50-75 m)		Limestone	Marine platform
	AMCO (1-3 m)	Blue-grey argillaceous limestone	Marine platform
Watt Mountain (7-15 m)		Green, shaley limestone	Lagoonal, restricted marine
Windy Point (10-50 m variable, on-laps reef from the north)		Limestone	Marine, reefal, time stratigraphic equivalent to upper Sulphur Point
Buffalo River 20-25 m, variable, on-laps reef from the north)		Shale	Shallow, open marine platform
Sulphur Point (0-80 m) Eroded to the north		Limestone	Reefal and marine platform
Muskeg (85-100 m, variable, on-laps reef from the south)		Interfingered dolomite and evaporite with the later becoming dominant to the south of the reef	Off-reef, restricted back-reef evaporite basin. Time stratigraphic equivalent of the Pine Point Fm and basal Sulphur Point Fm
Pine Point (40-140 m)		Dolomite and dolomitized limestone	Reefal and marine platform
	B-spongy (5-20 m)	Dolomite, vuggy	Marine bioherm, reefal?
Keg River (61-73 m)		Dolomite, locally argillaceous	Marine Platform
	E Shale (5-10 m)	Shale or shaly dolomite	Marine platform. 3-6 m below the top of Keg River Fm
Chinchaga (76 m)		Anhydrite, crystalline dolomite, quartz sandstone, dolomitic shale, halite	Restricted, back-reef basin

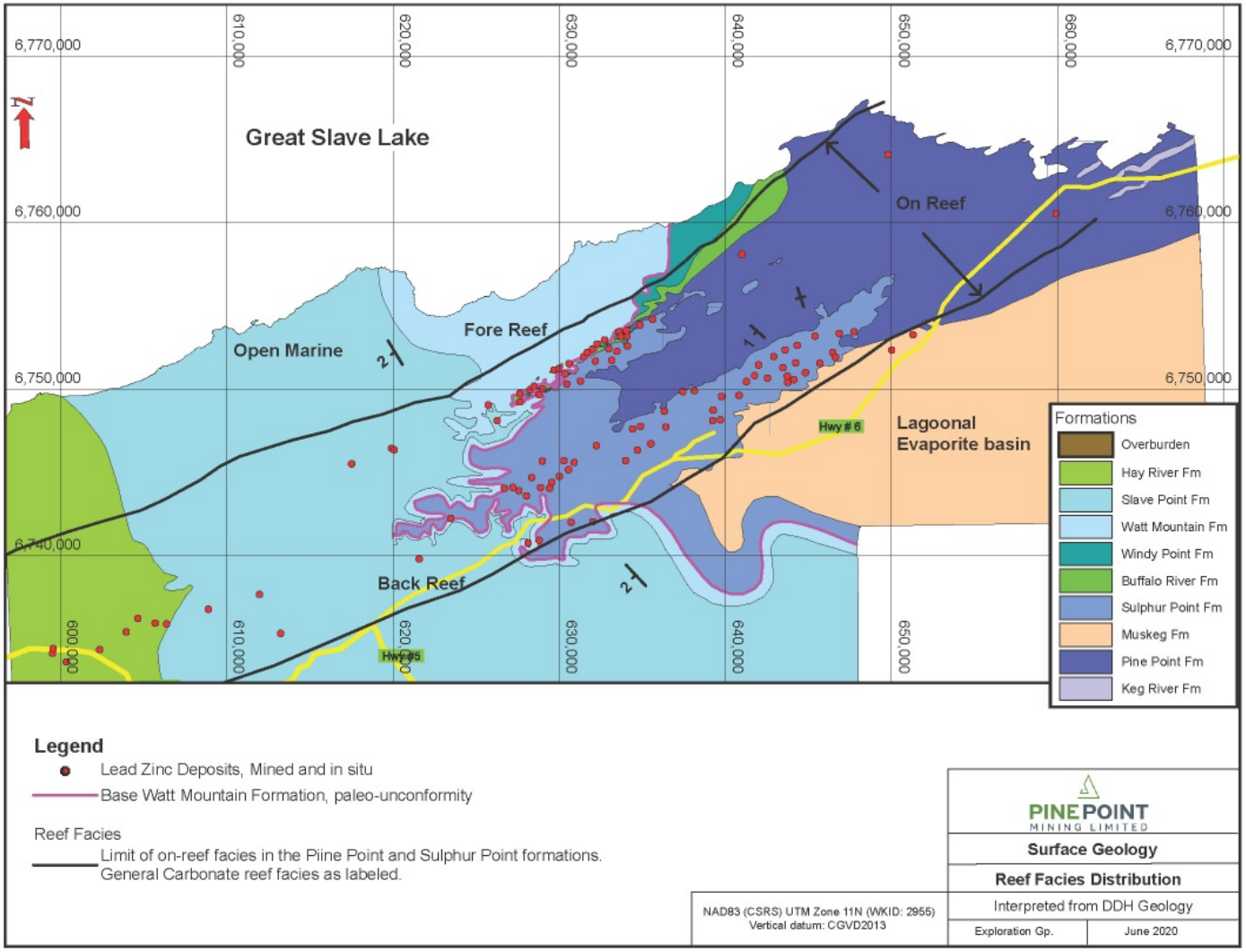
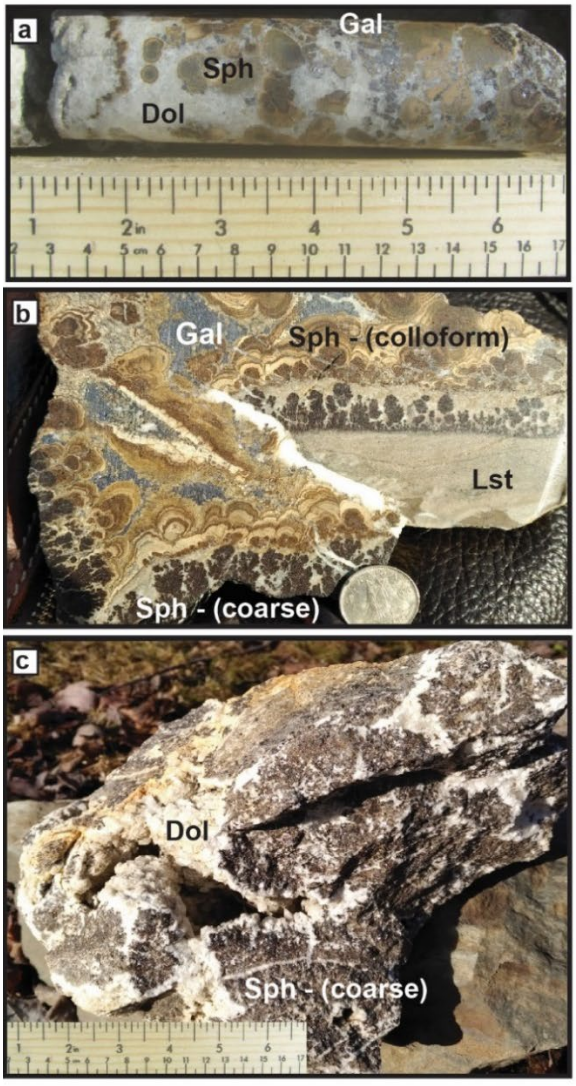


Figure 2-2: Geology in the Area of the Project

Given the extent and the variable conditions of the site, the former Cominco era mining camp has been divided into five zones: the East Mill Zone, the North Zone, the Central Zone, and the N-204 Zone all of which are mainly located east of the Buffalo River. The sixth zone is the West Zone formerly explored by the Westmin company, which is mainly located west of the Buffalo River (Figure 1-7).

The recoverable minerals at Pine Point are sphalerite (zinc sulphide) and galena (lead sulphide) (Figure 2-3), which are hosted in dolomitic limestone with minor amounts of marcasite (iron sulphide) that is locally associated with some of the deposits. The deposit types at Pine Point occur in varying shapes and thicknesses but basically fall into two categories: “Tabular” and “Prismatic” (Figure 2-4). Mineralization can be encountered anywhere in the area; however, abundances are likely below economic interest except where Tabular and Prismatic deposits are developed. Further exploration is aimed at the potential discovery of new deposits.



a) Colloform Sphalerite (brown - Sph) with coarse galena (grey - Gn). Gangue is HTD (coarse sparry dolomite: white - Dol).

b) Colloform (brown - Sph) and coarse sphalerite (purple - Sph) with coarse galena (grey - Gn). Gangue is coarse sparry dolomite (white - Dol).

c) Coarse sphalerite (purple - Sph) with HTD (coarse coarse sparry dolomite: white - Dol).

d) White hydrothermal dolomite (HTD) infiltrating orginal dolomite/limestone in the Sulphur Point Formation.

e) Lighter HTD alteration in the darker original dolomite/limestone witin the Sulphur Point Formation, L37 Pit

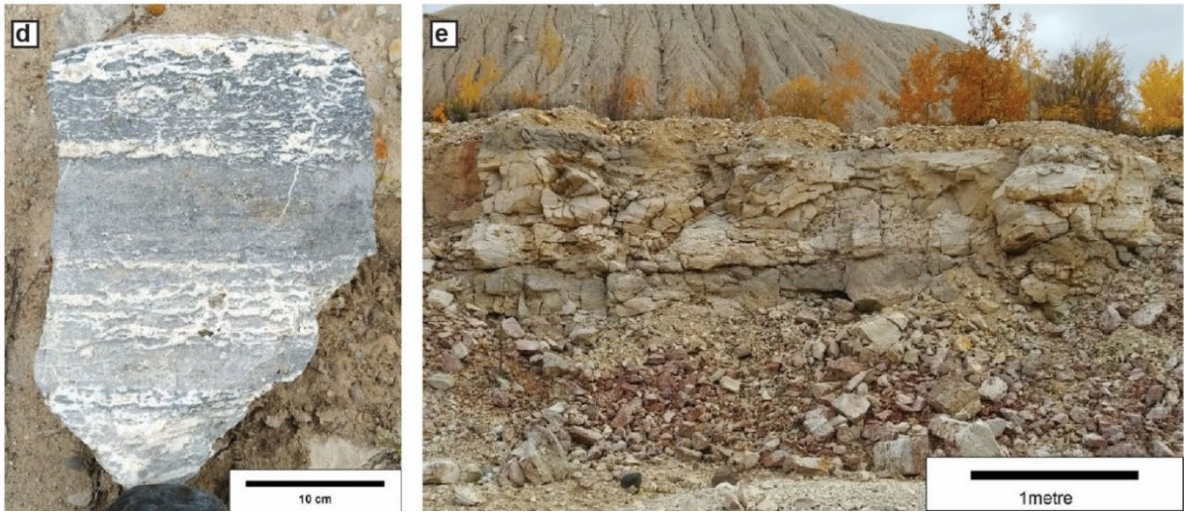


Figure 2-3: Mineralization and Alteration Styles

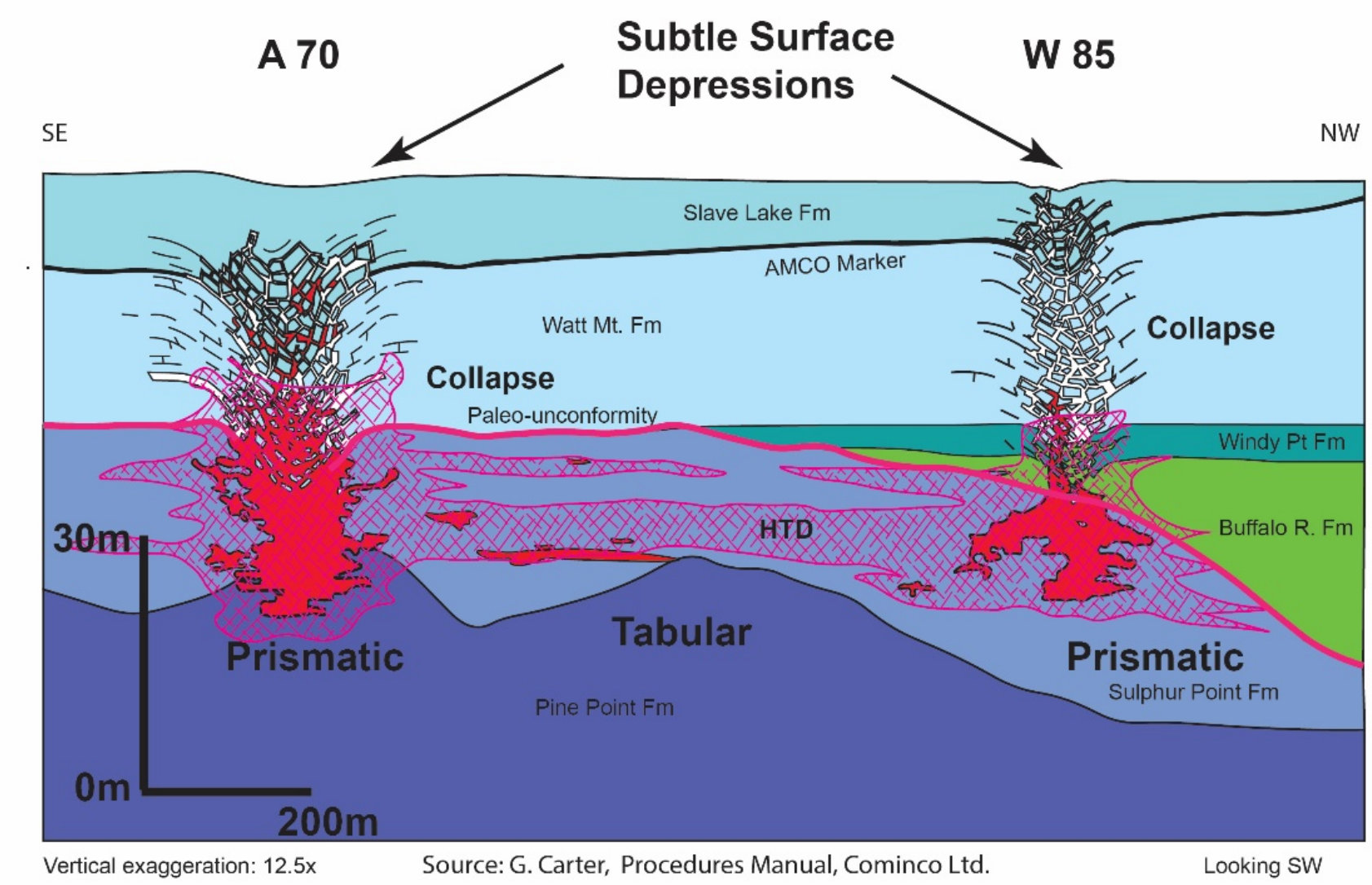


Figure 2-4: Deposit Types

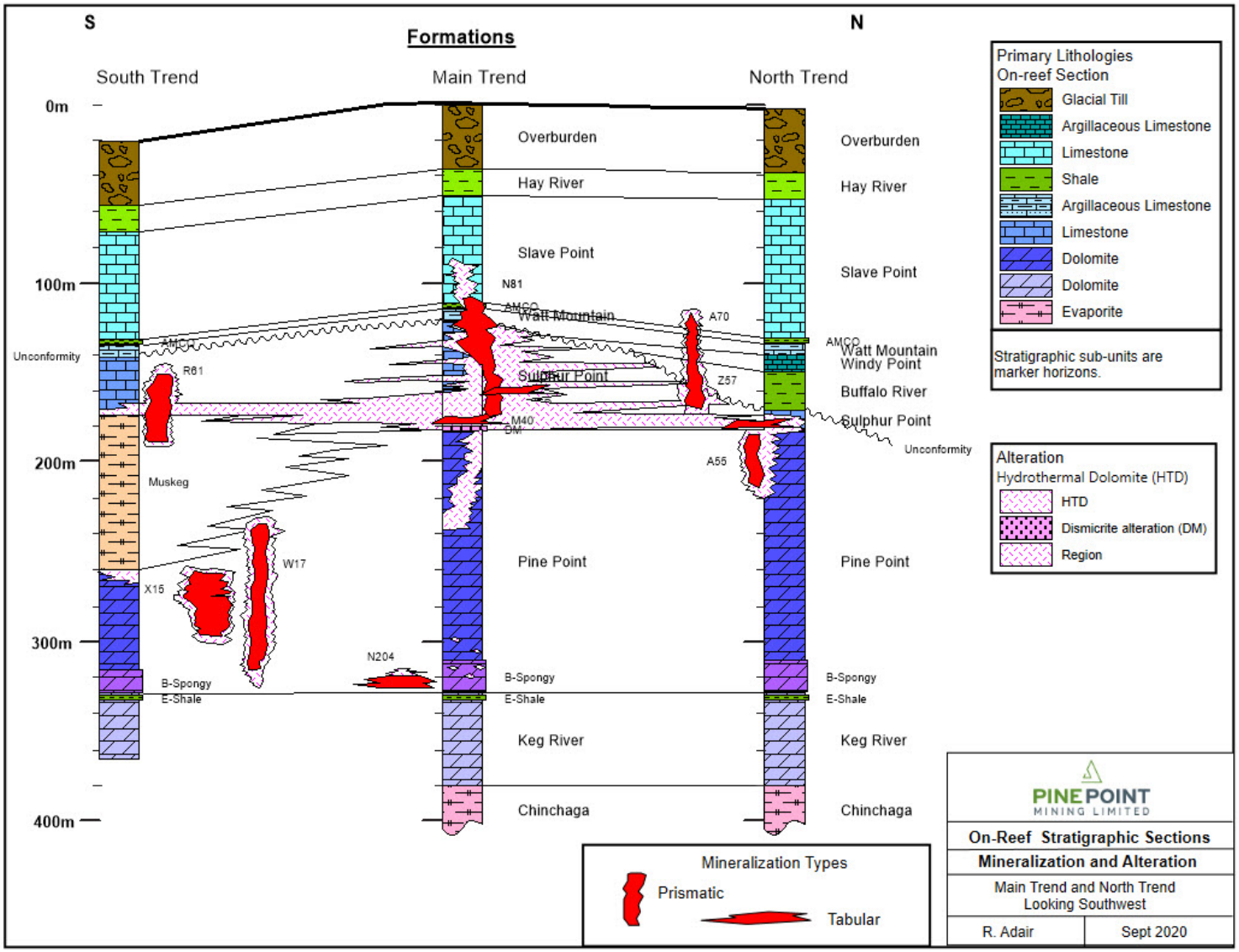


Figure 2-5: Stratigraphy, HTD Alteration, and Mineralization

Tabular deposits may extend along strike for several kilometres at varying lateral widths from 50 to 200 m wide, and usually are on average between 5 to 10 m in thickness. Prismatic deposits at Pine Point have a more vertical cylindrical morphology or shape, and often are not larger in diameter than their vertical dimension. The deposits to be mined are both Tabular and Prismatic and hosted within similar stratigraphy as those deposits previously mined by Cominco in this area.

The mineral deposits in the sector east of the Buffalo River are shallower and are anticipated to be mined mainly from surface (open-pit mining), except a few deposits in the Central Zone. The mineral deposits located west of the Buffalo River are deeper and will likely require underground mining (Figure 1-3). Mining methods will be optimized for each deposit and will vary depending on their respective conditions.

The Sulphur Point Formation has been affected, to a varying degree, by dissolution of primary carbonate rocks, followed by precipitation of sparry dolomite, calcite, and more localized sulphides within which are specific areas of higher sulphide precipitation that are now mineral deposits (Figure 2-3, Figure 2-4, and Figure 2-5). This is termed “Hydrothermal Dolomite” or HTD and is of varying intensity within the Sulphur Point Formation. This type of alteration is much more restricted to the immediate vicinity of mineralization where the latter occurs in the Pine Point, Muskeg and Slave Point Formations. HTD is characterized by high porosity.

2.1.3 Geochemical Conditions

Geochemical characterization data have been compiled for the purpose of identifying the metal leaching (ML) and acid rock drainage (ARD) potential of the mined materials (TetraTech 2018). Geochemical characterization data are available for waste rock, mineralization, tailings, overburden, and soil material. Waste rock and mineralization samples in the geochemical characterization database have been assigned to a geologic formation and include a basic lithological description. Geologic formation and lithology are presented with the analytical data results in TetraTech (2018).

Geochemical characterization data described in TetraTech (2018) were initially presented in Rescan (2011, 2012a,b). The Rescan reports detail the field programs, sample selection, and data analysis for the respective samples from borehole R190-11-GT1 and deposits X-25, P-499, O-556, Z-155, G-03, and N204. These data were collected for a 2011 geochemical characterization program conducted by Rescan as part of baseline environmental studies for the Pine Point Project and the data interpretation and analysis of the preliminary geochemical characterization results are presented in Rescan (2011, 2012a,b). pHase Geochemistry provided a draft review of these reports and compilation of available data (pHase Geochemistry 2017).

In November 2017, PPML collected and submitted an additional sixteen samples from drill core from the L-65, N-42, M-40, and EX-17 deposits. These samples were analyzed for acid-base accounting and trace element analysis. These data have not been presented in previous reports.

The following analytical tests have been conducted on samples from the Pine Point mining area. Discussion and results of these analyses are presented in the following sections. A compilation of all available data is presented TetraTech (2018) for the following analyses:

- Quantitative X-Ray Diffraction (QXRD) using the Rietveld method
- Acid-Base Accounting (ABA) analysis

- Net-Acid Generation test
- Solids trace element analyses using aqua-regia digestion with inductively coupled plasma mass spectrometry (ICP-MS) finish
- Whole rock analysis for major oxides using lithium metaborate fusion followed by X-Ray Fluorescence (XRF)
- Shake Flask Extraction (SFE) leachate analysis using a 3:1 liquid to solid ratio

These tests are static geochemical characterization tests, which measure the present composition of materials at the time of testing. The static tests typically measure chemical, physical and mineralogical properties of a sample. Each of these parameters assists in assessing the chemistry of any runoff or leachate that is in contact with the waste rock, and the ML/ARD potential of the materials. Kinetic tests have not yet been completed for materials from the Pine Point mining area.

Future test work will include confirmatory geologic review and sampling from the proposed mining areas to evaluate the consistency with the historical dataset. The historical dataset covers a wide range of lithologies across the mining area and are representative of the anticipated waste rock and mineralization mining units that are foreseen to be part of future mine development.

Future work may include assessing the historical waste rock dumps to evaluate the kinetic reaction rates. These waste rock dumps provide site-specific information on how the material has weathered and reacted to the site-specific environment over time. Static test information obtained prior to kinetic tests can be used to select the kinetic test samples and evaluate the approximate timeline of any metal leaching or the potential of significant acidic production in the waste rock materials.

2.1.3.1 Quantitative X-Ray Diffraction

A total of 22 samples from six different deposits were analyzed by Quantitative X-Ray Diffraction (QXRD) analysis. The QXRD method analyses for the relative amounts and ideal chemical formula of crystalline phases, normalized to 100%. Samples were analyzed at the University of British Columbia by quantitative phase analysis of powder samples using the Rietveld Method and X-Ray powder diffraction data.

As described in a report by pHase Geochemistry (2017), the quantitative phase analysis results indicate that all the rock samples were dominated by carbonate, specifically dolomite with lesser calcite. The QXRD data are consistent with the geologic units encountered in the mining area and correlate well with the elevated carbonate concentrations observed in the ABA data.

The artesian borehole precipitate sample from G-03 consists of secondary mineral precipitate gypsum and elemental sulphur. Sulphide mineralization consists of pyrite (FeS_2), sphalerite ((Zn,Fe)S), galena (PbS) and of varying amounts of marcasite (FeS_2) but typically ranging from trace to minor (<5%). Two samples from G-03 (G03TVI 193-203 and G03TVI 280-291) report pyrite concentrations of greater than 10.0% and 11.0%, sphalerite concentrations of 12.0% and 33.7%, galena concentrations of 2.6% and 4.5%, and marcasite of 3.1% and 10.0%. These results are consistent with ABA results for these two samples indicating elevated sulphide sulphur

content and correspondingly elevated maximum acid potential values. The ABA results for these samples are further discussed below.

2.1.3.2 Acid-Base Accounting Analysis

The potential for acid generation was tested by ABA analysis on a total of 82 samples and the results are presented in TetraTech (2018). The ABA analyses completed included determination of paste pH, total carbon, inorganic total sulphur, sulphate sulphur, sulphide sulphur, neutralization potential (NP), and fizz rating. Maximum potential acidity (MPA) values were calculated from the sulphide sulphur content. Net neutralization potential is calculated as neutralization potential minus maximum potential acidity (NP-MPA). The neutralization potential ratio (NPR) value is calculated as neutral potential divided by maximum potential acidity (NP/MPA). The $CaCO_3$ equivalent value is based on a calculation using the carbonate content and represents the Carbonate NP value.

- All samples from R-190 were analyzed using the Modified Sobek NP method. All samples from the other deposits were tested using the Standard Sobek NP method. Twelve of these other samples were also tested using the Modified Sobek NP method.
- The NPR values are based on the Modified Sobek NP for all samples except for the R-190 samples where the Standard Sobek NP is used.
- Sulphide sulphur was calculated as the difference between total sulphur and sulphate sulphur, except in the case of waste rock samples from deposit R-190. For these samples, sulphide sulphur was determined by analytical method using the HNO_3 extraction method.
- Elemental or Insoluble sulphur was measured for waste rock samples from the R-190 deposit and soil samples from the N-204 deposit.

ABA results are used to evaluate the classification of the analyzed samples as either potentially acid-generating (PAG) or as non-potentially acid generating (non-PAG). Material classification is based on the MEND Guidelines (Price 2009) as presented in Table 2-2. A sample classified as Uncertain requires additional information to evaluate ARD potential.

Table 2-2: Summary of ARD Classification based on NPR value (from Price 2009)

NPR Value	Classification
NPR <1	PAG
NPR >2	Non-PAG
1 <NPR <2	Uncertain

The analyzed samples are consistently classified as non-potentially acid generating (non-PAG), based on NPR values of greater than 2. Eighty out of the eighty-two samples are classified as non-PAG. The median NPR value for all 82 samples analyzed is 188. Figure 2-6 and Figure 2-7 present ARD classification for the sample set.

One sample, G03TVI 280-291, reports an NPR value of less than 1 (NPR= 0.42) and is classified as PAG. One sample, G03TVI 193-203, reports an NPR value of between 1 and 2 (NPR =1.92) and classifies as Uncertain. These two samples were not provided with a lithology description but

are assigned to the Watt Mountain and Slave Point formations, respectively. These two samples have considerably elevated sulphur contents when compared to the other samples in the database.

Waste rock samples from the Sulphur Point and Muskeg Formations generally report much lower values of total sulphur and sulphide sulphur. All the samples from these geologic formations came from the 2017 sampling of the L-65, N-42, M-40, and EX-17 deposits. Due to the low sulphur content, the associated maximum potential acidity value is lower than for other waste rock samples. The neutralization potentials are similar to other waste rock samples and, as a result of the above, the NPR values are generally higher than for other waste rock units.

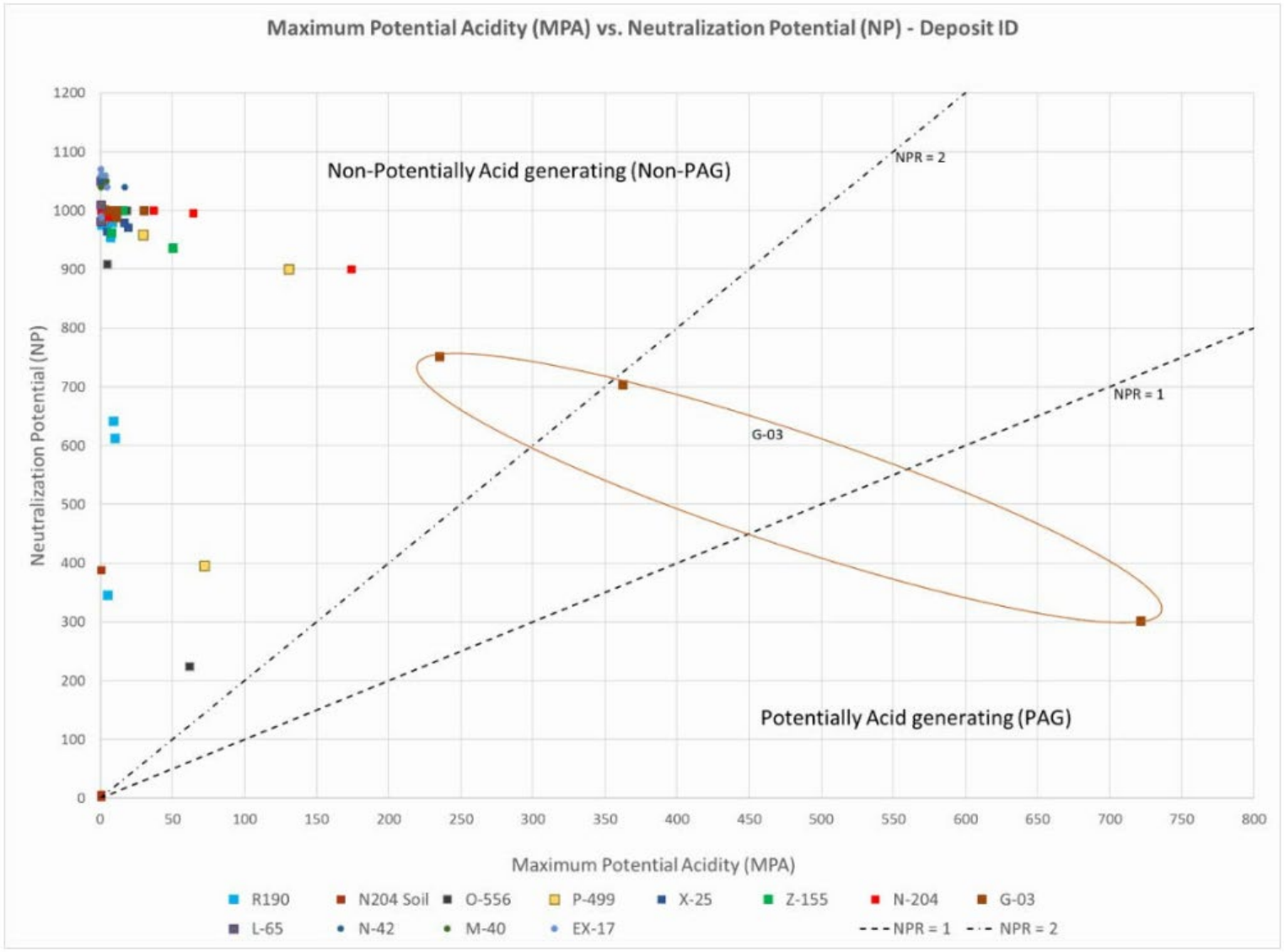


Figure 2-6: ARD Classification by Deposit ID

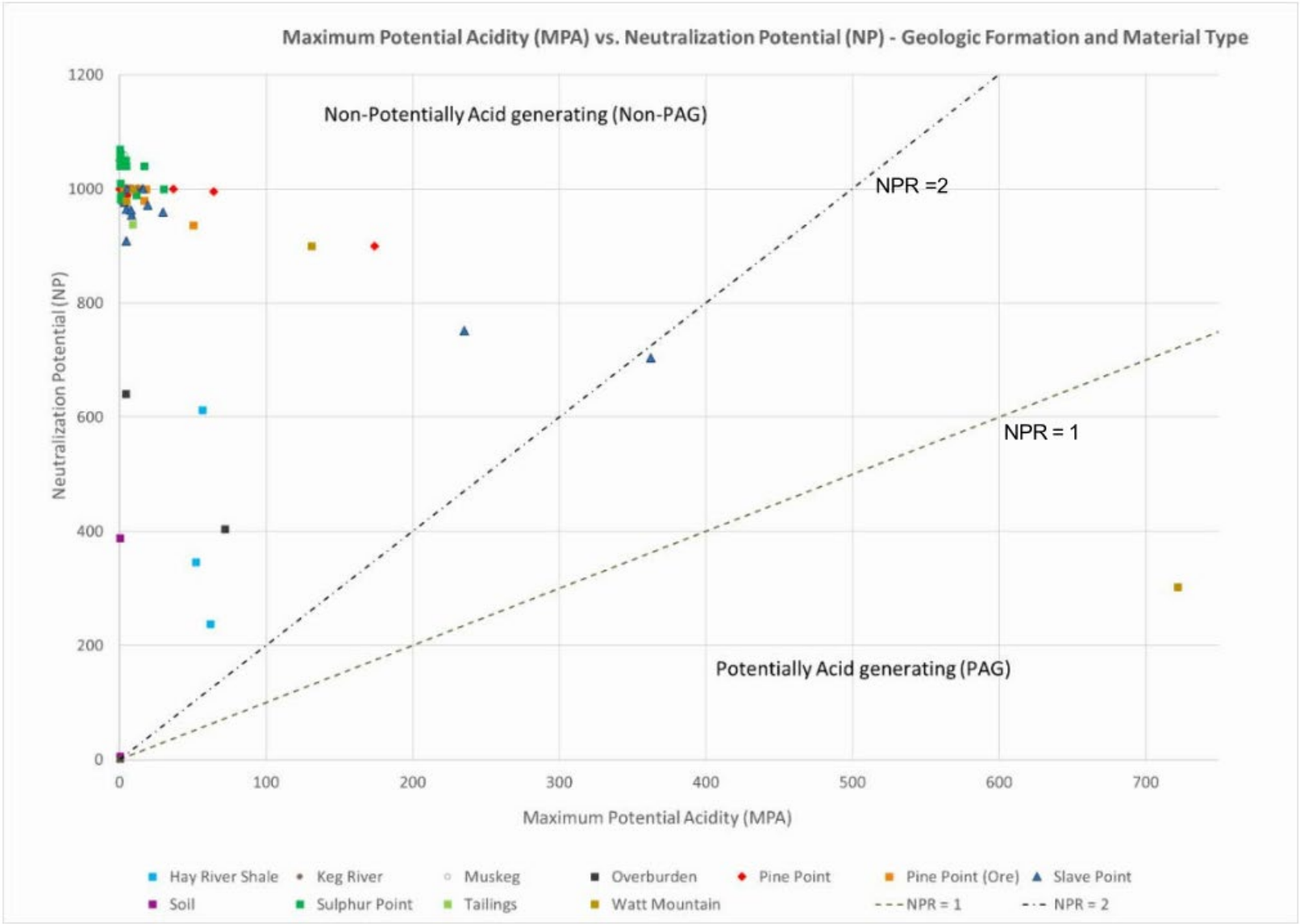


Figure 2-7: ARD Potential Classification by Geologic Formation and Material Type

The Carbonate NP value can be compared against the Sobek NP values to evaluate the contribution of carbonate minerals to the neutralization potential. The results show that the Carbonate NP values are typically 95% to 105% of the Sobek NP values. This indicates that the neutralization potential in the analyzed samples is almost entirely provided by carbonate sources, with a negligible component of neutralization influenced by other minerals such as silicates. This finding is consistent with the observed rock types and the QXRD data.

Carbonate minerals provide the most available and fastest reacting source of neutralization potential, and as such are more effective at neutralizing against acid production compared to other minerals. For classification of the analyzed samples, the NPR value calculated using the Sobek NP values is used. However, due to similarity between the two measures of neutralization potential, the NPR value calculated using the Carbonate NP would provide the sample classification.

2.1.3.3 Trace Element Analysis by ICP-MS

Trace element analysis by ICP-MS was completed on a total of 78 samples. The results are summarized in TetraTech (2018). Trace element analysis data were compared against typical element distribution values (TEDV) for carbonate rocks (Price 1997).

Price (1997) suggested that element concentrations above 10 times the typical element distribution values may provide an initial identification of significant mineral concentrations. Elevated concentrations of certain elements commonly reflect the deposit's mineralized nature and does not necessarily indicate that environmental effects will result from the exposure of these elements. Elevated concentrations do not correlate directly with increased metal leaching rate but may contribute to elevated metal loadings if the elements are susceptible to leaching.

Samples from L-165, N-42, M-40, and EX-17 were tested at Maxxam Laboratories in 2017 using the ultra-trace element analysis by aqua regia digestion and ICP-MS. The same test method was used at Acme labs for samples collected in 2011; however, there is a marked difference in measured concentrations, as described below.

Table 2-3 summarizes the number of samples from each deposit that have an element concentration exceeding the typical element distribution value by 10x or greater. As expected, concentrations of lead (Pb) and zinc (Zn) are elevated in a majority of samples. Nickel (Ni), cobalt (Co), cadmium (Cd), and sulphur (S) concentrations are also elevated in many cases. Notably, the samples collected in 2017 from the L-65, N-42, M-40, and EX-17 deposits have considerably lower metal concentrations than the other samples in the dataset. All these samples are from the Sulphur Point and Muskeg Formation, which were not sampled from the other deposits. Samples from these deposits also had lower sulphide content as noted above in the discussion of ABA results.

Table 2-3: Summary of Element Concentrations Exceeding 10x TEDV

Deposit ID	Total Number of Samples	Number of Samples with Element Concentration Exceeding 10x TEDV											
		Mo	Pb	Zn	Ni	Co	Fe	As	Sr	Cd	Ba	S	Se
R-190	10	-	1	2	4	4	-	-	-	1	-	4	-
O-556	6	-	1	2	1	1	-	-	-	2	-	1	-

Table 2-3: Summary of Element Concentrations Exceeding 10x TEDV

Deposit ID	Total Number of Samples	Number of Samples with Element Concentration Exceeding 10x TEDV											
		Mo	Pb	Zn	Ni	Co	Fe	As	Sr	Cd	Ba	S	Se
P-499	5	-	2	3	1	1	-	-	-	3	1	2	1
X-25	5	-	2	2	1	1	-	-	1	2	-	-	-
Z-155	6	-	1	4	4	1	-	-	2	4	-	1	-
N-204	22	-	18	21	11	1	-	1	-	20	2	3	2
L-65	3	-	-	-	-	-	-	-	-	-	-	-	-
N-42	3	-	-	-	1	-	-	-	-	1	-	-	-
M-40	2	-	-	-	-	-	-	-	-	-	-	-	-
EX-17	8	1	-	-	2	1	-	-	-	-	-	-	-
G-03	8	-	6	6	6	2	3	-	-	6	-	2	4
Total	**78**	**1**	**31**	**40**	**31**	**12**	**3**	**1**	**3**	**39**	**3**	**13**	**7**

2.1.3.4 Whole Rock Analysis by X-Ray Fluorescence

Whole rock analysis using X-Ray fluorescence (XRF) was completed on a total of 62 samples. The results of whole rock analysis are summarized in TetraTech (2018). Whole rock analysis is used to quantify elemental concentrations that may impact drainage chemistry. The whole rock analysis does not reveal the forms in which an element occurs in, but this information can be used in conjunction with the QXRD data for this purpose.

The whole rock analyses indicate that the sampled rocks are dominated by calcium and magnesium with minor components of silicate minerals (silica, aluminum, and iron oxides). Median values for calcium oxide for the various material types and geologic formations range from 15.5% to 33.1%. Median values for magnesium oxide for the various material types and geological formations range from 3.3% to 20.7%. Loss on ignition values are consistently elevated with median values between 18.9% and 46.6%.

The results reflect the predominant mineralogy of dolomite and calcite, with minor quartz and micas, consistent with QXRD analyses.

2.1.3.5 Shake Flask Extraction Analysis

Shake flask extraction (SFE) leach analysis was conducted on seven waste rock samples, one mineralization sample and one tailings sample. Dissolved metal results were compared against Federal Contaminated Sites Action Plan Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites Tier 2 Guidelines for Residential / Parkland Land Use - coarse- and fine-grained soils. This comparison is only intended as a first pass review of potential elevated metals. Elevated concentrations of dissolved metals in the SFE analysis do not necessarily result in elevated constituents in a field setting; however, it can be used to identify which leachable constituents may be of future concern. This test work and analysis does not consider the receiving water chemistry, dilution volumes, or long-term metal dissolution for evaluating the effect of metal leaching potential on surface water receptors. Concentrations that

exceed the guideline values by an order of magnitude or greater are flagged for further consideration.

Shake flask extraction analysis results will be compared against site-specific data regarding water quality objectives, baseline water quality from surface or groundwater analysis, and environmental conditions such as proximity to surface receptors and climactic conditions.

2.2 Geotechnical Conditions

No geotechnical study is currently available for open-pit mining. The parameters used in the PEA for open pits were conservative at a 45° overall slope angle considering that the pits are shallow, but this takes into consideration the ramp and the berm widths.

A geotechnical review for the West Zone (W1 Area) was conducted in 2011-2012 by AMC Mining Consultants Canada (AMC), and provided rock mass classification, stability assessments, and ground support guidelines (AMC 2012). Underground design recommendations are based entirely on this report and most of the geotechnical information is from this review. The rock mass classification Q-RMR values indicate generally a fair to good rock mass quality overall.

There is no geotechnical information for the Central Zone underground workings.

2.2.1 Underground Rock Mass Classification

Based on the geotechnical review (AMC 2012), upper and lower bound values of Q' and Rock Mass Rating (RMR) are summarized in Table 2-4.

Table 2-4: Comparison of Rock Mass Rating Values

Rock Group	Q' Average		RMR Upper Bound (0.3 m - 1 m spacing, rating=20)		RMR Lower Bound (0.05 m - 0.3 m spacing, rating=10)	
	Q' logged	RMR^{eq}=9lnQ+44	Q_{eq}=exp[RMR-44)/9]	RMR logged	Q_{eq}=exp[RMR-44)/9]	RMR logged
Hay River Shale	4.5 (Jn-6) *fair*	57 *fair*	1.1 *poor*	45 *fair*	0.3 *very poor*	34 *poor*
Slave Point Limestone	11.5 (Jn-9) *good*	66 *good*	5.9 *fair*	60 *fair-good*	1.9 *poor*	44 *fair*
Watt Mountain Shale	4.3 (Jn=12) *fair*	57 *fair*	2.9 *poor*	54 *fair*	0.9 *very poor*	44 *fair*
Pine Point Host/Ore Body	5.9 (Jn=9) *fair*	60 *fair-good*	3.4 *poor*	55 *fair*	1.1 *poor*	45 *fair*
E-Facies	5 (Jn=6) *fair*	58 *fair*	2.4 *poor*	52 *fair*	0.8 *very poor*	42 *poor-fair*

The rock mass classification values in Table 2-4 give a general indication of the relative rock mass quality and competency that would be encountered during development drifting and mining. For example, the Slave Point Limestone Q-RMR values indicate a strong rock, with fair to good rock mass quality overall.

2.2.2 Stope Dimensions

Mineralization in the West Zone has an average height of 50 m, a length (deposit radius in the long axis) of 240 m, and a width (deposit radius in the short axis) of 120 m. To optimize the extraction of the mineralized material and reduce the number of top sills, stope sizes have been slightly modified from the AMC (2012) report. For design purposes, instead of 30 m x 10 m x 25 m

(HxWxL) stopes, lower and wider stopes were chosen with a dimension of 25 m x 15 m x 25 m. The Mathews-Potvin stability method was carried out to confirm the stability of this new stope dimension.

In Figure 2-8, it can be noted that even for the worst-case scenario (i.e., the RMR spacing rating 10), stope walls remain in the 'Stable with Support' zone. This area refers to the zone where ground support is required to provide stope stability during the stope's mine life. After blasting, the support of stope walls is provided by the mineralized material in place. Immediately after mining, the backfilling schedule will maintain control over wall dilution. This stope dimension is retained for the underground mining design in the West Zone.

2.2.3 Crown Pillar Thicknesses

A crown pillar thickness assessment was carried out in the PEA to confirm the stability of mined stope backs with the new stope dimension Table 2-5. In this assessment, the average logged value for Q was used as provided in the geotechnical review (AMC 2012).

Table 2-5: Crown Pillar Assessment – Carter method

Class	Description and Expectancy	Factor of Safety (FoS)	Maximum Scaled Span Equation (CS)(=SC)	Public Access	Maximum Scaled Span (C_s)	Years (Life Expectancy)	Crown Pillar Span (S) (m)	Span Ratio (Span/Length)	Calculated Resultant Maximum Thickness (m)
C	**Very Short Term** (Quasi Temporary Stope Crowns) *(to be monitored continuously with instruments)* *(High level of concern at closure)*	1.2	$2.74Q^{0.44}$	Actively Prevented	5.98	2-5	2	0.08	0.3
							3	0.12	0.7
							4	0.16	1.3
							5	0.20	1.9
							6	0.24	2.7
							8	0.32	4.5
							10	0.40	6.6
							15	0.60	13.0
D	**Short-Term Crown Pillar** (Semi-temporary crowns, e.g. under non-sensitive mine structure) *(to be mined out in near future)*	1.5	$2.33Q^{0.44}$	Prevented	5.09	5-10	2	0.08	0.5
							3	0.12	1.0
							4	0.16	1.8
							5	0.20	2.7
							6	0.224	3.7
							8	0.32	6.2
							10	0.40	9.1
							15	0.60	18.0

Based on this assessment, for a crown pillar with an estimated life expectancy of 5 to 10 years, the minimum thickness of the crown pillar should never drop below 18 m for a maximum hydraulic radius of 120 m. A central pillar of 20 m wide is left to limit the span of the final opening.

In general, the production time per deposit is one year on average and never exceeds two years. After mining completion, the underground mine is closed (restriction of access via signage as well as fencing is required) and no return is planned in this phase of the Project. In addition, on average, the back of the mined stopes for the West Zone is approximately 100 m below bedrock surface, with an additional 35 m of overburden. For the C1 Area, the back of the mined-out stopes is 60 m below surface, and therefore, within discussed limits.

2.2.4 Room and Pillar Stopes

To complement the longhole stoping method for the West Zone, the room and pillar method is used. It is also the main mining method for the C1 Area. The adopted dimensions of the rooms and pillars are based on standard industry practices and are summarized in Figure 2-8.

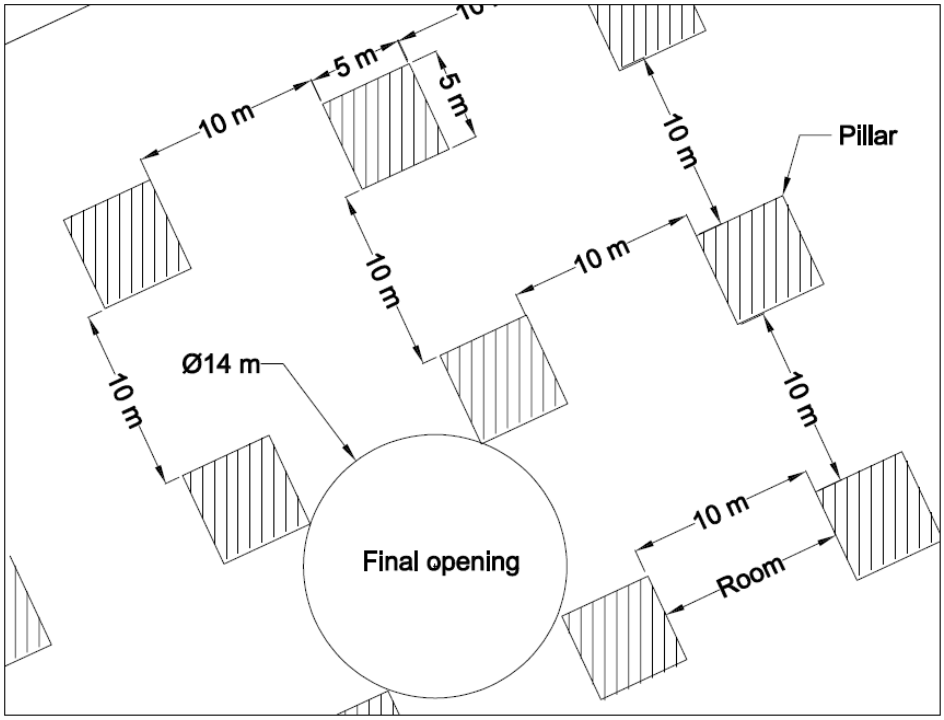


Figure 2-8: Plan View of the Room and Pillar Configuration

The height of the rooms and pillars is 5 m, and therefore, the same as that of the development levels. This allows for the use of the same equipment used in the West Zone. Mining is performed in stages. The first step is a development cut (5 m x 5 m) in the mineralized zone. During this primary development phase, the support is installed as proposed by AMC (2012). While advancing the secondary cut (also 5 m x 5 m), a secondary ground support is installed on the back to retain the rooms new span of 10 m. The proposed support consists of rebars of 3 m installed with a 1.5 m x 1.5 m pattern. This support must be installed as the development progresses. The last cut is done by retreating towards the accesses, which does not expose the workers to the final opening of 14 m in diameter.

Historically mined deposits from the Cominco era also used the room and pillar method (Figure 2-9). This method will be investigated in more detail at the next phase of the Project development.

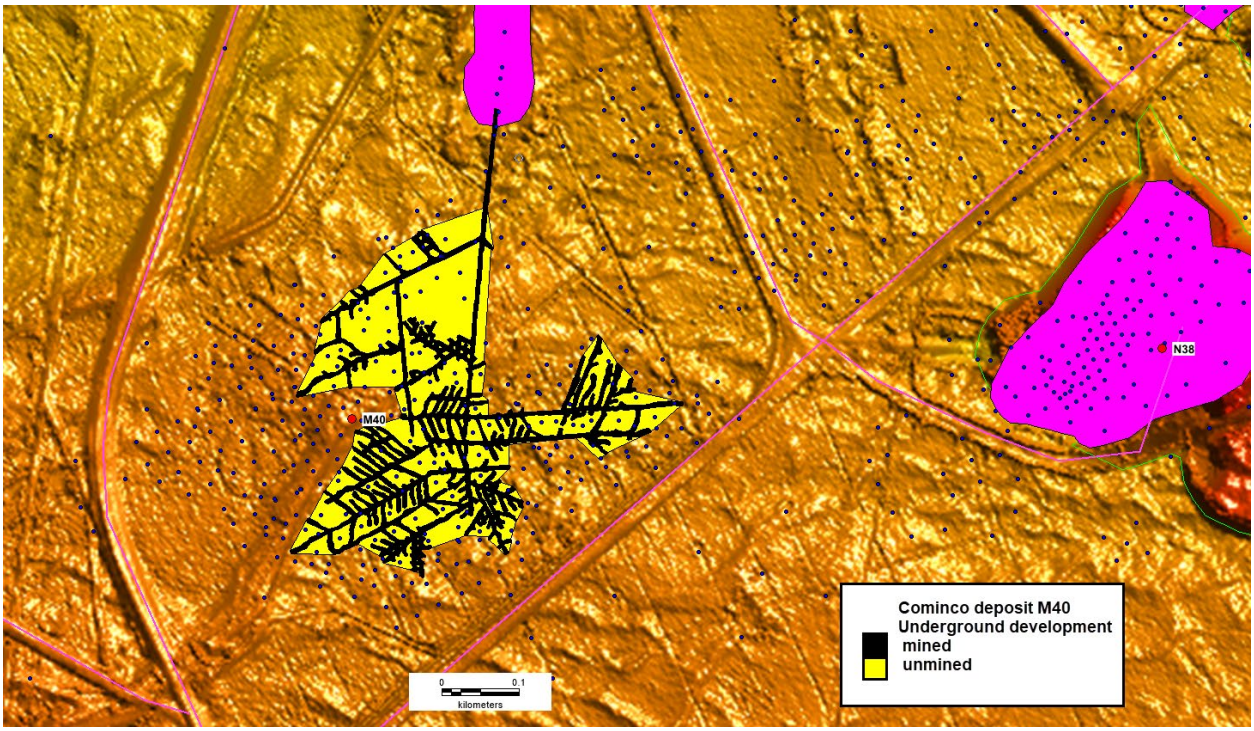


Figure 2-9: Historical Underground Mine Development from Cominco Era

2.2.5 Ground Support

In their geotechnical review, AMC (2012) provided estimates of ground support requirements for different underground excavations in the various rock units. These estimates have been evaluated and validated in the PEA. The ground support systems discussed below will be installed for both zones, regardless of the mining method used. Additional clarifications are made for the room and pillar method.

2.2.5.1 Development Headings

The NGI-Q ground support chart method was used to provide an approximation of ground support requirements for long-term development in the major lithologic units. The assumptions made are that the development headings are 5 m x 5 m, and an Excavation Support Ratio ("ESR") (permanent mine opening) of 1.6 is applied. The results are shown in Figure 2-10 and Figure 2-11. A range of ground support types have been estimated from the expected variability in ground conditions. For mine design and cost estimation purposes, an average ground support system for development drifts was decided (see Table 2-6 for excavation type versus ground support system).

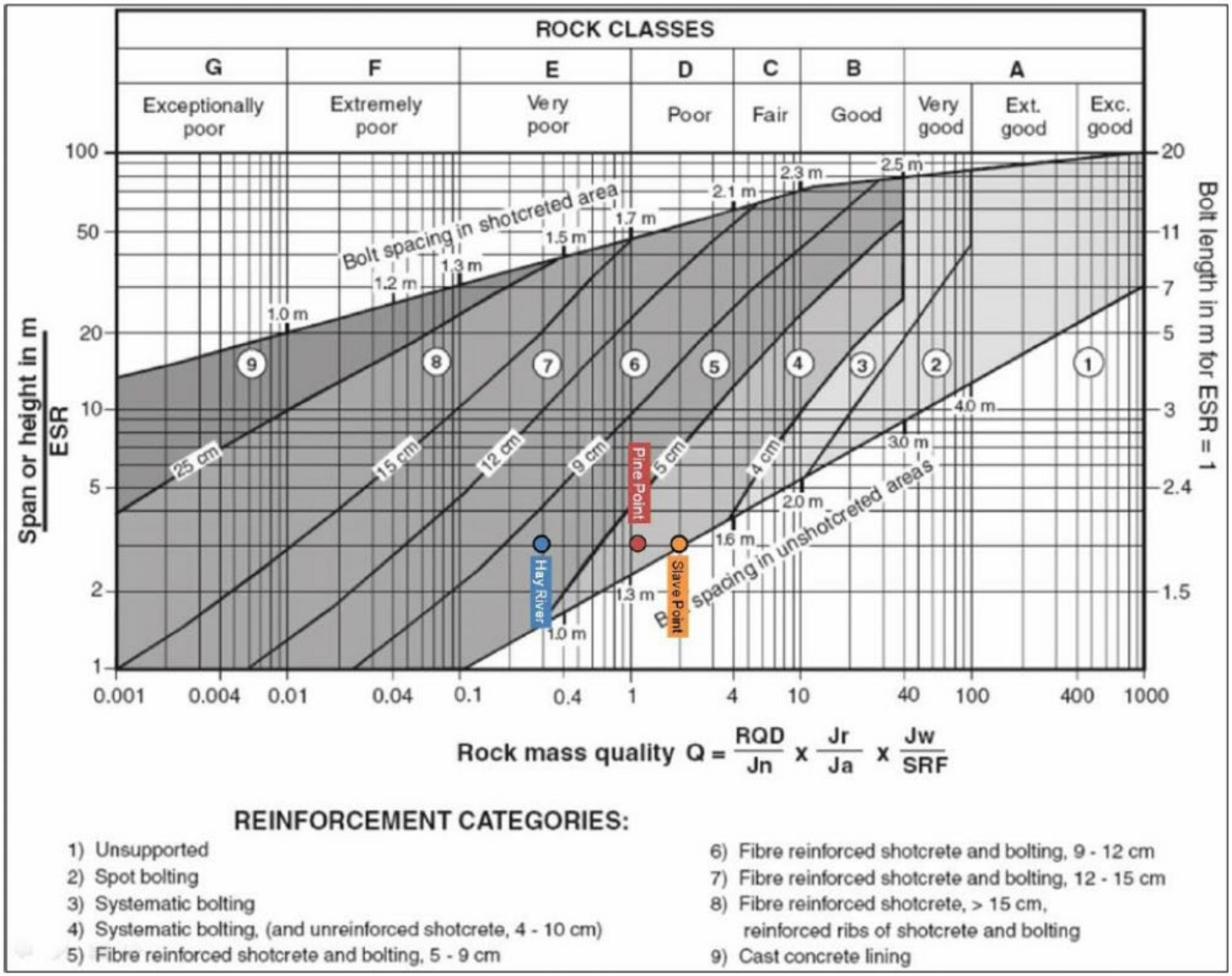


Figure 2-10: Ground Support – RMR Spacing Rating 10

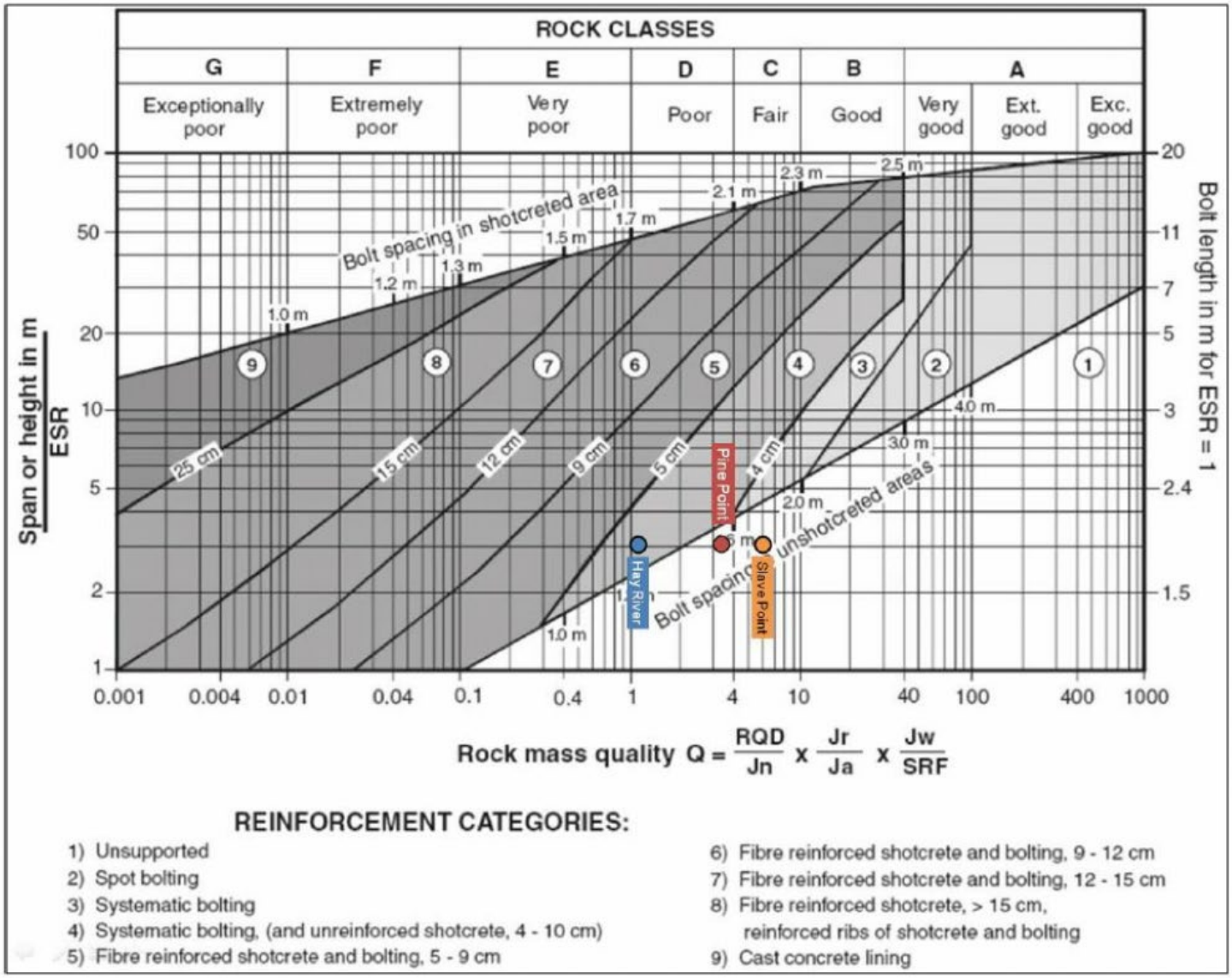


Figure 2-31: Ground Support – RMR Spacing Rating 20

Table 2-6: Excavation type versus Ground Support System

Waste Lateral Development (m)	Dimension	Ground Support
Ramp	5 m x 5 m	8' rebars pattern 1.2 x 1.2 m with mesh on roof and walls
Sublevel access	5 m x 5 m	8' rebars pattern 1.2 x 1.2 m with mesh on roof and walls
Drilling access Drift	5 m x 5 m	8' rebars pattern 1.2 x 1.2 m with mesh on roof and walls
Haulage Drift	5 m x 5 m	8' rebars pattern 1.2 x 1.2 m with mesh on roof and walls
PS Drift	5 m x 5 m	8' rebars pattern 1.2 x 1.2 m with mesh on roof and walls
Room and pillar drift	5 m x 5 m	8' rebars pattern 1.2 x 1.2 m with mesh on roof and walls
Ventilation Access	5 m x 5 m	8' rebars pattern 1.2 x 1.2 m with mesh on roof and walls
Gear Bay	5 m H x 8 m W	8' rebars pattern 1.2 x 1.2 m with mesh on roof and walls + 10' rebar pattern 1.8 x 1. 8m as back secondary support

For mine design and costing purposes, a Type 3b was selected as an average ground support system for development drifts (Figure 2-12).

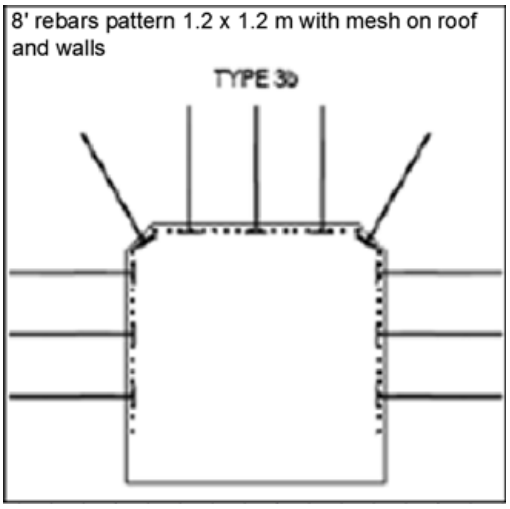


Figure 2-12: Typical Development Drift Ground Support Layouts

2.2.5.2 Sills Support

Stope entry development is generally deemed a short-term mine opening and an ESR of 2 has been applied to the ground support charts. Depending on the longevity requirements of the drifts and the ground conditions encountered, AMC (2012) recommended that planned support of stope entry excavations is achieved using both cement grout single strand cable bolts and split set or swellex bolts for surface support. Since the width of the stopes has increased from 10 m to 15 m, a re-evaluation of the secondary support at the stopes back was completed. For a width of 15 m and an RMR of 60, 9 m long double-strand cables with a pattern of 2 m x 2 m must be installed at the upper stope access (top sill). Preliminary estimates of ground support for the upper and lower stope access drifts are summarized in Table 2-7.

Table 2-7: Sills Ground Support

Stope Drift	Primary Support
Upper Stope Access	Split Sets/Swellex L-2.5m; S-1 to 1.5m c/c
Lower Stope Access	Split Sets/Swellex L=2.5m; S-1 to 1.5m c/c

2.3 Hydrogeology

A hydrogeological review was conducted in the PEA to estimate the dewatering rate required to lower the water table in the different zones of the Project. Four principal carbonate bedrock units are present beneath the overburden and Hay River Shale at the site (TetraTech 2020). These include the Slave Point Limestone, the Sulphur Point Formation (limestone with HTD), the underlying Pine Point dolomite and the underlying Keg River Formation. A highly porous alteration zone (HTD alteration) is well developed in the Sulphur Point Formation in areas of mineralization (Prismatic and Tabular styles). Channelways of HTD are present laterally in areas of Tabular mineralization and form distinct trends. The intensity of HTD in the Sulphur Point appears to drop considerably between the trends (North Trend, Main Trend, and South Trend) of mineralization. HTD is present in the Slave Point, Pine Point, Watt Mountain, and Lower Slave Lake formations and is very restricted to only the immediate area of the deposits. The presence of the HTD alteration also greatly enhances porosity and permeability. The HTD alteration zone comprises the aquifer unit. Figure 2-13 shows the HTD zone for the Main and North Trend areas as an example.

However, the East Mill Zone is considered to be drier and some of the historical pits are empty and above the top of the ambient water table. As indicated in the PEA, hydrogeological settings in the West Zone indicate high porosity and high hydraulic conductivity (1.10 E-4 m/s) except for deposit G03, which has a hydraulic conductivity slightly lower (7.41 E-4 m/s); the Central Zone has hydraulic conductivity in the same order of magnitude (1.10 E-4 m/s), and varies between 8.37 E-7 and 1.1 E-4 m/s.

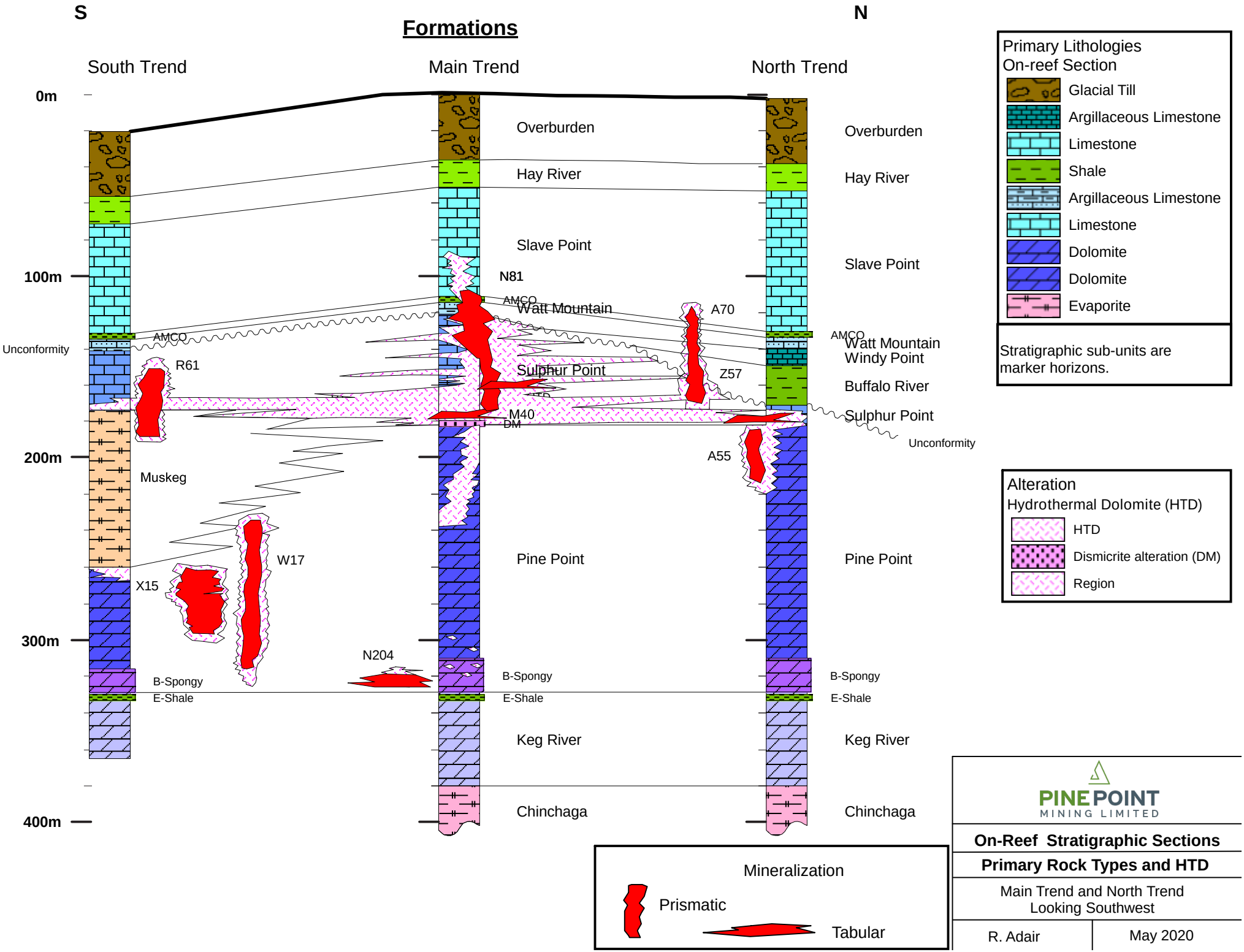


Figure 2-13: **On-reef Lithology and Stratigraphy of Main and North Trends with Schematic HTD Superimposed (Example of HTD Replacement)**

3 PROJECT COMPONENTS

3.1 Mine Plan and Schedule

The Project is to be mined both as open pits and underground workings. Two types of geological deposits (Tabular and Prismatic) are included in the mineralized material. The Tabular deposits are a rather flat layer, at shallow depth (less than 200 m), and generally thin (5 to 10 m). The Prismatic deposits have more vertical extent that could have up to 60 m thickness and are also shallow. The shape of these two types of deposits creates a series of aligned pit shells or underground workings that are generally less than 1,000 m in diameter. Some of the deposits are extensions of pits from the Cominco era that were not known or not economical at the time, while others are new discoveries.

Most of the deposits are planned to be mined as open pits and are located in the North and Main Trends (Figure 3-1). The deeper deposits with higher strip ratio are planned to be mined from underground when the grade can support this mining method and operating costs. The total mineralized material is 32.5 Mt grading 3.9% Zn and 1.48% Pb for 5.38% ZnEq for open pits, and 6.6 Mt grading 6.75% Zn and 3.34% Pb for 10.09% ZnEq for underground workings. The total combined mineralized material planned to be mined for the Project is 39.1 Mt at 4.38% Zn and 1.79% Pb for 6.17% ZnEq.

- Forty-seven deposits from four zones (East Mill, Central, North, and N204) are expected to be mined as open pits, considering the deposit's size, shape, orientation, and proximity to the surface as well as economic parameters. Drilling, blasting, loading, and hauling are used to mine the near surface mineralized material to meet the mine production schedule.
- Two zones involve underground mining methods: the West Zone (W1 Area) and the Central Zone (C1 Area). The West Zone (W1 Area) includes five underground workings mined by longhole mining methods with some stopes extracted by the room and pillar mining method (less than 10%). Three deposits from the Central Zone (C1 Area) are anticipated to be mined by underground methods due to their high strip ratio and good grades. These deposits are planned to have portal access through mined-out pits M64 (historical) and M67 (proposed).

The mining production schedule is based on a throughput of 11,250 tpd at the process plant during 10 years of operation. If additional resources are added to the mine plan, this would extend the life of mine. Indicated and Inferred Mineral Resources account for 28% and 72% of total process plant feed, respectively at this time. Further definition drilling of the Inferred Resources will increase the definition and convert these Resources to the Indicated Resource category.

Since the deposits are generally shallow, pre-stripping will be minimal. An allowance has been allocated for Year -1 but most of the stripping occurs during the first quarter of operation and it is possible to reach the Mineral Inventory deposit within a month. The first year ramp up throughput gives an average of 70% of full capacity of the mineralized material. Of the 47 pits, 20 are in operation for less than 3 months, 22 are in operation for 1 to 2 years, and 5 are in operation for more than 2 years.

Mine production is scheduled to come from open pits only in Years 1 and 2. Underground mine production supplements the open pit production feed to the plant between Years 3 and 9. The Life of Mine ("LOM") production schedule is presented in Table 3-1.

The LOM production schedule of a multi-deposit project has to take into account several aspects. The proposed schedule for the Project is a balance between the numerous deposits and their respective characteristics, considering various constraints including multiple mining methods, while aiming to optimize the plant feed. The Project has numerous specific aspects to consider, for example the West Zone deposits are high grade but require higher capital investments since they are mined from underground. Dewatering and haulage requirements would promote mining pits within “Cluster” areas, but the nearby deposits can have very variable tonnage, grades, and strip-ratios, which impacts their profitability.

The open-pit mining sequence is based on the profit margin per pit. The profit per ton was estimated for each pit based on preliminary costs including dewatering, haulage, and processing. The pits were sorted from the highest profit margin to the lowest and the sequence was developed with the following assumptions:

- 25% of the yearly production will come from the East Mill Zone, allowing access to mineralized material nearby the process plant and requiring less dewatering, as a contingency measure for the freshet.
- Preferably four clusters can be mined simultaneously, to facilitate logistics and benefit from the cumulative effects of dewatering while prioritizing pits with higher profit margins.

Generally, the pits that contain less than 1 Mt of mineralized material are mined within one year. The pits that have more than 1 Mt are mined in two to three years. The open-pit mining schedule was adjusted to be balanced with the 4,000 tpd coming from the underground operations between Years 3 to 7, and 1,500 tpd from Years 7 to 9. There will be eight pits in operation per year but less than four pits operated simultaneously. These assumptions may change as the mine plan is optimized in future studies; for example, the number of concurrent pits being mined or the number of clusters may increase or decrease.

Underground mining has been set to start in Year 3 to delay capital costs. The underground mining sequence is also based on the relative profit margin while considering the proximity (connection ramp) and underground mining methods for the production rate and reuse of equipment (West Zone completed before Central Zone).

Table 3-1: Mine Production Schedule

	Unit	LOM	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Open-pit Production												
Open pits	#		8	7	7	6	8	6	8	8	8	5
Mineralized Material	Mt	**32.6**	2.9	4.1	3.2	2.6	2.6	2.6	3.5	3.6	4.0	3.4
Zn Grade	%	**3.9**	5.0	4.9	4.6	3.8	3.5	3.7	3.2	3.8	3.2	3.2
Pb Grade	%	**1.5**	2.5	1.8	1.5	1.6	1.7	1.6	1.6	1.0	0.9	0.9
ZnEq Grade	%	**5.4**	7.6	6.8	6.1	5.4	5.2	5.3	4.8	4.9	4.1	4.1
Total Waste Rock	Mt	**167.1**	15.4	23.5	18.1	14.2	12.7	16.7	15.3	23.4	15.1	12.7
Overburden	Mt	**66.4**	5.5	9.6	9.6	7.1	6.1	6.2	7.5	9.1	3.1	2.7
Waste Rock	Mt	**100.6**	9.9	13.9	8.5	7.1	6.6	10.4	7.8	14.2	12.0	10.0
Underground Production												
Mineralized Material	Mt	**6.6**	0.0	0.0	0.9	1.5	1.5	1.5	0.6	0.5	0.1	0.0
Zn Grade	%	**6.8**	0.0	0.0	9.9	6.3	6.9	5.7	5.8	6.0	6.0	0.0
Pb Grade	%	**3.3**	0.0	0.0	5.0	4.2	2.9	3.1	2.0	1.8	1.8	0.0
ZnEq Grade	%	**10.1**	0.0	0.0	14.9	10.5	9.8	8.8	7.8	7.8	7.8	0.0
Total Production to Process Plant												
Mineralized Material to Process Plant	Mt	**39.1**	2.9	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.4
Zn Grade	%	**4.4**	5.0	4.9	5.9	4.7	4.7	4.4	3.6	4.1	3.3	3.2
Pb Grade	%	**1.8**	2.5	1.8	2.3	2.5	2.1	2.1	1.7	1.1	0.9	0.9
ZnEq Grade	%	**6.2**	7.6	6.8	8.1	7.2	6.8	6.5	5.2	5.2	4.2	4.1

MINING PRODUCTION SEQUENCE

- YEAR 1
- YEAR 2
- YEAR 3
- YEAR 4
- YEAR 5
- YEAR 6
- YEAR 7
- YEAR 8
- YEAR 9
- YEAR 10

NE2 AREA
X 18
X 17
N204 AREA
N204A
N204B
N204C
NE1 AREA
T37
EM AREA
N1 AREA
X55
Y53
X49
Y55
X59
X60
X61
Y62
Y65
Y56
Y58
Y57
X71
Z60
Y68
X68
L25
L26
L27
L35
L24
O27
O26
N31
N39
M40
N32
N34
N33
K51
M48
K57
K52
O53
N2 AREA
YBM
W85
C1 AREA
C2 AREA
K60
M63UG
J68
K68
M67
L65UG
M67UG
R67
C3 AREA
BIG BUFFALO RIVER
W1 AREA
G03
X25
R190
O556
P499
6
5

SCALE 1:100 000
0 2 500 5 000 7 500 10 000m

Figure 3-1
PRELIMINARY

KEY PLAN

GENERAL NOTES

LEGEND:

- PROPOSED PITS
- HISTORICAL PITS
- PROPOSED UNDERGROUND WORKINGS
- PROPOSED WASTE ROCK PILE
- PROPOSED OVERBURDEN PILE
- MINERAL SORTER REJECT
- WOODEN AREA
- WATER AREA
- WETLAND AREA
- EXISTING ROADS
- WATERCOURSES

NOTES:

1. LIDAR PROVIDED BY THE CLIENT. PRODUCED IN DECEMBER 2019.
2. UTM NAD83, ZONE 11 COORDINATE SYSTEM.
3. BASEMAP : CANVEC , 1:250000, TILE 085B, ©HER MAJESTY THE QUEEN IN RIGHT OF CANADA, AS REPRESENTED BY THE MINISTER OF NATURAL RESOURCES, 2017.

REV	DATE	DESCRIPTION	DR.	CHK	APP
ZB	2020-07-02	FOR INFORMATION	E.G.	-	S.L.
ZA	2020-06-30	FOR INFORMATION	E.G.	-	S.L.

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1800, BOULEVARD RENÉ-LÉVESQUE OUEST, 11ème ÉTAGE,
MONTRÉAL (QUÉBEC) CANADA H3H 1P9
TEL. : (514) 340-0046 | FAX. : (514) 340-1337 | WWW.WSPGROUP.COM

OSISKO METALS
PINE POINT MINING LIMITED

DESIGN :	H. LATULIPPE, Eng.	2020-07-02
DRAWN :	E. GAMSBY, tech.	2020-07-02
CHECKED :	-	-
APPROVED :	H. LATULIPPE, Eng.	2020-07-02
CLIENT :	-	
SCALE :	1:100 000	DATE

PROJECT :
PINE POINT

SUB-PROJECT :
PRELIMINARY ECONOMIC ASSESSMENT

TITLE :
MINE SURFACE FACILITIES
GENERAL ARRANGEMENT
MINE PRODUCTION SCHEDULE

DRAWING NUMBER
301-G-0110-ZB
DET. AREA - DISCIPLINE - SEQUENTIAL NO. - REVISION

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3.2 Mining

The Project is based on an updated MRE that converts 12.9 Mt to an Indicated Mineral Resource (pit constrained) and includes 37.6 Mt of Inferred Mineral Resources (underground and pit constrained). The mineral inventory will be mined at an estimated production rate of 6,000 tpd ramping up to 11,250 tpd for a life of mine that is approximately 10 years or longer. At this time, the deposits located in the East Mill, North, Central and N204 Zones, east of the Buffalo River, are mainly planned to be mined as open pits. Some of the deeper deposits, such as those located in the West Zone, west of the Buffalo River, and the Central Zone, east of the Buffalo River, will likely involve underground mining methods. The deposits are listed below in Figure 3-2 and their locations are presented in Figure 3-1.

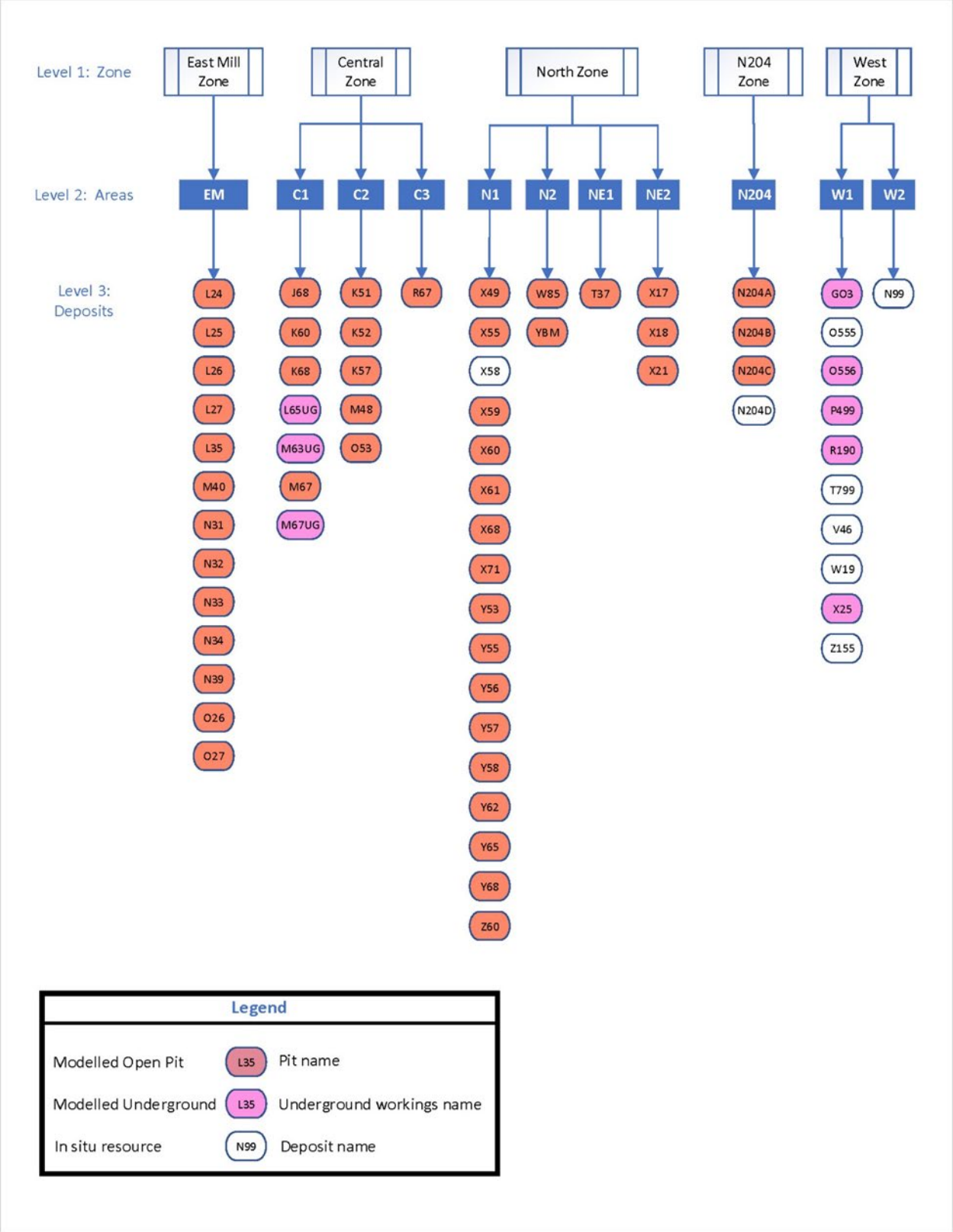

Figure 3-2: Deposit List and Locations

3.2.1 Open-Pit Mining

Most of the mineralization will be mined using open-pit mining methods. Ramps will be used to move personnel and equipment in and out of each mine, and to move mineralization and waste rock to surface. The larger pieces of mining equipment will be moved to the pits as the need arises and will generally remain in operation in the pits until no longer required, except for maintenance activities.

Open pits will be developed in stages, concurrently mining multiple pits from various zones, to provide the required material for optimized process plant operations. The site preparation work will include the stripping of overburden and placement of the material in designated overburden piles. Mineralization-bearing rock will be drilled and blasted and then transported by haul truck to the process plant.

As an alternative, when shallow and Tabular deposits are encountered, a surface miner (Figure 3-3) could be used. Each year, mineralized material will be produced from one to twelve open pits, usually located within the same zone but sometimes located in two to three different mine working areas.

Figure 3-3: Example of a Surface Miner

At full capacity, it is currently estimated that it will take 80 to 100 truck trips per day from the various sources of mineralization with a truck payload capacity of approximately 100 tonnes to haul material to the concentrator. Future trade-off studies will determine the most cost-effective truck capacity, and as such, the truck trips required.

Alternatives being considered in the Project planning stage include optimizing haulage distances and road alignments, combining open pits where possible, the use of alternative equipment and fuel for the transport fleet.

3.2.2 Underground Mining

The process of removing the economically viable mineralization from the deeper deposits will require underground mining methods. This will begin through the development of underground ramps, which will also require overburden stripping. Quantities of overburden and waste rock are expected to be considerably less than the volumes generated by open-pit mining.

Underground ramps will be used to move personnel and equipment in and out of the mines, and to move mineralization and waste rock to surface. The production period of deposits to be mined by underground methods is currently planned for Years 3 to 9 of the approximate 10-year LOM.

The deposits that are planned to be mined from underground are located in two zones: the West Zone (W1 Area), and the Central Zone (C1 Area) (Figure 3-1). For both zones, the mineralized material is accessed via a ramp and transported to surface using 45-t trucks. Waste rock material is brought to the surface and placed on a temporary stockpile near the mine portal before being used to backfill mined-out stopes after mining completion.

For the West Zone and C1 Areas, two different strategies are used to allow access to the deposits. For the West Zone, the excavation of overburden is necessary beforehand while for the C1 Area, portals would be excavated from the bottom of existing mined-out and dewatered pits and future proposed open pits.

The West Zone consists of five deposits. Three of these deposits (R190, G03, and X25) are accessed by a surface portal, while P499 and O556 are proposed to be mined at this time by a connection ramp, which is excavated from the R190 decline. For the Central Zone (C1 Area), portals are excavated from the bottom of existing pits. M67 is mined earlier in the mining schedule and from which M67UG and L65UG will be accessed. M64, which was mined during the Cominco era, will be used to access M63UG, after dewatering.

Secondary accesses are possible via ventilation raises. After the completion of decline/ramp development, ventilation raises (fresh air) are excavated in priority to create a second emergency exit before the start of production. Therefore, these raises are equipped with a manway from the surface to the bottom level of the mine.

Underground mineralized material transportation to the process plant will be carried out by a contractor. For the West Zone, the long-haul trucks are loaded at the portal and will take Highway 5 to cross the Buffalo River and then Highway 6 to the nearest haul road so that the highway is used for a limited distance. For the C1 Area, 45-t articulated trucks will transport the mineralized material.

3.3 Processing

The Project is currently being assessed based on an average mining production rate ranging between approximately 6,000 to 11,250 tpd of Run of Mine mineralization from open pit and underground operations. The mining production rate will be optimized over time, particularly if resources are added to the current resource base.

The Project includes the development of a new plant site concentrator processing facility (the "process plant") near the old Cominco process plant site location that will include pre-concentration, crushing, grinding, flotation, and dewatering circuits.

Processing pre-concentration facilities will include X-Ray Transmission (XRT) material sorters and associated crushing and screening equipment (Figure 3-4 and Figure 3-5). The advantage of using preconcentration is that it removes approximately 40% of the volume of material from the process plant feed. This reject material will not require further processing.

3.3.1 Process Plant Design

Haul trucks will transport the mineralized material to the plant site concentrator for processing into marketable zinc and lead concentrates (Figure 3-4). All of the economically viable mineralization will be sent through the pre-concentrator circuit located within the process plant between the primary crusher and the grinding circuits to sort gangue (non-mineralized rock) from mineralized material that will reduce the volume of rock to be processed in the grinding and flotation section of the process plant compared to the total mine production rate.

The process plant consists of a three-stage crushing circuit incorporating mineral sorting followed by grinding, differential flotation of lead and zinc, and dewatering of concentrate and tailings. Historical and new mined-out open pits will be used for tailings disposal.

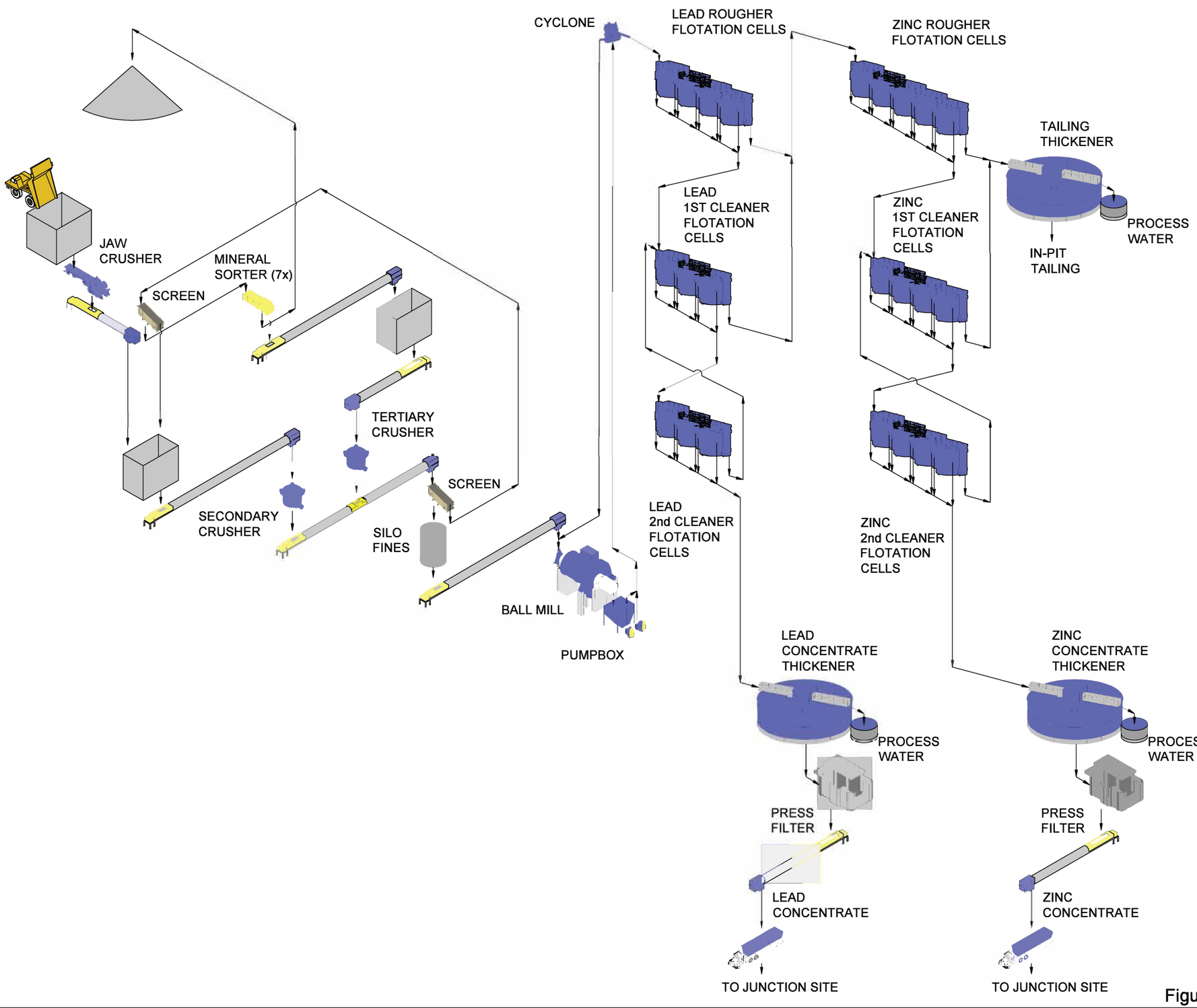

Figure 3-4

KEY PLAN

GENERAL NOTES

OSISKO METALS
FOR INFORMATION
NOT TO BE USED FOR CONSTRUCTION
DATE: 2020-06-30
BY: D. MATHIEU

REV	DATE	DESCRIPTION	DR.	CHK	APP.
ZB	2020-06-30	FOR INFORMATION	D.M.	-	-
ZA	2020-06-26	FOR INFORMATION	D.M.	-	-

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OSISKO METALS

DESIGN :	C. LAROCHE	2020-03-20
DRAWN :	D. MATHIEU	2020-06-22
CHECKED :		
APPROVED :		
CLIENT :	-	
SCALE :	N/A	DATE

PROJECT :
PINE POINT

SUB-PROJECT :
PRELIMINARY ECONOMIC ASSESSMENT

TITLE :
FLOWSHEET OVERALL SCHEMATIC
PROCESS FLOWSHEET
-
-

DRAWING NUMBER
600-D-0001-ZB
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3.3.2 Crushing and Mineral Sorting Circuit

The primary crushing circuit (Figure 3-5) located prior to the pre-concentrator circuit will consist of a primary jaw crusher and screening unit to remove the fine fraction from the crushed material that is to fine grained and not appropriate for the XRT sorting equipment. The fines will be sent directly ahead to the grinding circuit for further processing.

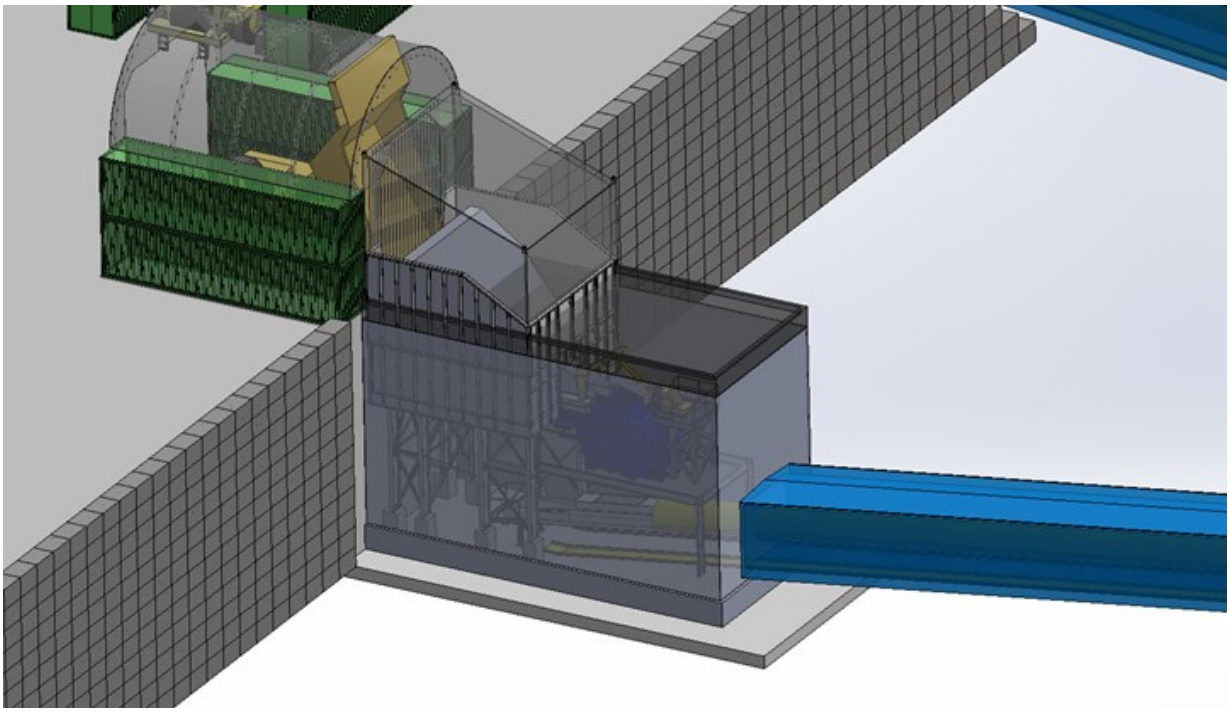


Figure 3-5: Primary Crushing Arrangement

The crushing circuit is designed to be fed 4.1 Mt of mineralized material per year. The primary crushing circuit is composed of a vibrating grizzly feeder followed by a 160 kW jaw crusher. The crusher reduces the feed size from a maximum of 500 mm to a P80 of approximately 90 mm with a 105 mm closed side setting. The crushed material is transported to the crushed mineralized material bin in the secondary crushing area via a conveyor.

The secondary crushing/screening circuit will reduce the Run of Mine material into two size fraction products: a coarse fraction of 10 to 60 mm and a fine fraction of minus 10 mm particle sizes. The coarser product will be conveyed to a surge bin that will feed the XRT material sorter circuit, whereas the fine fraction (-10 mm) will be conveyed into the concentrator surge hopper bin. The coarse mineralized fraction after XRT sorting will be re-combined with the primary crushing circuit fines as the combined process plant feed to the concentrator for processing.

Non-mineralized material rejected from the XRT sorter process (rejects) will be in the size range of 10 to 60 mm and conveyed out of the concentrator for temporary storage in a sorter reject stockpile and managed as waste rock, as per the Tailings and Waste Rock Management Plan.

Stockpiles at the process plant will be established to enable blending of mineralization to obtain a consistent grade and metallurgical properties in the feed to the concentrator. The number and location of the stockpiles near the plant will be determined in the next study phase.

Where possible, previously cleared land that was used by Cominco for industrial development will be used for infrastructure locations.

Two alternative technologies were considered for the pre-concentration process: Dense Media Separation, and XRT material sorting. Both alternatives require that the mineralization-bearing rock be crushed prior to separation. Dense Media Separation uses a water-based separation media in its processing equipment while XRT is a dry process that does not use a separation media. XRT was selected due to lower water consumption requirements.

Waste material from the XRT sorter (sorter rejects) will be transported by truck to the waste rock storage facility (WRSF) or tailings disposal area (TDA) to be deposited as cover material on these areas.

3.3.3 Grinding

Following the primary and secondary crushing and preconcentration circuits, the process plant feed will then be conveyed to the grinding circuit. The grinding circuit will consist of a single ball mill in a closed circuit with a cluster of hydro cyclones for size classification. The ball mill discharge product will be a slurry (water and solids), to be pumped to hydro cyclones. Coarse material will report to the cyclone underflow and be recirculated back to the ball mill. Fine material will report to the cyclone overflow and flow by gravity to the flotation circuit.

3.3.4 Flotation

The flotation process will separate the mineralized from non-mineralized particles and produces three products: zinc concentrate, lead concentrate, and 4,500 to 5,600 tpd of slurry tailings. Reagents, called collectors, frothers, and modifiers, are added to the grinding circuit product (slurry) before flowing into the flotation circuit which consists of flotation cells that are connected in series.

The flotation cells inject air into the slurry as it passes through the cell and the mineral particles are collected on the resulting froth bubbles, which overflow into a collection launder located at the top of each cell. Lead concentrates are first collected in the lead flotation circuit. Lead flotation circuit tails flow into the zinc flotation circuit where zinc concentrates are produced and both concentrates are filtered separately prior to transport to the trader or smelter.

After flowing through the flotation cells, the non-mineralized particles remaining in the slurry are tailings. These tailings will be pumped to a tailings thickener to remove excess water for reuse before the thickened tailings are pumped into previously mined-out open pits. The location of these pits and the pit volumes required will be refined as part of the next study. Clarified water, that is decanted from the overflow of the thickener, will be recirculated back to the grinding circuit for reuse. This recirculation will substantially reduce the Project's overall freshwater usage.

An inventory of process chemicals anticipated to be needed is provided in Table 3-2 along with their planned supply and storage methods.

Table 3-2: List of Reagent Use, Supply, and Storage

Reagent	Application	Delivery	Storage	Preparation	Estimated Consumption (tpy)
Zinc sulphate	Zinc depressant	Bags - solid	Dry warehouse	Mixing tank, water addition	873
Aero3894	Lead promoter	Totes - liquid	Dry warehouse	No preparation required	70
Copper sulphate	Lead activator	Bags - solid	Dry warehouse	Mixing tank, water addition	1,980
Aerofloat 3418A	Zinc promoter	Totes - liquid	Dry warehouse	No preparation required	37
MIBC (methyl isobutyl carbinol)	Frother	Totes - liquid	Dry warehouse	No preparation required	79
Quick lime (CaO)	pH modifier	Trucks - solid	Silo	Mixing tank, water addition	2,888
Flocculant	Flocculation of solids in thickeners	Bags solid	Dry warehouse	Eductor, mixing tank, water addition to inline mixer	175

Note: All numbers are provided for information purposes only. During actual operations, values are expected to vary.

3.3.5 Concentrate and Tailings Dewatering

Both lead and zinc concentrates will be pumped to their dedicated dewatering systems. Concentrate thickeners followed by filter feed tanks will provide enough retention time for the operation of a dedicated vertical filter press for each concentrate. The lead concentrate filter is designed to filter 76 m^3/h and the zinc concentrate filter is designed to filter 156 m^3/h of 62% solids thickened slurry. For operational flexibility, a third filter press will be installed as a stand-by for both lead and zinc concentrate filtration processes. The filtered concentrate cakes hold about 8% moisture and will be transferred by trucks.

Flotation tailings will be pumped to a 30 m diameter conventional high rate thickener. Tailings will be dewatered to 60% of solids in the underflow for disposal. Thickened tailings will be transferred to an existing or new mined-out open pit. Thickener overflow will be returned to the process plant as process water. Tailings will be managed as per the Tailings and Waste Rock Management Plan.

3.4 Waste Management Infrastructure

3.4.1 Waste Rock Storage Facilities

3.4.1.1 Reclamation Material

Reclamation material stockpiles will be located close to WRSFs and/or overburden piles and open pits to provide storage for topsoil and organics. The expected volume of reclamation material is expected to be relatively low. The reclamation material stockpiles will include mainly topsoil, peat, gravels, and small trees.

3.4.1.2 Waste Rock and Overburden Material

Mine rock will be mined using excavators or shovels. If rock is needed for on-site construction purposes (i.e., road building, pad construction, and berms), it will be crushed and screened with a mobile aggregate plant to the desired size and used as required providing that the geochemical

properties of the material are appropriate for such use. Excess Mine rock that is not required for construction will be stored on-site. As for all the Project infrastructure, WRSFs will be built, to the extent possible and practical, on disturbed areas, including mined-out pits. The WRSF location will aim at optimizing haulage distance and segregating to separate PAG material.

The volumes of the WRSFs and overburden have been calculated based on the mine plan and are listed in Table 3-3. The waste rock tonnage was converted to volume using a dry density of 2.71 t/m^3 as specified in the MRE, and a swell factor of 1.3. The overburden was converted to volume based on the assumption that it will mainly be composed of till, with a dry density of 2.0 t/m^3 (Rice et al. 2013).

Studies of ML/ARD completed to date (Rescan 2011, 2012a,b) and reviewed by TetraTech (TetraTech 2018) concluded that analyzed samples are consistently classified as non-PAG, based on NPR values of greater than 2. Eighty out of the eighty-two samples are classified as non-PAG.

Where possible, the waste rock will be backfilled in nearby historical pits or in available proposed mined-out pits. The overburden will be stockpiled separately as a major part of it will be used during reclamation. Considering the number of pits, the design and locations of the WRSFs were developed based on proximity, which limited the overall footprint and expected hauling distances. Considering the performance of existing waste rock piles at the site and in agreement with the preliminary geochemical assumptions, no improvement of the foundation for groundwater protection is deemed necessary.

The preliminary design of the WRSFs is based on typical criteria and considers the Design for Closure concept. Reshaping and reworking the waste rock material is thus limited during the active reclamation phase. The WRSFs have been designed using the following geometry; however, this may be updated in the next study:

- Maximum height: approximately 30 m
- General Slope: 2,5 H:1 V
- Lift thickness: approximately 10 m
- Berms: approximately 4 m wide berms at each lift
- Pile width and length: dependent of the site restrictions

General information on the geotechnical conditions was found in historical documents and will be confirmed with field investigations and stability studies. Observations made of existing waste rock facilities does not suggest notable issues with stability.

Site restrictions, such as historical pits and piles as well as transport infrastructure, have also been considered in the design of WRSFs. In total, 12 WRSFs and 12 overburden stockpiles have been designed. The total volume of waste rock produced over the LOM is estimated at approximately 52 Mm^3; the total overburden volume is estimated to be about 50 Mm^3. The volumes will change as the mine plans are refined during the next study; however, these volume estimates can be considered as representative of the Project. If additional resources are added to the mine plan, this will also increase the quantities of waste rock and overburden produced. Table 3-3 lists the WRSF capacities with respect to each area, as well as the list of historical and

new open pits proposed to be used for backfilling. Using 100 tonne trucks, it is currently estimated that it will take between 275 and 550 round trips per day to transport the waste rock between the open-pit mines and WRSFs. Waste rock will be managed as described in the Tailings and Waste Rock Management Plan.

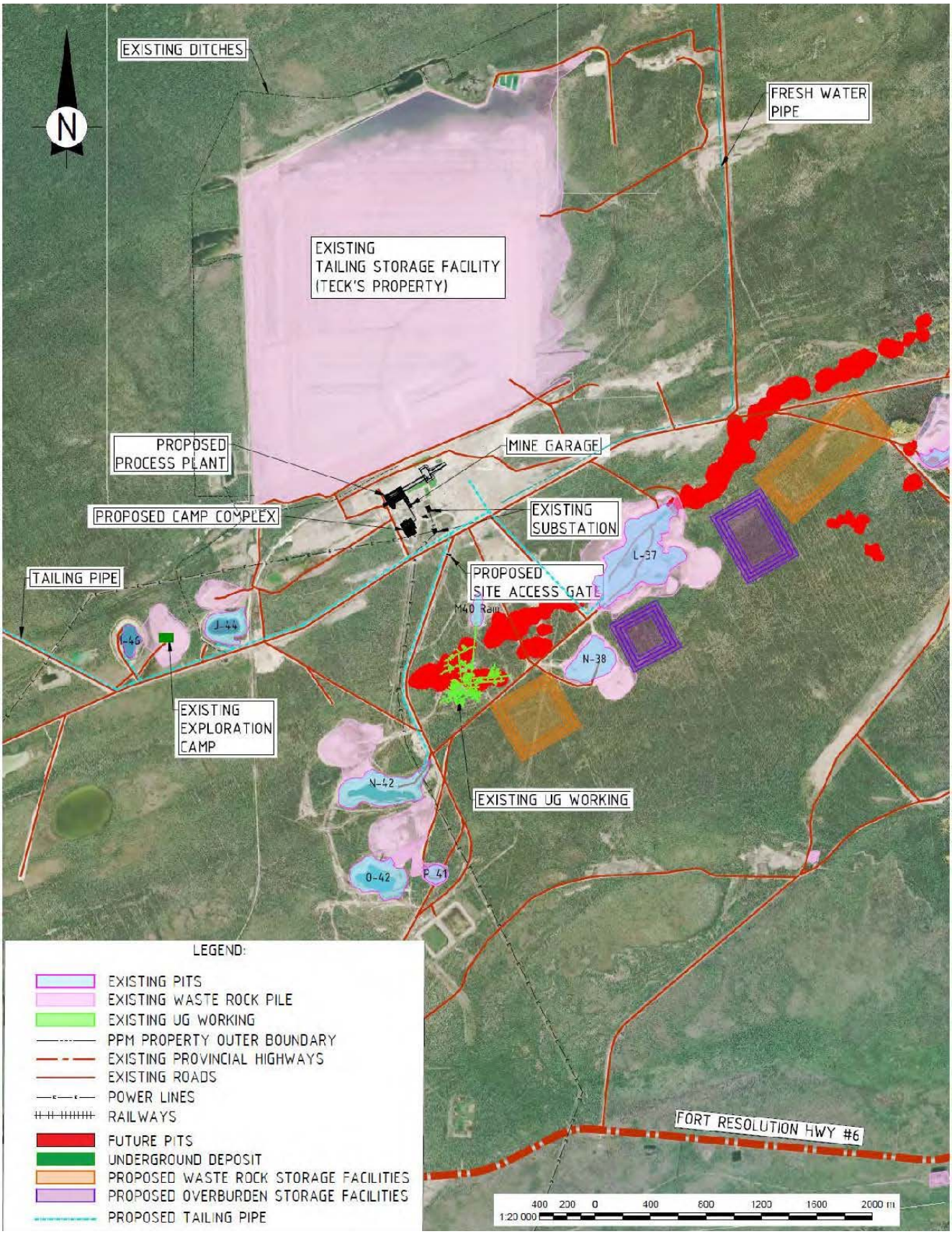
Table 3-3: Volumes of Waste Rock or Overburden Capacities in Each Pile or Pit Group

Waste Rock or Overburden Storage ID	Area	Pit Receiving Waste Rock		WRSF capacity (m^3)	Overburden stockpile capacity (m^3)
		Historical Pit	Proposed Mined-Out New Pit		
1	NE2	WRSF beside the pit.		238,904	27,208
2	N204			10,701,251	1,157,871
3	N2			4,213,922	1,643,588
4	W1			230,838	3,571,000
5	W1			84,059	2,483,000
6	W1			86,811	245,000
7	C1	I65, M64	J68, K68, M67	3,290,360	3,290,360
8	C2	NA	K51, K52	2,295,131	2,295,131
9	EM	O42, P41	N39, M40	2,040,817	2,040,817
10	EM	N/A – External only		2,747,476	2,747,476
11	N1	N/A	X59, X60, X61, Z60	7,635,277	7,635,277
12	N1	N/A	Y65	11,850,216	11,850,216
INPIT-1	NE1	T37	T37	71,078	71,078
INPIT-2	C3	S65	R67	701,841	701,841
INPIT-3	C2	M52	O53	391,703	391,703
INPIT-4	EM	X15	L26	251,861	251,861
INPIT-5	EM	O28, L30	L27, L24	1,281,062	1,281,062
INPIT-6	N1	X51-X54	NA	878,457	878,457
INPIT-7	N1	X51-X54	Y53, Y57	2,338,543	2,338,543
INPIT-8	EM	K62	K60	478,236	478,236
Totals				51,807,843	45,379,725

WRSF = Waste Rock Storage Facility

3.4.1.3 Mineral Sorter Rejects

A mineral sorter rejects pile, with a capacity of about 5 Mt (approximately 2.4 Mm^3), will be located east of the process plant (Figure 3-6). The volume may increase if additional resources are added to the mine plan. The pile is designed to have a thickness of approximately 20 m and will be used to temporarily store mineral sorter rejects before they are transferred to the TDA, available mined-out pits, or WRSF. The pile location will be refined as the process plant design advances.



PROJECT
Pine Point Project

TITLE
Process Plant Site Infrastructure Overview

PROJECT NO.		REV.	FIGURE
19125747	**B4100**	**0**	**3-6**

3.4.2 Tailings Disposal

3.4.2.1 Tailings

Mineralization-bearing material that is sent to the process plant will undergo processing including grinding and flotation. After being processed through the flotation cells, the non-mineralized particles remaining in the slurry will be separated as tailings. These tailings will be discharged into a tailings thickener to recover water for recycling and to increase the percent solids before the tailings are pumped through a pipeline for disposal into selected mined-out pits (TDAs). Clarified water, decanted from the thickener, will be recirculated back to the grinding circuit for reuse. Decanted water from the TDAs will be pumped to avoid overflow and reclaimed back as part of the overall water management system.

Survey and bathymetries conducted for the existing pits have confirmed there is sufficient available space for the entire LOM. Thickened tailings will be transported via pipeline from the concentrator to nearby TDAs. Direct transfer of tailings to TDAs has many advantages including fine ground wet material does not disperse as dust, saturated conditions reduce the potential for oxidation, and the use of previously disturbed land rather than creating new land disturbances.

A hydraulic transport system will have to be constructed for movement of tailings and reclaim water. At this point, it is expected to be above ground, with drainage points and spill containment areas located at naturally occurring low points along the route. Pipelines will follow the existing on-site road alignments where possible and will be protected by berms. Ditching will direct potential spillage to constructed containment areas. Where the pipelines will need to deviate from existing on-site roads, access roads will be built for construction and used as a service road for pipeline maintenance during operations.

Approximately 3,800 to 6,200 tonnes of thickened tailings could be produced each day. The tailings management system would need to accommodate approximately 18 Mm^3 of tailings over the LOM. The thickened tailings will be approximately 60% solids by weight when delivered to the disposal site. Tailings will be managed as described in the Tailings and Waste Rock Management Plan.

3.4.2.2 Pre-Concentration Rejects

The pre-concentration process should decrease the amount of tailings produced and would generate approximately 2,000 to 4,500 tpd of rejects comprising similar material to waste rock. This material has a size range between 10 and 60 mm and will be trucked or conveyed to a waste stockpile or to adjacent TDAs for disposal. Pre-concentration rejects will be managed as described in the Tailings and Waste Rock Management Plan.

3.4.3 Waste Management Facilities

On-site waste facilities will be provided to contain, store and treat solid wastes:

- a waste transfer sorting and storage area
- a landfill for inert solid wastes
- a landfarm for petroleum-contaminated soils (constructed as required)
- an oil-water separator for treatment of petroleum-contaminated snow/ice/water
- incinerators for combustible waste and waste oil

- burn pits for oversized, non-hazardous combustibles
- a domestic sewage treatment system

Wastes will be managed as per the Waste Management Plan. Some wastes may also be transported off-site to municipal or third-party waste management facilities, pending further Project design and discussions with the municipality.

3.4.3.1 Waste Transfer Storage Area

The waste transfer storage area will be established near the process plant/accommodation complex for the handling and temporary storage of wastes. Non-food waste products that are not incinerated or placed in the landfill immediately will be collected, sorted, and placed in designated areas within the storage area. The waste transfer storage area will include a lined pad for the collection of hazardous waste including contaminated soil and snow/ice. Hazardous material that cannot be treated on site will be returned to the suppliers or to a hazardous waste disposal facility. It will be fenced to prevent wildlife from entering and human access will be controlled.

3.4.3.2 Landfill

The active landfill will be located within a combination of completed open pits, small areas of the mine rock piles, TDAs, or overburden stockpiles. Some landfill material may be shipped off site to a licensed facility when required. The landfill will receive inert bulk waste that cannot be recycled or re-used such as conveyor belts, tires, chute liners, and building debris. Incinerator ash from the combustion of kitchen and office waste will go to the landfill.

Landfill waste will be buried to minimize exposure to wind and care will be taken to prevent the presence of wastes that could attract wildlife. The landfill in the mine rock piles will represent a single landfill in operation at any given time, which will be covered and buried as mine rock piles or overburden piles are completed. As the landfill area(s) would be in the WRSFs or overburden piles, any potential runoff and seepage from the landfill area will be contained within the Project site.

3.4.3.3 Landfarm

A landfarm for the bioremediation of hydrocarbon contaminated solids from spills may be constructed. This dyke bounded cell would be located adjacent to the fuel storage area and would consist of an arctic geo-membrane liner placed under fill material. Hydrocarbon-contaminated soils would be placed in the landfarm and spread during summer months. Any soil that has subsequently reached acceptable levels of hydrocarbon degradation would be removed and reused or transferred to the landfill. Details will be provided in the Waste Management Plan.

Arctic conditions may impede the remediation of contaminated soil through natural microbiological processes. If remediation of hydrocarbon-contaminated soils in the landfarm proves to be ineffective and no other remediation system has proved effective in northern climates, the contaminated soils will be collected and shipped to suitable licensed disposal facilities.

3.4.3.4 Incinerators

Two dual-chamber, diesel-fired incinerators will be provided for the incineration of combustible waste, including kitchen waste. The incinerators can also be used to burn waste oil. Incinerator ash will be collected in sealed, wildlife-resistant containers and, if non-hazardous, transported to the landfill. Hazardous ash will be sent to a hazardous waste disposal facility.

Each modular unit will be pre-assembled and will be housed in a pre-engineered module accessible from the accommodation complex or the waste management transfer storage area. The facility will be capable of meeting the demand of the construction workforce housed in the construction camp. The transport of waste to nearby landfill sites for disposal is also an option if required. Currently, removal of some combustible wastes to an off-site facility is also being considered to limit the amount of waste incinerated at the Project.

3.4.3.5 Domestic Sewage Treatment Plant

A sewage treatment system to handle a peak load of up to 500 people will be provided as part of initial construction. Treated domestic effluent will be discharged to the septic field or discharged to the environment, such as an unused pit or wetland, if it meets effluent criteria. If may also be shipped off-site if required. Sewage sludge will be dewatered and incinerated on-site or transported to a licensed facility.

3.5 Buildings and Infrastructure

3.5.1 Process Plant

The process plant and proposed infrastructure is expected to be sited in the same area as the historical Cominco process plant complex. Existing infrastructure from the historical operations that are planned to be reused for the Project include:

- water ponds (2) for water management once rehabilitated
- building pads for the process plant and the camp complex foundations
- open pits near the process plant to be used for tailings disposal and water management

The process plant will consist of four main areas:

- primary crusher dump building: 8.2 m wide by 18.2 m long with a height of 12 m
- crusher building: 35.4 m wide by 45 m long with a height of 41 m
- mineral sorting and screening building: 36 m wide by 36 m long with a height of 41 m
- process building: total of 176 m long with heights adapted for three sections (grinding 28 m, tailings area 19 m, concentrate filtering and load-out area 22 m). The main building will have a width of 36 m, except for the concentrate filtering and load-out area where the width will be reduced to 22 m. It will also include allocated space for the process services such as an electrical room (7 m wide by 16 m long with a height of 5 m), lab (122 m^2 surface area with a height of 5 m), mechanical shop, and HVAC.

The primary crusher building will contain the vibrating grizzly feeder with the jaw crusher. Added to this building, there will be a light shelter for truck discharge. This area will contain an overhead crane with enough capacity to lift the heaviest crusher parts. The secondary and tertiary crusher will be housed in the crusher building as well as the fine mineralized material bin.

The mineral sorting and screening building will contain the mineral sorters and the vibrating screens of the crushing circuit. Both buildings will contain an overhead crane with enough capacity to lift the heaviest equipment parts.

The reagent preparation area and concentrate thickeners will be in the process building. The tailings thickener will be outside of the process building.

3.5.2 Gate House, Parking, Weigh Scale

The gate house modular building and parking lot will be installed on the existing access road between Highway 6 and the process plant area. This area will have a gravel surface surrounded by a perimeter fence to control access to the process plant site.

All site security cameras and alarms (e.g., fire, safety shower) will be available to the gate keeper.

A 100-ton truck scale with remote monitoring system will allow to gather information on incoming delivery trucks and outcoming concentrator transportation trucks.

3.5.3 Truck Shop, Warehouse, and Laydown Area

The maintenance truck shop will include four maintenance bays and one wash bay. A central lubrication and fluid distribution and an oil recuperation system will be installed.

The warehouse will be an insulated steel frame, fabric-covered building located near the truck shop (24 m x 40 m). Another steel frame, fabric-covered building will be dedicated for emergency vehicles.

A laydown area will be constructed adjacent to the plant site to accommodate outdoor storage of equipment and supplies during construction and operations.

3.5.4 Administrative and Dry Building

As part of the camp complex, the administrative and dry building will include washroom facilities, work clothes storage, a separated men and women changing rooms and laundry facilities, if required. A dedicated ventilation and dehumidifier system will be installed to allow proper drying of clothing.

3.5.5 Camp

The workers accommodation camp will be connected to the process plant site concentrator, truck shop and administration offices. The camp will comprise dormitory rooms with central washrooms, kitchen, HVAC systems, cafeteria, entertainment areas, laundry areas, gymnasiums/fitness rooms, fire protection systems, potable water treatment plant, sewage treatment system, telecommunications systems, and an electrical substation and distribution system. It will be used during the construction phase and refurbished where necessary for the operations phase of the Project. At this stage, for operations, the camp is planned to accommodate approximately 230 to 250 workers (230 to 250 workers on rotation for a total of 456 to 550 workers). A temporary camp will provide accommodation for an additional 250 to 270 people on site per rotation during the construction phase.

Portable buildings are planned to be used while operating in more remote areas such as the W1 Area west of the Buffalo River. The Portable buildings will allow for re-location to other remote areas to meet the varying needs of the Project. The Portable buildings will consist of offices, lunchroom, mine dry, supply and storage areas. Supporting infrastructure (located near the mine portals) will be a garage (fold-away), shipping containers for storage, mine ventilation and heating system, air compressors, fuel storage and distribution area, air compressors, generators,

electrical distribution system, including a mobile substation and switching gear, for underground and surface facilities, and a communications system.

An exploration camp has been in place since 2018 that is permitted to accommodate up to 49 persons This camp is expected to remain in place to support flexibility in ongoing exploration activities.

3.5.6 Site and Access Roads

The main access to the Project site is via Highway 6. The expected traffic to and from the Project consists of the transportation of employees, shipment of concentrates, as well as transportation of equipment and supplies as required to support the construction and operations of the mine, process plant, and camp facilities. The main haul roads within the site will require rehabilitation work to suit Project needs; however, the existing 100 km of haul roads and service roads provides good access to a considerable portion of the site. New site roads are expected to required for access to some areas. The next study will determine the need and location for new onsite roads.

Construction equipment and supplies will be delivered to the site by rail or truck transport to Hay River and then by truck or barge from Hay River to the Project site. A barge may be required for some larger components because of limitations (physical dimensions and weight restrictions) of the bridges on both the Hay and Buffalo rivers.

PPML will work with the GNWT to troubleshoot “oversized” equipment delivery to the Project site. Delivery alternatives for the oversized components include specialized helicopter ferrying, winter ice road crossings of the two rivers, winter ice road from Hay River rail terminal across Great Slave Lake to the site and the use of barges on Great Slave Lake during the open water season to Dawson’s Landing. If the barge option is chosen, a haul road to the landing to facilitate overland delivery of the components to the process plant site will be constructed, to the extent, possible along existing road allowances.

3.5.7 Explosive Storage

Explosive storage for the Project will consist of the following four main components:

- bulk ammonium nitrate storage
- bulk emulsion storage and emulsion plant facility
- explosives storage magazines
- possible off-site preparation of emulsion particularly in the early and final years of operations.

Bulk ammonium nitrate and bulk emulsion for drill and blasting purposes will be shipped to site and stored in silos. Packaged explosives and explosive detonators will be stored in approved explosives magazines located on separate pads. The design of all storage facilities will meet government regulations and will be located according to required separation distances as regulated by the Explosives Regulatory Division of Natural Resources Canada. The final location of the explosive’s storage site will be determined as part of future studies. Explosives will be transported to site by trucks on an as-required basis.

3.5.8 Fuel and Hazardous Materials

The mining operation will use various hazardous materials including diesel, gasoline, lubricating and waste oil, antifreeze/glycol and propane, as required for heavy equipment operation, heating,

back-up power generation and small vehicles. The processing operation will use chemical reagents in the processing plant as described in Table 3-2. All chemicals and fuels will be brought to site by trucks and will be stored in a secured area with adequate secondary containment. The Spill Contingency Plan will document mitigation to reduce the likelihood of spills and document spill response measures. Hazardous waste will be stored on-site in a secure area and removed by a suitably licenced hazardous waste handler for proper disposal at a licenced facility (see the Waste Management Plan).

On-site fuel storage will include secondary containment as required by *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* (SOR/2008-197) and accompanying Code of Practice (CCME 2015). Fuel dispensing equipment for mining, process plant services, and freight vehicles will be located adjacent to the fuel tank containment area and the fueling area will drain into the containment area.

3.6 Traffic / Transportation

3.6.1 Primary Site Access

The Project site is easily accessible via Highway 6, a paved road that is maintained 365 days a year. The use of existing historic haul roads and exploration cut lines will be maximized whenever possible to minimize the need for additional ground disturbance. Waste rock from historical and proposed mining activities may be used for road construction if geochemical testing demonstrates that it can be used as construction material.

3.6.2 Employee Transportation

Workers will be transported to and from the Project site by a variety of means, including buses, small vans, and private vehicles. Transportation from local communities to the site will be available when required. Every effort will be made to recruit locally, taking advantage of the current forecasted decrease in diamond mining; however, PPML anticipates that part of the workforce may come from locations that will require flying to Hay River and then connecting with surface transport to site.

3.6.3 Concentrate Transportation

There is no zinc or lead smelter located in the NWT. Several alternatives are available for transporting the mineral concentrates to smelter facilities outside the territory. The most practical and cost-effective transportation option is to use the existing rail line transload facilities near Hay River or Enterprise communities.

Alternatives eliminated include the extension of the rail line to Pine Point and the construction of a transload facility at Polar Lake due to the cost of constructing new rail bridges over the Hay and Buffalo rivers.

Concentrates will be hauled from the site to an existing rail yard (Hay River or Enterprise) using long-haul trailer trucks on the public highway. The capacity and the condition of the existing bridges over Hay River and Buffalo River will be assessed during the next engineering study. Alternative types of long-haul equipment will be evaluated, including double trailers or single trailers. Loads will not exceed 53.5 tonnes, as per NWT regulations. It is currently estimated that there will be approximately 10 to 15 round trips per day to transport the ore concentrate to the rail yard transloading facility.

To eliminate the chance of wind-borne dispersal of concentrate along the highway corridor, alternatives available for the loading of concentrate onto the trucks at the process plant and stored at the rail yard, include:

- bagged concentrate
- bulk transport in trucks with a tarp cover, loaded at the process plant, and transferred directly to rail cars

3.7 Equipment

Mobile equipment that will be used during the construction and operation phases of the Project include:

- Pickup trucks
- Bolters
- Haul trucks (100t, 20-45t)
- Power shovels
- End dumps (LHDs)
- Excavators
- Dozers (tracked and rubber tire)
- Loaders
- Compressors
- Rock drills (diamond, rotary, percussion for underground and surface), track and skid mounted
- Water well drills, tracked and rubber tire.
- Jumbos
- Graders
- Compactors
- Skid steers
- Cranes/boom lifts various capacities
- Light towers/mobile generators

Ancillary equipment for construction and operation is expected to include:

- Welding service trucks
- Picker trucks
- Skidders
- Flat deck trailers and trucks
- Scissor neck trailer
- Personnel transport (e.g., buses)
- Rock slingers
- Cement truck
- Roll off truck
- Heat van (2T)
- Fuel trucks
- Water trucks
- Sanding trucks
- Shipping containers (storage and workshops)
- Lube service trucks
- Tire handlers
- Spare parts/service truck
- Emulsion delivery truck
- Ambulance
- Fire truck
- Pipe fusing machines
- Portable heaters
- Mobile crushing and screening plant
- Mobile pumps including sump pumps
- Mobile generators (Diesel and Compressed Natural Gas)
- Piping (various sizes and lengths)
- ATVs (winter and summer), including side-by-sides

The equipment used in many cases will be in various sizes and capacities.

3.8 Power

Power requirements to operate the pre-concentration, dewatering and concentrator facilities comprises the bulk of the electrical demand for the Project. At full capacity, the Project could use up to approximately 25 megawatts (MW) of electrical power. Some of that demand can be supplied by the current electrical production from the Taltson Hydro Dam. Additional power will be required as soon as the process plant comes online.

A local power generation strategy for the project has been developed with the goal of maintaining mining operations throughout the year. Preliminary discussions were held with the Northwest Territories Power Corporation (NTPC), the owner/operator of the Taltson facility, to gauge their interest and ability to expand capacity for the Project. The power required for the site will therefore be a combination of NTPC supplied power and local power production from compressed natural gas (CNG).

The available power from the NTPC will be mainly used for fixed installations, such as the process plant and camp, while the local power production equipment will be dedicated to mining operations (dewatering and ventilation) and will move according to pits and underground mines that are in production.

3.8.1.1 Project Power Demand

The total power demand varies over the years of operation (Table 3-4).

Table 3-4: Site Power Demand

Year		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Area	**Description**	**Average power demand (MW)**									
200	Underground Mine	2.40	5.00	5.20	3.45	0.85	1.20	1.00	0.35		
300	Open-pit Mine	5.40	5.75	7.50	5.25	4.75	4.30	2.75	3.50	3.15	0.95
500	Site Infrastructure	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
600	Process plant	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75
	Total power demand (MW)	**19.38**	**22.33**	**24.28**	**20.28**	**17.18**	**17.08**	**16.08**	**15.43**	**14.73**	**12.53**

3.8.1.2 NTPC Network

NTPC supplies power to South Slave region of the NWT via the Taltson Hydro Dam. The Taltson facility was brought online in 1965 to supply power to the original Cominco facilities at Pine Point, which closed in 1988, and to the town of Fort Smith, NWT. The facility now supplies power to the towns of Hay River, Fort Smith, Fort Resolution, and Enterprise. The dam complex currently has an 18.5 MW capacity with a forecasted capacity increase of 4 MW (power upgrade scheduled to be completed in 2022 at the Taltson Generation Station). Of that, 9 MW will be unused and available for PPML during the winter months (October to March) and 12 MW unused and available during the summer months (April to September). Energy cost provided by the NTPC is $0.12 per kilowatt hour (kwh) and due to the relatively low-cost energy, power supply from NTPC is favoured over on-site power generation.

3.8.1.3 On-site Power Generation

On-site power generation will be primarily required for mining operations located too far from the existing NTPC substation. After establishing the loads required for dewatering and ventilation for the open pits and underground operations, discussions were held with various suppliers to identify the best economical power supply solution.

The Project will seek to benefit from an existing CNG delivery network (virtual pipeline) for industrial clients sourced out of Alberta. This network can supply the southern area of the NWT through an existing public road network. A supply contract would be established with a local CNG provider to source, transport, and transform the natural gas on-site for local generator use.

On-site power generation will consist of two types: a stationary power plant to supplement power supply for the fixed installations, and a fleet of mobile generators to support underground and open-pit mining operations. Each of these power generation setups are intended to be under a rental contract with a local supplier, which will also include the main electrical equipment to interconnect with the local distribution network.

3.8.1.4 Stationary Power Plants

There will be two stationary power plant setups: one for the process plant and nearby dewatering activities, and another to service the five underground mines located in the West Zone of the Project. The stationary power plant located near the NTPC substation and process plant will include heat recovery to help heat adjacent infrastructure. The main purpose of this power plant will be to supply supplemental power that is unavailable from NTPC. The power plant will also provide redundancy for the network. The current load demand would require an installed power plant capacity of 3.9 MW, which would consist of three 1.3 MW modular units installed in tandem with a stationary Pressure Reduction System (PRS) to receive CNG trailer deliveries.

Another stationary power plant located near the underground mines in the W1 Area will be installed. The power plant capacity will be scaled on an annual basis according to the power needs aligned with the forecasted loads shown in Table 3-4. This plant will include up to six 1.3 MW modular units installed in tandem with a stationary PRS to receive CNG trailer deliveries. The plant will also include heat recovery systems to preheat the ventilated air for the underground mine.

3.8.1.5 Mobile Genset Fleet

A fleet of mobile gensets will be rented from the same local supplier as the stationary power plant and will be used to service the multiple open-pit mines throughout the site. As open pits will constantly be opened and closed throughout the mine life, a mobile genset fleet concept will give PPML the flexibility to relocate gensets as needed.

The fleet will consist of multiple natural gas generator packages installed on mobile trailers that can be relocated and interconnected at any required location. Depending on which pit or cluster of nearby pits are being mined, a set of mobile trailers will be locally mobilized to service nearby dewatering needs. Each mobilization will include a local electrical distribution and a trailer mounted PRS able to receive CNG transport trailers.

To minimize costs, given the fluctuating power needs over time (power demand expected between 950 to 7,500 kilowatts (kW), the quantity of rented mobile gensets will vary from month-to-month. The intent being to best match the expected power generation requirements and therefore avoid unnecessarily mobilizing too large a fleet. Generator sizes for the individual mobile

trailers will be optimized with the local supplier to identify the best fit that minimizes mobilization and demobilization efforts.

3.8.1.6 Site Distribution

As the NTPC currently owns and operates an electrical substation (138 - 12.5 kilovolts [kV]) located near the historical Pine Point infrastructure, it was agreed with NTPC that the electricity required for the site would be available at 12.5 kV from two existing main breakers. From the NTPC substation, two full capacity interconnections have been identified between the existing substation and the process plant, which will provide reliability and flexibility for maintenance.

Inside the process plant, a main electrical room including main 12.5 kV switchgears, 600 Volt (V) transformers, and motor control centres have been planned. The main switchgear will distribute power throughout the concentrator building. An allocation for electrical distribution to the camp and other service buildings has also been included. Local distribution at the underground mines and open pits will be constructed at a capacity of 12.5 kV.

The site currently has power distribution lines that are being used to serve power to nearby communities. The Project does not plan on using or modifying this infrastructure and intends to keep the Project's infrastructure independent.

3.8.1.7 Emergency Power

Critical loads, such as the concentrator, pumping stations, and camp, will include local emergency diesel power generators if the main power from NTPC is offline. The emergency system will be optimized so that the generation capacity is adequate. For mining operations additional emergency diesel power generators have not been planned at this stage.

3.9 Water and Water Management Infrastructure

The Mine Water Management Plan includes all water uses, sources, and discharges throughout construction, operation, and closure and reclamation. The infrastructure that will be required to manage the water remains to be designed, but the main components that are expected to be needed during construction and operation are described below.

Water management during closure and reclamation is described in Section 5.0 - Closure and Reclamation.

3.9.1 Construction

Water use during construction will primarily be for manufacturing concrete, dust suppression, and camp services (toilets, showers, and kitchen). Water management will also include the capture and containment of surface runoff. The existing network of drainage ditches will be used and maintained when consistent with Project activities. As needed, construction water management may also include stormwater collection ponds to manage runoff and dry sumps to provide emergency spill containment.

3.9.2 Operation

Water use during operation will include processing, production drilling, emulsion mixing, dust suppression, vehicle cleaning at the maintenance facility and camp services (toilets, showers, and kitchen). Water management during operations will include mine dewatering (open pits and underground), water in tailings, surface runoff and stormwater management. Infrastructure from construction will still be used as appropriate. As needed, there may be construction of additional stormwater ponds to manage runoff, dry sumps to provide emergency spill containment, and cut and fill to create pads for structures and laydown purposes (Figure 3-7).

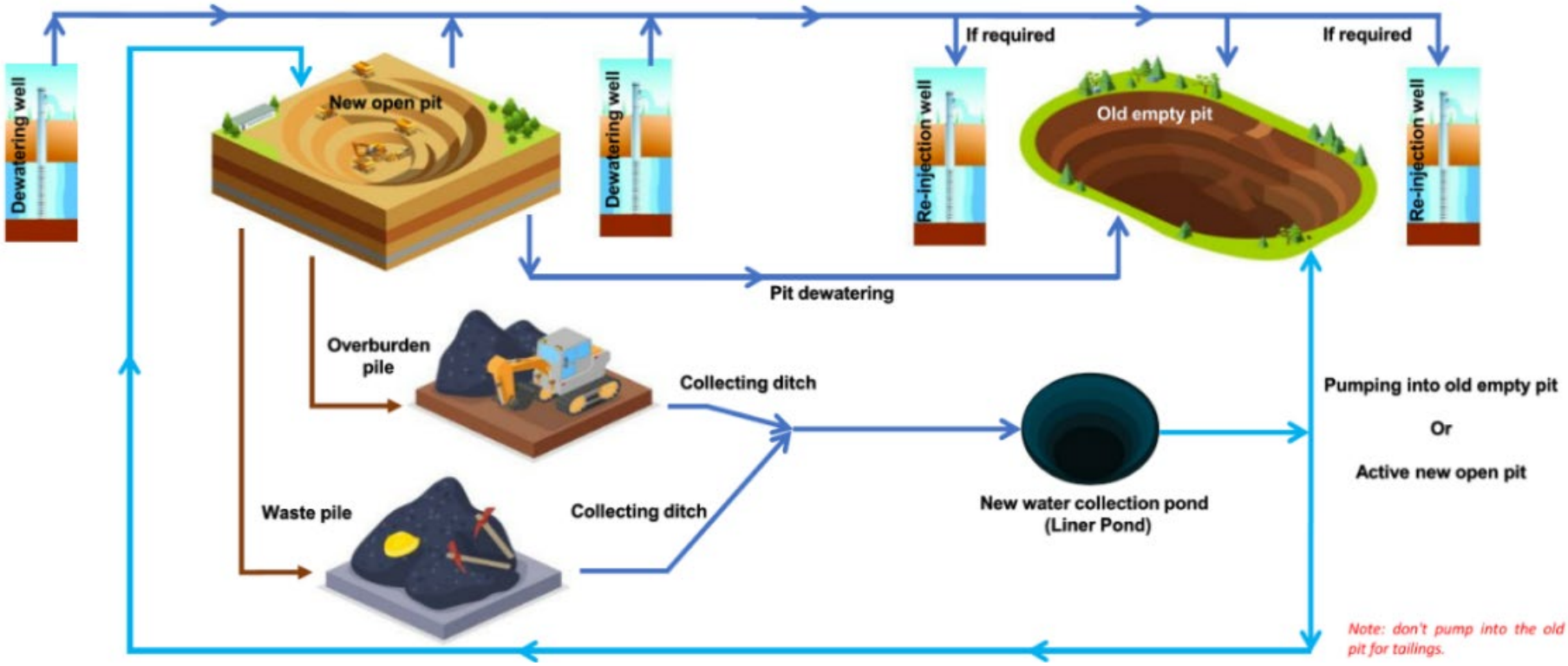


Figure 3-7: Water Management Overview

Historical open-pit capacity to store water was considered in the process of identifying preferred alternatives for water management. The mine dewatering and reclaim water systems will be constructed as the Project evolves, based on each production zone and tailings management requirements. Equipment and facilities proposed includes multiple pumps, pumping stations, injection wells, and pipelines for water recirculation and reclaim. Similar to other Project infrastructure, water management structures will be built on existing disturbed lands where possible and efforts will be made to relocate and/or re-use the existing dewatering equipment when feasible.

Re-injection wells are being evaluated as a method to dispose of groundwater that infiltrates open pits and underground mines where existing or proposed pits are not available or have insufficient capacity. The injection wells will be used to return the groundwater to the existing underground aquifer.

All sewage from the office, camp and other remote locations will be sent to a septic system or an alternative treatment plant and then discharged to the environment.

During operation, water will be stored in existing pits, which may include excess water from tailings, mine dewatering, dust suppression, and drainage systems from the vehicle and machinery maintenance facilities. As part of the ongoing design of water management for the Project, a water balance will be developed to understand how to manage the capacity of existing pits.

The maximum daily water use during operation, the water supply sources, the location of the water management infrastructure, and potential mine water discharge location(s), if required, will be evaluated and will be determined during the feasibility study design process. If operational mine water discharge is required, environmental studies will be conducted to evaluate potential effects of the discharge.

3.9.3 Mine Water

Studies are ongoing to assess the extent of mine dewatering required for both the open pit and underground operations. During mining operations, it will be necessary to manage groundwater infiltration, stormwater, and meltwater from within each operating area and have developed procedures and alternatives for managing water that does not meet environmental effluent discharge criteria.

3.9.4 Process Water

The water requirements for the process plant is divided into two main areas: freshwater and process water. Freshwater will be sourced from Great Slave Lake and used for reagent preparation, gland seal water, and stored for helping to extinguish a possible fire. The freshwater requirement for the process plant is estimated at 42 m^3/h or approximately 1,000 m^3/day.

Process water for start-up could be pumped to the process plant from historical open pits if the water quality is suitable. Sources for start-up water being evaluated include historical open pits T37, I46, and J44. To the extent practicable, once in operation, water required by the processing plant will be provided through recycling and re-use of the concentrator process water, including decant water from tailings thickener and TDAs overflow management, collected runoff, and mine water.

The process water is used throughout the process plant and is collected from thickener overflows. Effluent from the process plant that cannot be reclaimed may be pumped to historical open pits if capacity and water quality are determined to be suitable. The total amount of process water recirculating in the process plant is estimated to be 1,021 m^3/h.

Two historical ponds are located 3 km south of the former Cominco operation site. These ponds will be rehabilitated and used to store reclaim water from the TDA and runoff from the process plant site. Water from these ponds will also be used for the process plant. It is estimated that the ponds have a capacity of 40,000 m^3 each.

Reclaim water is brought back to the plant in a high-density polyethylene (HDPE) pipeline installed next to the tailings line.

3.9.5 Surface Water Runoff Management

Surface water management infrastructure at the Pine Point site includes the following:

- perimeter wells for pit water management and in-pit sumps and pumping equipment for runoff water management
- ditches and collection ponds for WRSF and overburden stockpiles
- two rehabilitated water collection ponds for storing reclaim and process water surplus

3.9.6 Waste Rock Storage Facilities and Overburden Stockpiles

Waste rock and overburden disposal strategy consists of building WRSFs and overburden stockpiles. Contact water from the WRSF and overburden stockpiles will be collected and directed to the collection ponds via a network of perimeter collection ditches.

Submersible pumps installed on floaters will be used to pump out the content of the collection ponds. Pit runoff and contact water from neighbouring WRSF or overburden stockpiles will be combined and sent to a receiving pit in the proximity. In some areas no piles are planned and runoff collected in the development of the open pits will be the only contact water to be transferred to the receiving open pit. When required, a booster pumping station will be added for water transfer to the process plant. In isolated cases where no receiving pit is available at close range, contact water will be reinjected via boreholes. Whenever possible, collection pond pumps, booster pumping stations, and piping are assumed to service the next developed area once a pond is rehabilitated. There will be no direct discharge of contact water from the WRSF and overburden stockpiles to the environment, as water collected will be directed to the nearest historical open pit.

3.9.7 Dewatering

Mine dewatering requirements and methods are also being evaluated based on past experience and studies. Dewatering methods are anticipated to be variable for each zone based on the site conditions. In contrast, the shallow open pits in the East Mill Zone area will be relatively dry except for surface water inflow.

3.9.7.1 Open Pit Dewatering

Groundwater levels are lowered using 180 m^3/h, 150 hp submersible pumps installed into multiple 400 mm diameter boreholes prior to open-pit mining. The groundwater is pumped into historical mined-out pits or wells located in the vicinity to be reinjected into the aquifer. The dewatering

requirements for each pit in terms of borehole quantities and water flows have been established by TetraTech (TetraTech 2020). For each submersible pump, HDPE piping (300 mm diameter DR11) is installed to reach the nearby booster pump station.

The centrifuge pumps are all the same models with an 1,875 m^3/h capacity and a 500 hp motor. For each booster pump, 5,000 m of HDPE piping (660 mm diameter DR17) is installed for reinjection into the aquifer far enough away to avoid repumping the same water. The number of booster pumps varies between one and three per open pit. In accordance with the mine production schedule, the submersible pumps, booster pumping stations, and piping are planned to be relocated to another pit once an open pit is no longer in operation. For the 47 open pits, 16 pumps are required. Overall, eight different pump models are being considered with motor powers ranging from 10 hp to 200 hp.

Rainwater accumulation at the bottom of the open pits will be pumped out using centrifugal diesel pumps mobile systems. Rainwater collected from adjacent operating pits is pumped to a common booster pump located on surface that transfers this water to a nearby receiving pit (either directly or combined with waste rock and overburden runoff). The pumps' head is calculated based on the pits' elevation data and approximate location of the booster pumps.

3.9.7.2 Underground Dewatering

Similar to open pits, dewatering requirements for the underground workings have been established by TetraTech (TetraTech 2020). The same pumping strategy with submersible pumps in boreholes, booster pumping stations transferring the groundwater to previously mined open-pits or reinjected into the aquifer via boreholes is used, as well as the relocation of equipment to the next deposit when a mine is no longer in operation.

However, the underground workings located West of the Buffalo River will require groundwater control (grouting) prior to dewatering. In contrast, some underground workings in the Central Area are expected to be fully or partially dewatered by drawdown from dewatering nearby open pits. The wells will be built in the same manner as for the open pits but will use 400 hp pumps.

3.9.8 Tailings and Reclaim Water Management

Tailings from the processing plant are pumped into historical and mined-out open pits (TDAs) (Figure 3-8) via HDPE pipelines. Over the life of the Project, the pipeline network will be expanded to reach the seven pits that have been identified for tailings storage (Figure 3-7). Thus, no surface tailings storage facility is required for the Project. To deposit tailings at the farthest distance from the processing plant, a booster pump station will be required.

Reclaim water is brought back to the process plant in a HDPE pipeline installed next to the tailings line. Submersible pumps (200 hp) installed on floaters are used to pump back reclaim water from TDA until pits have been fully filled. The distance between the TDA and the process plant varies from 2 km to 14 km. No booster pumps are required for the reclaim water.

Along with the piping, pumping stations will be moved to the next TDA once operations are completed in one location. Three or more reclaim water pumping stations will be required for the Project.

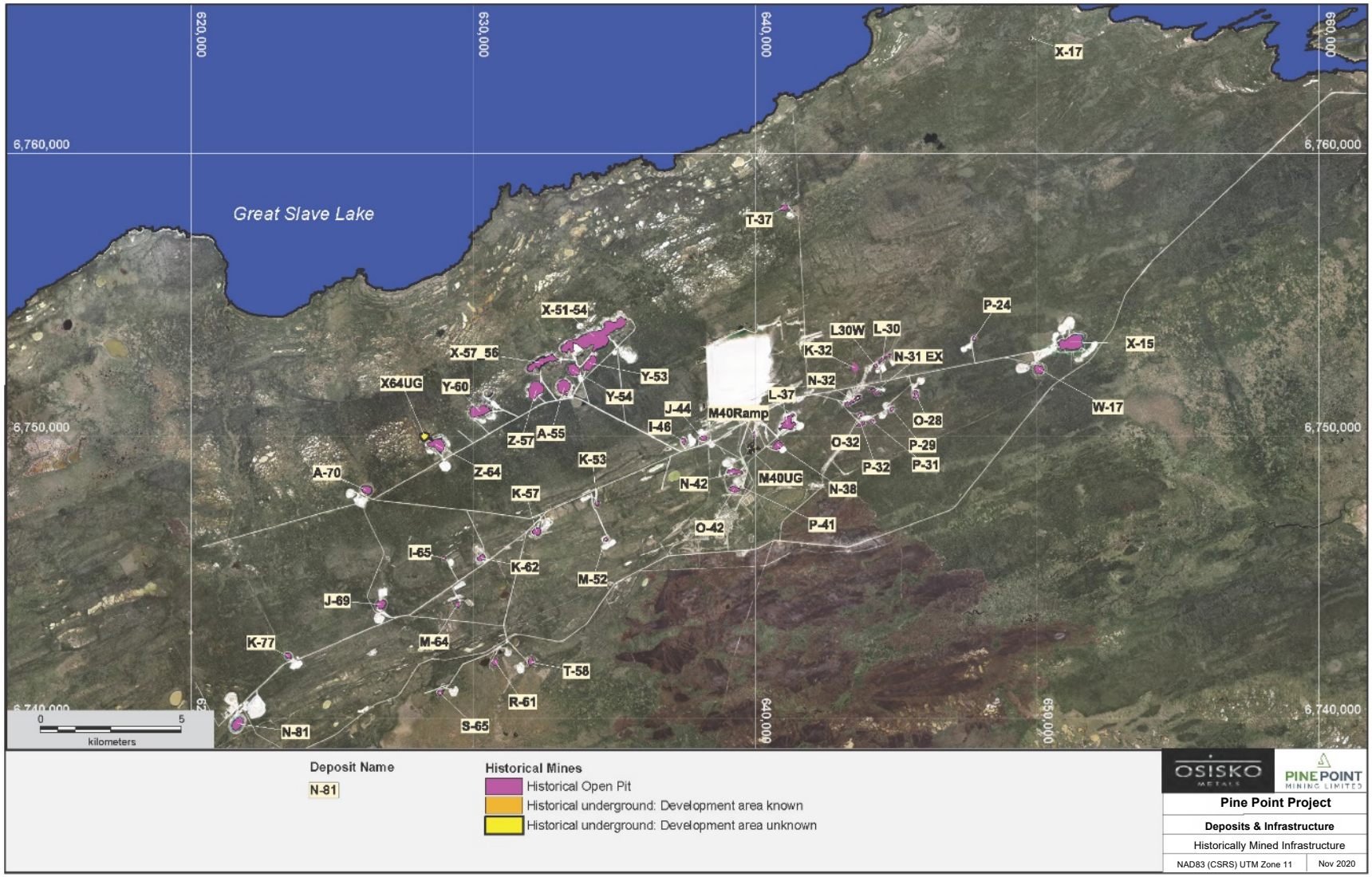


Figure 3-8: Historical and Mined-out Open Pits

3.9.9 Freshwater Requirements

The source of freshwater for non-human consumption will be investigated during field studies. The most likely source of freshwater will be Great Slave Lake, however other possible sources of freshwater include existing pits, existing water storage lagoons at the old town site, and groundwater at or near the camp. Based upon Cominco's experience, the groundwater may not be suitable for human consumption because of problems with taste, odour, and chemical content. If there are taste or human health issues due to hydrogen sulphide or other contaminants that cannot be easily managed through simple treatment to address taste and/or quality issues, then freshwater will be sourced from Great Slave Lake.

Domestic water will be required for human consumption, showers, laundry, and cooking. The total quantity needed will depend upon the capacity of the camp facility and will be further refined during the next study. The most likely source of potable water for the camp be through restoring/reusing the water system that Cominco used (i.e., piping water from Great Slave Lake into storage lagoons).

3.9.10 Water Balance

The volume of water generated by a rainfall event and/or snowmelt over the process plant site sub-watershed as well as direct precipitation on the sedimentation pond area was determined by performing a preliminary simulation with PCSWMM software. A simple mass balance was then performed to establish the relationship between inflows of water, sedimentation ponds capacity, volumes of water required to feed the process plant, and the water reclaim volume from the TDA. Assumptions using available information were made in terms of the water quality. Water quality modelling will be undertaken to support future engineering studies.

3.10 Monitoring and Management Programs and Plans

PPML has drafted environmental management and monitoring plan frameworks to support the Mackenzie Valley Environmental Impact Review Board EA Initiation Package for the Project. Updated plans will be developed during the permitting phase of the Project and will incorporate additional information based on ongoing Project design and the results of the environmental assessment, as well as relevant feedback from communities and regulators, including commitments made by PPML during the environmental assessment review process.

The frameworks were developed based on relevant guidance from regulators and administrative bodies in the NWT, including the following:

- Engagement and Consultation Policy (LWBMV 2018a)
- Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits (LWBMV 2018b)
- Guidelines for Spill Contingency Planning (INAC 2007)
- Water and Effluent Quality Management Policy (MVLWB 2011a)
- Guidelines for Developing a Waste Management Plan (MVLWB 2011b)
- Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories (MVLWB and AANDC 2013)
- Wildlife Management and Monitoring Plan Guidelines (GNWT-ENR 2019).

- Guidelines for Aquatic Effects Monitoring Programs (MVLWB and GNWT 2019)
- Guidelines for Adaptive Management - a Response Framework for Aquatic Effects Monitoring (WLWB 2010)
- Draft Guidelines for Developing Baseline Water Quality Monitoring Programs in the Northwest Territories (MVLWB 2018)

Each of the plans will continue to undergo periodic review and amendment according to current circumstances and in accordance with the principles of adaptive management. Many of the plans are requirements of the Water Licence and as such, will be subject to the public review and approval process conducted by the MVLWB.

3.10.1 Engagement and Collaboration Plan

Engagement with Potentially Affected Parties (i.e., Indigenous groups and governments, communities, the territorial and federal government, regulators, and the general public) will represent a key aspect of Project planning and development. Indigenous Traditional Knowledge obtained through the engagement process will help to inform mitigations, the Project design, and the assessment of the effects from the Project.

The Engagement and Collaboration Framework describes past engagement on the Project as well as engagement activities that PPML proposes to undertake during the early engagement phase of the Project. Engagement activities beyond those proposed for the early engagement phase will be proposed and discussed with relevant Potentially Affected Parties as the Project advances following submission of the EA Initiation Package. The Engagement and Collaboration Framework describes the following:

- engagement principles and goals
- engagement to date
- identification of Potentially Affected Parties
- methods of engagement
- engagement process and milestones
- incorporation of Indigenous Traditional Knowledge
- record of engagement

The Engagement and Collaboration Framework is a living document to be updated based on feedback from communities and other stakeholders. As engagement activities unfold, planned engagement activities will be modified based on input regarding preferred methods and timing of engagement.

3.10.2 Spill Contingency Plan

The purpose of the Spill Contingency Plan is to provide policies and procedures to all site personnel in the event of an accidental release of fuel or other materials from the Project. The Spill Contingency Plan provides the protocols for personnel to follow in response to a spill. The objectives of the Spill Contingency Plan are to provide references to other approvals, relevant

standards, control plans and procedures for training, communications, investigation, corrective action, and audit that are required under the Project Agreement.

Subsequent versions of the Spill Contingency Plan will provide additional information related to the following:

- list of hazardous materials
- spill response procedures
- reporting
- equipment and resource inventory
- training and exercises

3.10.3 Erosion and Sediment Control Plan

The purpose of the Erosion and Sediment Control Plan will be to provide construction and operations personnel with principles and procedures for mitigating erosion potential from activities related to the construction and operation of the Project. Erosion and sedimentation are naturally occurring processes of loosening and transporting soil through the action of wind, water, or ice, and the subsequent transport and deposition of sediment particles. Construction and operation activities can result in increased erosion and sedimentation where soil surfaces are exposed to rainfall or snowmelt and runoff, or wind erosion and aerial sediment transport.

The Erosion and Sediment Control Plan framework outlines best management practices that will be considered and applied as appropriate during the Project, and describes inspections, maintenance, and reporting. As additional design details are available, future versions will include information on locations where the land disturbance will occur in critical areas, in relation to the need for sediment and erosion control measures, and more information on best management practices and site-specific erosion and sediment control measures.

3.10.4 Mine Water Management Plan

The overall objective of the Mine Water Management Plan will be to detail water management activities for the Project throughout all Project stages (i.e., construction, operation, closure, and post-closure). The Mine Water Management Plan framework is intended to provide a preliminary outline of approaches to managing water flow into, out from, and within the Project footprint.

The objectives of water management are to enable safe and timely mining operations at the Project, while minimizing adverse effects to the aquatic receiving environment in terms of water quantity, water quality, and aquatic life. The Mine Water Management Plan framework outlines objectives and strategies, provides definitions, and describes water management facilities.

Subsequent versions of the Mine Water Management Plan will provide additional information related to the following:

- details on water management during construction, operation, closure, and post-closure
- design of water management infrastructure
- water balance
- monitoring

- contingencies and adaptive management

3.10.5 Waste Management Plan

The waste management practices that PPML will apply during Project activities are described in Waste Management Plan, which provides policies and procedures to effectively manage waste streams. The goals of the Waste Management Plan are to:

- Identify waste streams and areas for waste reduction or reuse.
- Comply with all regulations, whether federal, territorial, or local.
- Reduce the environmental impact of operations.
- Minimize impacts on land use by other groups.
- Protect aesthetics in the camp area.
- Identify, label, store, and transport all hazardous waste and dispose of at appropriate licensed disposal facilities.

The Waste Management Plan framework outlines the waste stream hierarchy, definitions, monitoring and inspections, and training. The types of waste that may be generated during the Project can be categorized as:

- non-hazardous, non-mineral wastes
- recyclable and reusable material
- non-hazardous, combustible waste
- non-hazardous, non-combustible waste
- hazardous waste
- wastewater

As additional Project details become available, subsequent versions of the Waste Management Plan will include additional details regarding the types of wastes that will be generated by the Project and primary disposal methods.

3.10.6 Tailings and Waste Rock Management Plan

The purpose of the Tailings and Waste Rock Management Plan framework is to address the management of mined waste rock and process plant tailings to limit the generation of acidic drainage and metal leaching. The Tailings and Waste Rock Management Plan provides information on:

- country rock geology
- country rock geochemistry
- waste rock classification
- decision criteria for waste rock storage and use

- waste rock management responsibilities
- tailings disposal

Key objectives of PPML waste rock management include:

- Identifying potentially acid-generating waste rock during mining.
- Directing appropriate use and storage of waste rock types.

PPML strategies to achieve these objectives include:

- Standard Operating Procedures to provide clear identification, segregation, storage, and re-mining procedures.
- Criteria for waste rock used in construction.
- Tracking locations of potentially acid-generating waste rock.

As additional Project details become available, subsequent versions of the Tailings and Waste Rock Management Plan will include additional details regarding the geochemical characterization process, operating procedures, and disposal locations.

3.10.7 Wildlife Protection Plan

The Wildlife Protection Plan framework outlines mitigation that will be implemented to avoid and reduce the Project effects on wildlife and wildlife habitat, and the monitoring actions proposed to understand the effects of the Project on wildlife, test the predictions made during the Developer's Assessment Report, and inform adaptive management. The objectives of the Wildlife Protection Plan framework include the following:

- Document how mitigations will be applied to avoid and minimize effects of the Project construction and operation on wildlife.
- Describe how adaptive management will be applied to wildlife mitigation and monitoring.
- Form part of the engagement with communities, regulatory agencies, and other interested parties in wildlife effects mitigation and monitoring.
- Describe how PPML will meet relevant guidelines and regulatory requirements.

The Wildlife Protection Plan describes wildlife species of concern, potential effects and mitigations, monitoring, reporting, and responsibilities. The proposed monitoring for the Project is expected to include the following:

- Wildlife Sightings Monitoring.
- Wildlife Surveillance Monitoring.
- Bird Nesting and Bat Roosting Monitoring.
- Pre-clearing Monitoring.
- Wildlife Incident Reporting.

Additional information will be included in subsequent versions based on Project design information, the results of the environmental assessment, and feedback from reviewers.

3.10.8 Aquatic Effects Monitoring Program

An Aquatic Effects Monitoring Program (AEMP) is a requirement of a Type A Water Licence. The purpose of the AEMP will be to provide a systematic framework to monitor and assess environmental effects from the Project on surrounding watercourses, and to respond with appropriate actions if or when adverse effects from the Project are identified. The AEMP framework outlines the following:

- Indigenous Traditional Knowledge and engagement
- description of the aquatic environment
- problem formulation (i.e., identification of ecosystems, receptors of potential concern, potential stressors of concern, environmental pathways, preliminary impact hypotheses, and assessment endpoints and measurement indicators)
- AEMP design (monitoring components, study areas, reference areas, sampling design and frequency, and data analysis and interpretation, and quality assurance/quality control)
- methods and analysis for monitored components
- special effects studies
- Response Framework
- reporting

It is anticipated that the following core components of the AEMP will be monitored: hydrology, water quality, benthic invertebrates, and fish. These monitoring components are based on the broad categories of receptors of potential concern in the aquatic ecosystem; however, inclusion of each monitoring component, specifically the benthic invertebrate and fish health components, will be dependent on Project design and the outcome of the environmental assessment.

A Response Framework will be required to meet the requirements of the Water Licence and be approved by the MVLWB. The goal of the Response Framework is to systematically respond to monitoring results such that the potential for significant adverse effects are identified, and mitigation actions are undertaken and confirmed effective to prevent such effects from occurring.

Additional details will be provided in subsequent versions based on updated project design details, the outcome of the environmental assessment, and feedback received through the environmental assessment review process.

3.10.9 Closure and Reclamation Plan

The Closure and Reclamation Plan framework describes the conceptual plan for temporary or permanent closure of the Project. The general purpose of the Closure and Reclamation Plan framework is to demonstrate the satisfactory closure and reclamation of the Project and to describe the likely residual risks to human health and the environment. The closure goal and principles for the areas developed by the Project are reflective of the Guidelines for the Closure

and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories (MVLWB and AANDC 2013).

The Closure and Reclamation Plan framework outlines permanent closure and reclamation, progressive reclamation and temporary closure. Conceptual closure options for the Project components (open pits, underground mines, waste rock disposal areas, TDAs, water management system, and support and ancillary infrastructure) are provided under permanent closure. As Project design is advanced and feedback is received from parties, additional information related to the following will be provided in subsequent versions:

- closure objectives and criteria
- selected closure activities, rationale for selection, and associated engineering works
- predicted residual effects, uncertainties, and contingencies
- post-closure monitoring, maintenance, and reporting
- schedule of activities

4 LABOUR FORCE AND HUMAN RESOURCES

4.1 Workforce and Employment

In 2019, 25,785 people were active in the NWT labour force, representing a participation rate of 73.6% of the population aged 15 and over. Of those participating in the labour force, 10.9% are unemployed. Yellowknife's size and concentration of territorial economic and service provision activity creates an environment where participation in the labour force is high (78.9%), and unemployment is low (4.7%). In Hay River and Fort Smith, participation in the labour force (76.5% and 70.0%, respectively) and unemployment rates (6.6% and 10.2%) are in line with territorial averages, reflective of their larger size relative to the other South Slave communities and the greater abundance of economic opportunities (GNWTBS 2019).

Labour force participation rates are slightly lower, but still substantial, in Fort Resolution and Fort Providence (65.9% and 65.0%, respectively); however, the unemployment rate in both communities is high (29.7% and 30.6%, respectively). This reflects a labour market where a large portion of the population aged 15 and over is seeking work, but unable to secure employment. Participation in the labour force is lower on the Hay River Reserve (58.9%), in Dettah (58.8%), Enterprise (55%) and Łutsel K'e (54.2%). With the exception of Enterprise, the unemployment rate in each community is high, suggesting that, as is the case in the larger South Slave communities, securing employment is a challenge for those participating in the labour force due to a lack of opportunities (GNWTBS 2019). It is anticipated that the construction of the concentrator and associated infrastructure will require an average workforce of approximately 280, peaking at 500. During operations, a workforce of approximately 460 people (two shifts of 230 on rotation) will be required. The working schedules will vary depending on the positions and employment status but will likely include a combination of rotation schedules. For safety reasons with 12-hour shifts, employees will stay at the worker accommodation camp. It is anticipated that both construction and mining/processing operations will run on 12-hour shifts.

Nearby communities have labour forces experienced in construction, mining, and industrial development. The Project will benefit from this extensive experience associated with recent mineral exploration and decades of mining activity. Employment opportunities will be provided preferentially to qualified candidates from nearby communities and subsequently to current Territorial residents. It is expected that those communities with which the Project will sign an Impact Benefit Agreement will be prioritized for employment consideration and business opportunities. The Project has already entered into Collaboration Agreements with the Deninu Kųę First Nation and the Northwest Territories Métis Nation (Osisko Metals 2019), and an Exploration Agreement with the K'atl'odeeche First Nation. The Project will include local content development strategies aimed at notifying local communities of employment and business opportunities, including the educational and experience requirements for successful candidates, in advance of construction and operation.

While the hiring of local employees will be a priority, out-of-area employees will likely be required to fill some specialized positions. These employees will fly to Hay River or Fort Smith and be transported to the Project site by vehicle.

Employment opportunities at the Project will include a range of positions from entry-level (e.g., custodial, housekeeping, food service), to semi-skilled (e.g., clerical, administrative), to skilled (e.g., plumbers, welders, mechanics) and professional (e.g., engineers, scientists, planners). Most operational jobs for the Project will be accessible to candidates with a high school diploma and some level of technical or academic training.

As Project planning advances and the understanding of the associated workforce requirements evolves, the composition of the construction and operations workforce will be re-evaluated.

4.2 Training

It is expected that the Project will include programs for on-the-job training and career development for the existing workforce. Such programs will be developed in advance of construction and operation as recommended by the Socio-economic Management Plan (SEMP) that will be developed through the environmental assessment process. The SEMP will also identify the community investment priorities of the Project, which typically include investment in education programs, infrastructure and initiatives, with an aim of enhancing the local labour force's ability to take up Project employment and participate in contracting opportunities. An employee and family assistance program will be outlined in the SEMP, and will address topics such as career planning, employee counselling, family support, and transition planning. Workplace policies and programs including worker codes of conduct, workplace safety programs, and cultural awareness training programs will be developed. Benefit measures will be developed through the socio-economic assessment of the Project and will be included in the SEMP.

5 CLOSURE AND RECLAMATION

Details on closure activities are being developed as part of the design work. The design will provide for progressive reclamation and design for closure where possible. Closure activities are expected to include demolition, removal and disposal, reclamation and remediation of any infrastructure developed or used by the Project. This will include the demolition of buildings developed by PPML, removal of all temporary structures and equipment, grading any pits that may have been filled with waste rock and conducting the required post-closure environmental

monitoring related to the Project. The site will be closed in accordance with all applicable legislative requirements.

Progressive reclamation will be carried out whenever possible. Material generated from site preparation, such as the stripping of overburden and waste rock mining, will be stockpiled at locations to be used for reclamation and closure.

The Project is located on a brownfield site resulting from Cominco's historical mining, milling, and working accommodation activities. Currently, the remaining railway bed is a federally listed contaminated site (Site 00024168 - Pine Point Railbed) which is Active and listed as "high priority for action", requiring remediation/risk management. Site 00023778 - COMINCO PIT N - 32 PINE POINT is listed as "closed", requiring no historical review. The historical tailings impoundment for the Pine Point Mine is undergoing closure activities by Teck Metals, who holds a Land Use Permit (MV2019X0006) for the purposes of water treatment, site maintenance, and geotechnical and environmental investigations at the Pine Point Tailings Impoundment Area.

As such, closure and reclamation planning is only being conducted for components, facilities, and infrastructure directly associated with the Project and not for activities or monitoring associated with historical mining activities at or near the Project. Closure and reclamation planning is limited to construction camps, access roads, open pits, underground mine portals, overburden stockpiles, waste rock piles, TDAs, water management infrastructure, and plant site constructed or used as part of the Project.

A Closure and Reclamation Plan framework has been developed to support the EA Initiation Package for the Project. An updated Closure and Reclamation Plan will be developed during the permitting phase of the Project, or potentially earlier if required, based on feedback through the environmental assessment process. An updated Closure and Reclamation Plan will be submitted to the MVLWB to support the Water Licence and Land Use Permit application for the Project. PPML also expects that an Interim Closure and Reclamation Plan will be developed upon receipt of the Water Licence and Land Use Permit which will include additional details to meet the requirements of the *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories* (Closure Guidelines; MVLWB and AANDC 2013) as well as engagement.

A preliminary schedule for the Project, including closure and reclamation, is provided in Section 1.1.5. Additional details on the schedule of closure and reclamation activities, including post-closure monitoring, will be developed as the Project design progresses.

5.1 Closure Goal, Principles, and Objectives

The closure goal for the Project is similar to that shown in the Closure Guidelines (MVLWB and AANDC 2013) and comprises two parts to reflect the historical disturbance that has already been experienced by the site:

> "For previously undisturbed areas, the goal is to return the affected areas of the site developed by the Project to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and human activities. Where areas of the Project have been previously disturbed through historical mining activities, the goal is to return the areas of the site affected by the Project to at least an equivalent environmental state that they were left by the Government of Canada prior to the Project."

Closure principles for the areas developed by the Project are reflective of the Closure Guidelines and include:

- physical stability
- chemical stability
- no long-term active care
- consideration of future use

The objectives for the Closure and Reclamation Plan are to minimize the lasting environmental effects of operations to the extent practical and to allow disturbed areas to return to a similar state that existed prior to disturbance. The reclamation objectives will be developed through engagement with local communities.

Overall short-term reclamation objectives include:

- Progressively reclaim disturbed areas as soon as they are no longer required for mining activities.
- Minimize the risk and effects of water erosion and sediment transportation.
- Stabilize slopes.
- Prevent soil drifting/dust.

Overall long-term Project objectives include:

- Return disturbed areas to similar state as existed prior to the Project disturbance.
- Maintain the level of wildlife habitat.

Considering the current available geochemical information, the concepts and short- and long-term reclamation objectives are mostly pertinent to the WRSFs and TDAs of the Project.

5.2 Closure Activities

The approach to reclamation of the primary components of the Project are described below and in the Closure and Reclamation Plan Framework. Details will be further developed as mine design advances, including more details on methods, technology, equipment, infrastructure, and personnel requirements.

Progressive reclamation will be carried out where possible for facilities that have no further operational value. Opportunities for progressive reclamation will be further detailed during the next study and as an ongoing process during operations. Opportunities for progressive reclamation may exist in areas as they are mined out, such as the reclamation of the open pits, adjacent rock piles, and nearby infrastructure components. Material generated from preparation, such as the stripping of overburden and waste rock mining, will be used where possible and stockpiled at locations to facilitate reclamation.

5.2.1 Buildings and Infrastructure

The buildings, infrastructure, and equipment on the site will be dismantled and disposed of according to established procedures. Hazardous materials will be removed from buildings. Any remaining fuel and product in storage tanks will be removed prior to the tanks being dismantled. Contaminated soil will be remediated where required. The approach for the reclamation of haul roads built for the Project will be developed based on engagement with local communities.

5.2.2 Open Pits and Underground Mines

Closure options for the open pits developed for the Project may include backfilling with tailings capped by waste rock and allowing the pits to refill by natural water inflows and potentially supplemented with groundwater from nearby pits and/or diversion of surface water. Underground mine accesses will be blocked to mitigate potential risks to the safety local populations.

5.2.3 Tailings Disposal Areas

The tailings from the process plant will be deposited in historical pits, along with the mineral sorter rejects, thereby avoiding the construction of a conventional tailings management facility. Upon closure, the open pits used for tailings deposition will have been filled to ground surface with mineral sorter rejects and waste rock where necessary. The pits will be covered with stored overburden, if available, and contoured to restore the natural drainage. Measures to stabilize the surface and limit erosion will be implemented. The measures will be developed through engagement with local communities and may include revegetation.

5.2.4 Waste Rock Storage Facilities

A portion of the waste rock will be backfilled into historical or proposed mined-out pits during the operation to limit the Project's footprint and double handling. Where waste rock cannot be stored in nearby pits, the final design of the waste rock piles will be developed for the Closure and Reclamation Plan.

5.2.5 Water Management Facilities

Part of the remaining overburden material will be used to backfill waste rock and overburden water management network, such as ditches and collection ponds. Pumps and pipelines will be removed.

At the process plant site, the water management system components will be reclaimed by breaching the sedimentation ponds, removing pumps and pipelines, and dismantling any other water management infrastructure.

5.3 Monitoring and Maintenance

Monitoring for physical and chemical stability, and maintenance of the reclaimed facilities will be required after closure and post-closure until closure objectives and criteria are met. The specific schedule and program for monitoring, maintenance, and engagement will be prepared as part of the Closure and Reclamation Plan developed through the Water Licence process following completion of the environmental assessment.

The environmental monitoring programs developed during operations will be used as the basis for post-closure monitoring. Monitoring during closure will be designed to track reasonably foreseeable post-closure contamination pathways and to allow for the identification of any specific post-closure monitoring to address potential effects through adaptive management.

6 REFERENCES

Acts and Regulations

Federal

Canadian Environmental Protection Act, 1999. SC 1999, c 33. Current to 15 July 2020. Available at https://laws-lois.justice.gc.ca/eng/acts/c-15.31/

Canadian Navigable Waters Act. RSC 1985, c N-22. Last amended 4 October 2019. Available at https://laws.justice.gc.ca/eng/acts/N-22/

Explosives Act. RSC 1985, c E-17. Current to 28 July 2020. Available at https://laws-lois.justice.gc.ca/eng/acts/e-17/

Explosives Regulations, 2013. SOR/2013-211 under the *Explosives Act*. Last amended 2 November 2018. Available at https://laws-lois.justice.gc.ca/eng/regulations/SOR-2013-211/index.html

Fisheries Act. RSC 1985, c F-14. Last amended 28 August 2019. Available at https://laws-lois.justice.gc.ca/eng/acts/f-14/

Mackenzie Valley Land Use Regulations. SOR/98-429 under the *Mackenzie Valley Resource Management Act*. Last amended 20 June 2017. Available at https://laws-lois.justice.gc.ca/eng/Regulations/SOR-98-429/index.html

Mackenzie Valley Resource Management Act. SC 1998, c 25. Last amended 28 August 2019. Available at https://laws-lois.justice.gc.ca/eng/acts/m-0.2/

Metal and Diamond Mining Effluent Regulations. SOR/2002-222 under the *Fisheries Act*. Available at https://laws-lois.justice.gc.ca/eng/regulations/sor-2002-222/

Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations. SOR/2008-197 under the *Canadian Environmental Protection Act.* Last amended 2 July 2017. Available at https://laws-lois.justice.gc.ca/eng/regulations/sor-2008-197/index.html

Transportation of Dangerous Goods Act, 1992. SC 1992, c 34. Last amended 28 August 2019. Available at https://laws-lois.justice.gc.ca/eng/acts/t-19.01/

Transportation of Dangerous Goods Regulations. SOR/2001-286 under the *Transportation of Dangerous Goods Act*. Last amended 19 February 2020. Available at https://laws-lois.justice.gc.ca/eng/regulations/SOR-2001-286/index.html

Territorial

Archaeological Site Regulations. R-024-2014 under the *Archaeological Sites Act.* In force 1 April 2014. Available at https://www.justice.gov.nt.ca/en/files/legislation/archaeological-sites/archaeological-sites.r1.pdf

Archaeological Sites Act. SNWT 2014, c 9. In force 1 April 2014. Available at https://www.justice.gov.nt.ca/en/files/legislation/archaeological-sites/archaeological-sites.a.pdf

Explosives Use Act. RSNWT 1988, c E-10. Last amended 29 November 2016. Available at https://www.justice.gov.nt.ca/en/files/legislation/explosives-use/explosives-use.a.pdf

Explosives Regulations. RRNWT 1990, c E-27 under the *Explosives Use Act.* Available at https://www.justice.gov.nt.ca/en/files/legislation/explosives-use/explosives-use.r1.pdf

Forest Protection Act. RSNWT 1988, c F-10. Last amended 2010. Available at https://www.justice.gov.nt.ca/en/files/legislation/forest-protection/forest-protection.a.pdf

Land Withdrawal Order (South Slave Region). R-058-2014. Last amended 2019. Available at https://www.justice.gov.nt.ca/en/files/legislation/northwest-territories-lands/northwest-territories-lands.r27.pdf

Northwest Territories Land Use Regulations under the *Northwest Territories Lands Act*. R-012-2014. Last amended 1 April 2018. Available at https://www.justice.gov.nt.ca/en/files/legislation/northwest-territories-lands/northwest-territories-lands.r3.pdf

Northwest Territories Lands Act. SNWT 2014, c 13. Last amended 1 April 2016. Available at https://www.justice.gov.nt.ca/en/files/legislation/northwest-territories-lands/northwest-territories-lands.a.pdf

Public Health Act. SNWT 2007, c 17. Last amended 15 February 2019. Available at https://www.justice.gov.nt.ca/en/files/legislation/public-health/public-health.a.pdf

Quarrying Regulations. R-017-2014 under the *Northwest Territories Lands Act*. Last amended April 2018. Available at https://www.justice.gov.nt.ca/en/files/legislation/northwest-territories-lands/northwest-territories-lands.r6.pdf

Scientists Act. RSNWT 1988, c S-4. Last amended 1 April 2014. Available at https://www.justice.gov.nt.ca/en/files/legislation/scientists/scientists.a.pdf

Waters Act. SNWT 2014, c 18. Last amended 31 August 2016. Available at https://www.justice.gov.nt.ca/en/files/legislation/waters/waters.a.pdf

Wildlife Act. SNWT 2017, c 19. Last amended 31 October 2017. Available at https://www.justice.gov.nt.ca/en/files/legislation/wildlife/wildlife.a.pdf

Literature Cited

AMC (AMC Mining Consultants Canada). 2012. Pine Point Geotechnical Review Phase 2 R190 Deposit. AMC Report #AMC711018.

CBC. 2018. Jay pipe expansion at Ekati mine delayed, again. May 9, 2018. Available at: https://www.cbc.ca/news/canada/north/jay-pipe-nwt-delay-1.4655020#:~:text=Company%20official%20said%20work%20for,hold%20while%20it%20studies%20profitability&text=Expansion%20of%20one%20diamond%20mine,year%20has%20been%20delayed%2C%20again.&text=The%20new%20open%20pit%2C%20called,2033%2C%20the%20company%20previously%20said.

CCME (Canadian Council of Ministers for the Environment). 2015. Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products (PN 1326)

De Beers (De Beers Group). 2020. Gahcho Kué Mine. Available at: https://canada.debeersgroup.com/operations/mining/gahcho-kue-mine

Eagle Eye Concepts. 2007. K'atl'odeeche First Nation Traditional Knowledge Assessment. June 2007.

GNWT (Government of the Northwest Territories). GNWT. 2019. Finding Common Ground. A renewed commitment to regional land use planning in the Northwest Territories. Department of Lands. May 2019. https://www.lands.gov.nt.ca/sites/lands/files/resources/lup_stratetic_approach_web_ready_2_0.pdf

GNWT. 2020. Land use planning in the NWT. https://www.lands.gov.nt.ca/en/services/land-use-planning-nwt

GNWTBS (Government of the Northwest Territories, Bureau of Statistics). 2019. Community Labour Force Activity. 1986-2019. Accessed January 2020. Available at https://www.statsnwt.ca/labour-income/labour-force-activity/

GNWT-ENR. 2019. Wildlife Management and Monitoring Plan (WMMP): Process and Content Guidelines. Department of Environment and Natural Resources, Government of the Northwest Territories, Yellowknife, NT. June 2019.

Government of Canada and GNWT. 2019. Species at Risk Act, Conservation Agreement for the Conservation of the Boreal Caribou. Available at https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/administrative-agreements/agreement-conservation-woodland-caribou-boreal-northwest-territories.html.

INAC (Indian and Northern Affairs Canada). 2007. Guidelines for Spill Contingency Planning. Water Resources Division, INAC, Yellowknife, NT. April 2007.

LWBMV (Land and Water Boards of the Mackenzie Valley). 2018a. Engagement and Consultation Policy. June 2018.

LWBMV. 2018b. Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits. June 2018.

MVLWB (Mackenzie Valley Land and Water Board). 2011a. Water and Effluent Quality Management Policy March 31, 2011

MVLWB. 2011b. Guidelines for Developing a Waste Management Plan. MVLWB, Yellowknife, NWT. March 2011.

MVLWB. 2018. DRAFT Guidelines for Developing Baseline Water Quality Monitoring Programs in the Northwest Territories. May 2018.

MVLWB and AANDC (Mackenzie Valley Land and Water Board and Aboriginal Affairs and Northern Development Canada). 2013. Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories. November 2013.

MVLWB and GNWT (Mackenzie Valley Land and Water Board and Government of Northwest Territories). 2019. Guidelines for Aquatic Effects Monitoring Programs. Developed and published in collaboration with Mackenzie Valley Land and Water Board, Gwichin Land and Water Board, Sahtu Land and Water Board, Wek'èezhìi Land and Water Board, and Government of the Northwest Territories. March 2019. Yellowknife, NWT, Canada.

Osisko Metals. 2019. News Release: Osisko Metals Announces Pine Point Collaboration Agreements. https://www.osiskometals.com/medias/iw/190930-Collaboration-Agreements_FINAL_EN.pdf

pHase Geochemistry. 2017. Review of Geochemical Data for the Pine Point Project – Draft. Vancouver, BC. 8 May 2017. Report prepared for Knight Piesold.

Price WA, Errington J. 1997, Guidelines for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia, British Columbia Ministry of Employment and Investment (formerly BC MEMPR)

Price WA. 2009, MEND “Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials”

Rescan. 2011. Pine Point Project: Metal Leaching / Acid Rock Drainage Characterization: Static Testing Results from Borehole R190-11-GT1

Rescan. 2012a. Pine Point Project: 2011 Metal Leaching / Acid Rock Drainage Baseline Study – N-204. Prepared for Tamerlane Ventures Inc. by Rescan Environmental Services Ltd.: Vancouver, British Columbia.

Rescan. 2012b. Pine Point Project: 2011 Metal Leaching / Acid Rock Drainage Baseline Study – X-25, P-499, O-556, Z-155, and G-03. Prepared for Tamerlane Ventures Inc. by Rescan Environmental Services Ltd.: Vancouver British Columbia

Rice JM, Paulen JM, McClenaghan MB, Oviatt NM. 2013. Glacial stratigraphy of the Pine Point Pb-Zn mine site, Northwest Territories Geological Survey of Canada. Current Research 2013-5.

Rio Tinto. 2020. Closure Diavik Diamond Mine. Available at: https://www.riotinto.com/sustainability/closure.

Swisher S. 2006a. Traditional Knowledge Summary Report. Pine Point Pilot Project. Fort Resolution, NWT. December 2006.

Swisher S. 2006b. Traditional Knowledge Summary Report. Pine Point Pilot Project. Hay River, NWT. December 2006.

TetraTech. 2018. Summary of Geochemical Characterization Data for the Pine Point Project, NWT by TetraTech Canada Inc, Vancouver, British Columbia

TetraTech. 2020. Pine Point Mine Dewatering Estimates. Technical Memo prepared for Pine Point Mining Limited by consultants Gutmann, C., Hsieh, A., July 20, 2020, 30 p.

WLWB (Wek'èezhìi Land and Water Board). 2010. Guidelines for adaptive management - a response framework for aquatic effects monitoring. Yellowknife, NWT, Canada.

Appendix A Osisko Metals Code of Ethics

Code of Ethics

May 23, 2018

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Where appropriate, the Code of Ethics of Osisko Metals Incorporated **("Osisko Metals" or the "Corporation") also applies to the directors of the Corporation and the term "employees", as well as to any third party providing goods or services to the Corporation, and the term "employees", when used herein, is, where appropriate, deemed to apply to such directors, as well as to any third party providing services or goods to the Corporation.**

SUMMARY

Osisko Metals's Code of Ethics (the "**Code**") provides basic guidelines setting forth the ethical behavior expected from every employee of the Corporation with respect to the use of Corporation time and assets, protection of confidential information, conflicts of interest, trading in Osisko Metals's securities and other matters. Every Director and employee of Osisko Metals and its affiliated entities is subject to the Code and will be requested to sign a form acknowledging that he or she understands its contents and agrees to be bound by its provisions.

In summary, all employees must:

- Follow applicable laws and regulations wherever the Corporation does business;
- Work safely, in accordance with regulatory and other industry standards;
- Treat everyone fairly and equitably: customers, suppliers, other employees, Corporation stakeholders and third parties dealing with the Corporation;
- Refrain from speaking publicly on Corporation matters, unless authorized;
- Refrain from trading on, and "tipping" others on, confidential information;
- Respect the confidential nature of the information to which they may have access and refrain from sharing same, except on a need-to-know basis;
- Always perform their duties in the best interests of the Corporation;
- Avoid conflicts of interest, both real and perceived;
- Be honest and act with integrity strictly refraining from bribery or corruption activities;
- Handle Corporation assets with care and refrain from using same and Corporation time for personal purposes;
- Respect the right of all employees to fair treatment and equal opportunity;
- Respect the right of all employees to a working environment free from discrimination or harassment of any sort;
- Act in a respectful and professional manner with other employees;
- Refrain from inappropriately influencing the political process;
- Work in an environmentally responsible manner;
- Respect the cultures and rights of communities where the Corporation operates its business;
- Ensure that all transactions are handled honestly and recorded accurately; and
- Report any violation to this Code.

INTRODUCTION

It is the Corporation's policy and objective to maintain the highest standards of ethical business behaviour. Ethical behaviour in the performance of one's duties essentially comes down to being honest and fair in one's dealings with other employees, customers, suppliers, competitors, Corporation stakeholders and the public. No one in the Corporation, from the President and Chief Executive Officer to the hourly employee, is ever expected or authorized to commit an illegal or unethical act, or to allow, direct or encourage others to do so.

The Corporation's reputation for business integrity is one of its most valued assets; it was achieved and is maintained through the efforts of its employees and their avoidance of any activity or interest that might reflect unfavourably upon the Corporation's image or reputation, or their own. Every transaction of the Corporation must be able to withstand public scrutiny without risk of causing embarrassment to the Corporation, its employees and its stakeholders.

The guidelines and principles set forth herein have been established by management of the Corporation as a code of ethics to be observed by all directors and employees of the Corporation (the "employees"). They are applicable in all jurisdictions in which the Corporation conducts business, unless the laws of those jurisdictions require otherwise.

The Code was approved by the Corporation's Board of Directors and, thus, no officer or employee has the authority to allow exceptions to its provisions. Strict adherence to the Code is a condition of employment and any breach thereof will be cause for appropriate disciplinary action, which may include dismissal.

Whereas no single booklet can define every circumstance that might be considered improper and no list of do's and don'ts will address every potential situation in which employees may find themselves, the Code cannot be construed as a comprehensive document. Therefore, above all, employees are expected to use their common sense and good judgment in observing this Code.

Each employee must be vigilant in preventing fraud, bribery and corruption. Thus, should an employee have a concern regarding the application of the Code to a particular action, situation or transaction, he or she should promptly discuss the matter with his or her immediate supervisor. If the matter is not resolved through this discussion, the employee and the immediate supervisor are expected to raise the issue with higher levels of management or with the Corporation's Chief Financial Officer.

OSISKO METALS'S CODE OF ETHICS

Each employee with executive or managerial responsibilities is responsible for communicating the expectations contained in this Code to all employees under his supervision and obtaining their undertaking as to their awareness and compliance with this Code in the attached form of undertaking.

Policies adopted by the Corporation regarding specific subject matters relating to the Code will be distributed to all employees in a timely manner.

LAWS AND REGULATIONS

Compliance with Laws and Regulations

The Corporation's operations are subject to an important number of very complex and changing laws and regulations, and its employees must comply with same as well as various rules, policies and guidelines of regulatory authorities and governmental agencies wherever it does business. Each employee is reminded that the law takes precedence in cases where there may be a conflict between the law and traditional or industry practices.

Lobbying

Communication with a member of a government or legislature (be it federal, provincial, state, municipal, local or other level) may be considered lobbying. Lobbying is regulated in many countries where the Corporation does business. Certain jurisdictions require that the Corporation or its employees be formally registered prior to engaging in such activities, and relevant employee are all expected to comply with these requirements.

Consequently, prior to engaging in any such activities, an employee must contact the Chief Executive Officer in order to ensure that the appropriate course of action is taken.

Dealing in Corporation's Securities

Securities and stock exchange laws and regulations are extremely strict regarding the use and selective disclosure of information that, if publicly disclosed, could have a significant impact on the market price or value of the Corporation's securities or affect any reasonable investor's investment decision.

Employees are prohibited from purchasing and selling Corporation shares or securities convertible into Corporation shares when they are in possession of material non public information concerning the business and affairs of the Corporation, and they are similarly prohibited from informing others about such information, except in the necessary course of business and were the other is under an obligation of confidentiality.

Fair Competition

The Corporation is committed to the principles of fair competition in the purchase and sale of products and services. All procurement decisions shall be based exclusively on normal commercial considerations, such as quality, price, availability, service, reputation and other factors bearing directly on the product, service or supplier. Customers and potential customers of the Corporation shall be provided with equal rights to make purchasing decisions based on the same competitive terms.

The Corporation will neither seek, encourage nor tolerate special favors or arrangements with suppliers or customers that impair, or give appearance of impairing, fair and unfettered commercial relationships. Under no circumstances is it acceptable to offer, give, solicit or receive any form of bribe, kickback, or inducement. In the same manner, the Corporation must avoid either the fact or the appearance of improperly influencing relationships with organizations or individuals with whom the Corporation deals in the course of its business.

Competitors' Information

From time to time, the Corporation gathers information about the industry in which it does business, including information about competitors. The Corporation is committed to gathering this information honestly and ethically; no employee should use improper means to obtain competitors' confidential business information.

DEALING WITH PUBLIC OR GOVERNMENT OFFICIALS

Anti-Bribery and Anti-Corruption

The Corporation promotes zero-tolerance against bribery and corruption and entrenches such fundamental principles in its corporate values.

Many countries, such as Canada and the United States, have passed legislation criminalizing bribery of government officials such as the *Corruption of Foreign Public Officials Act* (Canada), the *Foreign Corrupt Practices Act* (USA) and other relevant local laws in the countries where the Corporation may carry on business activities. The sanctions for violating such laws can be acute and may include individual and corporate fines, as well as imprisonment.

The Corporation is determined to ensure compliance to anti-bribery and anti-corruption laws, principles and rules. All employees shall refrain from offering, giving or receiving, directly or indirectly, anything of value (ex.: money, gifts, entertainment, employment, contracts or advantages of any kind) or any other form of improper payments to a public or government official in order to influence a government action or obtain an improper advantage and shall not knowingly participate in any form of corrupt activity.

For example, "public or government officials" may include without limitation:

- a person who holds a legislative, administrative or judicial position of a foreign state;
- a person who performs public duties or functions for a foreign state, including a person employed by a board, commission, corporation or other body or authority that is established to perform a duty or function on behalf of the foreign state, or is performing such a duty or function; or
- an official or agent of a public international organization that is formed by two or more states or governments, or by two or more such public international organizations.

Employees who have questions regarding the requirements or application of these laws must seek guidance from the Chief Financial Officer of the Corporation. In some instances, the Corporation may be subject to government investigations. While the Corporation has a policy to cooperate fully with such investigations, no employee should readily respond on behalf of the Corporation to any regulatory authority or governmental agency unless he or she has had an opportunity to consult with the Chief Financial Officer and his or her supervisor, and has received appropriate guidance in that respect.

Gifts, Hospitality and Expenses

Employees shall not, either directly or through an intermediary, offer or provide gifts, hospitality or reimbursement of travel or other expenses to a public or government official, except with the prior approval of the Chief Financial Officer or in accordance with the Corporation's Code. Employees may pay or reimburse reasonable meal expenses incurred in good faith by or on behalf of a public or government official related to the promotion, demonstration, or explanation of products or services of the Corporation or the execution or performance of a contract between the Corporation and the public official's government or agency thereof without pre-approval of the Chief Financial Officer. Any such payment or reimbursement must at all times be in compliance with the Corporation's Code, or any other related policy or guidelines.

In addition, employees must refrain from giving anything of value indirectly (for example, to a consultant, agent, intermediary, business partner or other third party) if such employee has reason to believe that it will be passed on to a government official or a private commercial partner to obtain an improper advantage. As such, all employees must take the necessary measures to:

- Ensure that the Corporation's partners, such as consultants, representatives and agents, understand and will abide by the Code and more specifically by the provisions relating to anti-bribery and anti-corruption;

- Evaluate the qualifications and reputation of the Corporation's partners (including the use of a due diligence review prior to entering into such a relationship); and

- Draft agreements and contracts that include such requirements to protect Osisko Metals. The Corporation will conduct a due diligence review on these matters prior to any decision to invest in another business – whether it is to acquire a business in whole or in part, or a joint venture arrangement.

The Chief Financial Officer is responsible for ensuring that any gift, hospitality and/or reimbursement of travel or other expenses ultimately provided to a third party, including a public or government official, is fully and accurately recorded in the Corporation's accounting records. Confirm accuracy of this statement.

Facilitating Payments

Any request for a payment to be made by or on the behalf of the Corporation, to facilitate or secure a routine transaction (*i.e.* obtain permits, licenses or work orders to which the Corporation is already entitled) are considered to be at high-risk of constituting a bribe. Therefore, the Corporation prohibits facilitating payments.

ENVIRONMENT, HEALTH AND SAFETY

Occupational Health and Safety

The Corporation is committed to ensuring a healthy working environment and safe working conditions, equipment and work sites for its employees and promoting their involvement in preventing occupational injuries.

Protection of the Environment

The Corporation is committed to conducting its business in a manner that protects the environment, preserves resources and ensures sustainable development. It is continuously seeking to improve its environmental performance, in keeping with applicable law, regulations and guidelines.

Each employee is expected to be alert to environmental issues and has a responsibility to work in an environmentally responsible manner.

PUBLIC COMMUNICATIONS AND DISCLOSURE

Media Relations and Disclosure of Information

The Chairman, President and Chief Executive Officer and the Chief Financial Officer are the only official spokespersons of the Corporation. Unless authorized by the President and Chief Executive Officer or the Chief Financial Officer, no employee may give his personal opinion, disclose confidential information or discuss matters pertaining to the Corporation to members of the news media and the public in general. Any inquiry or request for an interview must be referred to the President and Chief Executive Officer or the Chief Financial Officer.

No material undisclosed information related to the Corporation's business may be communicated to anyone until public disclosure of such information has been made to the general public, except to those who need to know said information in the necessary course of business and are under an obligation of confidentiality.

If any material information about the Corporation not yet disclosed to the public is inadvertently disclosed, employees aware of such disclosure shall contact the President and Chief Executive Officer, the Chief Financial Officer immediately so that the Corporation may promptly take corrective action.

CONFLICT OF INTEREST

Disclosure of Conflicts of Interest

In discharging their duties, employees must act honestly and in good faith with a view to the best interests of the Corporation. Employees must avoid situations involving a conflict between their personal interests and the interests of the Corporation. Actions taken and decisions made by any employee should be based on impartial and objective assessment of the facts in each situation, free from influence by gifts, favours and the like, which may adversely affect the employee's judgments.

The integrity and effectiveness of any employee is impaired when he or she has such a substantial personal interest in a transaction, or in a party to a transaction, that either his general duty of undivided loyalty to the Corporation or his independent judgment, or his decisions or actions taken on the Corporation's behalf might reasonably be expected to be adversely affected. Undisclosed interests or obligations in firms with which, or property in regards to which, the Corporation transacts business or contemplates such transactions, create at least the presumption of a conflict of interest and must be avoided. An employee who may have conflicting or potentially conflicting interests between his personal, business or other outside activities and any business interest of the Corporation in any transaction that he knows is under consideration by the Corporation, must withdraw from any discussions, decisions or assessment related to the particular subject and inform his immediate supervisor of the matter and of his conflict (or potential conflict). Employees may confront a variety of situations that represent real or potential conflicts of interest. The Corporation expects all employees to be sensitive to such possibilities and to consult their immediate supervisor or the Chief Financial Officer when ambiguous situations arise.

Outside Business Activities

Involvement or employment outside the Corporation which might reduce an employee's general duty of undivided loyalty to the Corporation, or adversely affect his independent judgment, as well as his decisions or actions taken on the Corporation's behalf, must be avoided. No conflict should exist between the private interests of employees and their official duties. To ensure that employees give their full attention to their work and their undivided loyalty to the Corporation, employees are discouraged from engaging in paid employment outside of the Corporation without the express written permission of their immediate supervisor, and, in any event, are strictly prohibited from engaging in paid employment that might conflict with the interests of the Corporation. Employees must also obtain the consent of their immediate supervisor for all professional activities (such as, for example, service in professional associations and on boards of directors) which ensue from their function or status at the Corporation or which would necessitate time or energy during the working day.

PROTECTION AND USE OF CORPORATION'S ASSETS

Corporation's Time and Assets

Employees must use Corporation's assets and resources solely for the purposes for which they are intended: any personal or other use must be avoided. Every employee has an obligation to safeguard the Corporation's assets and to exercise care in using Corporation's equipment and vehicles. Each employee must use Corporation's time solely for Corporation's purposes and not for personal purposes. Any waste, misuse, destruction or theft of Corporation's property or any improper or illegal activity must be brought to the attention of management.

Employees ceasing employment with the Corporation must return all objects, documents or data belonging to the Corporation such as computer hardware and software, databases, cellular telephones, credit cards, books, manuals, etc. and shall comply with the Corporation's guidelines and policies in that respect.

E-mail and Internet

E-mail and Internet systems are provided for business use. The use of e-mails is not entirely secure and may be susceptible to interception and creates a permanent record. Any e-mail sent may be printed by the recipient

and forwarded by the recipient to others, and is probably retained on company computer for a substantial period of time. Therefore, employees should exercise the same care, caution and etiquette in sending an e-mail message as they would in normal written business communications.

In relation to the Corporation's Internet connection, it is forbidden to download any data that is unprofessional or inappropriate for business use.

Confidential Information

Confidential information relating to the Corporation's business is a very important asset of the Corporation and must be treated accordingly.

During the course of their employment, employees may be provided with access to and knowledge of confidential information, to the extent that such information is necessary or at least useful to ensure the proper performance of their duties. Confidential information includes, but is not limited to, information not publicly disclosed about the Corporation's business, projected property acquisitions, exploration, drilling and other technical results, mining methods or techniques, production, discoveries, information relative to past, present and prospective customers and suppliers, joint ventures, financial data, marketing techniques, strategies, and business plans and personal information concerning employees of the Corporation.

Employees must preserve the confidentiality of such information and shall not at any time, both during and after their employment with the Corporation, disclose to anyone (within or outside the Corporation), any of the Corporation's confidential information, except on a need to know basis in the normal course of business. Moreover, employees shall not use such information for their, or anyone else's, personal gain. Employees shall return to the Corporation such confidential information upon request by the Corporation and, in any event, immediately after their employment termination.

The above restrictions apply not only to the Corporation's confidential information, but also to information received by the Corporation from third parties under an obligation of confidentiality.

Social Media

All directors, officers and employees of the Corporation must exercise proper care and good judgment when using social media. It is important that we do not give the improper impression that they are individually speaking on behalf of Osisko Metals when using social media, unless they are expressly authorized to do so.

Social media refers to the external online tools used to share on an ongoing basis any developments concerning the Corporation's activities. Social media tools include, but are not limited to: professional networking sites (e.g., LinkedIn), social networking sites (e.g., Facebook, Tumblr), video and photo sharing websites (e.g., YouTube), micro-blogging sites (e.g., Twitter), personal websites and blogs, forums and discussion boards (e.g.,Yahoo! Groups, GoogleGroups, Yelp).

HUMAN RESOURCES AND COMMUNITY

Employment and Equal Opportunity

The Corporation is committed to maintaining a challenging working environment in which ability and performance are recognized, free from any form of discrimination contrary to law and discrimination on the basis of personal relationships. Thus, every employee holding leadership responsibilities shall treat all other employees in a fair an equal manner and shall not allow any personal relationship with any other employee under his or her supervision compromise this principle.

The Corporation allows the employment of related persons, but in every case the procedure followed must be equitable and situations involving a conflict or a potential conflict between any employee's personal interests and the interests of the Corporation must be avoided. The following relationships between an employee and the person to whom he or she reports to may give rise to violations of this principle and must be avoided or, if they exist, be brought to the attention of the local head of the management team who shall, if appropriate, recommend specific conditions: a spouse (including common-law relation), a child or grandchild, a spouse of such child or grandchild, a sibling, a father-in-law, a mother-in-law, or any employee in the direct parent-child bloodline of another where there is a real or potential conflict of interest as a result of the relationship and the positions the employees occupy.

Respect and Integrity of the Person

The Corporation is committed to encouraging the respect of individuals, their integrity and their dignity by ensuring that the working environment and relations between employees shall be free of discrimination or harassment. Any person who believes that he is a victim of harassment may directly contact the Chief Financial Officer. The matter will be treated with discretion and diligence and in accordance with appropriate procedures.

Business and Professional Relationships

Employees must maintain professional relationships based on honesty and respect for individuals and the organization with a view to establishing lasting and equitable employment and business relationships. Employees must specifically encourage respect for others and cooperation and professionalism among colleagues.

Community Relations

The Corporation is committed to conducting its business responsibly with the communities in the areas where it operates, and to making a positive contribution to the well-being and development of said communities. Every employee shall reflect this commitment in his everyday dealings, and respect the different cultures and the dignity and rights of individuals in all countries where the Corporation carries out its activities.

CORPORATE RECORDS

Records and Reporting

The Corporation's records serve as the means and evidence of the management of the Corporation's business, as the measure of the Corporation's fulfillment of its obligations to shareholders, employees, suppliers and others, and of the Corporation's compliance with tax, financial, and other reporting requirements. Directors, officers, shareholders and other stakeholders of the Corporation cannot make informed decisions about the Corporation if its records and business information contains material errors, omissions, falsifications or misleading statements.

The Corporation is committed to maintaining adequate accounting and auditing procedures and controls to ensure that financial statements fairly present, in all material respects, the financial condition and results of operations of the Corporation in accordance with the requirements of applicable law and the International Financial Reporting Standards.

All employees involved in collecting, drafting, gathering, processing or recording such information are responsible for its integrity and shall ensure, to the best of their ability, that all entries, books, records and accounts of the Corporation accurately and fairly reflect the Corporation's operations and transactions. Accounting, financial and legal documents and records of the Corporation shall not be destroyed without the prior consent of the Chief Financial Officer.

Each employee must be vigilant in preventing fraud and dishonesty, and report immediately to his immediate supervisor any evidence of wrongdoing. No WB policy

COMPLIANCE

Employee Compliance and Reporting

All officers and managers at all levels shall maintain an "open door" policy regarding questions of business conduct as regards this Code and its applicability. Employees shall be encouraged to ask such questions in respect of any particular situation no matter how small or insignificant it may seem to be.

Each employee is encouraged to be alert to any work related activities which could be construed as a violation of the Code, should bring the matter to the attention of his or her immediate supervisor, or an (other) officer of the Corporation, as appropriate, and should take corrective action, if possible, to remediate the situation and/or prevent recurrence of the violation.

If any employee is uncertain whether an activity in which he is engaged or an activity he is witnessing could be construed as a violation of the Code, he must discuss the matter with his immediate supervisor, or an (other) officer of the Corporation, as appropriate.

Where a corporate policy provides specific complaint procedures, theses procedure will be applicable in case of violation of the policy. Otherwise, an employee who has knowledge that a violation to this Code has been committed or will be committed shall bring the matter to the attention of his immediate supervisor and, if this avenue is not appropriate or if the matter has not been corrected by the immediate supervisor, to the hierarchical supervisor of the employee's immediate supervisor and so on, up the corporate ladder, for as long as the violation has not been corrected and if necessary, as high as the President and Chief Executive Officer, as appropriate. If an employee has reasons to believe that this avenue is not appropriate, he may bring the matter to any officer of the Corporation, as appropriate.

Retaliation against any employee who honestly reports a concern about an illegal or unethical conduct will not be tolerated. Persons involved in illegal or unethical conduct, may be sanctioned even if they have reported it. It is unacceptable to file a report knowing it to be false.

Investigation and Enforcement

If any member of management receives reports of any violation of the Code, he must conduct such investigations, inform the Corporation's President and Chief Executive Officer, the Chief Financial Officer, and the head of the relevant department or division of such investigation and of its outcome, and take such other actions as he or she considers necessary to determine whether a violation has in fact occurred and shall recommend appropriate corrective and, if applicable, disciplinary action (including termination of employment) to Osisko Metals's President and Chief Executive Officer, as appropriate. Any employee who withholds information during the course of an investigation regarding a possible violation of the Code is subject to disciplinary action, including termination of employment.

Certification

Each current and new employee, director, officer and employee will be required to certify his awareness and compliance with this Code in the attached form of undertaking. Subsequently, each key director, officer and employee, as determined by management and excluding third parties, will be required to reiterate annually his or her undertaking in the attached form of renewal. Any director, officer and employee who is required to so certify and declines doing so cannot thereafter claim that he is not aware of the provisions of the Code.

REVIEW AND MONITORING

The Corporate Governance Committee shall review this Code periodically, as it deems appropriate, and propose recommended changes to the Board of Directors.

The Board of Directors, directly or through its Corporate Governance Committee, will monitor compliance to this Code.

OSISKO METALS INCORPORATED

and its affiliated entities (Pine Point Mining Limited)

UNDERTAKING TO COMPLY WITH OSISKO METALS'S CODE OF ETHICS

(For current and new employees)

I, the undersigned, hereby acknowledge having received and read a copy of the **Code of Ethics** for employees of Osisko Metals Incorporated and its affiliated entities (the "Code"), and I hereby undertake to comply with its provisions, promote the goals, measures, objectives and principles set forth therein and take all the necessary steps to ensure its application in my work environment.

I further agree that I have the responsibility to speak to my immediate supervisor, or an (other) officer of the Corporation, should I have any concerns about a possible breach, by anyone, of the Code.

Signed at _____, this _____ day of _____, 20__.

_____

Employee's signature

_____

Employee's name (print)

OSISKO METALS INCORPORATED

and its affiliated entities

UNDERTAKING TO COMPLY WITH OSISKO METALS'S CODE OF ETHICS

(Renewal Form)

I, the undersigned, hereby acknowledge having received and read a copy of the **Code of Ethics** for employees of Osisko Metals Incorporated and its affiliated entities (the "Code"), and I hereby undertake to comply with its provisions, promote the goals, measures, objectives and principles set forth therein and take all the necessary steps to ensure its application in my work environment.

I confirm that since the date of my previous undertaking to comply with the Code, I have complied with it and that:

☐ I have not been made aware of any violation to the Code; or

☐ I have not been made aware of any violation to the Code other that the violations listed in the schedule attached hereto.

I further agree that I have the responsibility to speak to my immediate supervisor, or an (other) officer of the Corporation, should I have any concerns about a possible breach, by anyone, of the Code.

_____

Date

_____

Employee's name (print)

_____

Employee's signature

_____

Location

OSISKO METALS INCORPORATED
and its affiliated entities

UNDERTAKING TO COMPLY WITH OSISKO METALS INCORPORATED'S CODE OF ETHICS

(FOR THIRD PARTY – INDIVIDUAL)

I, the undersigned, hereby acknowledge having received and read a copy of the **Code of Ethics** for employees of, and third parties providing services and goods to, Osisko Metals Incorporated and its affiliated entities (the "**Code**"), and I hereby undertake to comply with its provisions, promote the goals, measures, objectives and principles set forth therein and take all the necessary steps to ensure its application in my work environment.

I further agree that I have the responsibility to speak to an officer of Osisko Metals Incorporated, should I have any concerns about a possible breach, by anyone, of the Code.

_____
Date

_____
Name of individual (print)

_____
Individual's signature

_____
Location

OSISKO METALS INCORPORATED
and its affiliated entities

UNDERTAKING TO COMPLY WITH OSISKO METALS INCORPORATED'S CODE OF ETHICS

(FOR THIRD PARTY – BUSINESS)

_____ hereby acknowledges having received and read a copy of
(Name of business)
the **Code of Ethics** for employees of, and third parties providing services and goods to, Osisko Metals Incorporated and its affiliated entities (the "**Code**"), and hereby undertakes to comply with its provisions, promote the goals, measures, objectives and principles set forth therein and take all the necessary steps to ensure its application in its work environment.

_____ further agrees that it has the responsibility to speak to an officer of
(Name of business)
Osisko Metals Incorporated, should it have any concerns about a possible breach, by anyone, of the Code.

_____
Date

_____
Name of business (print)

_____
Signature by a duly authorized person of the business

Signed at _____, this _____ day of _____, 20__.

_____
Employee's signature

_____
Employee's name (print)