Avalon Rare Metals Inc.

PROJECT DESCRIPTION REPORT
THOR LAKE PROJECT
NORTHWEST TERRITORIES

Submitted To:
MACKENZIE VALLEY LAND AND WATER BOARD

April 2010

EXECUTIVE SUMMARY

Avalon Rare Metals Inc. ('Avalon') is a publicly traded company engaged in the exploration and development of rare metal deposits in Canada. Avalon's 100% owned Thor Lake Property is located at Thor Lake in the Mackenzie Mining District of the Northwest Territories, about 5 km north of the Hearne Channel of Great Slave Lake and approximately 100 km southeast of the city of Yellowknife. Avalon proposes to mine, mill and produce rare earth carbonate and oxides, zirconium, niobium and tantalum oxides, and possibly gallium from the Nechalacho deposit, located on its Thor Lake Property. The proposed project is referred to as the Thor Lake Project (TLP).

Approximately 9 million tonnes of indicated resources will be mined from the Nechalacho deposit over a period of approximately 14 years of operations. Construction will begin 16-24 months prior to operations, and reclamation activities will commence following cessation of all operations and continue for a period of approximately three years.

The proposed TLP has two site components: an underground mine and flotation plant (Nechalacho Mine and Flotation Plant site), to be located at the Thor Lake Property, and a hydrometallurgical plant (Hydrometallurgical Plant site) to be located at the existing brownfields site of the former Pine Point Mine, 85 km east of Hay River, NT on the south shore of Great Slave Lake.

Rare earth elements (REEs) will be mined underground and concentrated at the Nechalacho Mine and Flotation Plant site. The resulting REE concentrates will be barged across the east end of Great Slave Lake to the Hydrometallurgical Plant site. Upon arrival, the concentrate will be transported from the south shore of Great Slave Lake to the Hydrometallurgical Plant site via a haul road. The concentrate will be further processed at the Hydrometallurgical Plant. The resulting final products will be hauled to the Hay River railhead via truck, and direct shipped to downstream customers.

Nechalacho Mine and Flotation Plant

Mine: The Nechalacho Deposit will be mined underground. A decline ramp (15% ramp grade) will be utilized to access the ore zone located at approximately 200 m depth. Initial production will be approximately 1000 tpd and ramp up to 2000 tpd in year four. Mining will be conducted with a first pass of primary stopes, followed by pillar extraction after the primary stopes have been filled. Rubber-tired mechanized equipment will be utilized to provide maximum flexibility. Primary crushing will be completed underground and crushed ore and waste rock will be conveyed to the surface.

Flotation Plant: The process to produce the REE concentrate will involve conventional grinding, crushing and flotation techniques. Processing facilities will include a Flotation Plant that will produce a high grade concentrate that will be barged off-site to the proposed Hydrometallurgical Plant site for secondary processing.

Water Supply: The proposed fresh and process water supply source is Thor Lake.

Tailings Management Facility: The tailings management facility will be located up slope from the Flotation Plant and northeast of Thor Lake in the local catchment of Ring and Buck lakes. The tailings will be discharged to a number of locations around the tailings management facility to develop a relatively flat tailings beach and centralized supernatant pond to maximize tailings storage efficiency. Construction of the tailings management facility will occur in two phases over a period of three years.

Camp: A 150 person camp to house the employees and staff will be constructed adjacent to the Flotation Plant and in close proximity to the airstrip.

Power Supply: All site power is currently planned to be generated by a diesel powered generation facility at the site. The power requirements will range from a maximum of 7.4 MW for the 1000 tpd operation to an average of 8.4 MW for the 2000 tpd operation. Standby diesel generators will be installed as a secondary power source. Wind, Biomass and geothermal power are also being investigated as supplementary power sources for the Thor Lake Mine and Flotation Plant site.

Concentrate Storage and Loading: Approximately 180 tonnes per day (tpd) of concentrate will be produced from the Flotation Plant during the first three years. Production is planned to ramp up to 360 tpd commencing in year four. The concentrate will be loaded directly from the Flotation Plant into half-height intermodal containers. Once loaded, the containers will be removed from the Flotation Plant and transported to the dock either for shipment to the Hydrometallurgical Plant or for winter storage in a designated stacking area to be located at the dock facility.

Access Road: The existing 8 km access road that extends from the proposed Nechalacho Lake Mine and Flotation Plant site to the current barge landing site will be upgraded for the safe transport of concentrate and supplies.

Airstrip: The current airstrip (to be constructed during the summer of 2010) is located northwest of the proposed Flotation Plant and west of Thor Lake. The airstrip will be upgraded and extended 600 m to a total length of approximately 1000 m. The upgraded airstrip will accommodate Dash 8 and Buffalo aircraft and facilitate the safe transport of employees and supplies.

Fuel Storage: Diesel fuel will be transported from the south side of Great Slave Lake to the barge dock at the Nechalacho Mine and Flotation Plant site. Upon arrival, fuel will be offloaded to an upland receiving fuel storage facility to be located adjacent to the dock at Great Slave Lake. It will then be transferred by tanker truck to the main storage facility to be located west of the Flotation Plant near the diesel power plant.

Dock Facility: A seasonal dock facility comprised of a single barge connected to shore for the open water period and an adjacent yard will be used for concentrate storage and shipment to the Hydrometallurgical Plant site. It will also be used to receive and handle the annual resupply of major Mine consumables including fuel.

Hydrometallurgical Plant

Hydrometallurgical Plant: The proposed Hydrometallurgical Plant will further process the REE concentrates from the Nechalacho Mine and Flotation Plant. The process will include acid baking, caustic cracking, water washing, filtration, caustic regeneration and evaporation, double salt precipitation, solvent extraction and product drying facilities to produce direct ship products.

Water Supply: Potable and process water will be obtained from an existing nearby open pit lake and treated on-site as necessary for its intended uses.

Hydrometallurgical Tailings Facility: The proposed hydrometallurgical tailings facility will be an engineered facility located within the existing tailings facility that remains from the historic Pine Point Mine lead-zinc mining operation. Using this location presents significant environmental and operational benefits for the overall Project. Any water decanted from the hydrometallurgical tailings facility will be discharged in compliance with MVLWB Water License discharge criteria into the extensive wetland area located between the tailings facility and Great Slave Lake.

Concentrate Storage and Loading: Upon arrival at the Hydrometallurgical Plant, the concentrate storage containers will be unloaded from the trucks and placed into a secure storage area. As required, the containers will be moved into a heated thaw shed. Once in the thaw shed, the concentrate will be removed from the containers. The containers will be cleaned prior to shipment back to the Nechalacho Mine.

Power Supply: Average power consumption for the Hydrometallurgical Plant during start-up through year four is estimated at 6 MW. This power will be provided through the existing Northwest Territories Power Corporation (NTPC) power grid and substation located at the former Pine Point Mine site. Up to 5-10 MW of supplementary power may be required at the Hydrometallurgical Plant during full production. Additional power needs will be obtained either through the Talston Dam expansion or through secondary diesel generated power. Secondary and backup supply of power will be provided by diesel powered generating units on-site. Wind and geothermal power are also being investigated as supplementary power sources for the Hydrometallurgical Plant site.

Coal and Limestone Storage: The coal required to generate the balance of heat required for the acid bake and caustic crack methods will be shipped from the south via railway and transported by truck 85 km to the Hydrometallurgical Plant site. It will be stockpiled near the Hydrometallurgical Plant in an open stockpile that will be sloped and lined to prevent water intrusion or seepage.

The limestone used to neutralize the Hydrometallurgical Plant's waste stream prior to discharge to the tailings management facility will be obtained from local supply sources and stockpiled in a designated area that is in close proximity to the Hydrometallurgical Plant. Because the limestone is a neutralizing product, no special stockpile considerations will be necessary.

Avalon recognizes that coal is not the most environmentally preferred method for heating. However, it is necessary as an economic heating source for the Hydrometallurgical Plant. The Company will be investigating the use of Biomass and geothermal power as alternative heating sources.

Haul Road: An existing access road remaining from historical mine activities will be upgraded to safely transport the concentrate offloaded from barges on the south shore of Great Slave Lake to the Hydrometallurgical Plant located at the former Pine Point Mine site. The haul road will be approximately 8.6 km long. It will be aligned directly north-south along an existing drainage ditch for approximately 4.9 km prior to connecting to an existing haul road from a former mine pit located north of the main Pine Point Mine area.

Dock Facility: A seasonal dock facility consisting of two barges connected together to create a temporary floating dock and a marshalling yard will be installed on the south shore of Great Slave Lake approximately 8.6 km from the Hydrometallurgical Plant. The seasonal dock facility will permit the berthing and offloading of Thor Lake REE concentrates onto flatbed trucks for transportation to the Hydrometallurgical Plant. This facility will also be used for the annual shipment of major mining consumables, including fuel, to the Nechalacho Mine site.

Product Transportation to Railhead: The Hydrometallurgical Plant will produce approximately 80 tpd of final products. This amount will double to 160 tpd starting in year four. The final products will be packaged and hauled 85 km from the Hydrometallurgical Plant to the Hay River railhead on flatbed trucks. The final products will be direct-shipped from the railhead to downstream customers.

Human Resources

Nechalacho Mine and Flotation Plant: The Nechalacho Mine and Flotation Plant site is planned to operate 365 days per year with a 24/7 schedule. The employment schedule will be based on fly-in/fly-out transportation, onsite camp facilities and a three week in/three week out rotation.

Manpower requirements during construction of the Nechalacho Mine and Flotation Plant are estimated at 100-200 full-time positions. These numbers include employment generated through the third-party business contract opportunities needed to service the Project. Manpower requirements for the Nechalacho Mine and Flotation Plant operations are estimated at 184 full-time employees. Following cessation of all operations, approximately 20 positions will be retained for reclamation of the Nechalacho Mine and Flotation Plant site.

Hydrometallurgical Plant: The Hydrometallurgical Plant site is planned to operate 351 days per year with a 24/7 schedule. The Plant will shut down for maintenance 14 days every year during the summer. All employees with the exception of staff and contract maintenance will take vacation during the annual shutdown. Avalon will provide employees bus transportation from Hay River and Fort Resolution to the Hydrometallurgical Plant site.

Manpower requirements during construction of the Hydrometallurgical Plant are estimated at 100-200 full-time positions. These numbers include employment generated through the third-party business contract opportunities needed to service the Project. Manpower requirements for the Hydrometallurgical Plant operations are estimated at 88 full-time employees. Approximately 10 positions will be retained for reclamation of the Hydrometallurgical Plant site following completion of all operations.

Community Engagement

Avalon supports and practices the core business value that effective and meaningful communication contributes to the development of sound corporate and community relationships.

The Thor Lake Property is situated in the Akaitcho Territory and is subject to a comprehensive land claim negotiation between several communities of the Dene Nation and Canada's federal government. An interim measures agreement is currently in place and includes a land withdrawal that was implemented in 2007. The land withdrawal precludes new mineral title from being granted by the Crown in the Akaitcho territory for a period of up to five years while a land-use planning process is completed. The rights of existing mineral rights holders in this area are unaffected.

Starting in 2005, and continuing throughout the baseline data collection period to present, Avalon has made continuous efforts to keep the affected Dene communities informed of all aspects of the Project. Avalon's efforts have been communicated through telephone conversations, emails, presentations, site visits, personal visits and meetings. To date, all issues have been dealt with in an open, honest, transparent and mutually agreeable manner. Avalon has also initiated meetings and correspondence with the Department of Indian and Northern Affairs (INAC) and the Mackenzie Valley Land and Water Board (MVLWB) during this period. Collectively, these activities have provided the Company the opportunity to share information, coordinate activities and develop relationships in the proposed TLP area. Engagement activities with all affected stakeholders are planned to continue throughout the permitting process and the Project's life.

Environmental Setting

As indicated, the TLP will have two main site components, with site-specific environmental conditions. The sites include the Nechalacho Mine and Flotation Plant site located at the Thor Lake Property, about 5 km north of the Hearne Channel of Great Slave Lake, and the Hydrometallurgical Plant site, located at the existing brownfields site of the former Pine Point Mine on the south shore of Great Slave Lake.

Nechalacho Mine and Flotation Plant Area: The proposed Nechalacho Mine and Flotation Plant site area is located within the Great Slave Upland High Boreal (HB) Ecoregion, which is a subdivision of the more extensive Taiga Shield HB Ecoregion (Ecosystem Classification Group, 2008). The landscape is dominated by subdued topography and fractured bedrock plains. Black spruce, jack pine, paper birch, and trembling aspen form discontinuous forested patches that are interspersed with exposed rock. Wetlands and peat plateaus commonly form around the margins of shallow lakes, as well as in wetter depressions and lowlands.

The landscape in the proposed Mine area is dominated by bedrock outcrops, interspersed with veneers of unconsolidated till overlying bedrock and topographic depressions consisting of organic accumulations of variable depth. The organic rich horizons are poorly drained, which has led to the preponderance of bogs and fens in these areas.

The Thor Lake watershed covers an area of 2,100 ha. The Ring Group (Ring, Buck, Drizzle, and Murky Lakes) constitutes 800 ha or 38% of that watershed, and about 19% of the annual Thor Lake discharge (1.8 million m3/yr). Water discharge from Ring and Buck Lakes alone, which are proposed as the tailings management facility area, make up about 7% of the annual Thor Lake discharge.

In general, waters in the proposed Nechalacho Mine and Flotation Plant site area have high alkalinity, hardness, and calcium. These characteristics indicate a high acid buffering capacity. Lakes tend to be relatively clear with low suspended sediment levels, and low nutrient and metals concentrations. However, these levels typically rise in the shallow lakes (<3 m) during the winter due to highly reducing, anoxic conditions that develop under the ice, which result in reduced pH and a corresponding increase in the solubility of metals. In particular, levels of iron were several times higher in winter than the federal Canadian Council of Ministers of the Environment (CCME) guidelines. It is important to note that no CCME exceedances were noted for Thor Lake, into which discharges from the tailings area would ultimately drain.

Nineteen lakes within the Thor Lake watershed area have been sampled for fish. Seven of the sampled lakes were found to be devoid of fish: Buck, Cressy, Megan, North Tardiff, Ring, South Tardiff, and Thorn. All of these are shallow lakes, with four having maximum depths of two metres or less. Sampling for fish presence in Drizzle Lake has not been carried out. However, since the maximum depth of Drizzle Lake is 2.5 m, it is not likely to support populations of fish.

The preliminary Mine plan includes the deposition of Mine tailings in the area presently occupied by Ring and Buck Lakes, and the release of supernatant decant into Drizzle Lake, which in turn drains into Murky Lake. No fish were captured in Ring and Buck Lakes, and only one northern pike was captured in Murky Lake. These four lakes, which make up the Ring Lake group, are all very shallow (<2.5 m), and are likely to either freeze completely in winter or have free water that becomes anoxic after freeze-up.

Stream habitats within the entire proposed Nechalacho Mine and Flotation Plant site area effects footprint are either very poor or absent. Fish were only captured in outlet streams of Long Lake (ninespine stickleback) and Murky Lake (northern pike), and only in very limited numbers. The overall indication from existing information is of low to moderate fish and fish habitat potential in the effects footprint area of the proposed Nechalacho Mine. Several of the lakes in this area are very shallow, and in some cases, isolated due to a lack of channel connections capable of providing fish passage. This is particularly true of the Ring group of lakes (Ring, Buck, Drizzle, and Murky), which will be the most affected by tailings deposition and supernatant discharge.

Thor Lake, and to some extent Long Lake (due to its connection to Thor Lake) are the principal fish habitats in the proposed Nechalacho Mine and Flotation Plant site area. Both Lakes support significant populations of lake whitefish, lake cisco, and northern pike. These lakes can also be considered to be a closed system from a fish production perspective because immigration is excluded by a natural obstruction at the outlet of Thor Lake and because there are no lakes upstream providing suitable habitats. As such, the fish populations in these lakes are self-sustaining.

As noted, the proposed Nechalacho Mine and Flotation Plant site area lies within the boreal forest of the Taiga Shield Ecoregion. However, both boreal and tundra animal species frequent the area. Approximately 26 species of mammals may frequent this region. Tundra species, such as barren-ground caribou are typically found within this Ecoregion during the winter months only, spending the summers on the tundra. Other species, such as moose, gray wolf, grizzly bear, and wolverine are residents of both tundra and boreal forest, and frequent the transitional Ecoregion to the north throughout the year. Boreal species such as mink and beaver are reaching their northern limit at this latitude and are seldom found beyond the treeline.

The Taiga Shield Ecoregion is also home to approximately 150 species of birds, the majority of which are seasonal migrants. However, considerably fewer species are expected to occur in the proposed Nechalacho Mine and Flotation Plant site area. The lakes and wetlands of the area provide habitat for a wide variety of waterbirds and shorebirds. A number of birds of prey, or raptors, utilize this region, either as residents or migrants.

Hydrometallurgical Plant Area: As previously noted, the Hydrometallurgical Plant site will be located in an existing brownfields area of the former Pine Point Mine site, which remains a relatively degraded and barren area from an environmental perspective. Nevertheless, the Plant site is located within the Great Slave Lowlands Mid-Boreal Ecoregion of the Taiga Plains Ecozone. The area is characterized by short, cool summers and long, cold winters. This ecoregion is classified as having a subhumid mid-boreal eco-climate.

Nearly level lacustrine and alluvial deposits with a mosaic of sedge wetlands and grass meadows, diverse forests and wetlands typify the Slave Lowland MB Ecoregion. The vegetation of this Ecoregion is characterized by medium to tall, closed stands of jack pine and trembling aspen. White spruce and black spruce dominate later successional stands. Poorly drained fens and bogs in this region are covered with low, open stands of larch, black spruce and ericaceous shrubs.

There are no streams or significant natural water bodies and thus no fisheries values or habitats in the Hydrometallurgical Plant site area. Great Slave Lake, the second largest lake in the Northwest Territories, will be used for the barging component of the TLP. The lake supports at least 27 species of fish including lake trout, lake whitefish, inconnu, pike, walleye and burbot, which are highly valued by the communities in the region.

Moose, woodland caribou and occasionally wood bison are the main ungulates found in the area of interest, although none are considered common. The bird life present is typical of the boreal forest, and the south shore of Great Slave Lake is considered to be an important concentration site for many bird species during their annual migrations.

Environmental Effects & Mitigation Measures

The main components of the TLP are expected to have some effects on the local receiving environment. The major potential environmental effects pathways include air, water and terrestrial resources. Tables 1 and 2 summarize the main project components and Valued Ecosystem Components (VECs) that may be impacted by the development of the TLP.

TABLE 1: THOR LAKE PROJECT: NECHALACHO MINE & FLOTATION PLANT SITE ENVIRONMENTAL ISSUE MATRIX

Project Component	Air Quality	Water Quality	Fish	Wildlife	Vegetation
Site Preparation and Construction	✓	✓	✓	✓	✓
Underground Mining	✓	✓			
Mine Rock Storage		✓	✓	✓	✓
Acid Rock Drainage (ARD) if present		✓	✓		
Thor Lake Flotation Plant	✓	✓	✓	✓	✓
Power Generation	✓			✓	✓
Sewage		✓	✓		
Tailings Containment		✓	✓	✓	✓
Water Supply/Water Management		✓	✓		
Solid and Hazardous Waste Management	✓	✓	✓	✓	
Airstrip	✓			✓	✓
Access Roads	✓	✓	✓	✓	✓
Temporary Docking Facility		✓	✓		✓
Seasonal Barge Traffic	✓	✓	✓		

TABLE 2: THOR LAKE PROJECT: HYDROMETALLURGICAL PLANT SITE ENVIRONMENTAL ISSUE MATRIX

Project Component	Air Quality	Water Quality	Fish	Wildlife	Vegetation
Site Preparation and Construction	✓			✓	✓
Hydrometallurgical Plant	✓	✓	✓	✓	✓
Power Generation (back up)	✓			✓	✓
Sewage		✓			
Tailings Containment		✓	✓	✓	
Water Supply/Water Management		✓			
Solid and Hazardous Waste Management	✓			✓	
Haul Road and Site Access Roads	✓	✓		✓	✓
Dock Facility		✓	✓		✓

Avalon is confident that with the application of the sound engineering, environmental planning and best management practices described in this Project Description Report, as well as, compliance with anticipated permits, licenses, approvals, existing federal and territorial environmental regulations and guidelines, that the environmental issues associated with the development and operation of the TLP can be effectively addressed and managed.

Closure and Reclamation

Reclamation planning is an integral component of a sound environmental management system for any development. Avalon is committed to achieving a number of goals for the progressive reclamation of the development area following closure of the Project. Avalon's goals for reclamation will be consistent with INAC's guidelines for abandonment and restoration planning for mines as well as the requirements of the anticipated Land Use Permit.

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TECHNICAL TERMS AND ABBREVIATIONS

ABA	Acid Base Accounting
AEMP	Aquatic Effects Monitoring Program
ANFO	Amonium Nitrate-Fuel Oil
ARD	Acid Rock Drainage
bgs	below ground surface
CANOR	Canadian Northern Economic Development Agency
CCME	Canadian Council of Ministers of the Environment
CDA	Canadian Dam Association
CEAA	Canadian Environmental Assessment Act
CN	Canadian Northern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSR	Contaminated Site Regulations
CWS	Canadian Wildlife Service
DCDA	Double Conversion, Double Absorption
DFO	Department of Fisheries and Oceans
DIAND	Department of Indian Affairs and Northern Development
DKFN	Deninu K'ue First Nation
DOT	Department of Transportation
DRWED	Department of Resources, Wildlife and Economic Development
EA	Environmental Assessment
EC	Environment Canada
EEM	Environmental Effects Monitoring
EHS	Environmental Health and Safety
EMP	Environmental Management Plan
ENE	East-Northeast
GA	General Arrangement
GNWT	Government of the Northwest Territories

TECHNICAL TERMS AND ABBREVIATIONS

gpm	gallons per minute
GSC	Geological Survey of Canada
ha	hectares
HADD	Harmful Alternation, Disruption, or Destruction
HB	High Boreal
HREE	Heavy Rare Earth Elements
HREO	Heavy Rare Earth Elements (calculated as) Oxides
ICPOES/MS	Inductively Coupled Plasma-Optical Emission Spectroscopy / Mass Spectroscopy
KFN	K' atlodeeche First Nation
km	kilometres
kW	kilowatts
LKDFM	Lutsel K'e Dene First Nation
LOI	Loss on Ignition
LREE	Light Rare Earth Elements
LREO	Light Rare Earth Oxides
LSA	Local Study Area
m	metre
M	Million
MAC	Mining Association of Canada
masl	metres above sea level
MLA	Members of the Legislative Assembly
Mm	Millimetres
MMER	Metal Mining Effluent Regulations
MVEIRB	Mackenzie Environmental Impact Review Board
MVLWB	Mackenzie Valley Land and Water Board
MW	megawatts
NAG	Net Acid Generation

NI 43-101	National Instrument 43-101 "Standards of Disclosure for Mineral Projects"
NORM	Naturally Occurring Radioactive Material
NP/AP	Neutralisation Potential Ratio (where NP is Neutralisation Potential and AP is Acid Potential)
NRC	Natural Resources Canada
NTCL	Northern Transportation Company Limited
NTPC	Northwest Territories Power Corporation
NWPA	Navigable Waters Protection Act
NWT	Northwest Territories
PAN	Potentially Acid Neutralising
PEA	Preliminary Economic Assessment (PEA)
REE	Rare Earth Elements
RLS	Ring Lake System
ROM	Run of Mine
RSA	Regional Study Area
SAG	Semi-Autogenous Grinding
SARA	Species at Risk Act
SRC	Saskatchewan Research Council
SRPR	Species at Risk Public Registry
SX	Solvent Extraction
TDGR	Transportation of Dangerous Goods Regulations
TLP	Thor Lake Project
tpa	tonnes per annum
tpd	tonnes per day
tph	tonnes per hour
TREO	Total Rare Earth Oxides
TSS	Total Suspended Solids
VEC	Valued Ecosystem Component

VLF	Very Low Frequency
WLM/y	Working Level Months per Year
WGGSNWT	Working Group on General Status of NWT Species
XRD	X-Ray Diffraction
YKDFN	Yellowknives Dene First Nation

DEFINITIONS

BTW Diameter	Core size = 27mm, where BTW means B core Thin Wall
Heavy Rare Earth Elements	Refers to the elements europium to lutetium plus yttrium by atomic weight.
Heavy Rare Earth Oxides	Refers to the elements europium to lutetium, plus yttrium, expressed as oxides.
HQ Diameter	Core size = 63.5 mm
Light Rare Earth Elements	Refers to the elements lanthanum to samarium by atomic weight.
Light Rare Earth Oxides	Refers to the elements lanthanum to samarium, expressed as oxides.
NI 43-101	A rule supervised by the Canadian Securities Administration that governs how issuers disclose scientific and technical information about their mineral projects to the public.
NQ2 Diameter	Core size = 47.6 mm, where N is the core size. Q means “wireline” drilling.
Rare Earth Elements	Refers to the elements lanthanum to lutetium, plus yttrium.
Total Rare Earth Oxides	Refers to the elements lanthanum to lutetium, plus yttrium, expressed as oxides.

1.0 INTRODUCTION

Avalon Rare Metals Inc. ('Avalon') is a publicly traded company engaged in the exploration and development of rare metal deposits in Canada. Avalon proposes to mine, mill and produce a rare earth carbonate and oxides, zirconium, niobium and tantalum oxides and possibly gallium from the Nechalacho deposit located on its Thor Lake Property. The proposed project is referred to as the Thor Lake Project (TLP).

The TLP has two proposed site components: an underground mine and flotation plant (Nechalacho Mine and Flotation Plant site), to be located at the Thor Lake Property, and a hydrometallurgical plant (Hydrometallurgical Plant site) to be located at the existing brownfields site of the former Pine Point Mine (Figure 1.0-1).

The Nechalacho Mine and Flotation Plant will have an operating life of approximately 14 years. The initial expected daily mill throughput is approximately 1,000 tpd. Mill throughput is planned to ramp up to 2,000 tpd by year four. Camp facilities will be constructed and operated at the site for the life of the TLP. The rare metals concentrate produced at the Nechalacho Mine and Flotation Plant will be barged across Great Slave Lake for further processing at the Hydrometallurgical Plant. No permanent camp facilities will be needed at the Hydrometallurgical Plant site.

Avalon has produced this Project Description Report (PDR) to support its application for a Water License and Land Use Permit for the development of the TLP. The application is in the name of Avalon Rare Metals Inc., which will also be the Project operator. The Project Description Report is divided into the following six sections:

- Introduction
- Project Description
- Public Engagement and Communications
- Environmental Overview
- Potential Environmental Effects and Mitigation Measures
- Closure and Reclamation

This report provides the information required for the technical review of the TLP. Avalon was assisted by EBA Engineering Consultants Ltd. (the Company's lead consultant). The report identifies the technical aspects and environmental interactions the Project may have during the design, construction and operation phases. It also delineates the mitigation measures proposed to effectively address these matters. The appendices provide the technical information collected to support the report.

LEGEND

- Site Location
- Community
- All-Weather Roads
- Railway
- Watercourse
- Waterbody

NOTES

Base data source:
ESRI Data Maps

ISSUED FOR USE

THOR LAKE PROJECT

Site Location

PROJECTION	DATUM
UTM Zone 12	NAD83

Scale: 1:2,000,000

40 20 0 40

Kilometres

FILE NO.
V15101007_006_Figure1_0-1_SiteLocation.mxd

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	DM	2

OFFICE	DATE
EBA-VANC	April 21, 2010

AVALON RARE METALS INC

EBA Engineering Consultants Ltd.

Figure 1.0-1

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1.1 CORPORATE OVERVIEW

Avalon Rare Metals Inc. is a mineral exploration and development company focused on the exploration and development of rare metal deposits in Canada. The share structure and listing information for the company follow in Table 1.1-1.

TABLE 1.1-1: AVALON SHARE STRUCTURE AND LISTING INFORMATION

Share Structure	Project Team
Name: Avalon Rare Metals Inc. Symbol: TSX:AVL Incorporation: September 29, 1994 Records: Avalon Rare Metals Inc., Toronto Common Authorized Shares: Unlimited Preferred Authorized Shares: 25,000,000 Shares Outstanding: 78,504,448 Warrants Outstanding: 3,528,750 Options Outstanding: 4,825,000 Broker Warrants: 450,000 ½ Warrants on Broker: 225,000 Fully Diluted: 87,533,198 Date Listed: September 30, 1994 Year End: August 31	Donald S. Bubar, M.Sc., P. Geo, President & CEO David D. Swisher, B.Sc. V.P., Operations William Mercer, Ph.D., P. Geo. V. P., Exploration R. J. Andersen, CA, CPA, CFP, V.P. Finance & CFO
Corporate Address	**Operations Address**
Avalon Rare Metals Inc. 1901-130 Adelaide St. West Toronto, ON Canada M5H 3P5 Telephone: (416) 364.4938 Facsimile: (416) 364-5162	Avalon Rare Metals Inc. Unit 330 - 6165 Hwy 17 Delta, BC Canada V4K 5B8 Telephone: (604) 940-3800 Facsimile: (604) 940-3808

1.2 CORPORATE GOVERNANCE

Avalon's Board of Directors ('Board') is responsible for supervising the Corporation's management and for approving the overall direction of the Corporation in a manner that is in the best interests of the Corporation and its stakeholders. The Board participates fully in assessing and approving strategic plans and material prospective decisions proposed by management. To ensure that the principal business risks that are borne by the Corporation are appropriate, the Board receives periodic reports from management on the Corporation's assessment and management of such risks. The Board regularly monitors the financial performance of the Corporation, including receiving and reviewing detailed financial information contained in management reports.

The Board monitors the activities of the senior management through regular meetings and discussions amongst the Board and between the Board and senior management. The Board holds regular meetings at least four times a year. Additional meetings are held to address special business items.

1.2.1 Business Conduct and Ethics

Avalon requires high standards of professional and ethical conduct from its employees. Employee cooperation is necessary for the continued success of Avalon's business and the cultivation and maintenance of its reputation as a good corporate citizen.

To this end, all Avalon employees are required to sign and comply with the Company's Code of Business Conduct and Ethics as a condition of employment. Avalon's Code reflects its commitment to a culture of honesty, integrity and accountability. It outlines the basic principles and policies with which all employees are expected to comply. No employee is permitted to achieve results through violations of laws, regulations, or unscrupulous dealings. Employees who violate the Company's standards set forth in its Code of Ethics are subject to disciplinary action up to and including dismissal

In addition to following the Code in all aspects of business activities, employees are expected to seek guidance in any case where there is a question about compliance with both the letter and the spirit of the Company's policies and applicable laws.

1.3 ENVIRONMENTAL AND SAFETY POLICY

Avalon recognizes that maintenance of environmental quality is vital to the Corporation's existence, progress, and continued development. The Corporation will maintain high environmental standards limited only by technical and economic feasibility. The Corporation will take positive action to protect the safety of its workers, conserve natural resources, and minimize the impact of its activities on the environment through diligent application of appropriate technology and responsible conduct at all stages of exploration, mine development, mining, mineral processing, decommissioning, and reclamation.

The purpose of Avalon's Safety and Environmental Policy is to provide a measurable framework for the performance of the Corporation's activities in an environmentally responsible manner, ensuring compliance by the Corporation and its employees with all applicable environmental regulations and commitments.

Avalon Rare Metals Inc. will:

- Obey the law and conduct all business in an ethical manner;
- Evaluate, plan, construct, and operate all projects and facilities to reduce adverse environmental impacts and to meet or exceed applicable environmental laws,

regulations, and standards. In the absence of applicable regulations, the Corporation will apply cost effective best management practices to protect the environment. Managers of all projects and operations are required to adhere to the Corporation Environmental Policy and to identify, evaluate, and minimize risks to the environment;

- Continuously review environmental achievements and technology to seek and implement methods for further improvement;
- Require all operations to have site specific emergency response plans which meet or exceed all applicable regulations;
- Conduct regular environmental, health and safety preparedness and emergency response plans to verify compliance with the Corporation's policy and applicable regulations. Identify revisions or improvements to current practices in order to minimize environmental impacts. Report findings regularly to the Board of Directors;
- Educate employees in environmental matters and responsibilities relating to performance of their assigned tasks;
- Foster communication with shareholders, the public, employees, Aboriginal people and government to enhance understanding of environmental issues affecting the Corporation's activities;
- Work pro-actively with government and the public to define environmental priorities. Participate in the development of responsible laws for the protection of the environment; and
- Allocate sufficient resources to meet the Corporation's environmental goals. Annually assess the projected costs of decommissioning and reclamation of appropriate amount to ensure that there will be sufficient cash reserves to pay for these costs upon closure.

1.4 PROPERTIES

Avalon owns five rare metals and minerals project properties in Canada. The project properties include: Thor Lake, a rare earth elements (REE) property in Thor Lake, Northwest Territories; Separation Rapids, a lithium property in Ontario; Warren Township, a calcium feldspar property in Ontario; East Kemptville, a tin-indium-gallium-germanium property in Nova Scotia; and Lilypad Lakes, a cesium property in Ontario.

1.4.1 Thor Lake Property

Avalon's 100% owned Thor Lake Property is located at Thor Lake in the Mackenzie Mining District of the Northwest Territories, about 5 km north of the Hearne Channel of Great Slave Lake and approximately 100 km southeast of the city of Yellowknife. The Property is shown on National Topographic System (NTS) map sheet 85I/02 at approximately 62°06'30"N and 112°35'30"W (6,886,500N, 417,000E – NAD83)(Figure 1.4-1).

The Property is remote but accessible year-round via helicopter from Yellowknife and seasonally by barge from Yellowknife or Hay River. The Property is also seasonally accessible via ice road from Yellowknife and by float/ski plane.

The Thor Lake Property hosts six rare earth metal bearing mineral deposits: the Nechalacho deposit, North T Zone, South T Zone, S Zone, R Zone and Fluorite Zone. The focus of the TLP is the Nechalacho deposit. The Nechalacho deposit is the largest mineralized body on the property. It covers an approximate area of two square kilometres.

Figure 1.4-1: Thor Lake Property Location

1.5 MINERAL CLAIMS, LEASES AND ROYALTY AGREEMENTS

The Thor Lake Property is comprised of five contiguous mineral leases and four claim blocks that encompass an area of 4,249 hectares (ha) (10,449 acres). Mining leases have a 21-year life and each lease is renewable in 21-year increments. Annual payments of $2.47 per hectare ($1.00 per acre) are required to keep the leases current. Avalon owns 100% of the leases. The property is subject to two royalty agreements (Table 1.5-1, Figure 1.5-1).

The agreements originated with Highwood Resources Ltd., the original developer of the property, and include the Murphy Royalty Agreement and the Calabras/Lutoda Royalty Agreement. The Murphy Royalty Agreement was signed in 1977 and entitles J. Daniel Murphy to a 2.5% NSR. The Murphy Royalty Agreement applies to the entire Thor Lake Property and the royalty is capped at an escalating amount indexed to inflation. The Calabras/Lutoda Royalty Agreement was signed in 1997 and entitles Calabras (Canada) Ltd. (Calabras) to a 2% NSR and Lutoda Holding Ltd. (Lutoda) to a 1% NSR.

TABLE 1.5-1: MINING LEASES AND MINING CLAIM DATA – THOR LAKE PROPERTY				
Lease Number	Area (ha)	Legal Description	Effective Date	Expiration Date
3178	1,053	Lot 1001, 85 I/2	22/05/1985	22/05/2027
3179	939	Lot 1000, 85 I/2	22/05/1985	22/05/2027
3265	367	Lot 1005, 85 I/2	2/3/1987	2/3/2029
3266	850	Lot 1007, 85 I/2	2/3/1987	2/3/2029
3267	1,040	Lot 1006, 85 I/2	2/3/1987	2/3/2029
TOTAL	**4,249**			

1.6 REQUIRED PERMITS, LICENSES AND AUTHORIZATIONS

The construction and operation of the TLP (all components) will require a Type A Water License for all water uses, and a Type A Land Use Permit. The Mackenzie Valley Land and Water Board (MVLWB) is the regulatory body responsible for permit issuances under the authority of the *Mackenzie Valley Resource Management Act,* the *Mackenzie Valley Land Use Regulations,* and the *Northwest Water Regulations.*

Other environmental permits/approvals anticipated to be required for the TLP include:

- A Navigable Waters Protection Act (NWPA) approval for the seasonal docking facilities; and,
- A Section 35.(2) Fisheries Authorization or Letters of Advice from the Department of Fisheries and Oceans (DFO) under the federal Fisheries Act.

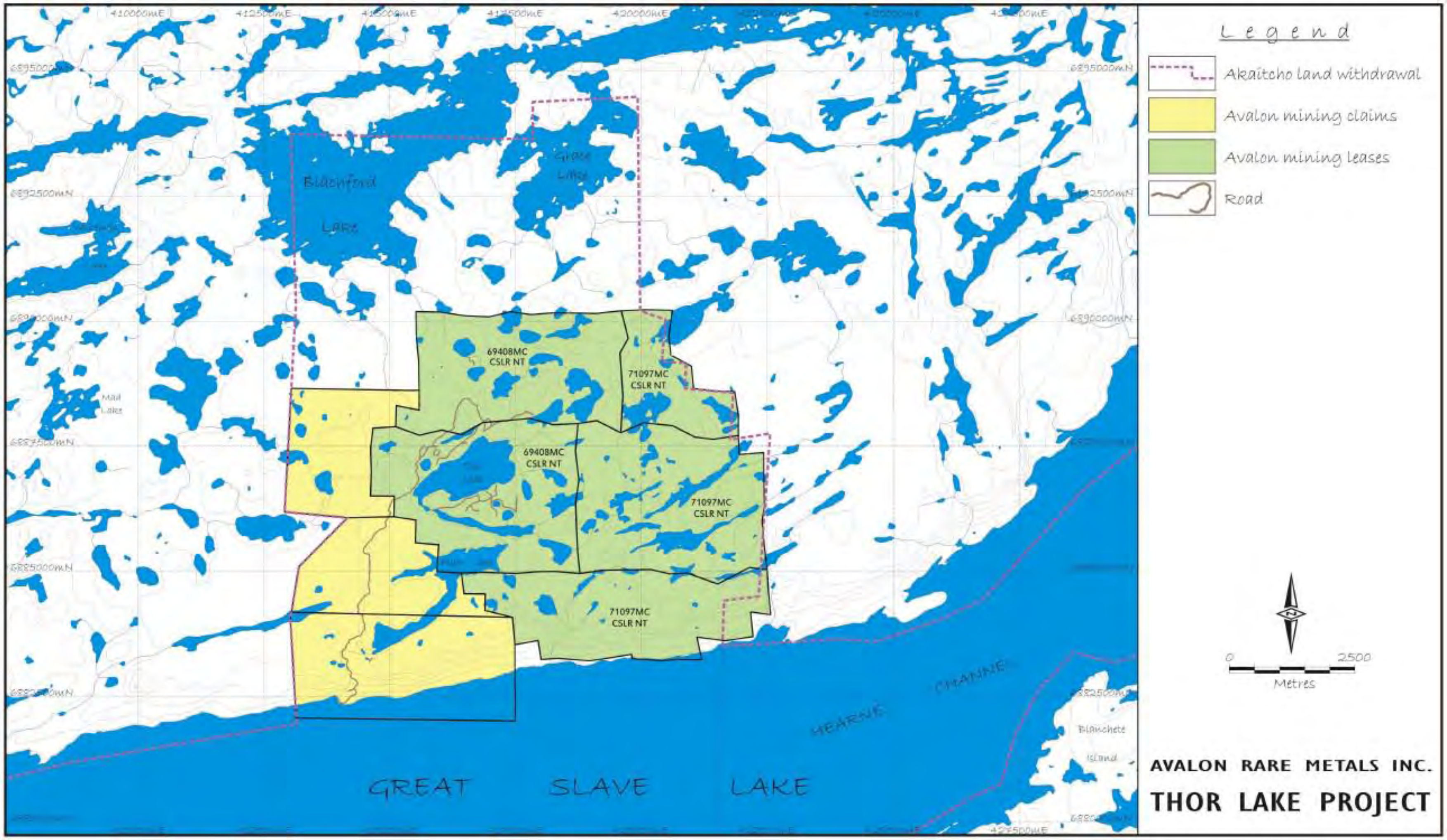


Figure 1.5-1: Claim Location Map

2.0 PROJECT DESCRIPTION

2.1 PROJECT RATIONALE

The rare earth metals were first discovered in the 18th century. They are a group of 17 metallic elements with unique properties that make them critical for many technological applications (Sinton, 2006). They were long considered chemical curiosities rather than vital building blocks for technology. Despite their name, rare earths are relatively abundant in the Earth's crust. However, the high cost of extracting rare earths means that only those areas with high value deposits, such as the Nechalacho deposit, can be feasibly exploited.

Avalon is focussed on mining, milling and refining five (5) rare metal products from the TLP's Nechalacho deposit. These include: a rare earth carbonate and oxides, zirconium, niobium and tantalum oxides, and possibly gallium. Currently, there is no available rare earth mineral concentrate that offers consumers the kind of REE distribution as contained in the Nechalacho deposit. This unique distribution is ideally-suited to current market demand.

Rare earths currently play critical roles in industry including the electronics, automotive, petrotechnical and environmental sectors (green technologies). A list of uses for the rare earths is found in Table 2.1-1. It is anticipated that as these sector industries continue to grow, and their associated technologies develop, the demand for rare earth materials will continue to increase (Sinton, 2006).

Avalon's REEs will sell into the world market at prevailing prices. The TLP will create significant training, employment and business opportunities for the people of the region and the NWT. It will also contribute to the NWT and Canadian Gross Domestic Product, as well as, provide a return for investors considered acceptable in today's market.

TABLE 2.1-1: RARE EARTH ELEMENT USES		
Rare Earth Element	Symbol	Industry Use
Cerium	Ce	Catalytic converters for diesel engines
Praseodymium	Pr	Alloying agent for aircraft engines
Neodymium	Nd	Key component of high-efficiency magnets and hard disc drives
Lanthanum	La	Major ingredient for hybrid car batteries
Samarium	Sm	Lasers and nuclear reactor safety
Promethium	Pm	Portable X-rays and nuclear battery
Gadolinium	Gd	Compact Discs, Shielding for nuclear reactors
Dysprosium	Dy	Improves efficiency of hybrid vehicle motors
Terbium	Tb	Component in low-energy light bulbs
Erbium	Er	Fibre optics
Europium	Eu	Flat screen displays and lasers
Holmium	Ho	Ultra-powerful magnets and nuclear control rods
Thulium	Tm	Lasers and portable X-rays
Ytterbium	Yb	Earthquake monitoring equipment
Lutetium	Lu	Oil refining

2.2 PROPERTY/PROJECT HISTORY

2.2.1 Odin and Mailbox Claims

The Thor Lake area was first mapped by J.F. Henderson and A.W. Joliffe of the Geological Survey of Canada (GSC) in 1937 and 1938. According to National Mineral Inventory records of the Mineral Policy Sector, Department of Energy, Mines and Resources, the first staking activity at Thor Lake dates from July 1970 when Odin 1-4 claims were staked by K.D. Hannigan for uranium. The Odin claims covered what was then called the Odin Dyke and is now known as the R Zone. Shortly after, the Odin claims were optioned to Giant Yellowknife Mines Ltd. and were subsequently acquired by Bluemount Minerals Ltd.

In 1971, the GSC commissioned an airborne radiometric survey over the Yellowknife region that outlined a radioactive anomaly over the Thor Lake area (GSC Open File Report 124). Simultaneously, A. Davidson of the GSC initiated mapping of the Blachford Lake Intrusive Complex. It has subsequently become clear that this radiometric anomaly is largely due to elevated thorium levels in the T Zone.

Four more claims (Mailbox 1-4) were staked in the area in 1973. No description of any work carried out on the claims is available and both the Odin and Mailbox claims were allowed to lapse. No assessment work was filed.

2.2.2 Highwood Resources Ltd.

In 1976, Highwood Resources Ltd., in the course of a regional uranium exploration program, discovered niobium and tantalum on the Thor Lake Property. The Property was staked as the Thor 1-45 claims and the NB claims were added in 1976 and 1977. From 1976 to 1979, exploration programs included geological mapping and sample trenching on the Lake, Fluorite, R, S and T Zones. Twenty-two drill holes were also completed, seven of these on the Lake Zone. This work resulted in the discovery of significant concentrations of niobium, tantalum, yttrium and REEs. Hole 79-1 intersected 0.67% Nb_2O_5, and 0.034% Ta_2O_5 over 24.99 m. Results also indicated an absence of uranium mineralization and that the anomalous radioactivity was due to thorium. Following this and inconclusive lake bottom radiometric and radon gas soil surveys, Calabras, a private holding company, acquired a 30% interest in the property through financing further exploration by Highwood. This was done through Lutoda Holdings; a company incorporated in Canada and owned by Calabras.

Recognizing a large potential resource at Thor Lake, Placer Development Ltd. (Placer) optioned the property from Highwood in March 1980 to further investigate the tantalum and related mineralization. Placer conducted magnetometer, very low frequency (VLF) electro-magnetic and scintillometer surveys on the Lake Zone. Thirteen holes were initially drilled in 1980. This was followed by five more in 1981 focused around drill hole 80-05 (43 m grading 0.52% Nb_2O_5 and 0.034% Ta_2O_5). Preliminary metallurgical scoping work was also conducted, but the mineralization did not prove amenable to conventional metallurgical extraction at the time. Placer relinquished its option in April of 1982.

From 1983 to 1985, the majority of the work on the property was concentrated on the T Zone and included geochemical surveys, berylometer surveys, surface mapping, significant drilling, surface and underground bulk sampling, metallurgical testing and a detailed evaluation of the property by Unocal Canada. During this period, a gravity survey was conducted to delineate the extent of the Lake Zone. Five holes were also drilled in the Lake Zone to test for high grade tantalum-niobium mineralization and to determine zoning and geological continuity. Two additional holes were completed at the southeast end of Long Lake to evaluate high yttrium and REE values obtained from nearby trenches.

In August of 1986, the property was joint-ventured with Hecla Mining Company of Canada Ltd. (Hecla). By completing a feasibility study and arranging financing to bring the property into production, Hecla could earn a 50% interest in the property. In 1988, earlier holes were re-assayed and 19 more holes were drilled into the Lake Zone, primarily in the southeast corner, to further test for yttrium and REEs. Hecla withdrew from the project in 1990. The withdrawal came after the drilling was completed and a considerable amount of other work on the T Zone had been completed including some limited in-fill drilling, extensive metallurgical testing conducted at Lakefield and Hazen Research Ltd. (Hazen) in Denver and a marketing study on beryllium. In 1990, control of Highwood passed to Conwest Exploration Company Ltd. (Conwest) and the project property remained dormant until 1996, at which time Conwest divested itself of its mineral holdings. Mountain

Minerals Company Ltd. (Mountain), a private company controlled by Royal Oak Mines Ltd., acquired the 34% controlling interest of Highwood and Highwood and Mountain were subsequently merged under the name Highwood.

In 1997, Highwood conducted an extensive re-examination of Thor Lake that included a proposal to extract a 100,000 tonne (t) bulk sample. Applications were submitted for permits that would allow for small-scale development of the T Zone deposit, as well as, for processing over a four to five year period. In late 1999, the application was withdrawn.

Royal Oak's subsequent bankruptcy in 1999 resulted in the acquisition of the control block of Highwood shares by Dynatec Corporation (Dynatec). In 2000, Highwood initiated metallurgical, marketing and environmental reviews by Dynatec.

In 2001, Navigator Exploration Corp. (Navigator) entered into an option agreement with Highwood. Navigator's efforts were focused on conducting additional metallurgical research at Lakefield in order to define a process for producing a marketable tantalum concentrate from the Lake Zone. These efforts produced a metallurgical grade tantalum/zirconium/niobium/yttrium/REE bulk concentrate. The option was dropped in 2004 due to falling tantalum prices and low tantalum contents in the bulk concentrate.

Beta Minerals Inc. (Beta) acquired Highwood's interest in the Thor Lake Property in November, 2002 under a plan of arrangement with Dynatec. No work was conducted at Thor Lake by Beta.

2.2.3 Avalon Rare Metals Inc.

In May of 2005, Avalon purchased 100% interest and full title, subject to royalties, to the Thor Lake Property from Beta. Subsequently in 2005, Avalon conducted extensive re-sampling of archived Lake Zone drill core to further assess the yttrium and heavy rare earth element (HREE) resources on the property.

In 2005, Wardrop Engineering Inc. (Wardrop) was retained to conduct a preliminary economic evaluation (PEA) of the Thor Lake deposits (Wardrop, 2005). In 2007 and 2008 Avalon commenced further drilling of the Lake Zone. This led to a further technical report on the property in March, 2009 (Wardrop, 2009).

The July 2007 to 2009 drilling was organized into three separate drill programs:

- July to October 2007: 13 holes totalling 2,550 m (BTW diameter);
- January to May 2008: 45 holes totalling 8,725 m, including 11 metallurgical holes totalling 2,278 m (NQ2 diameter);
- June to September 2008: 27 holes totalling 5,565 m (NQ2 diameter);
- February to May, 2009: 26 holes totalling 5474 m (NQ2 diameter); and
- July to October, 2009: 44 holes totalling 9098 m (HQ diameter).

Core from both historic drilling and recent drilling is stored at the Thor Lake site. Archived core has been re-boxed where necessary, with all old core racks having been replaced with new ones. Core pulps and rejects are stored in a secure warehouse in Yellowknife and at site.

2.3 PROJECT ALTERNATIVES

The proposed TLP is comprised of two site locations, the Nechalacho Mine and Flotation Plant located on the Thor Lake Property, and the Hydrometallurgical Plant located at the brownfields site of the former Pine Point Mine near Hay River, NT.

The Nechalacho deposit will be mined underground and concentrated using conventional crushing, grinding and flotation techniques. The concentrate will be loaded into enclosed 22 tonne intermodal shipping containers and barged from a seasonal dock facility to be located adjacent to the Nechalacho Mine and Flotation site to a second seasonal dock facility to be located in the vicinity of the Hydrometallurgical Plant site. Upon arrival, the concentrate will be transported by truck from the south shore of Great Slave Lake to the Hydrometallurgical Plant site via a haul road. The concentrate will be further processed at the Hydrometallurgical Plant. The resulting products will be transported to the railhead at Hay River by truck in sealed containers, and direct shipped to downstream users.

Avalon investigated alternatives to major Project components to reduce potential impacts to safety, Aboriginal culture, communities, environment and project economics. Avalon's technical work conducted to date considered these impacts and utilized what it believes is the most environmentally responsible and operationally effective approach for the TLP. Future pilot studies, trade-off studies and field test work may result in one or more of the following alternatives to be reconsidered for updated technical studies and Project development. The following options were investigated:

- Alternative open pit mining method;
- Alternative Cressy Lake Tailings Management Facility;
- Alternative Hydrometallurgical Plant locations;
- Alternative concentrate transportation via ice road over Great Slave Lake or connecting to Ingraham Trail and then onto Yellowknife; and
- Alternative concentrate containers.

2.3.1 Open Pit Mining

Wardrop Engineering Inc. completed a PEA in 2005 to examine the economics of utilizing an open pit to recover mineralized material near the surface. However, once Avalon completed its 2007 drill program, a distinct high grade zone with higher than average HREEs was identified. This high grade zone, referred to as the Basal Zone, was located approximately 180 m below the surface. The high grade Basal Zone was attractive and economic for selective underground mining techniques. Utilizing underground mining also minimized the potential surficial impacts indentified by participating First Nations and surrounding communities. A resource update was completed by Wardrop Engineering in March, 2009 which emphasized the resource of the Basal Zone assuming underground mining (Wardrop, 2009).

The REE markets also played a role in determining the amount of REEs Avalon would inject into the markets. Upon consideration of these factors, Avalon chose to pursue underground mining techniques focussed on the Basal Zone.

2.3.2 Cressy Lake Tailings Management Facility

Cressy Lake was originally considered as the site for the tailings management facility, due to its close proximity to the proposed Flotation Plant (reduced piping needs) and its non fish-bearing nature. Upon further examination, Avalon identified the Ring Lake System (RLS) (including Ring, Buck & Drizzle Lakes) as the most viable and preferred option for the tailings management facility as explained below:

- Ring, Buck & Drizzle Lakes appear to be non-fish bearing (one more year of test work to verify);
- Natural topography of RLS allows for fewer construction activities (estimated 250,000 m^3 of fill required versus 1,000,000 m^3 for Cressy Lake);
- RLS can accommodate a 15 year operating life with additional capacity to expand for future years (Cressy limited to 8 year life with no expansion potential);
- RLS provides effluent discharge to Drizzle Lake (also identified as non-fish bearing, pending one more year of test work), with natural drainage back to Thor Lake (Cressy Lake drainage eventually reports to Great Slave Lake); and
- RLS provides a closed loop design system.

2.3.3 Hydrometallurgical Plant

Alberta and Saskatchewan were originally considered as possible locations for the Hydrometallurgical Plant. The southern provinces offer significant cost savings. They have the capacity to provide available low cost electric power, significantly shorter supply transport distances and lower cost labour.

In spite of these apparent advantages, Avalon has selected the old Pine Point Mine site as the base case location for the Hydrometallurgical Plant. The site is located 85 km east of Hay River and has all-season highway access. The site also has power from the Talston Dam which Avalon can utilize. Moreover, the old Pine Point site is a brownfields site with a 2.5 square km existing tailings facility area that can be utilized for Avalon's hydrometallurgical tailings facility. Justification for the former Pine Point mill site as the location for the Hydrometallurgical Plant follows:

- Avalon's First Nations partners strongly recommended utilizing the Pine Point site during the Company's engagement process. Locating the Hydrometallurgical Plant at this site provides Avalon's Aboriginal partners with additional business and employment opportunities;

- The federal and territorial governments are working with Avalon to develop incentives to keep the Hydrometallurgical Plant in the NWT. Early indications suggest that potential tax incentives, economic power, power alternatives and capital funding/support of one or more Aboriginal organizations may be possible. Ongoing collaboration with these groups will be essential to ensure that the Hydrometallurgical Plant will be located in the NWT;

Avalon also investigated Yellowknife as a potential location for the Hydrometallurgical Plant. Some hydro-power may be available at Yellowknife. However, any potential cost savings are diminished when compared to the additional cost of hauling more than 200,000 tonnes of reagents annually to supply the Plant.

It is Avalon's sincere hope that supportive economic arrangements can be achieved to justify the Hydrometallurgical Plant remaining in the NWT.

2.3.4 Concentrate Transport

The proposed Nechalacho Mine and Flotation Plant site is located approximately 100 km east of Yellowknife, 50 km south of the Ingraham Trail (an all season highway) and 8 km north of Great Slave Lake. During the site selection process for the Hydrometallurgical Plant, Avalon investigated several concentrate transportation alternatives from the Nechalacho Mine and Flotation Plant site including:

- All season road connecting to the Ingraham trail which leads to Yellowknife;
- Winter road connecting to the Ingraham trail;
- Winter road along the north shore of Great Slave Lake to Yellowknife;
- Winter road across Great Slave Lake to Hay River;
- Winter road across Great Slave Lake to Pine Point; and
- Barging across Great Slave Lake.

Once the historic Pine Point site was selected as the location for the Hydrometallurgical Plant, the option to barge the concentrate from the proposed Nechalacho Mine and Flotation Plant site across Great Slave Lake to the Pine Point site became the preferred alternative. A local access road currently exists at the historic Pine Point site from the proposed dock facility to the proposed Hydrometallurgical Plant location.

The previously considered all-season or winter roads were deemed impractical for the following reasons:

- Excessive construction costs associated with developing an all-season road from the Ingraham trail;

- Potential interference with Blachford Lodge should a winter or all-season road be connected to the Ingraham Trail;
- Excessive haulage costs associated with trucking to Yellowknife, then onto the railhead near Enterprise;
- Excessive maintenance and construction costs associated with an ice road to either Ingraham trail or along the north shore of Great Slave Lake;
- Excessive maintenance and construction costs associated with an ice road across Great Slave Lake, and variable annual ice conditions, which could significantly impact construction and haulage schedules; and
- Climate warming and associated implications for construction and use of ice roads.

An additional alternative exists for barging the concentrate from the Nechalacho Mine and Flotation Plant site directly to the railhead located in Hay River. For this alternative, the 22 tonne product containers would be unloaded from barges directly to railcars for shipment to customers. This option could be more favourable if the economics dictate that the Hydrometallurgical Plant should be located outside of the NWT.

2.3.4.1 Concentrate Containers

Avalon's current plans include utilization of 22 tonne, enclosed intermodal shipping containers to transport concentrate from the Nechalacho Mine and Flotation Plant site to the Hydrometallurgical Plant site. Avalon will continue to investigate other intermodal container sizes, including 35-40 tonne containers. Larger containers would reduce the number of containers required and may improve Project efficiencies.

2.4 GEOLOGY

2.4.1 Property Geology

The following section is summarized from Trueman et al. (1988), LeCouteur (2002), Pedersen et al. (2007) and more recent observations by Avalon geologists obtained through personal communications during the 2007 to 2009 drill programs (Pedersen, Heiligmann & Trueman, personal communications).

The Thor Lake mineral deposits occur within the Aphebian Blachford Lake Complex, which intrudes Archean Yellowknife Supergroup metasedimentary rocks of the southern Slave geologic province. The complex is of variably alkaline character and intrusive phases vary successively from early pyroxenite and gabbro through leucoferrodiorite, quartz syenite and granite, to peralkaline granite and a late syenite (Davidson, 1982). There appear to be successive intrusive centres; an early western centre that is truncated by a larger second centre consisting of the Grace Lake Granite and the Thor Lake Syenite. Nepheline syenite underlies Thor Lake Syenite and is only known from drilling on the Nechalacho deposit (Figure 2.4-1).

Davidson (1978) subdivided the Blachford Lake Complex into six texturally and compositionally distinct plutonic units including Caribou Lake Gabbro, Whiteman Lake Quartz Syenite, Hearne Channel Granite, Mad Lake Granite, Grace Lake Granite and Thor Lake Syenite

Based on exposed crosscutting relationships of dykes and main contacts, Davidson recognized a sequence of five intrusive events. The rocks of the last intrusive event, being compositionally and spatially distinct, are subdivided by Davidson into the Grace Lake Granite and the Thor Lake Syenite, although they bear no obvious intrusive relationship to each other to indicate a significant difference in time of emplacement. Davidson and Trueman et al. have further shown that the intrusions are petrochemically related.

As a result of the extensive drilling carried out from August 2007 to present, Avalon geologists have changed their views on the relationship of the Thor Lake Syenite to Grace Lake Granite. It is currently thought that the only real difference between the Thor Lake Syenite and Grace Lake Granite is the varying quartz content and degree of silica saturation. In fact, the two sub-units likely reflect a single early intrusive magma pulse which preceded a second related pulse of nepheline sodalite-bearing peralkaline magma. The hydrothermally altered apical portion of this nepheline syenite is only exposed under Thor and Long Lakes and was previously described as altered Thor Lake Syenite.

The drilling of the Nechalacho deposit has also led to the conclusion that the nepheline sodalite peralkaline syenite that underlies the Thor Lake Syenite is in fact a distinct intrusive.

Recent dating of the complex supports the view that all the intrusions are related as the main eastern intrusive, and the western intrusive centres exhibit comparable ages. The Hearne Channel Granite has been dated at 2,175 ± 5 million years, the Whiteman Lake Syenite at 2,185 ± 5 million years (Bowring et al., 1984) and the Grace Lake Granite at 2,176 ± 1.3 million years (Sinclair et al., 1994).

Henderson (1985) reports that small dioritic plugs assigned to the Compton Lake Intrusive Suite cut the Grace Lake Granite and diabase dykes of the 1,200 million year old Mackenzie. The 2,000 million year old Hearne dyke swarm cuts most of the members of the Blachford Lake Complex.

Gravity modeling by Birkett et al. (1994) suggests that the large area of granitic and syenitic rocks of the eastern intrusive centre form a thin tabular body with a maximum thickness of one kilometre. In contrast, the Caribou Lake Gabbro in the western centre is thought to have a deep root.

Most of the Thor Lake Property is underlain by the Thor Lake Syenite where it occurs in the centre of the Grace Lake Granite. The T Zone deposits are seen to cross both rock types which are only demarcated by the presence or absence of quartz. The Nechalacho deposit is seen confined solely to the Thor Lake Syenite.

The Grace Lake Granite is a coarse-grained, massive, equigranular, riebeckite-perthite granite with about 25% interstitial quartz. Accessories include fluorite, zircon, monazite, apatite, sphene, iron and titanium oxides, astrophyllite, an alkali pyroxene and secondary biotite. Near the contact of the Grace Lake Granite with the Thor Lake Syenite, the two units are texturally similar and the contact appears to be gradational over a few metres rather than intrusive. The presence of interstitial quartz is the main distinguishing feature, although the granite is also pinker in colour and less readily weathered than the syenite. Because of their textural similarity and gradational contact relations, Davidson suggested that both rock types derive from the same magma.

The Thor Lake Syenite is completely enclosed by the Grace Lake Granite. It has been divided into five subunits, four of which are amphibole (ferrorichterite) syenites that differ mainly in texture. The fifth and most distinctive subunit is a narrow arc of fayalite-pyroxene mafic syenite, which is locally steeply dipping and lies close to the margin of the main amphibole syenite and the Grace Lake Granite. It forms a distinct semi-circular ridge, and has been locally termed the rim syenite. It can be traced for a distance of about eight kilometres. In outcrop, Thor Lake Syenite is seen to transition to Grace Lake Granite with the appearance of quartz on the solidus in an otherwise felspathic rock.

The nepheline-sodalite syenite that hosts the Nechalacho mineralization has the following key distinctive features which contrast it to the Thor Lake Syenite and Grace Lake Granite:

- It has a distinct chemical composition showing undersaturation in quartz, with nepheline and sodalite variously as rock-forming minerals;
- It has cumulate layering;
- It contains agpaitic zircono-silicates including eudialyte; and
- It is the host to the Nechalacho zirconium-niobium-tantalum-rare earth mineralization.

This syenite is only exposed at surface in a window through the Thor Lake Syenite in the area encompassing Long Lake to Thor Lake. It is believed to dip underneath that Thor Lake syenite in all directions. Also, the Nechalacho deposit mineralization, which occurs in the top, or apex, of the syenite, is also present in this window through the Thor Lake syenite. For the sake of convenience at this time, this unnamed syenite will be referred to in this report as the "(Nechalacho) Nepheline Sodalite Syenite".

The (Nechalacho) nepheline sodalite syenite consists of a layered series of increasingly peralkaline rocks with depth. A consistent downward progression is observed from hanging wall sodalite cumulates, through coarse grained to pegmatitic nepheline aegirine syenites which are locally enriched in zirconosilicates, to foayaitic syenite with a broad zone of altered eudialyte cumulates (Basal Zone). This upper sequence is strongly to intensely hydrothermally altered by various K, Na and Fe fluids. Pre-existing zircon-silicates are completely replaced by zircon, allanite, bastnaesite, fergusonite and other minerals. Below the Basal Zone cumulates, alteration gradually decreases, with relict primary mineralogy and textures increasingly preserved. Aegirine and nephelline-bearing syenites and foyaitic syenites progress downward to sodalite foyaites and naujaite. Drilling has not extended beyond this sodalite lithology to date. Minerals related to agpaitic magmatism identified from this lower unaltered sequence include eudialyte, catapleite and analcime.

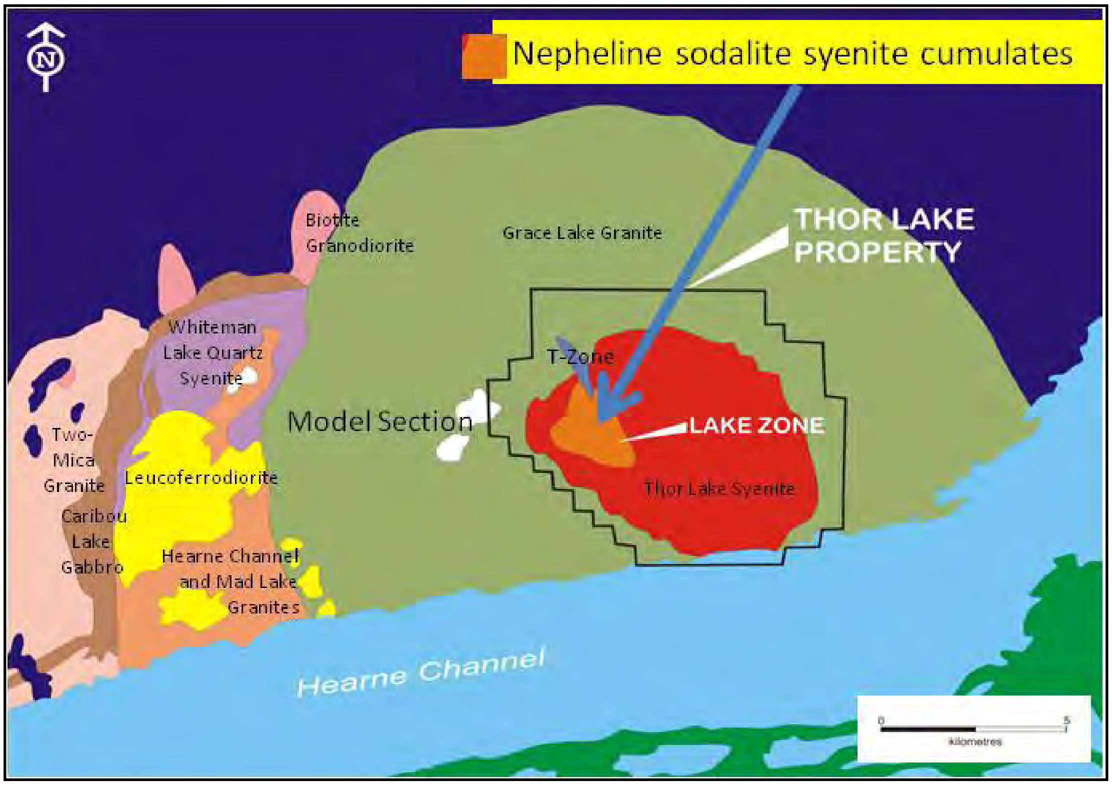


Figure 2.4-1: Thor Lake Property Geology Map

2.4.2 Nechalacho Deposit Geology

The Nechalacho deposit is the largest mineralized body on the property. As exposed, it is approximately triangular in shape and covers an area of about two square kilometres. Diamond drilling indicates that the deposit is upwards of 200 m in thickness.

The geology of the Nechalacho deposit is complex. Within the Avalon lease area, the geology is dominated by a succession of syenites including the nepheline-sodalite "(Nechalacho) Nepheline Sodalite Syenite" and the Thor Lake Syenite, the latter having evolved into a granitic counterpart (Grace Lake Granite). Together, these three phases form the eastern part of the Blachford Lake Intrusive Suite of Davidson.

The Ore (Nechalacho) Nepheline Sodalite Syenite consists of a series of cumulate rocks which pass upwards into porphyritic, mafic, laminated, and pegmatitic counterparts. Detailed descriptions of these rock types are provided in Table 2.4-1.

TABLE 2.4-1: NECHALACHO TABLE OF ROCK TYPES

		95	OVERBURDEN	
		90	DIABASE	
			Alkaline Rocks, Intrusive Suite 1	
		85	GRACE LAKE GRANITE	
		84	THOR LAKE SYENITE	
			Peralkaline Rocks, Intrusive Suite 2	
strong to pervasive alteration common; primary minerals and textures commonly obliterated	magmatic and hydrothermal Zr-REE mineralization	79	SODALITE CUMULATE (ALTERED)	Roof series cumulates
		78	AEGIRINE ARFVEDSONITE SYENITE (ALTERED)	
			a. Pegmatitic	
			b. Porphyritic	
			c. Eudialyte/zircono-silicate bearing	
		75	FOYAITE I (ALTERED)	Variable textures, +/- nepheline
			a - unmineralized	
			b - zircono-silicate bearing	
		70	TRACHYTIC MICROSYENITE	Fine grained, green-black to red with aligned fine white fspar
				(locally zircono-silicate bearing) (formerly "lujavrite")
		69	EUDIALYTE ARFVEDSONITE (+/-AEGIRINE) SYENITE (ALTERED)	moderate to abundant zircon-eudialyte pseudomorphs in matrix, aegirine/arfvedsonite pseudomorphs commonly preserved, poikilitic K-feldspar (former upper zone MRZ) (2a). Strong biotite/chlorite alteration.
moderately altered; primary minerals altered, primary textures preserved	magmatic mineralization	67	EUDIALYTE CUMULATES (ALTERED)	eudialyte/zircon pseudomorphs cumulate. Some remobilization. (former MRZ, 2b basal zone)
		65	AEGIRINE (NEPHELINE) SYENITE II (ALTERED)	
		63	FOYAITE II	coarse-grained, foyaitic syenite underlying cumulate zone
fresh or weakly altered; primary minerals and textures commonly preserved			a - pegmatitic	
		60	AEGIRINE SYENITE	fresh, green aegirine and white plagioclase (+/- nepheline)
		55	SODALITE NEPHELINE SYENITE	
			a - foyaitic	
		50	NAUJAITE	
		99	UNKNOWN	
			a - pervasive albitization - unknown precursor	
			b - pervasive mafic alteration - unknown precursor	
			c - pervasive fluorite-illite metasomatism	
		96	FAULT	
		97	BRECCIA	
			a. Green breccia unit	
			b. other	

The primary igneous peralkaline rocks noted above have been subject to pervasive hydrothermal and metasomatic activity which replaces in part, or in whole, the Syenite. The metasomatism has resulted in new assemblages of biotite, magnetite, specularite, albite and chlorite, which in turn host the rare metals and rare earth elements that form the basis of the present resource estimates. The last events in the metasomatic sequence include microclinization, albitization and silicification.

There is indication that the early formed rocks suffered some displacement through magmato-sedimentary processes, magmatic currents, and possibly foundering during cooling which makes geologic correlation difficult from section to section. The metasomatic rocks generally show a good chemical-stratigraphical correlation from section to section and they may reflect a Pressure/Temperature, or chemical disequilibrium boundary.

The Nechalacho deposit has previously been described as consisting of a core of "altered breccia" enveloped by a feldspathic "Wall Zone." The original protolith of the Nechalacho deposit appears to have been the Nepheline Sodalite Syenite and it appears from limited paragenetic analysis to have suffered successive periods of metasomatism and re-equilibration. It can be divided into several rock types based on constituent lithology, primary textural preservation and degree of alteration. It is difficult to correlate lithologic units from drill hole to drill hole due to intense and often episodic phases of metasomatism which commonly obscure original protoliths. Correlations of rock types in the Nechalacho deposit are made further difficult because of north-easterly trending faults running through the deposit and coincidentally, a number of Hearne diabase dykes which are parallel to or occupying these faults. These faults are poorly outlined due to the mainly vertical drilling, and thus their frequency is not well understood. This is also the direction of the regional schistosity where developed.

The REEs, Ta, Nb and Zr mineralization in the Nechalacho deposit occur in broad enriched sub-horizontal replacement zones, in addition to being widely disseminated over much of the deposit. Potential ore minerals consist primarily of fergusonite, ferro-columbite, allanite and zircon. Minor or accessory assemblages include bastnaesite group minerals, monazite, and apatite. The highest grades of HREEs, light rare earth elements (LREEs), niobium, and tantalum appear to occur in magnetite and zircon-rich areas within the sub-horizontal replacement zones.

The Nechalacho deposit is hosted in a layered magmatic peralkaline intrusion comprising a layered sequence of aegirine and nepheline syenites and cumulates. Ore minerals were originally deposited in situ during cooling as disseminated grains and as cyclic cumulate layers. Hydrothermal alteration of these original zircono-silicates has partially remobilized REEs, particularly LREEs as part of a process of metasomatism. Remobilization appears to be fairly local, but could also have been more extensive, depositing LREEs in zones away from their original site of crystallization. HREEs do not appear to be remobilized and their occurrence is considered to be in situ. Late brittle faults may locally vertically displace some mineralized zones in the order of a few to tens of metres.

The mineralization itself, as noted, is accompanied by intense hydrothermal metasomatism which commonly obscures original mineralogy and assemblages, but relict precursor textures are commonly preserved enough to recognize the original protolith. Metasomatic overprinting processes include Na (albitization, feldspathization), and K+Fe+Zr+F (magnetite, hematite, biotite, zircon).

2.4.3 Nechalacho Deposit Mineralization

Mineralization in the Nechalacho deposit includes LREEs found principally in allanite, monazite, bastnaesite and synchysite; yttrium, HREEs and tantalum found in fergusonite; niobium in ferro-columbite; HREE and zirconium in zircon; and gallium throughout but especially high in albitized feldspathic rocks. The relative abundance of the various rare earth bearing minerals, as from a Qemscan study of 30 selected samples from three drill holes (SGS Minerals Services, 2009) is:

- Zircon averaging 11%
- Allanite averaging 3.6%
- Monazite averaging 1.5%
- Synchisite averaging 0.9%
- Fergusonite averaging 0.6%
- Bastnaesite averaging 0.4%
- Columbite (not a REE mineral) averaging 0.9%

These averages should not be taken as statistically representing the whole mineralized body because there were an insufficient number of samples and they were not randomly collected. For example, the 11% zircon content is clearly higher than the average for the Nechalacho deposit. However, they do give a general indication of the relative abundance of the minerals. The statistical results are from both less and more highly mineralized samples, and from upper and lower parts of the mineralized zones.

The economically interesting minerals in the Nechalacho deposit are found to be fine grained and form intimate admixtures, which have in the past, presented metallurgical difficulties.

The Nechalacho deposit alteration system varies between 80 m (L08-65) and 190 m (L08-127) in vertical thickness, with the alteration usually starting from the surface. The whole alteration system is enriched to varying degrees in REEs, Zr, Nb and Ta, relative to unaltered syenite, with average values over the whole alteration package of approximately 0.75% to 1.0% total rare earth oxides (TREO). Within this alteration envelope, there are sub-horizontal zones of increased alteration accompanied by increased REE enrichment alternating with less enriched REE zones. Within the more intensely altered zones, the effect is that the original textures and mineralogy of the host rock is no longer apparent.

These zones of increased alteration, which can vary in thickness from a few metres to tens of metres, frequently contain TREO grades in the range of 2% and higher. The lowermost band, referred to here as the Basal Zone, contains the highest proportion of heavy rare earth oxides (HREO). Overall, the HREO proportion of the TREO within the 80 m to 190 m thick alteration system is typically between 7% and 15%. However within the Basal Zone this proportion can exceed 30%.

2.4.4 Seismicity

The central region of the Northwest Territories where the Thor Lake Property is located is a historically quiet earthquake zone. A seismic hazard assessment for the Thor Lake Property was completed using probabilistic calculations based on design tables from the 2005 National Building Code of Canada. The maximum acceleration for the proposed Nechalacho Mine and Flotation Plant site ranged from 0.007 g for a 1 in 100 year return period to 0.16 g for a 1 in 10,000 year return period.

A review of the tailings management facility consequence classification, following the Canadian Dam Association's 2007 Dam Safety Guideline, classified the Nechalacho Mine and Flotation Plant site's proposed tailings management facility (described in section 2.7.4.3) as 'Significant'. The resulting earthquake design ground motion is a 1 in 1,000 year event, which corresponds to a maximum acceleration of 0.035 g for the Nechalacho Mine and Flotation Plant site (Knight Piesold, 2010a).

2.4.5 Resources

Avalon's 2009 summer drill program confirmed continuity between earlier widely-spaced drill holes. The confirmation reclassified Inferred Resources in the Basal Zone of the Nechalacho deposit as Indicated. These Indicated Mineral Resources located within one continuous block in the southern part of the Basal Zone of the Nechalacho deposit are the basis for the TLP.

Indicated Resources are now estimated to total 9.00 million tonnes at 1.86% TREO, 0.43% HREO and 23.1% HREO/TREO at the 1.60% TREO cut-off grade. Inferred Resources now total 60 million tonnes at 1.96% TREO, 0.31% HREO and 16.0% HREO/TREO at the 1.60% TREO cut-off grade. The revised Inferred and Indicated Mineral Resources are summarized in Table 2.4-2 below.

The updated resource was prepared by Hudgtec Consulting Limited (Bruce Hudgins, P. Geo.). The methodology employed by Hudgtec was the same as that used in the previous update and at that time was reviewed by external consultants Scott Wilson Roscoe Postle Associates ("Scott Wilson RPA").

TABLE 2.4-2: RESOURCES				
Zone	Millions Tonnes	%TREO	%HREO	HREO\TREO
Indicted Resources				
Basal Zone	9.00	1.86	0.43	23%
TOTAL	**9.00**	**1.86**	**0.43**	**23%**
Inferred Resources				
Upper Zone	22.44	2.00	0.16	8%
Basal Zone	37.56	1.94	0.40	21%
TOTAL	**60.00**	**1.96**	**0.31**	**16%**

2.5 PROJECT COMPONENTS

2.5.1 Sites

The proposed TLP has two site locations, the Nechalacho Mine and Flotation Plant site, and the Hydrometallurgical Plant site (Figure 1.0-1, section 1.0). The proposed Nechalacho Mine and Flotation Plant site will be located at the Thor Lake Property approximately 100 km south of Yellowknife, NT, and about 5 km north of the Hearne Channel of Great Slave Lake. The project footprint at this site will encompass approximately 138 ha.

The proposed Hydrometallurgical Plant site will be located at the existing brownfields site of the former Pine Point Mine 85 km east of Hay River, NT, on the south shore of Great Slave Lake. The project footprint at this site will encompass approximately 152 ha.

REEs will be mined underground and concentrated at the Nechalacho Mine and Flotation Plant site. The resulting REE concentrates will be barged across the east end of Great Slave Lake to the Hydrometallurgical Plant site. Upon arrival, the concentrate will be transported from the south shore of Great Slave Lake to the Hydrometallurgical Plant site via a haul road. The concentrate will be further processed at the Hydrometallurgical Plant. The resulting final products will be hauled to the Hay River railhead via truck, and direct shipped to downstream customers.

2.5.2 Components

2.5.2.1 Nechalacho Mine and Flotation Plant Site

The primary components of the Nechalacho Mine and Flotation Plant site include an underground mine, flotation plant, water supply, tailings management facility, camp, power supply, concentrate storage and loading, access road, airstrip, fuel storage and dock facility The preliminary general arrangement (GA) for the Nechalacho Mine and Flotation Plant site is depicted in Figure 2.5-1. These components are discussed in brief below and in greater detail in subsequent applicable sections.

Mine

Underground mining will consist of decline ramp access (15% ramp grade) to the ore zone located at approximately 200 m depth. Primary crushing will be completed underground and crushed ore and waste rock will be conveyed to the surface.

Flotation Plant

The process to produce the REE concentrate will involve conventional grinding, crushing and flotation techniques. Processing facilities will include a Flotation Plant that will produce a high grade concentrate that will be barged off-site to the proposed Hydrometallurgical Plant site for secondary processing.

Water Supply

The proposed fresh and process water supply source is Thor Lake.

Tailings Management Facility

The tailings management facility will be located up slope from the Flotation Plant and northeast of Thor Lake in the local catchment of Ring and Buck Lakes. The tailings will be discharged to a number of locations around the tailings management facility to develop a relatively flat tailings beach and centralized supernatant pond to maximize tailings storage efficiency. Construction of the tailings management facility will occur in two phases over a period of three years. Excess water from the tailings management area will be discharged in compliance with Water License and federal discharge criteria into Thor Lake.

Camp

A 150 person camp to house the employees and staff will be constructed adjacent to the Flotation Plant and in close proximity to the airstrip.

Power Supply

All site power is currently planned to be generated by a diesel powered generation facility at the site. The power plant will consist of modular diesel generators in the 1.3 to 2.2 MW range. The power requirements will range from a maximum of 7.4 MW for the 1000 tpd operation to an average of 8.4 MW for the 2000 tpd operation. Standby diesel generators will be installed as a secondary power source for use in the event of a major power failure or loss of the main power house. Wind, Biomass and geothermal power are also being investigated as supplementary power sources for the Nechalacho Mine and Flotation Plant site.

Concentrate Storage and Loading

Approximately 180 tonnes per day (tpd) of concentrate will be produced from the Flotation Plant during the first three years. Production is planned to ramp up to 360 tpd commencing in year four. The concentrate will be loaded directly from the Plant into half-height intermodal containers. The containers will have 22 tonne load capacities, external dimensions of 6.1 m long (20') by 2.4 m wide (8') by 1.3 m high (4'3"), end doors and removable tops for ease of loading and unloading, and be capable of being stacked up to 4 containers high. Once loaded, the containers will be removed from the Plant and transported to the dock either for shipment to the Hydrometallurgical Plant or for winter storage in a designated stacking area to be located at the dock facility.

Access Road

The existing 8 km access road that extends from the proposed Flotation Plant site to the current barge landing site will be upgraded for the safe transport of concentrate and supplies.

Airstrip

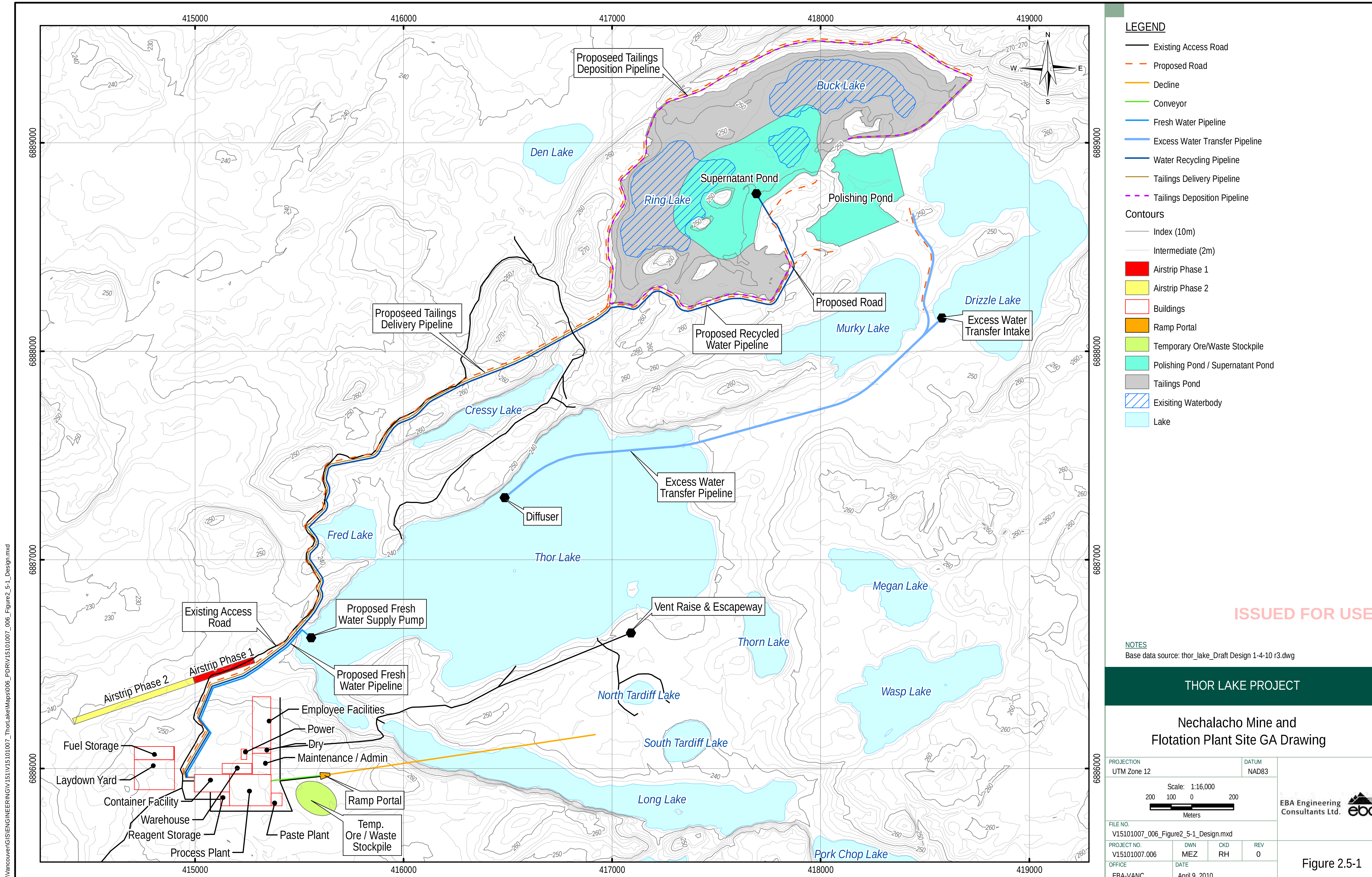
The current airstrip (constructed during the summer of 2010) is located northwest of the proposed Flotation Plant and west of Thor Lake. The airstrip will be upgraded and extended 600 m to a total length of approximately 1000 m. The upgraded airstrip will accommodate Dash 8 and Buffalo aircraft and facilitate the safe transport of employees and supplies.

Fuel Storage

Diesel fuel will be transported from the south side of Great Slave Lake to the barge dock at the Nechalacho Mine and Flotation Plant site. The barging contractor (tentatively Northern Transportation Company Limited) (NTCL) is equipped to load and transfer fuel at its Hay River base and has barges with the capacity to haul 1 M litres per barge. Upon arrival, fuel will be offloaded to an upland receiving fuel storage facility to be located adjacent to the dock at Great Slave Lake. It will then be transferred by tanker truck to the main storage facility to be located west of the Flotation Plant near the diesel generator.

Dock Facility

A seasonal dock facility comprised of a single barge connected to shore for the open water period and an adjacent yard will be used for concentrate storage and shipment to the Hydrometallurgical Plant site. It will also be used to receive and handle the annual resupply of major Mine consumables including fuel. During the first three years of operation, barge loading activities will occur during the summer over a thirty day period. Barge loading activities will increase to 60 days during the summer starting in year four.



Proposeed Tailings Deposition Pipeline
Buck Lake
Den Lake
Supernatant Pond
Ring Lake
Polishing Pond
Proposed Road
Proposed Recycled Water Pipeline
Proposeed Tailings Delivery Pipeline
Drizzle Lake
Excess Water Transfer Intake
Murky Lake
Cressy Lake
Excess Water Transfer Pipeline
Diffuser
Fred Lake
Thor Lake
Megan Lake
Existing Access Road
Proposed Fresh Water Supply Pump
Vent Raise & Escapeway
Thorn Lake
Airstrip Phase 1
Airstrip Phase 2
Proposed Fresh Water Pipeline
North Tardiff Lake
Wasp Lake
Employee Facilities
Power
Dry
Maintenance / Admin
South Tardiff Lake
Fuel Storage
Laydown Yard
Container Facility
Warehouse
Reagent Storage
Process Plant
Paste Plant
Ramp Portal
Temp. Ore / Waste Stockpile
Long Lake
Pork Chop Lake
415000
416000
417000
418000
419000
6889000
6888000
6887000
6886000
N
E
S
W
LEGEND
Existing Access Road
Proposed Road
Decline
Conveyor
Fresh Water Pipeline
Excess Water Transfer Pipeline
Water Recycling Pipeline
Tailings Delivery Pipeline
Tailings Deposition Pipeline
Contours
Index (10m)
Intermediate (2m)
Airstrip Phase 1
Airstrip Phase 2
Buildings
Ramp Portal
Temporary Ore/Waste Stockpile
Polishing Pond / Supernatant Pond
Tailings Pond
Exisiting Waterbody
Lake
ISSUED FOR USE
NOTES
Base data source: thor_lake_Draft Design 1-4-10 r3.dwg
THOR LAKE PROJECT
Nechalacho Mine and Flotation Plant Site GA Drawing
PROJECTION UTM Zone 12
DATUM NAD83
Scale: 1:16,000
200 100 0 200
Meters
EBA Engineering Consultants Ltd.
FILE NO. V15101007_006_Figure2_5-1_Design.mxd
PROJECT NO. V15101007.006
DWN MEZ
CKD RH
REV 0
OFFICE EBA-VANC
DATE April 9, 2010
Figure 2.5-1
Q:\Vancouver\GIS\ENGINEERING\V151\V15101007_ThorLake\Maps\006_PDR\V15101007_006_Figure2_5-1_Design.mxd

2.5.2.2 Hydrometallurgical Plant Site

The primary components of the Hydrometallurgical Plant site include a hydrometallurgical plant, water supply, hydrometallurgical tailings facility, concentrate storage and loading, power supply, coal and limestone storage, haul road, dock facility and product transportation to the railhead. The preliminary GA for the Hydrometallurgical Plant site is depicted in Figure 2.5-2. These components are discussed in brief below and in greater detail in subsequent applicable sections.

Hydrometallurgical Plant

The proposed Hydrometallurgical Plant will further process the REE concentrates from the Nechalacho Mine and Flotation Plant. The process will include acid baking, caustic cracking, water washing, filtration, caustic regeneration and evaporation, double salt precipitation, solvent extraction and product drying facilities to produce direct ship products.

Water Supply

Potable and process water will be obtained from an existing nearby open pit lake and treated on-site as necessary for its intended uses.

Hydrometallurgical Tailings Facility

The proposed hydrometallurgical tailings facility will be an engineered facility located within the existing tailings facility that remains from the historic Pine Point Mines lead-zinc mining operation. Using this location presents significant environmental and operational benefits for the overall Project. Any water decanted from the tailings facility will be discharged in compliance with MVLWB Water License discharge criteria into the extensive wetland area located between the tailings facility and Great Slave Lake.

Concentrate Storage and Loading

Upon arrival at the Hydrometallurgical Plant, the concentrate storage containers will be unloaded from the trucks and placed into a secure storage area. As required, the containers will be moved into a heated thaw shed. Once in the thaw shed, the concentrate will be removed from the containers. The containers will be cleaned prior to shipment back to the Nechalacho Mine.

Power Supply

Average power consumption for the Hydrometallurgical Plant during start-up through year four is estimated at 6 MW. This power will be provided through the existing Northwest Territories Power Corporation (NTPC) power grid and substation located at the former Pine Point Mine site. Up to 5-10 MW of supplementary power may be required at the Hydrometallurgical Plant during full production. Additional power needs will be obtained either through the Talston Dam expansion or through secondary diesel generated power. Secondary and backup supply of power will be provided by diesel powered generating units on-site. Wind and geothermal power are also being investigated as supplementary power sources for the Hydrometallurgical Plant site.

Coal and Limestone Storage

The coal required to generate the balance of heat required for the acid bake and caustic crack methods will be shipped from the south via railway and transported by truck 85 km to the Hydrometallurgical Plant site. It will be stockpiled near the Hydrometallurgical Plant in an open stockpile that will be sloped and lined to prevent water intrusion or seepage. Other potential fuel sources, such as Biomass and geothermal power are being investigated as alternatives to coal.

The limestone used to neutralize the Hydrometallurgical Plant's waste stream prior to discharge to the tailings management facility will be obtained from local supply sources and stockpiled in a designated area that is in close proximity to the Hydrometallurgical Plant. Because the limestone is a neutralizing product, no special stockpile considerations will be necessary

Haul Road

An existing access road remaining from historical mine activities will be upgraded to safely transport the concentrate offloaded from barges on the south shore of Great Slave Lake to the Hydrometallurgical Plant located at the former Pine Point Mine site. The haul road will be approximately 8.6 km long. It will be aligned directly north-south along an existing drainage ditch for approximately 4.9 km prior to connecting to an existing haul road from a former mine pit located north of the main Pine Point Mine area.

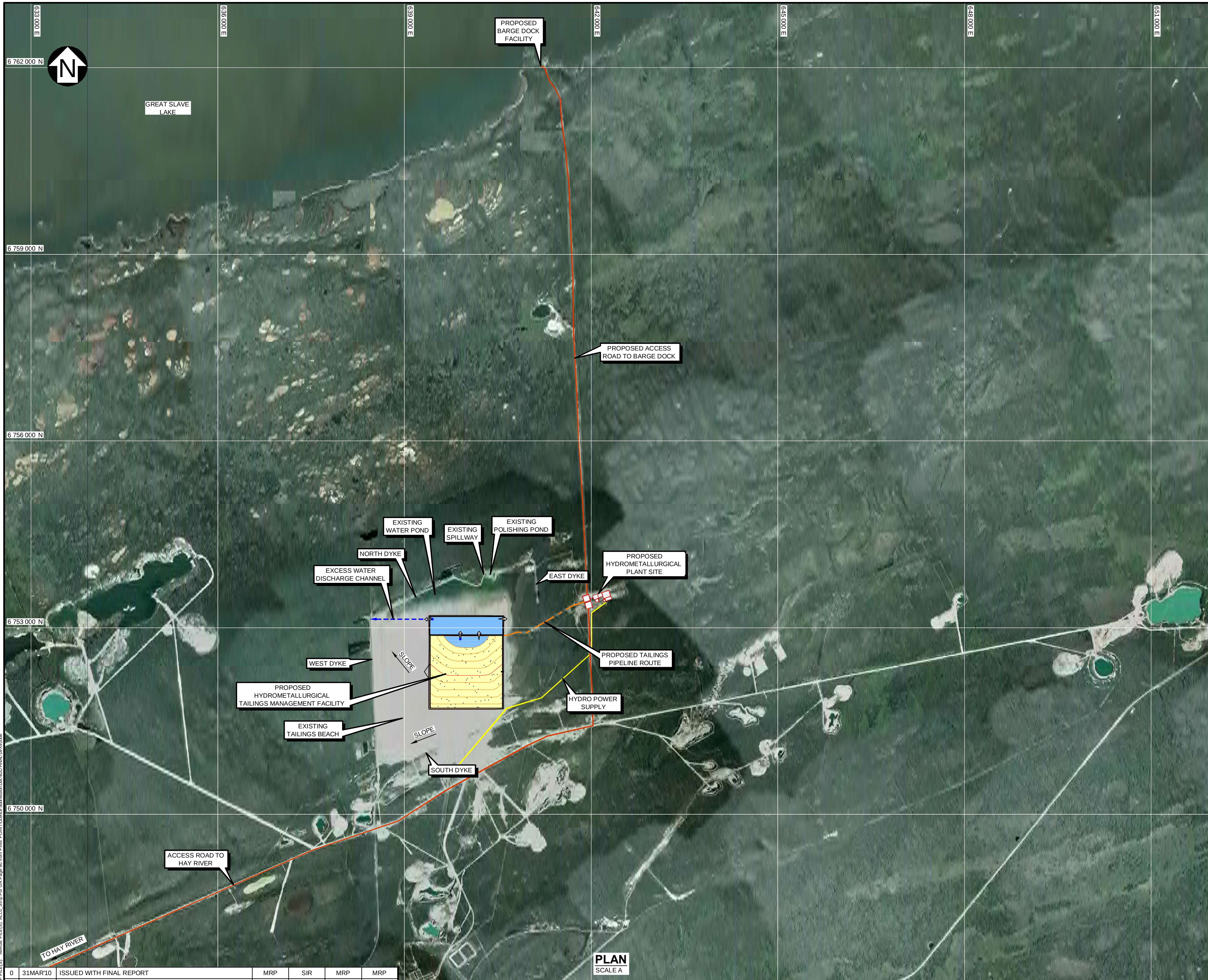
Dock Facility

A seasonal dock facility consisting of two barges connected together to create a temporary floating dock and a marshalling yard will be installed on the south shore of Great Slave Lake approximately 8.6 km from the Hydrometallurgical Plant. The seasonal dock facility will permit the berthing and offloading of Thor Lake REE concentrates onto flatbed trucks for transportation to the Hydrometallurgical Plant. This facility will also be used for the annual shipment of major mining consumables, including fuel, to the Nechalacho Mine site.

Product Transportation to Railhead

The Hydrometallurgical Plant will produce approximately 80 tpd of final products. This amount will double to 160 tpd starting in year four. The final products will include a rare earth carbonate and oxides, and zirconium, niobium and tantalum oxides. The value of the products will be very high.

The final products will be packaged in either sealed drums or sealed bulk bags for shipment to ensure that product is not lost during the handling and/or transportation process. The packaged products will be hauled 85 km from the Hydrometallurgical Plant to the Hay River railhead on flatbed trucks. Truck shipments are expected to occur once or twice per week due to the small volume of final products produced daily. The final products will be direct-shipped from the railhead to downstream customers.



0	31MAR'10	ISSUED WITH FINAL REPORT	MRP	SIR	MRP	MRP
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D

LEGEND:

- EXISTING TAILINGS
- PROPOSED WATER
- PROPOSED TAILINGS
- PROPOSED EMBANKMENT
- PROPOSED ACCESS ROAD
- HYDRO POWER SUPPLY
- PROPOSED EMERGENCY OVERFLOW SPILLWAY
- PROPOSED DECANT STRUCTURE
- PROPOSED TAILINGS PIPELINE ROUTE
- PROPOSED EXCESS WATER DISCHARGE CHANNEL

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 11N.
2. IMAGE PROVIDED BY AVALON METALS INC.

SCALE A 600 300 0 1000 2000 3000 m

AVALON RARE METALS INC.

THOR LAKE PROJECT

HYDROMETALLURGICAL PLANT SITE GA

Knight Piésold CONSULTING

P/A NO.	REF NO.
101-390/1	4

FIGURE 2.5-2 REV 0

2.6 PROJECT SCHEDULE

The TLP schedule is anticipated to include three years of regulatory review and approvals processes, 16-24 months of construction, 14 years of operation, and three years of closure and reclamation activities (Table 2.6-1)

- Regulatory Review and Approvals Processes: Quarter 2, 2010 – Quarter 1, 2013;
- Construction: Quarter 2, 2013 - Quarter 1, 2015;
- Operations: Quarter 2, 2015 – Quarter 1, 2029; and
- Closure and Reclamation: Quarter 2, 2029 – Quarter 1, 2032.

TABLE 2.6-1: THOR LAKE PROJECT SCHEDULE

Activity	Years (2010 – 2032)																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Regulatory Review & Approvals	■	■	■																			
Construction				■	■																	
Operations						■	■	■	■	■	■	■	■	■	■	■	■	■	■			
Closure & Reclamation																				■	■	■

2.7 NECHALACHO MINE AND FLOTATION PLANT SITE

2.7.1 Site Preparation and Construction

The proposed Nechalacho Mine and Flotation Plant will mine and concentrate REEs from Avalon's Thor Lake Property. The site has been the subject of drilling and exploration activities since the 1930's. Current infrastructure at the proposed Nechalacho Mine and Flotation Plant site includes an access road to an existing barge landing site at Hearne Channel, an exploration camp and several storage buildings.

Preparation and construction for the Project will include:

- Constructing site access roads from the Flotation Plant to the Mine's portal, ventilation raise and air heater;
- Upgrading existing access roads to the tailings management facility, water reclaim area, air strip, and dock facility at Great Slave Lake;
- Extending the existing airstrip located northwest of the Flotation Plant and west of Thor Lake;

- Upgrading the existing barge landing site to handle the logistical requirements of the project; and
- Utilizing a combination of steel and prefabricated structures for the surface facilities.

2.7.2 Mine

2.7.2.1 Plan and Operation

Access

The majority of the Nechalacho deposit's Indicated Mineral Resources are located directly beneath and to the north of Long Lake, approximately 180 m below surface. The deposit will be accessed via a decline ramp collared to the west of Long Lake. The main access decline ramp will be driven from a location near the mill at a grade of -15% and will be approximately 1,600 m in length. The development decline ramp and stope access headings will be driven as 5 m by 6 m headings and decline ramp grades will be approximately 15%.

Mining Method

The Nechalacho Mine plan will utilize underground methods to access the higher grade resources at the base of the deposit and to minimize surface disturbance. Ground conditions have been studied and identified as being very competent. The primary stopes are expected to be stable at widths of 15 m. In light of the high value of the resources in the Basal Zone, the use of backfill is planned. Mining will be conducted with a first pass of primary stopes, followed by pillar extraction after the primary stopes have been filled. Mining will be carried out with rubber-tired mechanized equipment to provide maximum flexibility. The modeled Mine design is shown in Figure 2.7-1.

Transport of Ore and Waste

During development, waste and ore materials will be hauled to the surface using low profile trucks and segregated in a temporary storage area. Once the underground crusher and conveyor are in place, broken rock will be hauled and deposited in an ore pass leading to the underground crushing chamber. The underground crushing circuit will include primary and secondary crushing as well as screening. From the crushing plant, the -15 mm fine ore will be stored in a 2,000 tonne fine ore bin excavated in the rock. The ore will be conveyed from the fine ore bin to the Flotation Plant. Waste from ongoing development activities will be diverted to stopes for use as fill, combined with planned paste backfill.

Ore Stockpiles

Decline ramp development activities will generate approximately 75,000 tonnes of waste, low grade and ore grade material. This material will be hauled to the surface and segregated in a temporary storage area. The waste rock will be used for surface construction activities and all the ore will be used as plant feed during start-up operations.

During operations, ore will be stockpiled underground in the ore bin prior to crushing.

Paste Backfill

Paste backfill will be utilized to maximize the extraction of the higher grade resources in the Basal Zone. It will be distributed via a pipeline installed in the main decline ramp. The paste fill pipeline's location in the main decline ramp will be advantageous because it will be exhaust ventilated, in a warm environment and more accessible for maintenance.

The paste plant will be installed as a component of the Flotation Plant, and will operate as part of the mill operations. The plant will be constructed in year 2 of operations. Once commissioned, it will operate on a continuous basis to progressively fill the voids created by the primary stopes and to allow full extraction of the secondary stopes. Use of the paste plant will also reduce the mass of tailings placed in the tailings management facility.

Mine Services/Supplies

Mine services/supplies include ventilation and Mine air heating, compressed air, electric power, communications, water supply, water discharge, explosives, warning system, primary and secondary escapeways and refuge stations.

Ventilation and Mine Air Heating. The Mine ventilation is planned to consist of a fresh air fan atop the fresh air intake raise located to the northeast of the ore body. The intake system will include the Mine air fans and direct fired propane air heaters. The intake raise will also serve as a service raise for power lines and as an emergency escapeway.

Compressed Air. Compressed air will be fed to the underground operations from a bank of primary compressors located inside the Flotation Plant building. Mining equipment will receive constant feed via 150 mm schedule 40 steel pipe that will be hung from the back of the decline ramp and placed near each working heading.

Electric Power. Electrical power will be generated at a diesel power station located at the site. The power will be generated and distributed throughout the site at 4160 V. The feed to the Mine will be by 4160 V power cables installed in the decline ramp feeding load centers with 4160:600 V transformers. When the ventilation raise is in place, an additional line may be installed in the raise to provide a loop for power distribution. In the alternative, bore holes may be used as conduit for power lines to the underground Mine to provide multiple feeds and to reduce the line loss with the shorter supply cables.

Communications. Mine communications will consist of telephone service to the main Mine switchboard, as well as, radio communications through a leaky feeder system. The communications system will also be used for monitoring and control of production equipment, ventilation systems, dewater and backfill.

Water Supply. Water will be required for all drilling activities in the Mine. Supply water will be taken off the process water feed line from Thor Lake and piped along the decline ramp to the active working faces.

Water Discharge. The Mine is expected to be relatively dry and ground water inflows are anticipated to be low at an estimated maximum of 18 m^3/h. Any excess water underground will be collected in a sump, pumped to the surface through a steel line along the ramp and discharged to the tailings management facility.

Explosives. Explosives will be stored on the surface in accordance with federal explosives storage guidelines in a temporary explosives and detonator magazine during construction. Once the underground magazines are constructed, all ammonium nitrate-fuel oil (ANFO) and detonators will be stored in separate approved explosives magazines which will be located underground.

Mine Warning System. The Nechalacho Mine will develop and maintain an emergency warning system to warn all surface and underground employees of any potential emergency that requires immediate worksite evacuation. The underground operations will have a stench warning system located at the fresh air intake. Both the underground Mine and surface Plant will have a siren and flashing beacon system.

Primary & Secondary Escapeways. Primary and secondary escape routes will be clearly marked and posted in all lunch rooms, refuge stations and primary working areas. The primary escape route will follow the course of fresh air and be directed to the ventilation shaft. The secondary escapeway will direct employees out of the Mine through the main access ramp.

Refuge Stations. Refuge stations will be installed near the most active work places that can be accessed within 15 minutes. Refuge stations will meet all requirements as outlined in the NWT Mine Health and Safety Act and Regulations.

2.7.2.2 Production Schedule

The Mine will produce approximately 9 million tonnes of ore during 14 years of operation. The Mine is planned to operate 365 days per year utilizing 12 hour rotating shifts. Production during the first year of mining will ramp up from 500 tpd to 1000 tpd during the first four months and will peak at 2,000 tpd in year four (month 48).

TABLE 2.7-1: NECHALACHO MINE PRODUCTION SCHEDULE

Month of Operation	Mined Tonnes Per Day
1	500
2-3	750
4-33	1,000
35	1,600
36	1,800
48+	2,000

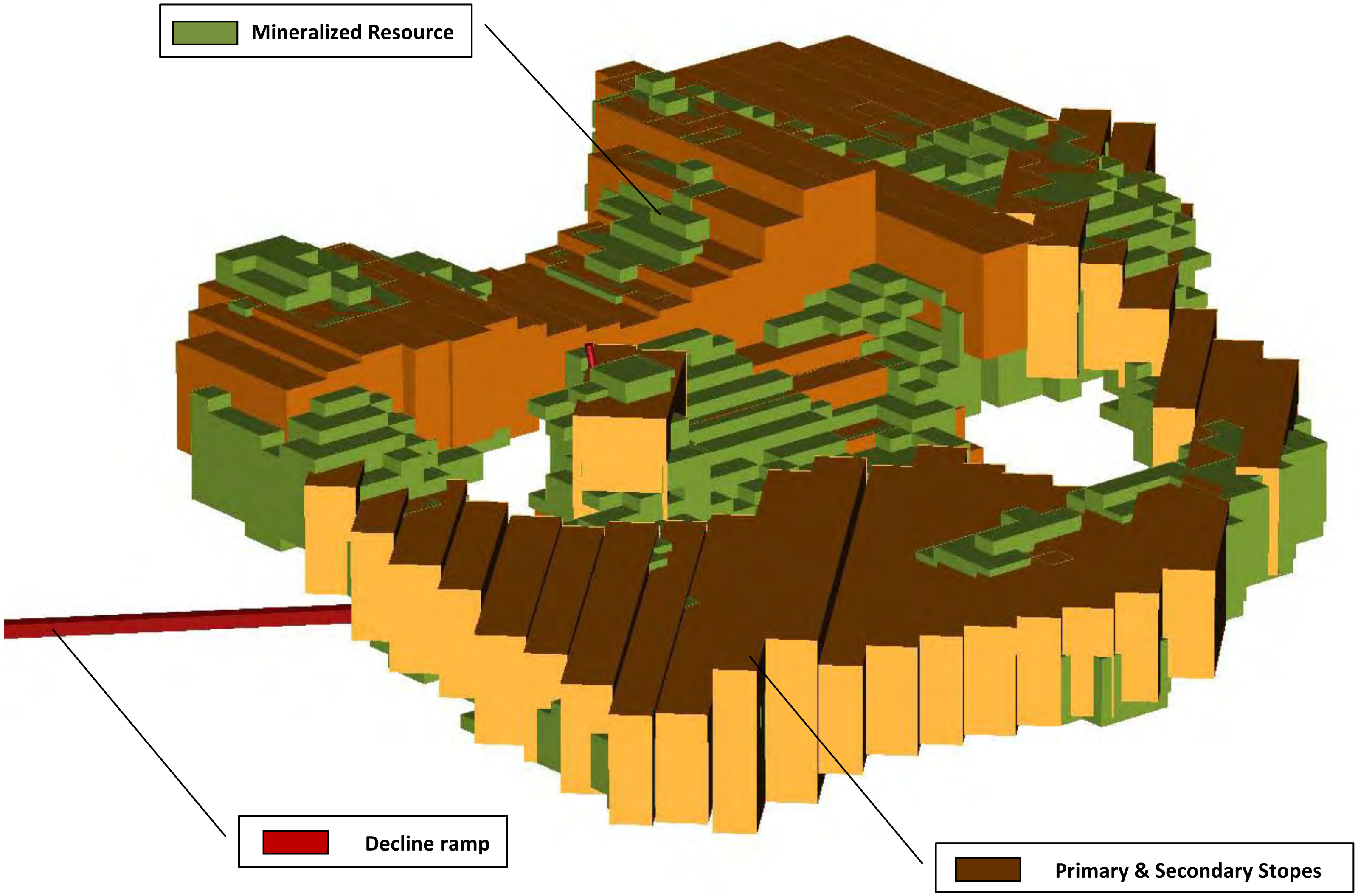


Figure 2.7-1: Nechalacho Mine Block Model

2.7.3 Processing

2.7.3.1 Flotation Plant

The Flotation Plant design is based on an initial throughput of 1,000 tpd, the specified production capacity for the first four years of operation. Planned expansion in year four will increase throughput to 2000 tpd.

The Flotation Plant process will be comprised of several unit operations including underground crushing and fine ore storage, delivery of mill feed to a surface Flotation Plant incorporating rod mill/ball mill grinding, desliming, magnetic separation and regrinding to recover coarse non-magnetics, dewatering of flotation feed, rougher/cleaner flotation to recover a flotation concentrate for further processing through gravity separation including gravity tails regrind, thickening, and pressure filtration of the gravity concentrate.

The upgraded concentrate will be shipped off-site for further processing at the Hydrometallurgical Plant and tailings will be discharged to the tailings management facility. A figure drawing of the Plant layout and summary flow sheet are found in Figures 2.7-2 and 2.7-3.

Underground Crushing

The crushing circuit, including coarse and fine ore storage facilities, will be located underground in a purpose-built excavation area. Run of mine (ROM) ore will be fed to a 500 tonne coarse ore pocket via a grizzly fitted with a rock breaker. The rock will be fed to a screen (grizzly) for preliminary scalping ahead of a jaw crusher located below the screen, which in turn will be located below the dump pocket. The discharge from the jaw crusher will be fed to a double deck screen located in a separate screening chamber. Screen oversize will discharge to a cone crusher, which will be returned to the sizing screen via a vertical conveyor. Screen undersize, minus 15 mm product, will be conveyed to a 2,000 tonne fine ore bin via a vertical conveyor.

The fine ore bin will discharge crushed product via slot feeders to a fine ore transport conveyor suspended from the back of the underground decline ramp. One transfer point approximately half way up the ramp has been included in the conceptual design. The discharge of the fine ore transport conveyor will be fitted with a two-way chute at surface to allow discharge of crushed rock to an outside stockpile during commissioning or discharge of crushed waste rock to a separate stockpile if needed.

Water sprays will be used for dust control. The crusher area sump pump will discharge to the main Mine sump.

Grinding

Ore will be metered from the fine ore bin via slot feeders and discharged onto the fine ore transport conveyor. The conveyor will discharge to the mill feed conveyor feeding the rod mill. A small feed hopper will also discharge onto the mill feed conveyor if feeding from a surface stockpile is required.

Slurry from the rod mill will discharge into a pumpbox feeding the grinding cyclones. Cyclone underflow, made up of coarse slurry, will be ground further in a ball mill. The ball mill will discharge into the cyclone feed pumpbox with the rod mill discharge. Cyclone overflow, with an 80% passing size of 38 microns, will be the grinding circuit product forwarded to the desliming conditioning tank.

Desliming

Cyclone overflow will be treated with a mixture of sodium silicate and sodium metaphosphate that will act as a slimes dispersant. Desliming will occur in three stages of small diameter cyclones: a first stage using 102 mm cyclones, a second stage using 51 mm cyclones and a third stage using 10 mm cyclones. The third stage overflow will be discharged to the tailings tank and the underflows from the three sets of cyclones will be forwarded to magnetic separation for further processing.

Magnetic Separation

The cyclone underflow from the desliming cyclones will be fed to a magnetic separator. The magnetics collected from the magnetic separator will be fed to 102 mm cyclones. The underflow will be reground in a small ball mill to 80% passing 37 micron and fed to a second stage magnetic separator along with the cyclone overflow. The magnetics from the second magnetic separator will be discharged to the tailings tank.

The non-magnetics from both magnetic separators will be collected and treated with sodium sulphide in a pre-treatment tank prior to reporting to the dewatering thickener.

Dewatering and Bulk Conditioning

The non-magnetics will be dewatered and thickened to approximately 62% solids (w/w) prior to being discharged to the bulk conditioning tank. The thickener overflow will then be discharged to the tailings tank.

The thickened non-magnetics, along with some recycle streams, will be treated with fluorosilicic acid and conditioned with the MX3 reagent mix depressant. The conditioned pulp, at a re-adjusted density of 25% solids (w/w), will be forwarded to bulk rougher flotation.

Bulk Flotation

The conditioned pulp from the dewatering circuit will be processed through rougher/scavenger flotation using the KBX3 reagent mix as a collector and the MX3 reagent mix as a gangue depressant.

The bulk rougher concentrate and the bulk scavenger concentrate will be collected and discharged by gravity to the cleaner conditioning tank where they will be conditioned with the MLC3 reagent mix acting as a dispersant/depressant ahead of cleaner flotation.

The bulk scavenger tailings will be discharged to the tailings tank.

Cleaner Flotation

Four cleaning stages will be used to upgrade the rare earths concentrate with upstream recycle of cleaner tails. A scavenger float on the first cleaner tails will recover some metal values which will be returned to the bulk conditioning tank ahead of bulk flotation. Reagents used will include the MX3 depressant reagent mix, the KBX3 collector reagent mix, the MLC3 dispersant/depressant reagent mix and ferric chloride.

The fourth cleaner concentrate will be fed to gravity separation.

Gravity Separation

The fourth cleaner concentrate will be conditioned with sodium hydroxide to raise the pH to 12 to disperse the froth contained in the concentrate ahead of gravity separation.

Recovery of gravity concentrate will be accomplished in Mozley C902 multi-gravity separators.

The gravity tails will be cycloned and the cyclone underflow will be reground to 80% passing 37 micron prior to being forwarded to the bulk conditioning tank along with the cyclone overflow. The upgraded gravity concentrate will be collected and forwarded to the concentrate thickener.

Concentrate Dewatering and Loadout

The concentrate thickener underflow will be held in a surge tank and fed to a pressure filter for dewatering to approximately 10% moisture. The filtered concentrate, the final product from the Flotation Plant, representing 18% of the mill feed, will be transferred to concentrate storage containers for barging to the off-site Hydrometallurgical Plant for refining.

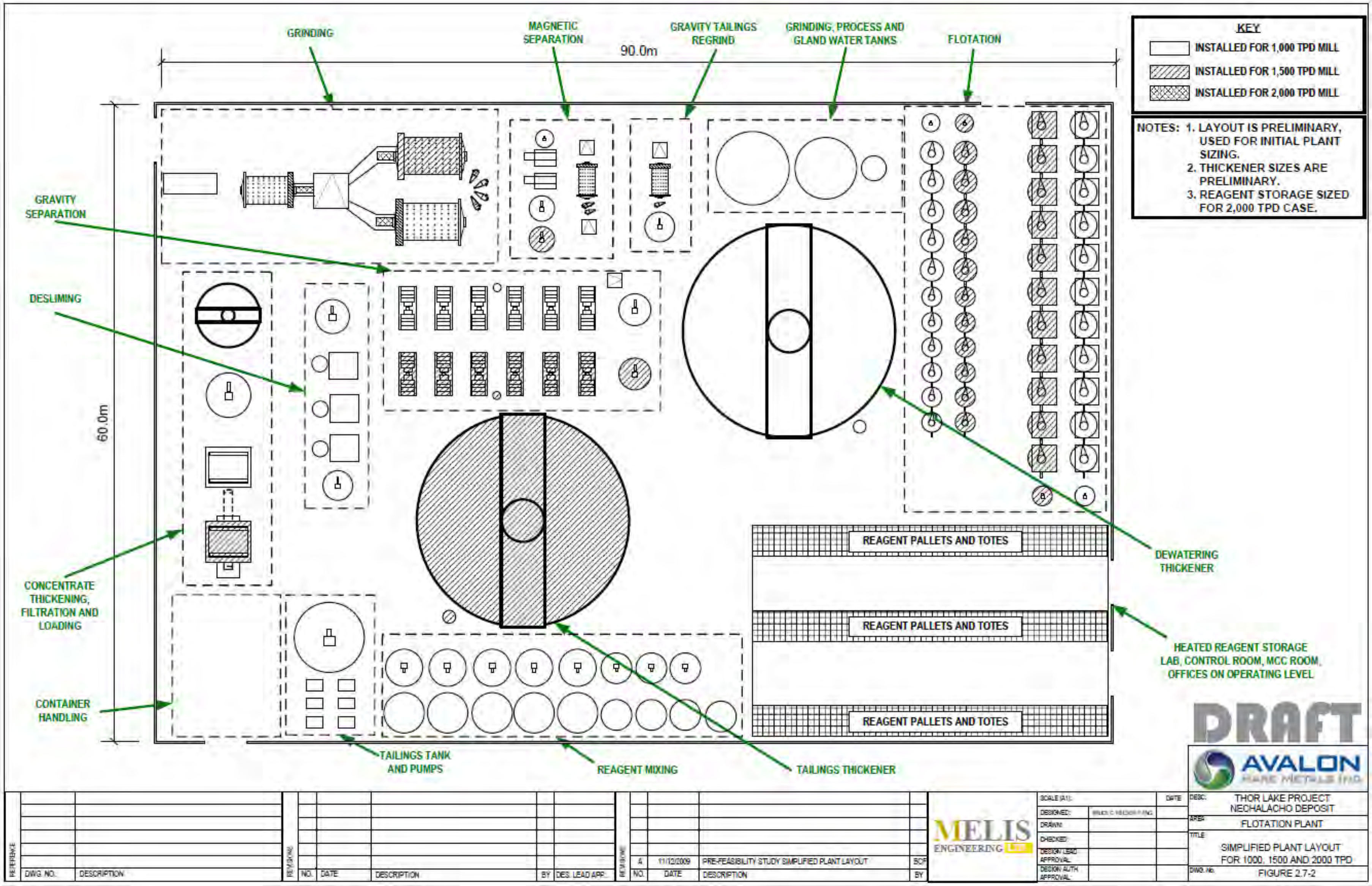


Figure 2.7-2: Simplified Flotation Plant Layout for 1000, 1500 and 2000 tpd

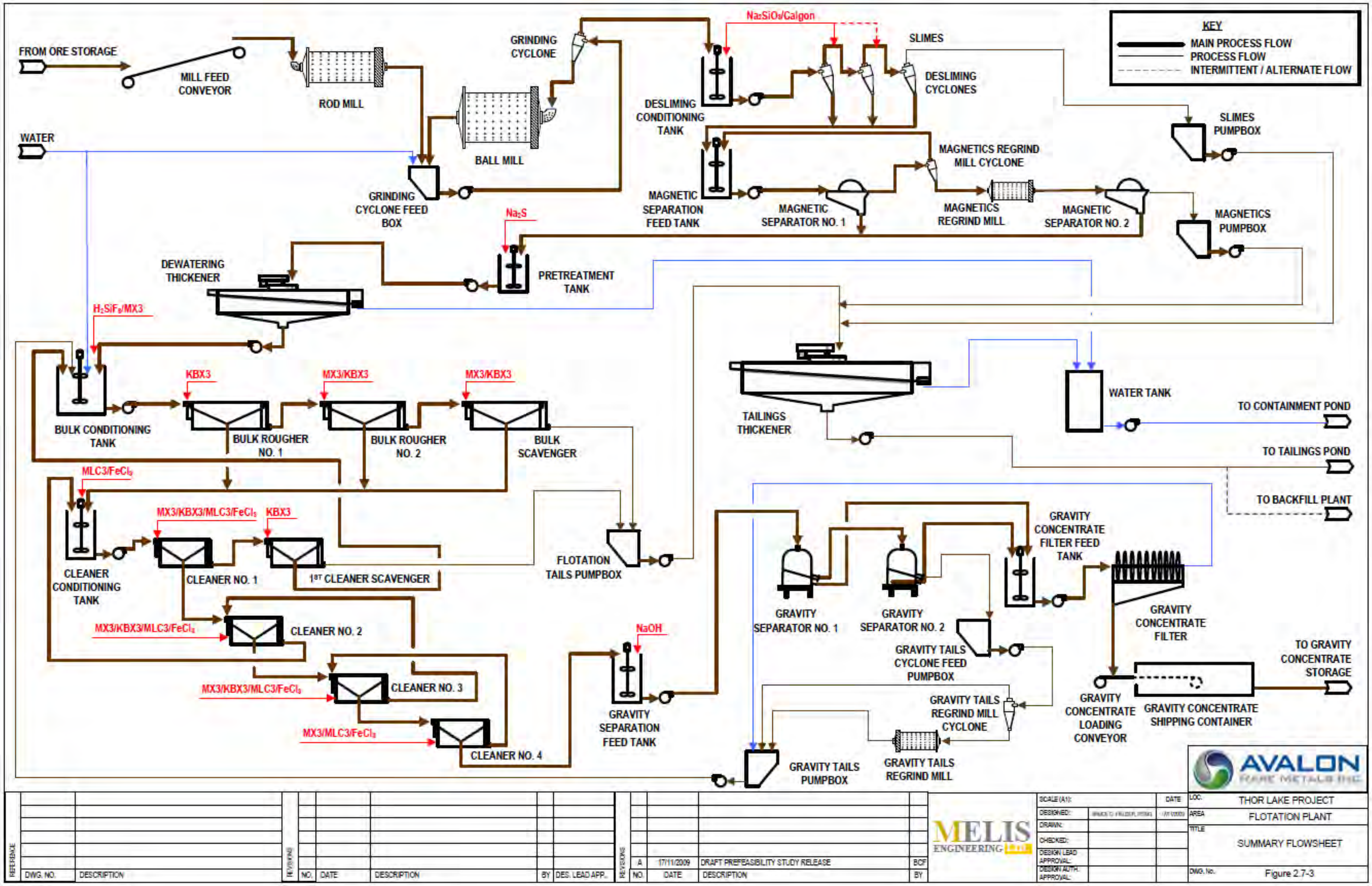


Figure 2.7-3: Flotation Plant Summary Flowsheet

2.7.3.2 Reagents

The following reagents are planned for use in the Flotation Plant during phase one and phase two operations (Table 2.7-2).

TABLE 2.7-2: FLOTATION PLANT: AVERAGE REAGENT CONSUMPTION ESTIMATE (TPA)

Reagent	Supplied As		Phase 1 Years 1-3 tpa	Phase 2 Years 4+ tpa
	Conc. %	Form	1000 tpd Mining Rate	2000 tpd Mining Rate
Ferric Chloride ($FeCl_3$)	98	Solid	69.8	139.6
Fluorosilicic Acid (H_2SiF_6)	24	Liquid	380	760
Flocculant (Magnafloc 156)	100	Solid	5.67	11.34
Sodium Hexametaphosphate $(NaPO_3)_6$	98	Solid	60.5	121
Sodium Hydroxide (NaOH)	99	Solid	64.5	129
Sodium Silicate (Na_2SiO_3)	100	Solid	59.3	118.6
Sodium Sulphide (Na_2S)	60	Solid	456	912
KBX3:				
Flotinor SM15 (1682)	100	Liquid	128	256
Aero 845	100	Liquid	76.4	152.8
Disponil SLS 101/103	30	Liquid	173	346
Witcomul 3251	100	Liquid	48.9	97.8
MLC3:				
Acumer 9400	43	Liquid	108	216
Rheosperse 3010	100	Liquid	46.4	92.8
Alginic Acid ($C_6H_8O_6$)	22	Solid	96.4	192.8
MX3:				
Oxalic Acid ($C_2O_2(OH)_2$)	99	Solid	94.0	188
Citric Acid ($C_6H_8O_7$)	100	Solid	93.1	186.2
Lactic Acid ($C_3H_6O_3$)	88	Liquid	52.9	105.8

2.7.3.3 Concentrate Storage and Loading

The Flotation Plant will receive 1,000 tpd of Mine feed during years 1-3 of operations, and 2,000 tpd starting in year four and beyond. Daily concentrate production will be 180 and 360 tonnes respectively. Concentrates will be dewatered in a filter press and will contain approximately 8-12% moisture content. The dewatered concentrates will then be conveyed and discharged into intermodal containers.

2.7.4 Nechalacho Mine and Flotation Plant Waste Management

Avalon contracted SGS Canada Inc. (SGS) to complete environmental characterization of the waste rock, tailings, ore and concentrate from the TLP. The purpose of the test program was to assess the geochemical, acid rock drainage (ARD), contaminant release potential and geotechnical characteristics associated with the Avalon products. The following section summarizes the results of those tests.

Subsequent subsections discuss Avalon's waste management strategies for:

- Temporary ore and waste rock;
- Flotation Plant tailings;
- Sewage and greywater; and
- Site, solid and hazardous waste.

2.7.4.1 Environmental Characterization of Waste Rock, Tailings, Ore and Concentrate

Environmental tests were conducted on:

- Ore composites, concentrates and tailings from the locked cycle test flotation project (SGS Project Reference No. 12180-001);
- A concentrate sample supplied by the hydrometallurgical group (SGS Project Reference No. 11806-005); and
- Waste rock and ore samples generated during semi-autogenous grinding (SAG) tests by the SAGDesign group that were shipped to the SGS facilities by Avalon.

Mineralogy

Semi-quantitative X-ray diffraction (XRD) analyses determined that the Nechalacho samples tested were predominantly comprised of silicates with minor to moderate amounts of oxides/hydroxides. Albite, microcline and quartz were identified as the dominant silicate minerals, while magnetite and hematite were identified as the dominant oxide minerals. Moderate to trace amounts of carbonate minerals were also documented. Due to the sample matrix and high levels of REEs, semiquantitative XRD analyses could not be completed on the concentrates. Qualitative XRD results for the concentrate samples did, however, indicate that the concentrates were also comprised predominately of silicates and oxides. Whole rock and inductively coupled plasma-optical emission spectroscopy/mass spectroscopy (ICPOES/MS) elemental analyses confirmed the primarily silicate composition of the Nechalacho samples.

Although the high loss on ignition (LOI) values determined for the composite, concentrate and waste rock samples suggests significant oxidizable/volatile species (e.g. sulphides, hydroxides and carbonates) are present in these samples, the low LOI values reported for the tailings samples indicates little of these species remaining in the tailings. The poor recovery sums reported for the whole rock analyses, especially for the concentrates, are expected to result directly from the considerable REE content of the samples.

Radionuclide Analysis

Rare earth deposits are often associated with elevated levels of thorium and/or uranium, both of which are radioactive elements. Radioactivity is an issue of concern as it relates to worker health in terms of exposure to radiation underground, mineral processing; transportation of radioactive materials; radioactive releases into the natural environment, and disposal of any radioactive product.

Regulations governing radioactivity include:

- Transportation of Dangerous Goods Regulations (TDGR), with limit of 70 Bq/g;
- Health Canada Regulations on Naturally Occurring Radioactive Material (NORM);
- Northwest Territories Mine Health and Safety Act and Regulations which require control on worker exposures where radon decay product levels exceed 0.4 WLM/y (Working Level Months per year); and
- Canadian Nuclear Safety Commission if uranium and/or thorium materials are produced.

Thor Lake has uranium levels that are higher than average naturally occurring granite but are far below levels typically experienced in other rare earth deposits. The thorium levels in the Nechalacho deposit are anomalous, but given the lower radioactivity equivalency of thorium relative to uranium, the overall effect of typical Nechalacho mineralization as a rock mass is predicted to be very low.

The rare earth concentration process planned at the Flotation Plant will concentrate the rare earths including the low levels of thorium in the rock minerals. The overall level is predicted to be below Canadian TDGR regulations and will not require special handling as Dangerous Goods.

As expected, the radionuclide analysis of the Nechalacho solids typically reported increased levels of radionuclides in the concentrate samples in comparison to the ore composites, while tailings reported lower levels than the ore samples. The analysis results typically reported only low levels of radionuclides for the ore composite, tailings and waste rock samples. The results demonstrated that all of the Thor Lake materials, including rock, concentrate and tailings from metallurgical testing for radioactive element leaching were well below World Bank and Canadian requirements.

No production of thorium or uranium will result from the mining, flotation processing and hydrometallurgical processing of the Nechalacho deposit.

Leach Tests

The shake flask analysis leachates reported all controlled parameters at concentrations well within the World Bank limits. Similarly, analysis of the fresh and aged tailings solutions reported all controlled parameters, with the exception of total dissolved solids (TSS) in the Day 0 solution, at concentrations well within the designated World Bank limits. Significant amounts of Cl, F, Ca, K, Mg, Na and Si were generally evident in both the shake flask and tailings solutions.

Modified acid base accounting (ABA) test results for the Basal Zone ore composites (*Master Comp 1* and *Master Comp 2*), concentrates (*F-29 Gravity Conc, F-30 Gravity Conc* and *F-3 Conc*), low grade sample (*SW-SAG Reject*) and Basal Zone sample (*S-BZ-A SAG Reject*) indicated that these samples are potentially acid neutralizing (PAN). Similarly, although ABA test results for the upper ore sample (*S-UZ-A SAG Reject*) and the tails samples (*Test F-29 Tls* and *Test F-30 Tls*) suggested some minor uncertainty, the very low sulphide concentrations reported, coupled with the significant carbonate (CO_3) neutralization potential ratios (NP/AP), indicate that these samples are highly unlikely to generate acidity. The alkaline final pH values reported after aggressive oxidation of these samples during net acid generation (NAG) testing, confirmed the highly unlikely acid generation potential of these samples.

ABA testing of the *S-UZ-B SAG Reject* Upper Zone ore sample however, reported a significant sulphide concentration, a negative CO_3 Net NP and CO_3 NP/AP ratio, suggesting insufficient carbonate neutralization potential and the potential for acid generation under oxidizing conditions. Reassay of the *S-UZ-B SAG Reject* sample confirmed the initial results reported. Results of the NAG tests completed on this sample (initial and reassay), however, reported no net acidity generated and near neutral final pH values. Avalon reports that out of 8158 sulphur assays on drill core intervals, the average sulphur assay is 0.05% and that the drill hole corresponding to the *S-UZ-B SAG Reject* had the highest sulphur content. Therefore, this particular sample is not typical of Upper Zone rock with respect to sulphur.

Settling Tests

Particle size distribution analyses indicated that both the ore composite samples (*Master Comp 1* and *Master Comp 2*) were comprised primarily of sand sized grains. Only minor fractions of the samples were classified as fines. In comparison, the concentrates (*F-29 Gravity Conc* and *F-30 Gravity Conc*) and tailings (*Test F-29 Tls* and *Test F-30 Tls*) showed a much finer particle size distribution with the majority of the samples being classified as fines.

Results of the settling tests indicated that the *Test F-29 Tls* and *Test F-30 Tls* will settle quite quickly in a tailings pond setting. The addition of drainage to the settling tests resulted in only minor increases to the final % solids reported by the samples.

2.7.4.2 Temporary Ore and Waste Rock Storage

During construction of the main underground access decline ramp, approximately 75,000 tonnes of waste and low grade rock will be hauled to the surface. The material will be temporarily stockpiled on the surface in a designated area, where natural drainage can be collected in the planned settling pond (utilized for Flotation Plant site runoff). Suitable waste rock will be used for surface construction. Once operations commence, the low grade rock will be comingled with underground ore and processed in the Flotation Plant.

2.7.4.3 Flotation Plant Tailings

Tailings from the Flotation Plant will be discharged to the tailings management facility.

Tailings Management Facility

The proposed tailings management facility will be located up slope from the Flotation Plant and northeast of Thor Lake in the local catchment of Ring Lake and Buck Lake. The location was selected based on a review of available sites within the project area and consideration of environmental and economic factors:

- The Ring and Buck Lakes basin provides adequate and efficient storage, thereby minimizing embankment construction and development costs;
- Discharge from the tailings management facility will be to Drizzle Lake, which flows to Thor Lake via Murky Lake. This will allow return of excess water from the tailings management facility to Thor Lake during Mine operations to minimize impacts to pre-production flows; and
- Baseline studies to date indicate that Ring, Buck and Drizzle Lakes are non fish-bearing water bodies.

The principle objective of the tailings management facility design is to ensure protection of the environment during operations and in the long-term (after closure) in order to achieve effective reclamation at Mine closure. The design takes into account the following requirements:

- Permanent, secure and total containment of all tailings solids within an engineered facility;
- Control, collection and removal of free draining liquids from the tailings during operations to recycle process water to the maximum practical extent; and
- Include monitoring features for all aspects of the facility to ensure performance goals are achieved and design criteria and assumptions are met.

The design criteria for the tailings management facility are based on federal standards for the design of dams. In particular, all aspects of the design have been completed in general conformance with:

- Canadian Dam Association (CDA) Dam Safety Guidelines (CDA, 2007); and
- The Mining Association of Canada (MAC) Guide to the Management of Tailings Facilities (MAC, 1998).

Design and Construction

The tailings management facility design is based on an approximate production life of 14 years, a total ore reserve of approximately 9 million tonnes, and storage for approximately 3.5 million tonnes of tailings. The average mining rate for the Nechalacho deposit will begin at approximately 1,000 tpd and is planned to increase to 2,000 tpd in year four of operations. The tailings management facility site GA is depicted in Figure 2.7-4.

The design includes a phase one and phase two configuration that is raised and expanded in a progressive manner throughout the Project's life. The planned construction is scheduled to ensure that there is always sufficient storage capacity available in the facility.

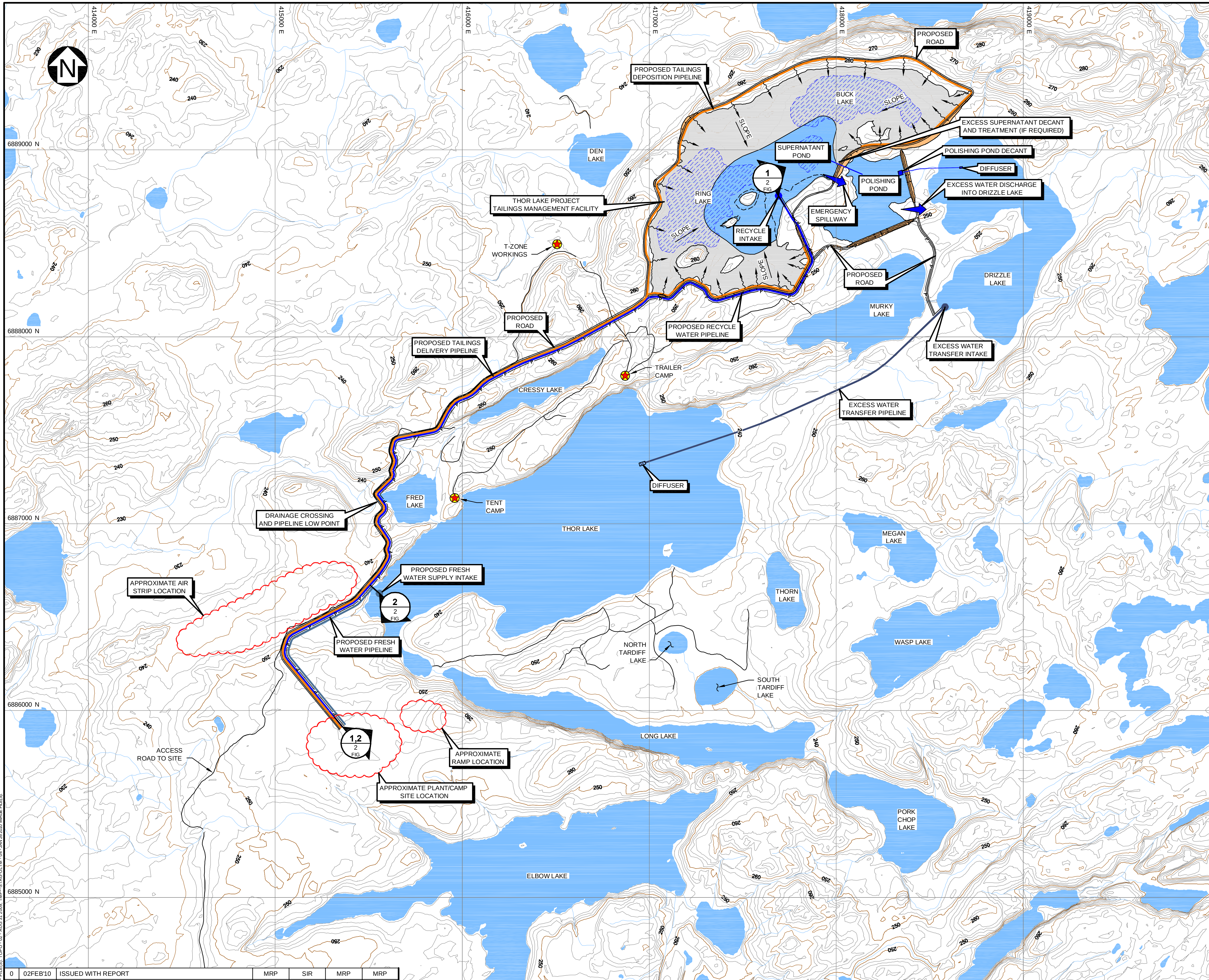
Phase one of the facility will include the construction of several small embankments and a temporary separator dyke to confine the tailings basin and establish a polishing pond. Phase two of the facility will include the raising of the existing phase one tailings basin embankments and the construction of two additional small embankments to establish a downstream polishing pond if required. Construction materials will consist of local borrow materials and development waste rock.

Tailings Delivery and Distribution

Tailings will be pumped from the Flotation Plant to the tailings management facility via a tailings delivery pipeline to the south west corner of the tailings basin. Tailings deposition to the basin will consist of single end-of-pipe discharge from the tailings deposition pipeline to reduce icing concerns during the winter months. During the first year of operations, 100% of the tailings solids at an approximate rate of 203 m^3 per hour, will be pumped to the tailings basin at a slurry consistency of 14.4% solids. Starting in year two, approximately 50% of the tailings will be bypassed and utilized in the on-site cement pastefill plant for redirection underground. During the planned production ramp up in year four, the quantity of tailings discharge from the Flotation Plant will double as a result of the increased production from 1,000 tpd to 2,000 tpd.

The tailings deposition pipeline will run along the south end of Ring Lake during phase one of operations. Tailings deposition to the basin will occur from several locations along the south end of Ring Lake as shown in Figure 2.7-5. Tailings discharge will be rotated between deposition locations to develop a relatively flat tailings beach sloping towards the north and to maintain a supernatant pond in the northern portion of Ring Lake. A temporary separator dyke will be constructed between Ring and Buck Lakes to retain the tailings solids in Ring Lake and to allow Buck Lake to be initially operated as a polishing pond. Phase one is estimated to provide tailings storage for approximately 2 years of operations.

During phase two of operations, the tailings discharge pipeline will be extended around Ring and Buck Lakes as shown in Figure 2.7-6. Additional discharge locations will be installed around the perimeter of the tailings management facility and tailings deposition will be rotated between outlet locations to develop a flat tailings beach around the facility and to maintain a supernatant pond in the central portion of the tailings management facility. A new polishing pond will be constructed at the southeast side of the tailings management facility if monitoring and testwork completed during phase one operations indicate that it is required.



REV	DATE	DESCRIPTION	PREPARED	DRAWN	CHK'D	APP'D
0	02FEB'10	ISSUED WITH REPORT	MRP	SIR	MRP	MRP

LEGEND:

- WATER
- TAILINGS
- EXISTING LAKE FOOTPRINT
- EMBANKMENT
- EXISTING ACCESS ROAD
- PROPOSED ROAD
- PROPOSED TAILINGS DELIVERY PIPELINE
- PROPOSED TAILINGS DEPOSITION PIPELINE
- PROPOSED RECYCLE WATER PIPELINE
- PROPOSED FRESH WATER PIPELINE
- PROPOSED EXCESS WATER TRANSFER PIPELINE
- PROPOSED POWERLINE
- DISCHARGE

NOTES:

1. COORDINATE GRID IS UTM (NAD83) ZONE 12N AND IS IN METRES.
2. PLAN BASED ON INFORMATION PROVIDED BY AVALON RARE METALS INC.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 2 METRES.
4. TAILINGS CONFIGURATION SHOWN REPRESENTS FINAL LAYOUT NEAR END OF MINE LIFE (15 YEARS).

FOR INFORMATION ONLY

SCALE 200 100 0 200 400 600 800 1000 m

AVALON RARE METALS INC.

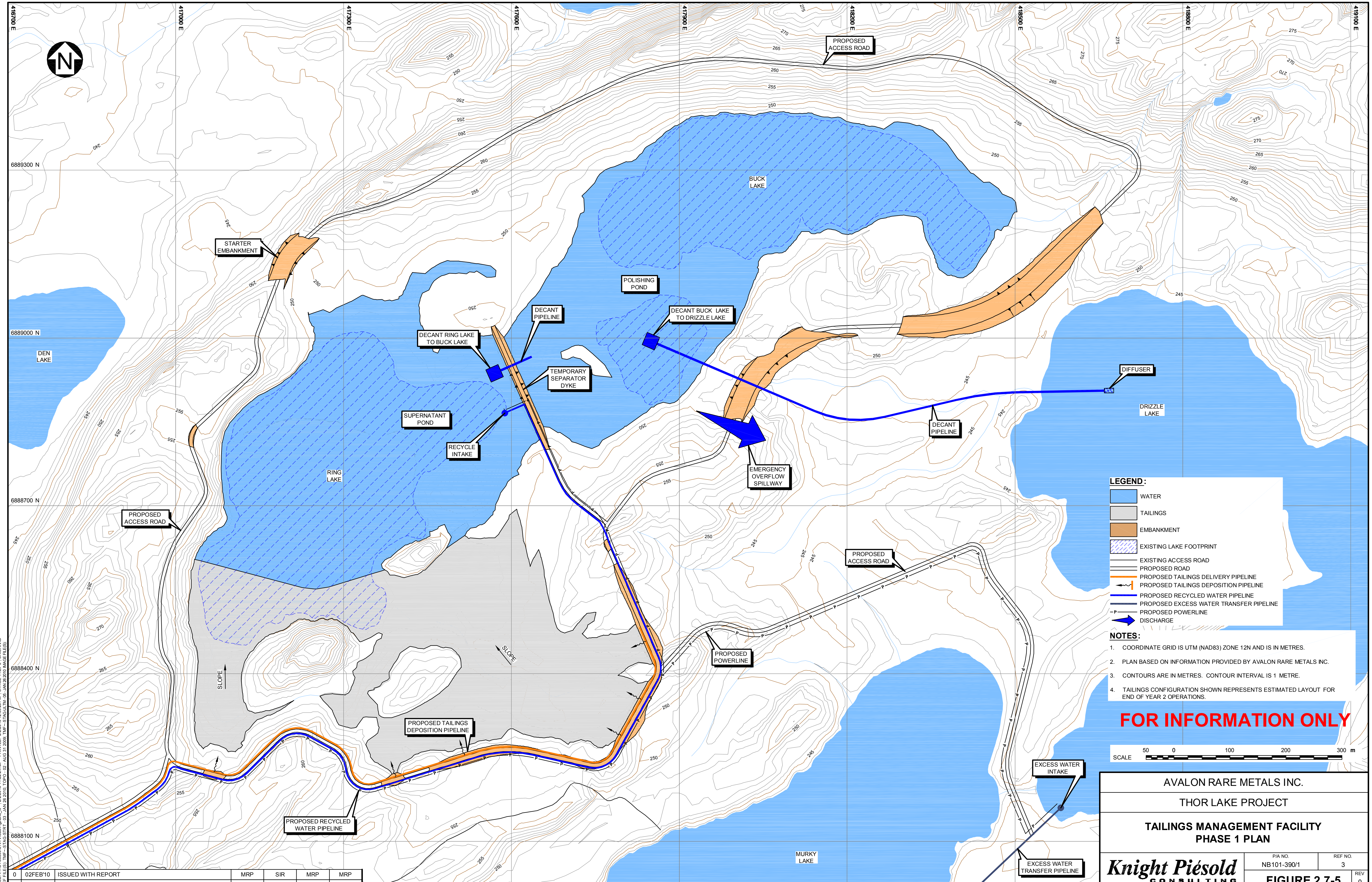
THOR LAKE PROJECT

TAILINGS MANAGEMENT FACILITY SITE GA

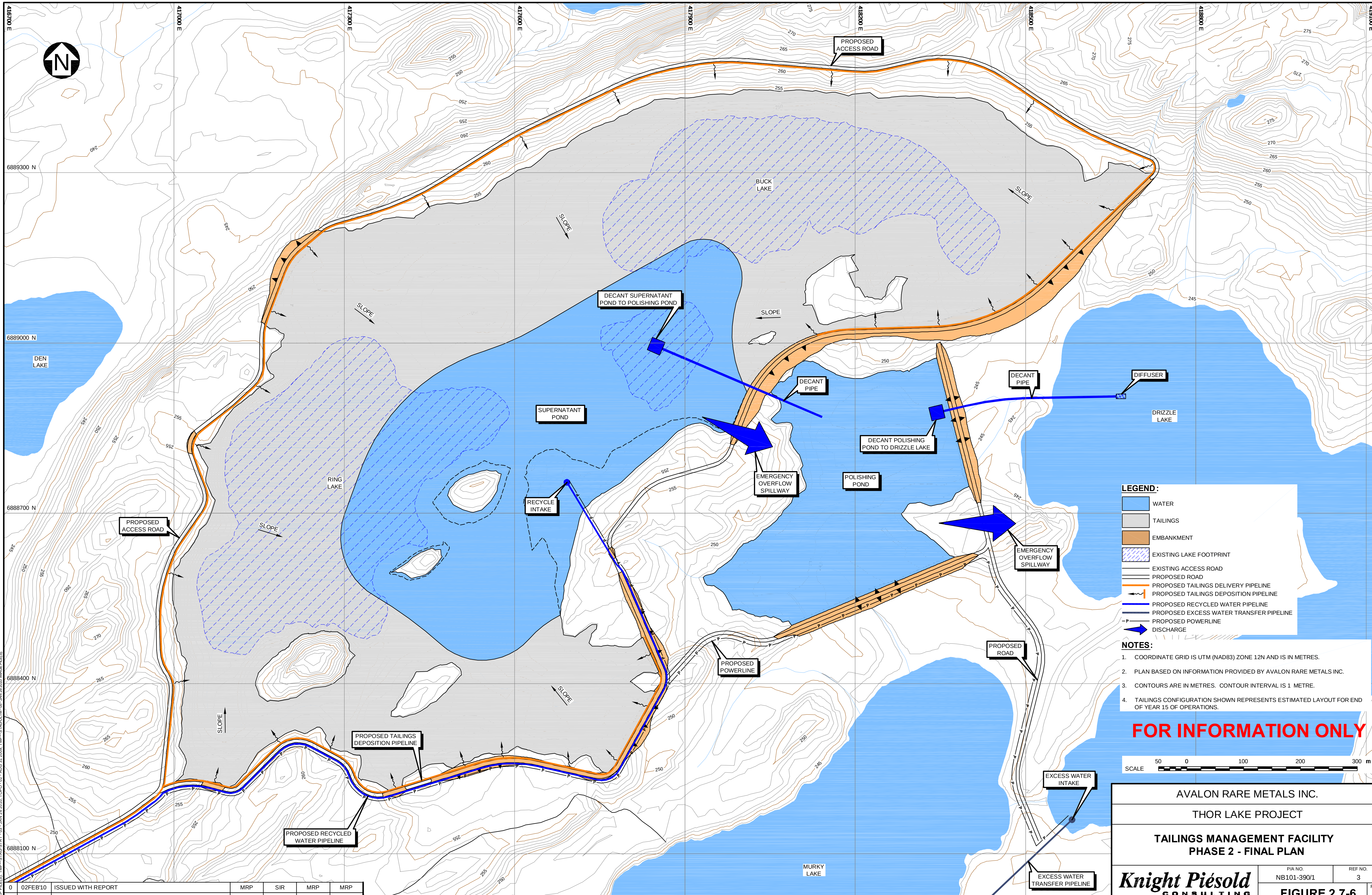
Knight Piésold CONSULTING

P/A NO. NB101-390/1 REF NO. 3

FIGURE 2.7-4 REV 0



PROPOSED ACCESS ROAD
STARTER EMBANKMENT
BUCK LAKE
POLISHING POND
DECANT PIPELINE
DECANT BUCK LAKE TO DRIZZLE LAKE
DECANT RING LAKE TO BUCK LAKE
TEMPORARY SEPARATOR DYKE
SUPERNATANT POND
RECYCLE INTAKE
RING LAKE
DEN LAKE
DIFFUSER
DRIZZLE LAKE
DECANT PIPELINE
EMERGENCY OVERFLOW SPILLWAY
PROPOSED ACCESS ROAD
PROPOSED ACCESS ROAD
PROPOSED POWERLINE
SLOPE
SLOPE
PROPOSED TAILINGS DEPOSITION PIPELINE
PROPOSED RECYCLED WATER PIPELINE
EXCESS WATER INTAKE
EXCESS WATER TRANSFER PIPELINE
MURKY LAKE
LEGEND:
WATER
TAILINGS
EMBANKMENT
EXISTING LAKE FOOTPRINT
EXISTING ACCESS ROAD
PROPOSED ROAD
PROPOSED TAILINGS DELIVERY PIPELINE
PROPOSED TAILINGS DEPOSITION PIPELINE
PROPOSED RECYCLED WATER PIPELINE
PROPOSED EXCESS WATER TRANSFER PIPELINE
PROPOSED POWERLINE
DISCHARGE
NOTES:
1. COORDINATE GRID IS UTM (NAD83) ZONE 12N AND IS IN METRES.
2. PLAN BASED ON INFORMATION PROVIDED BY AVALON RARE METALS INC.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 1 METRE.
4. TAILINGS CONFIGURATION SHOWN REPRESENTS ESTIMATED LAYOUT FOR END OF YEAR 2 OPERATIONS.
FOR INFORMATION ONLY
SCALE 50 0 100 200 300 m
AVALON RARE METALS INC.
THOR LAKE PROJECT
TAILINGS MANAGEMENT FACILITY PHASE 1 PLAN
Knight Piésold CONSULTING
P/A NO. NB101-390/1
REF NO. 3
FIGURE 2.7-5
REV 0
0 02FEB'10 ISSUED WITH REPORT MRP SIR MRP MRP
REV DATE DESCRIPTION PREPARED DRAWN CHK'D APP'D


PROPOSED ACCESS ROAD
BUCK LAKE
SLOPE
DECANT SUPERNATANT POND TO POLISHING POND
DECANT PIPE
SUPERNATANT POND
DEN LAKE
RING LAKE
RECYCLE INTAKE
EMERGENCY OVERFLOW SPILLWAY
POLISHING POND
DECANT POLISHING POND TO DRIZZLE LAKE
DIFFUSER
DRIZZLE LAKE
PROPOSED POWERLINE
PROPOSED ROAD
PROPOSED TAILINGS DEPOSITION PIPELINE
PROPOSED RECYCLED WATER PIPELINE
EXCESS WATER INTAKE
EXCESS WATER TRANSFER PIPELINE
MURKY LAKE
6889300 N
6889000 N
6888700 N
6888400 N
6888100 N
417700 E
417000 E
417300 E
417600 E
417900 E
418200 E
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419100 E
LEGEND:
WATER
TAILINGS
EMBANKMENT
EXISTING LAKE FOOTPRINT
EXISTING ACCESS ROAD
PROPOSED ROAD
PROPOSED TAILINGS DELIVERY PIPELINE
PROPOSED TAILINGS DEPOSITION PIPELINE
PROPOSED RECYCLED WATER PIPELINE
PROPOSED EXCESS WATER TRANSFER PIPELINE
PROPOSED POWERLINE
DISCHARGE
NOTES:
1. COORDINATE GRID IS UTM (NAD83) ZONE 12N AND IS IN METRES.
2. PLAN BASED ON INFORMATION PROVIDED BY AVALON RARE METALS INC.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 1 METRE.
4. TAILINGS CONFIGURATION SHOWN REPRESENTS ESTIMATED LAYOUT FOR END OF YEAR 15 OF OPERATIONS.
FOR INFORMATION ONLY
SCALE 50 0 100 200 300 m
AVALON RARE METALS INC.
THOR LAKE PROJECT
TAILINGS MANAGEMENT FACILITY
PHASE 2 - FINAL PLAN
Knight Piésold CONSULTING
P/A NO. NB101-390/1
REF NO. 3
FIGURE 2.7-6
REV 0
0 02FEB'10 ISSUED WITH REPORT MRP SIR MRP MRP
REV DATE DESCRIPTION PREPARED DRAWN CHK'D APP'D

2.7.4.4 Sewage and Greywater

Sewage and greywater waste from the operation will be processed through a packaged sewage treatment plant (Rotating Biological Contactor). Treated sewage effluent will report to a tailings sump that will be comingled into the tailings slurry. The slurry will report to the tailings management facility.

2.7.4.5 Site, Solid and Hazardous Waste

Garbage will be collected daily and incinerated consistent with current industry good management practices. Recyclable materials will be collected separately and shipped out annually for processing. A waste management site will be established on-site for the temporary storage of waste materials prior to removal. Waste oil will be used in oil heaters throughout the facility

Generated solid wastes will be managed in accordance with NWT regulations and issued licenses or permits similar to Avalon's current management of site solids and wastes. Hazardous materials waste will be disposed of in accordance with current GNWT hazardous waste management guidelines using standard best management practices. Waste will be disposed of either on-site or be shipped to an approved off-site facility designed to handle hazardous wastes.

2.7.5 Water Management

The primary objectives of the Nechalacho Mine and Flotation Plant site water management plan are to:

- Provide potable water for surface facilities;
- Provide the Flotation Plant with a reliable water supply throughout the Project;
- Dewater the underground operations as necessary to maintain stability and facilitate mining;
- Capture and manage all waters and effluent directed to the proposed tailings management facility.

2.7.5.1 Water Balance

The tailings and water management strategy for the Nechalacho Mine and Flotation Plant site consists of a closed loop system to minimize effects on the natural hydrologic flows within the Thor Lake watershed area. All tailings solids and fluids, as well as, process effluent from the Flotation Plant will report to the tailings basin. The tailings management facility design currently includes a polishing pond. Excess water from the tailings basin will be treated (if necessary) and discharged from the polishing pond to Drizzle Lake. Ultimately, all water from the tailings management facility will return to Thor Lake via Drizzle and Murky lakes.

Freshwater for operations will be drawn from Thor Lake and reclaim water will be drawn from the tailings basin. The water balance assumes that the process water fed to the Flotation Plant will consist of 50% freshwater and 50% recycled water from the tailings basin. Water balance details are found in (Figure 2.7-7).

Decant pipeworks have been included in the design to transfer water from the tailings basin supernatant pond to the polishing pond in phases one and two, and to transfer water from the polishing pond to Drizzle Lake. As a contingency for impact mitigation, a decant intake and pipeline has also been included to transfer excess water from Drizzle Lake to Thor Lake. The decant pipeworks have been included to provide operational flexibility and to maintain water volumes in each water body.

The overall water balance for the Nechalacho Mine and Flotation Plant site will be managed to ensure that the water level in Thor Lake will conform year-round to the specifications of the DFO Winter Withdrawal protocol.

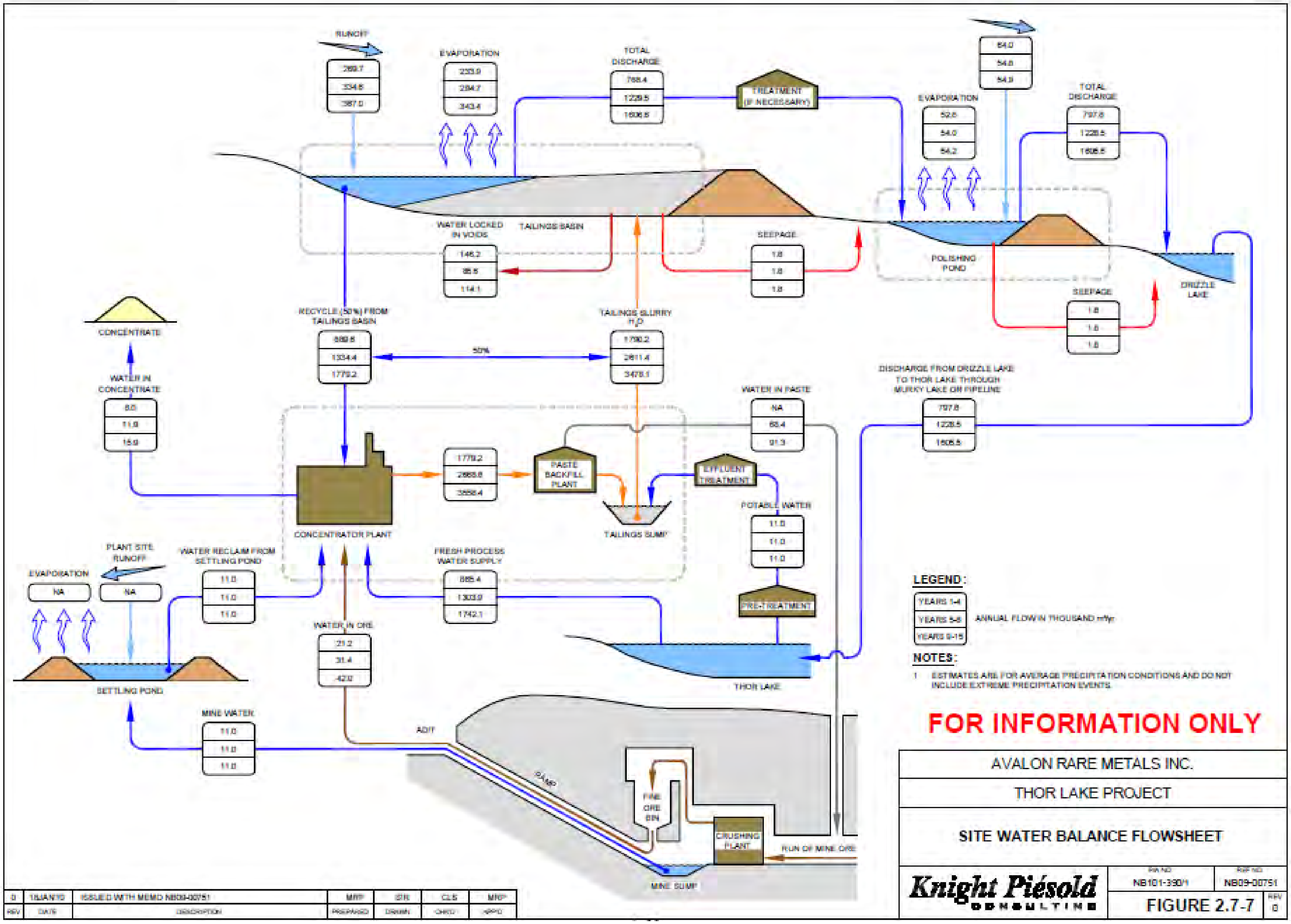


Figure 2.7-7: Nechalacho Mine and Flotation Plant Site Water Balance Flowsheet

2.7.6 Support Infrastructure

2.7.6.1 Power Supply

All site power is currently planned to be generated by a diesel powered generation facility at the site. Wind, Biomass and geothermal power are also being investigated as supplementary power sources for the Nechalacho Mine and Flotation Plant site. Ongoing third party test work is being conducted in partnership with the Yellowknives Dene First Nation to investigate the feasibility of wind power. Until additional technical support studies identify the feasibility of wind power for the Nechalacho Mine and Flotation Plant site, Avalon has assumed that power will be supplied by diesel generation.

The planned power plant will consist of modular diesel generators in the 1.3 to 2.2 MW range. The power requirements will range from a maximum of 7.4 MW for the 1000 tpd operation to an average of 8.4 MW for the 2000 tpd operation (Table 2.7-3). This table does not include separate emergency generators that will be required for the camp and may be required for some areas of the Flotation Plant.

Power will be generated at 4160V and distributed to the mill, administration and employee facilities at 4160V. Power will also be distributed to the grinding mills, the underground mine, the surface mine fans, mine air heater and the tailings pumps.

At the point of use at the fans and tailings area, the power will be transformed to 600 V for use. Within the Mine, a series of 4160V:600 V transformers will be used.

TABLE 2.7-3: ESTIMATED POWER DEMAND

Area	Max (MW) 1000 tpd	Average (MW) 1000 tpd	Average (MW) 2000 tpd
Mill	5.6	3.4	6.0
Mine	1.0	0.7	1.2
Camp	0.5	0.4	0.8
Surface	0.3	0.2	0.4
Total	**7.4**	**4.7**	**8.4**

Additional Power

Standby diesel generators for the camp and critical Flotation Plant equipment will be required and installed in a separate power house. This will ensure that a major power failure or loss of the main power house will not impact the standby units. Two 500 kW units with the ability to synchronize the two will be installed as emergency back-up power.

A small diesel generator will also be required at the dock facility to provide power for lights, an office and diesel transfer pumps. A 100 kW unit has been included in the plan for this area. The unit will be mounted in a skid equipped container with its own switchgear and a day tank for operation.

2.7.6.2 Site

The Nechalacho Mine and Flotation Plant facilities will be comprised of a combination of prefabricated and steel structures. The site surface facilities are planned to be organized into a compact footprint to minimize potential environmental effects and to optimize operational considerations. The facilities will be connected by corridors to provide pedestrian access in all weather conditions between the Flotation Plant/warehouse/power plant/maintenance shop/administration offices and employee camp facilities. The linked design will maximize heating efficiencies and minimize energy consumption. An uncovered fuel storage and laydown yard for construction supplies and materials will be located on the west side of the Flotation Plant.

Planned site structures include:

- Flotation Plant;
- Reagent Storage;
- Paste Backfill Plant;
- Warehouse;
- Maintenance Shop and Administration Offices;
- Employee Camp Facilities;
- Dry;
- Power Plant;
- Container Loading Facility.

2.7.6.3 Fuel Storage

Annual diesel fuel requirements are estimated at approximately 14 M litres/year for the initial planned production rate. Diesel fuel will be transported from the south side of Great Slave Lake to the barge dock at the Nechalacho Mine and Flotation Plant site. The barging contractor (tentatively Northern Transportation Company Limited) (NTCL) is equipped to load and transfer fuel at its Hay River base and has barges with the capacity to haul 1 M litres per barge. Upon arrival, fuel will be offloaded to an upland receiving fuel storage facility to be located adjacent to the dock at Great Slave Lake. It will then be transferred by tanker truck to the main storage facility to be located west of the Flotation Plant near the diesel generator.

Dock Fuel Storage Facility

The fuel storage facility at the dock will contain a minimum 3 M litre storage facility. The size will allow a complete barge load (3 barges) to be offloaded without disruption. The facility will contain two 15 m diameter by 10 m high tanks each capable of holding 1.5 M litres. The two tanks will be in a lined and bermed area approximately 60 m long by 45 m wide. The berm will be approximately 4 m high to generate a bermed storage volume of 110% of the largest tank capacity in conformance with the Canadian Council of Ministers of the Environment (CCME) environmental code of practice for fuel storage tanks.

Main Fuel Storage Facility

The fuel will be transported by tandem axle fuel tanker from the dock storage facility to the main storage facility. The main storage facility will be located on the west side of the Flotation Plant near the diesel power plant. It will contain six 1.5 M liltre capacity tanks within a bermed area. This will include fuel loadout from tankers and a dispensing station for vehicles. All mobile equipment on the Nechalacho Mine and Flotation Plant site, including personnel vehicles, will be diesel fueled. There will be room to add an additional 4 tanks when the operations are expanded to 2,000 tpd. The first phase of the main storage facility with six tanks will require a berm over 4 m high with outside dimensions of approximately 74 m by 57 m.

2.7.6.4 Explosives Storage

The storage of explosives will be conducted in accordance with the federal explosives storage guidelines. Explosives will be stored on the surface in a temporary explosives and detonator magazine during construction. Once the underground magazines are constructed, all ANFO explosives and detonators will be stored in separate approved explosives magazines which will be located underground.

The main explosive planned for use at the Nechalacho Mine is ANFO. The ANFO will be prepared on a batch basis in an approved facility to be located within the Mine. There will also be a need for packaged slurry explosives and “stick” powder for wet holes and/or for boosting the ANFO in some applications. These will be provided by a reputable explosives manufacturer in containers which will be stored and inventoried underground.

2.7.6.5 Roads

Site roads will be constructed from the Flotation Plant site to the Mine’s portal, fresh air raise and heater. Existing roads to the tailings management facility, water reclaim area and air strip will be upgraded.

The existing road that connects the Nechalacho Mine and Flotation Plant site with the planned dock facility will be upgraded and extended. A new section of road approximately 800 m to 1000 m long will be constructed to reduce the grade on the existing road to approximately 5%. The road improvements will allow regular transportation use and the safe movement of containers, fuel, equipment and other supplies.

2.7.6.6 Dock Facility

The Great Slave Lake shore topography south of the proposed Nechalacho Mine and Flotation Plant site is generally rocky and steep. The requirements for a barge loading-unloading dock include a water depth of about 3 m near shore and the need for a large (~ 2-ha) flat-graded marshalling yard for the efficient loading and unloading of the barges.

In the past, barge loads of fuel and equipment were brought in at a convenient bay from which the existing access road was constructed. A site reconnaissance concluded that this location will be suitable for the proposed seasonal dock facility. The seasonal dock facility will consist of a single barge moored to dolphins and connected to the shore by a ramp capable of handling the cargo loading and unloading equipment and associated activities.

The seasonal dock will be utilized only during the open water period. The adjacent upland area will be developed into a marshalling yard to handle load/offload materials and transfer containers between the Nechalacho Mine and Flotation Plant site and the dock (Figure 2.7-8). Yard elements will include:

- A 40 to 50 m long removable ramp to access the barge deck for loading and unloading barges;
- A 45 m by 60 m (3 M l capacity) lined bermed fuel storage area;
- A minimum 1200 m^2 area for full containers (276 containers stacked 4 high);
- Minimum 1200 m^2 area for empty and returning containers;
- Parking area for intermodal freight and trucks;
- Diesel pumps and piping for the transfer of fuel from the barges to the fuel storage tanks;
- A receiving/security office; and
- Diesel generation to power fuel pumps and office.

2.7.6.7 Airstrip

Float planes and ski planes with rotary wing support have been used to service the site to date. Avalon has a current permit to construct a 300 m long by 30 m wide airstrip on the West side of Thor Lake. Construction will commence during the summer of 2010. Avalon anticipates lengthening the airstrip to approximately 1000 m as the TLP advances. The airstrip extension is included in Avalon's land use application.

Once completed, the airstrip will allow safe year-round access for medium sized aircraft with light freight and personnel. The most common connection will be with Yellowknife, approximately 100 km from the site. Additional instrument controls will be investigated to maximize safe operation of the airstrip and to minimize delays due to limited daylight during the winter operations.

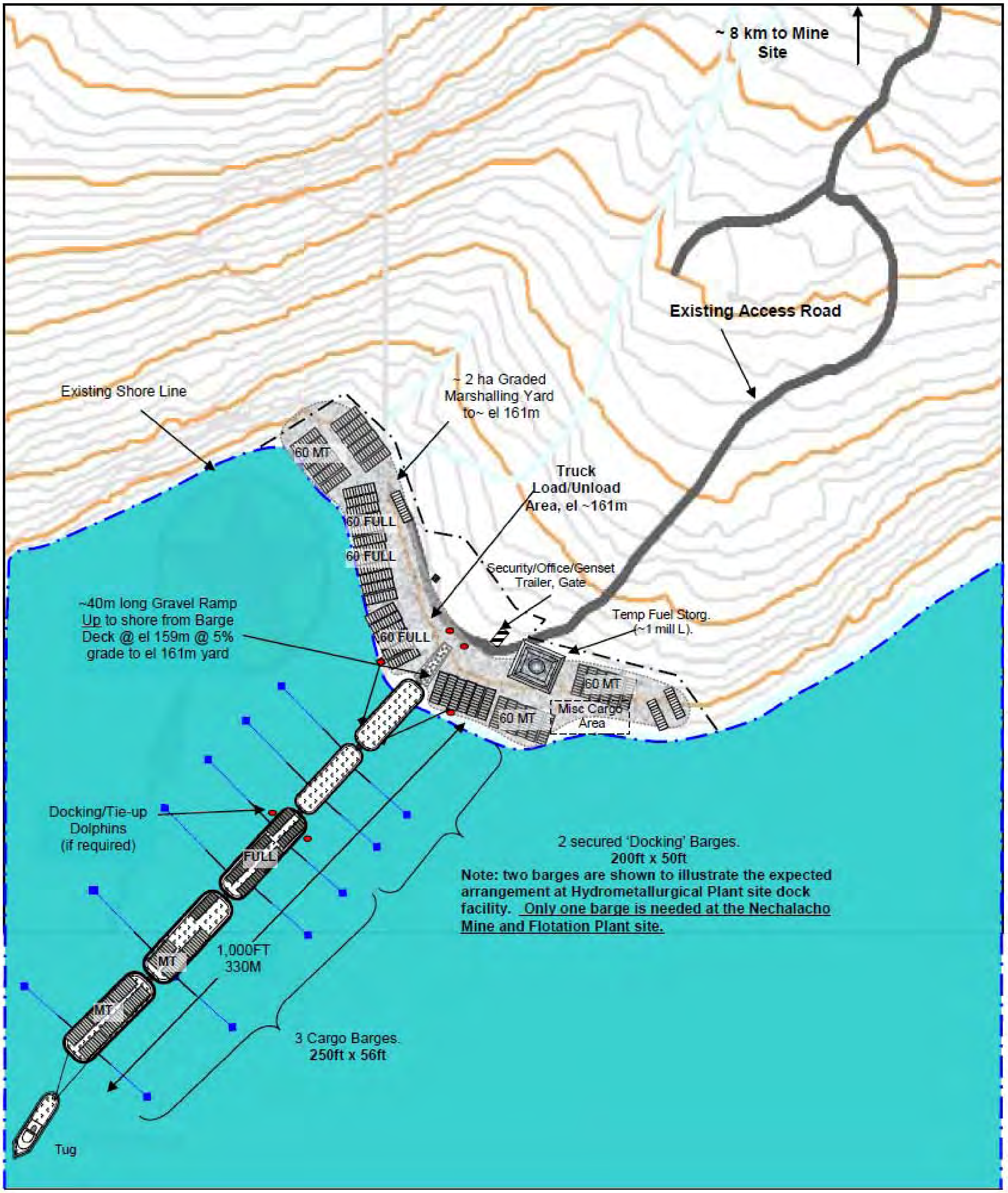


Figure2.7-8: Nechalacho Mine and Flotation Plant Site Dock Facility Layout

2.8 HYDROMETALLURGICAL PLANT SITE

2.8.1 Site Preparation and Construction

The proposed Hydrometallurgical Plant will further process the REE concentrates produced at the Nechalacho Mine and Flotation Plant site. The Hydrometallurgical Plant will be located at the site of the former Pine Point Mine. A preliminary GA for the Hydrometallurgical Plant site is depicted in Figure 2.8-1.

Locating the Hydrometallurgical Plant and its associated components at the former Pine Point Mine site presents significant environmental and operational benefits for the overall Project. In particular, the site is a very large brownfields area having been reclaimed by industry and government since the closure of the mine in 1987. A substantial amount of infrastructure exists that the proposed Project can utilize including:

- Known and adequate foundation conditions for the Hydrometallurgical Plant;
- Known and adequate tailings basin for the hydrometallurgical tailings facility;
- Direct Access via Territorial Highways 5 and 6. Highway 5 is classified as an all-weather highway by the GNWT Department of Transportation (DOT). The highway is rated for year-round use by commercial vehicles with no load restrictions for haul truck traffic and connects directly to the Canadian National Railways (CN) railhead located at Hay River; and
- Substation and line power service through the Northwest Territories Power Corporation (NTPC) from the Talston Dam.

Additional site preparation and construction for the Hydrometallurgical Plant will include:

- Upgrading existing property access roads;
- Constructing a haul road from the Hydrometallurgical Plant to the dock facility at Great Slave Lake; and
- Utilizing a combination of steel and prefabricated structures for most surface facilities.

0	31MAR'10	ISSUED WITH FINAL REPORT	MRP	SIR	MRP	MRP
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D

LEGEND:

- EXISTING TAILINGS
- PROPOSED WATER
- PROPOSED TAILINGS
- PROPOSED EMBANKMENT
- PROPOSED ACCESS ROAD
- HYDRO POWER SUPPLY
- PROPOSED EMERGENCY OVERFLOW SPILLWAY
- PROPOSED DECANT STRUCTURE
- PROPOSED TAILINGS PIPELINE ROUTE
- PROPOSED EXCESS WATER DISCHARGE CHANNEL

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 11N.
2. IMAGE PROVIDED BY AVALON METALS INC.

SCALE A 600 300 0 1000 2000 3000 m

AVALON RARE METALS INC.

THOR LAKE PROJECT

HYDROMETALLURGICAL PLANT SITE GA

Knight Piésold CONSULTING

P/A NO.	REF NO.
101-390/1	4

FIGURE 2.8-1 REV 0

2.8.2 Processing

2.8.2.1 Hydrometallurgical Plant

The design for the Hydrometallurgical Plant assumes an initial concentrate throughput at a 1000 tpd mining rate. Based on this assumption, the Hydrometallurgical Plant will process 65,700 tpa of concentrate on a dry basis. At 351 operating days per year and 90% availability, the Plant will operate for 7,582 hours each year for an average concentrate throughput of 8.67 tph or 208 tpd. Following expansion of the Mine to 2000 tpd in year four, the annual and hourly throughputs will be doubled.

A REE mineral flotation concentrate will be shipped as a moist filter cake from the Nechalacho Mine and Flotation Plant site to the Hydrometallurgical Plant site. The initial concentrate volume will average 180 tpd, rising to 360 tpd after about four years.

Acid Bake

Concentrate will be dumped from the shipping containers, mixed with concentrated sulphuric acid, heated to a temperature of 200º C and held with agitation for about one hour in a rotary kiln. The acid-baked products will be quenched with water and the resulting slurry will be pumped to automatic filter presses. The washed and blow-dried acid bake residue will be conveyed to the caustic cracking plant.

Caustic Cracking

Acid bake residue will be mixed with caustic soda solution, placed in process containers and moved through a tunnel furnace where it will be held at 600º C for 3 hours. At the end of the cracking process, the caustic crack calcine will be dumped from the container into a quench tank and the container will be cleaned and recycled.

Water Washing and Filtration

The calcine will be water washed and filtered. The resulting caustic crack residue will be sent for further processing. The caustic crack calcine water wash solution will be processed to remove contaminants, evaporated and new caustic soda solution will be added. This resulting solution will be re-used to treat acid bake residue.

Caustic Regeneration and Evaporation

The caustic crack process will liberate the zirconium, HREE, residual LREE, niobium and tantalum in the ore. The caustic crack residue will be leached with sulphuric acid which will dissolve all these elements.

Double Salt Precipitation

The pregnant solution from the acid bake process and from the caustic crack residue leach process will be combined and sodium sulphate added. This will cause the LREE to precipitate as double salts. These will be filtered from the mixed solution, dried and packed as a LREE product.

Solvent Extraction

The filtrate from the double sulphate step will contain all of the zirconium, HREE, niobium and tantalum. These will be sequentially recovered using three different solvent extraction (SX) systems. In the SX process, the aqueous stream will be contacted with an organic stream comprising kerosene and an active reagent that extracts the metal of interest away from unwanted elements which remain in the aqueous solution. The organic will then be stripped free of the element of interest and recycled to extract more metal.

Product Drying

The three SX circuits will produce partially refined strip solutions containing, respectively, zirconium, HREE, niobium and tantalum. Each metal of interest will be precipitated. The precipitates will dry and will subsequently be packed in shipping containers for transport to market.

Residue from the leaching operations will be neutralized with limestone and lime, along with excess acid, in a series of neutralization tanks. The final tailings from the Hydrometallurgical facility will predominantly consist of gypsum. It will be pumped to the tailings facility described below in Section 2.8.3.

The overall process is illustrated in the following block diagram (Figure 2.8-2).

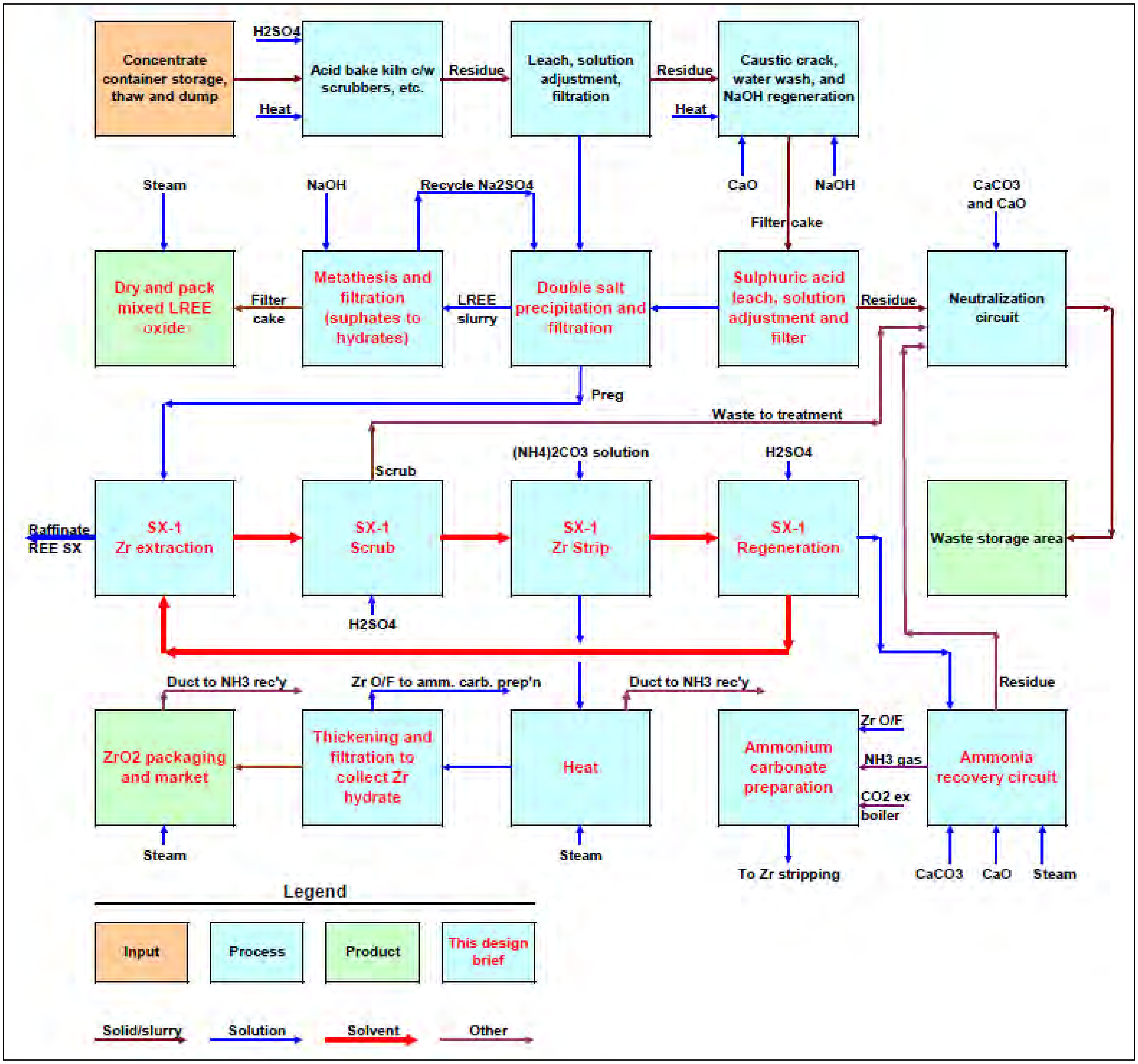


Figure 2.8-2: Hydrometallurgical Plant Process Block Diagram

2.8.2.2 Reagents

The process reagents currently planned to be used in the Hydrometallurgical Plant process during phase one and phase two operations are included in Table 2.8-1. Avalon does not consider the list complete and anticipates changes in quantities as the process is optimized.

TABLE 2.8-1: HYDROMETALLURGICAL PLANT: AVERAGE REAGENT CONSUMPTION ESTIMATE (TPA)

Reagent	Phase 1 Years 1-3 tpa	Phase 2 Years 4+ tpa
	180 tpd @ 1000 tpd Mining rate	360 tpd@ 2000 tpd Mining rate
Limestone	110,000	220,000
Lime	15,000	30,000
Na_2CO_3	5,100	10,200
H_2SO_4	101,000	202,000
HCl	7,000	14,000
NaOH	10,000	20,000

Limestone

The Hydrometallurgical Plant will utilize limestone and lime as neutralizing agents that will be added to the waste stream prior to discharge into the tailings management facility. The total annual limestone requirements for the first three years of operation will be approximately 137,000 tpa. Of this amount, 110,000 tpa will be minus 15 mm crushed limestone (containing 100% $CaCO_3$). This limestone will be further ground at the site to 44 micron prior to introduction into the waste stream. The other 27,000 tpa of limestone will be calcined to produce 15,000 of burnt lime.

Limestone requirements will double in year four to 274,000 tpa to meet Mine production requirements. Of this amount, 220,000 will be crushed to 44 micron prior to introduction into the waste stream. The other 54,000 tpa will be calcined to produce 30,000 tpa of burnt lime.

Supply. Avalon plans to obtain the limestone from local Pine Point area sources. The Company intends to work with the GNWT and its aboriginal partners to develop supply contracts for limestone originating from the Alexandra Reef-Complex, a known limestone complex (Gal & Anastas, 2007), located approximately 100 km from the proposed Hydrometallurgical site.

Avalon is also investigating alternative limestone sources located within the immediate Hydrometallurgical Plant site area. The Pine Point area is known to contain widespread dolomites and limestone. The geologic marker referred to as the "Slave Point Formation" contains micritic limestone which can range from 40-80 m thick (Hannigan, 2006). The Company is considering several open pits that remain from the historic Pine Point operations as potential limestone sources. The Company will conduct detailed analyses and tests during the summer of 2010 to determine the feasibility of this source.

Sulphuric Acid

Sulphuric acid will be needed to operate the Hydrometallurgical Plant. The Company anticipates either purchasing the sulphuric acid from suppliers in the south or purchasing elemental sulphur and producing the sulphuric acid in a plant located at the Hydrometallurgical Plant site.

If sulphuric acid is purchased from a supplier, 101,000 tpa on a 100% acid basis will be required during the first three years of operation. This amount will double to 202,000 in year four. If an acid plant is installed, 33,000 tpa of elemental sulphur will be required to produce the required sulphuric acid during the first three years, and double to 66,000 tpa in year four.

Supply. If Avalon purchases the sulphuric acid from a supplier, it will be brought to Hay River in unit trains, discharged into holding tanks at the siding, and then transported to the Hydrometallurgical Plant site in tanker trucks.

If Avalon constructs a sulphuric acid plant at the Hydrometallurgical Plant site, elemental sulphur will be brought to the site by truck and converted to sulphuric acid. The sulphuric acid plant specified by Avalon would be a Double Conversion, Double Absorption (DCDA) unit designed to meet the highest environmental standards. Heat recovery would be an important part of the design. Sulphuric acid produced in the plant would be stored in a tank prior to use in the Hydrometallurgical Plant.

2.8.2.3 Coal for Heating

The Project will use as much steam as is available from the acid plant to evaporate solutions and dry products. Some additional steam will be required beyond what the acid plant can produce. High quality, low sulphur coal will be used as a high heat fuel for the Hydrometallurgical Plant boilers and for acid bake and caustic cracking thermal processes.

Approximately 35,100 tpa will be needed for the phase one (1000 tpd) operation, increasing to 70,200 tpa for the phase two (2000tpd) operation. The coal will be shipped by rail to Hay River and then transported by truck to the Hydrometallurgical Plant where it will be unloaded and stockpiled near the Hydrometallurgical Plant for use in the boilers. Clean coal technologies, stack testing and air quality monitoring will be employed to ensure that federal and territorial ambient air quality objectives continue to be met in the airshed. Other potential fuel sources, such as oil, hydro-electric and geothermal power are also being investigated.

Avalon recognizes that coal is not the most environmentally preferred method for heating. However, it is necessary as an economic heating source for the Hydrometallurgical Plant. The Company will be investigating the use of Biomass and geothermal power as alternative heating sources.

2.8.2.4 Concentrate Storage and Loading

The concentrate from the Nechalacho Mine and Flotation Plant will be barged in enclosed 22 tonne intermodal containers to the seasonal Hydrometallurgical Plant dock facility to be located on the south shore of Great Slave Lake. The concentrate will be unloaded from the barges and trucked 8.6 km to a secure storage area located on the west side of the Hydrometallurgical Plant. Forklifts will move the containers into a heated thaw shed located adjacent to the Plant.

Once in the thaw shed, the concentrate will be removed from the containers and transferred to the Hydrometallurgical Plant. The empty containers will be cleaned, transported back to the dock facility and barged back to the Nechalacho Mine and Flotation Plant site.

2.8.2.5 Product Transportation to Railhead

The Hydrometallurgical Plant will produce approximately 80 tpd of final products. This amount will double to 160 tpd starting in year four. The final products will include a rare earth carbonate and oxides, and zirconium, niobium and tantalum oxides. The high value of the products will ensure that they will be stored and handled very carefully to eliminate any potential product loss during packaging. The rare earth, zirconium and niobium products will be packaged in sealed one tonne bulk bags. The tantalum product will be sealed in plastic drums. The packaged final products will be placed in covered and secure temporary storage in preparation for shipment to the railhead in Hay River.

The packaged products will be hauled 85 km from the Hydrometallurgical Plant to the Hay River railhead on flatbed trucks. Truck shipments are expected to occur once or twice per week due to the small volume of final products produced daily. The final products will be direct-shipped from the railhead to downstream customers.

2.8.2.6 Hay River Railhead

The packaged products transferred from the Hydrometallurgical Plant site to the railhead facility located outside Hay River will be temporarily stored in a secured enclosure. The enclosure will not require heat and will have forklift access for loading the product into rail cars. Avalon envisions that this railhead facility will be located on CN's property and will be managed by CN. Avalon will pursue a contractual arrangement with CN to handle and transfer the products shipped from the railhead site.

2.8.3 Hydrometallurgical Plant Waste Management

The following subsections discuss Avalon's Hydrometallurgical Plant waste management strategies for:

- Hydrometallurgical Plant tailings;
- Sewage and greywater; and
- Site, solid and hazardous waste.

2.8.3.1 Hydrometallurgical Plant Tailings

Tailings from the Hydrometallurgical Plant will be directed to the hydrometallurgical tailings facility described below.

Hydrometallurgical Tailings Facility

The proposed hydrometallurgical tailings facility will include a tailings basin for primary settlement of solids and supernatant water storage and a secondary pond (polishing pond) to allow for water treatment, if required. The engineered facility will be located within the existing tailings facility that remains from Cominco's historic Pine Point Mine lead-zinc operations. The proposed site is located approximately 85 km east of Hay River and 8 km north of the former town of Pine Point (Figure 2.8-3). This location was selected because it presents significant environmental and operational benefits for the overall Project. Characteristics of the historic Cominco tailings facility are summarized from the 2006 Restoration and Abandonment Plan update submitted to the Mackenzie Valley Land and Water Board (MVLWB). The characteristics are depicted in Figures 2.8-4 and 2.85 and described below:

- The (historic) tailings facility contains approximately 54 million tonnes of tailings from the Pine Point Mine's lead/zinc open pit mining operations from 1964 till 1988;
- The tailings facility is approximately 2.4 x 2.8 km, has a height ranging from 14 m to 5 m and is contained by perimeter dykes on the south, west and north sides;
- The existing tailings beach slopes from the south (discharge area) to the north at a grade of approximately 0.5 percent;
- Runoff from the historic tailings area collects against the North Dyke to create a water pond;
- Collected runoff from the historic tailings facility is typically treated by lime addition to reduce zinc concentrations, and discharged during the first part of summer (June); and
- A nominal layer (150 mm) of sand and gravel was placed over most of the exposed tailings surface to mitigate dust generation potential following cessation of operations in 1988.

Q:\Vancouver\GIS\ENGINEERING\V151\V15101007_ThorLake\Maps\006_PDR\V15101007_006_Figure2_8-3_RoadCorridor.mxd

ISSUED FOR USE

THOR LAKE PROJECT

Location of Historic
Pine Point Tailings and Smelter Site

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:70,000

1 0.5 0 1

Kilometres

FILE NO.
V15101007_006_Figure2_8-3_RoadCorridor.mxd

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	RH	0

OFFICE	DATE
EBA-VANC	April 9, 2010

AVALON RARE METALS INC

EBA Engineering Consultants Ltd.

Figure 2.8-3

Photo 1: South dyke looking west (discharge pipeline in foreground).

Photo 2: South dyke looking northeast.

Photo 3: South dyke looking northwest.

Photo 4: West dyke looking east.

Photo 5: West dyke looking east (Teck Cominco's lime silo and pond in background).

Photo 6: North dyke looking southeast.

Photo 7: North dyke looking east (pond in background).

Photo 8: Teck Cominco's Lime treatment system in foreground. Tailings surface in background looking northeast.

NOTES:
1. PHOTOS PROVIDED BY JOHN GOODE FROM AVALON PROJECT TEAM.
SITE VISIT COMPLETED SEPTEMBER 2009.

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	24MAR'10	ISSUED WITH MEMO	RSM	MRP	MRP

AVALON RARE METALS INC.

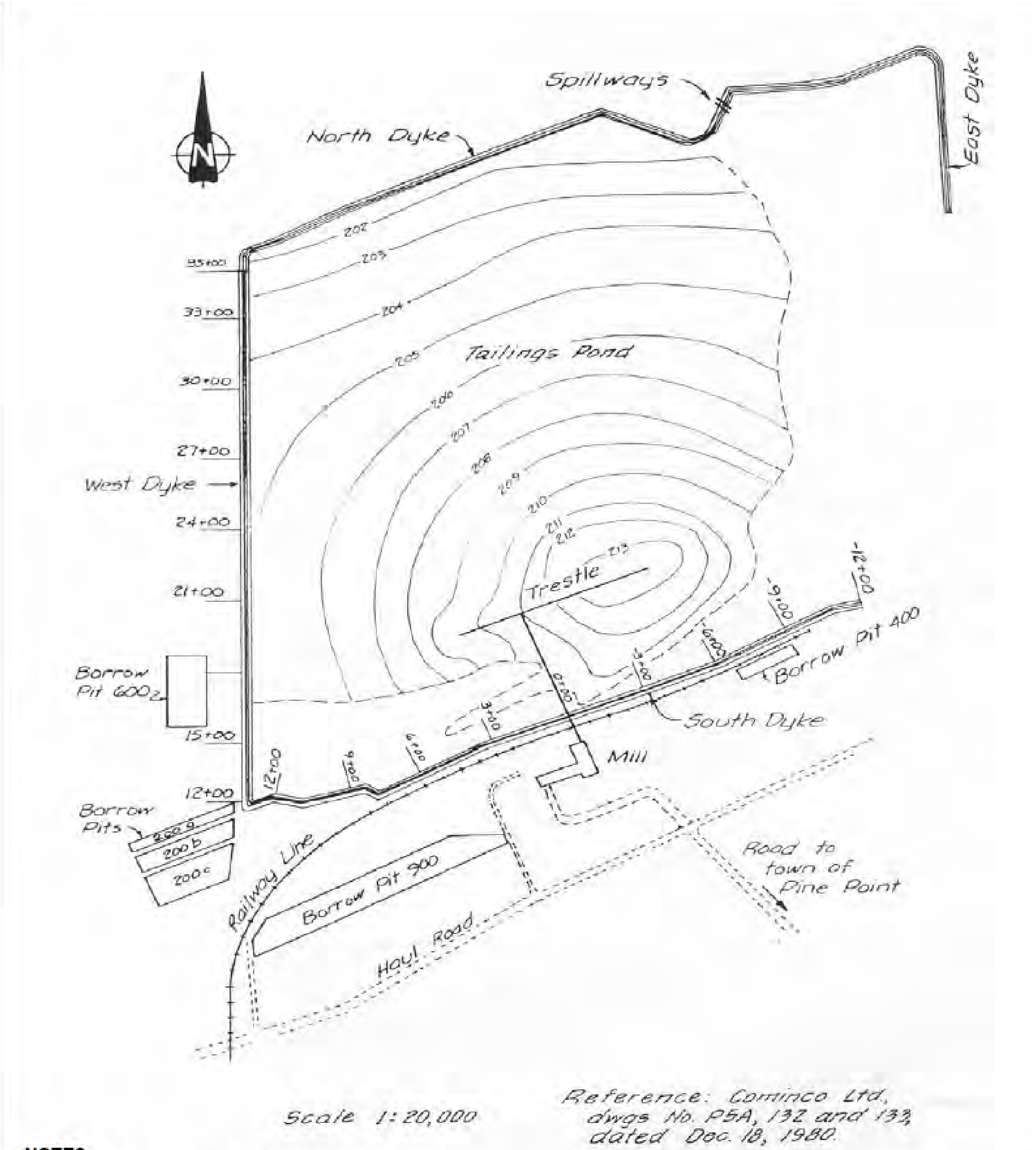
THOR LAKE PROJECT

PHOTOS OF HISTORIC TECK COMINCO TAILINGS POND PHOTO SUMMARY (SHEET 1 OF 1)

Knight Piésold CONSULTING

P/A NO.	REF. NO.
NB101-390/1	NB10-00133

FIGURE 2.8-4 REV 0



NOTES:

1. FIGURE OBTAINED FROM TECK COMINCO, 2006. PINE POINT MINE – UPDATE TO RESTORATION AND ABANDONMENT PLAN TAILING IMPOUNDMENT AREA, DECEMBER 2006.
2. FIGURE SHOWS THE HISTORIC LOCATION OF THE MILL, TRESTLE AND BORROW PITS. THE MILL AND TRESTLE WERE REMOVED DURING RECLAMATION OF THE SITE. THE RAILWAY LINE IS AN ABANDONED LINE.

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	24MAR'10	ISSUED WITH MEMO	RSM	MRP	MRP

AVALON RARE METALS INC.

THOR LAKE PROJECT

HISTORIC TECK COMINCO TAILINGS POND PLAN

Knight Piésold CONSULTING

P/A NO. NB101-390/1 | REF. NO. NB10-00133

FIGURE 2.8-5 REV 0

Figure 2.8-5: Historic Teck Cominco Tailings Pond Plan

The principle objective of the Hydrometallurgical tailings management facility design is to ensure protection of the environment during operations and in the long-term (after closure) in order to achieve effective reclamation at Mine closure. The design takes into account the following requirements:

- Permanent, secure and total confinement of all tailings solids within an engineered facility;
- Control, collection and removal of free draining liquids from the tailings during operations to recycle process water to the maximum practical extent; and
- Inclusion of monitoring features for all aspects of the facility to ensure performance goals are achieved and that design criteria and assumptions are met.

The design criteria for the tailings management facility are based on federal standards for the design of dams. In particular, all aspects of the design have been completed in general conformance with:

- Canadian Dam Association (CDA) Dam Safety Guidelines (CDA, 2007); and
- The Mining Association of Canada (MAC) Guide to the Management of Tailings Facilities (MAC, 1998).

Design and Construction

The design for the hydrometallurgical tailings facility is based on an approximate project life of 14 years. The initial throughput of tailings from the Hydrometallurgical Plant will be 1,000 dry tpd (based on processing 180 tpd concentrate) and will increase to 2,000 dry tpd (based on processing 360 tpd concentrate) by year four of operations.

The hydrometallurgical tailings facility design includes a phase one and phase two construction configuration. Phase one will include construction of the tailings basin embankments to an intermediate level (3 m below the final design crest) to provide containment of tailings solids and supernatant water for the first three years.

Phase two will begin in year four and will include three sequential one meter raises to the embankments. The embankment raising schedule provides sufficient freeboard to safely accommodate the supernatant pond and Environmental Design Storm event, combined with wave run-up. An emergency overflow spillway is included to pass the Inflow Design Flood event. The proposed polishing pond is preliminarily planned to be constructed during the first year of operations.

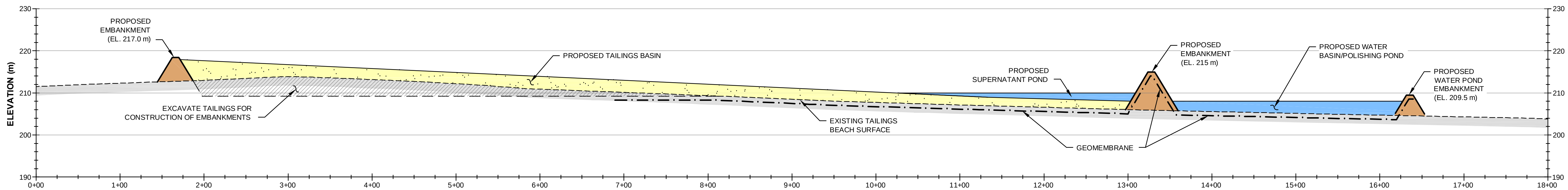
The tailings basin will be a square paddock with dimensions of approximately 1200 m x 1200 m. The polishing pond will be rectangular with dimensions of approximately 1200 m x 300 m. Both basins will be situated on the existing historic tailings surface. The tailings basin and polishing pond will be developed by constructing embankments on all 4 sides. The sand and gravel cover material and historic tailings within the paddock footprint area are the proposed materials for embankment construction. It is assumed that the nearby historic borrow areas that remain from the historic Pine Point Mine operations could be reopened to supply granular material for the construction of the embankments if required. The existing tailings material is expected to be relatively well drained near surface.

The embankment section will consist of a homogeneous berm comprised mainly of compacted historic tailings with a sand blanket drain to collect any seepage. In order to control or minimize seepage, the north portion of the tailings basin where supernatant water will collect will be lined with a geomembrane. The geomembrane will be laid on a prepared and graded subgrade following excavation of sand and gravel cover and historic tailings for berm construction. An underdrain system consisting of a series of perforated CPT pipes surrounded in drainage gravel will be placed under the geomembrane to monitor the performance of the geomembrane liner system. The geomembrane will be covered on the upstream slopes of the containment berm with a cover layer of historic tailings followed by riprap (separated with a non-woven geotextile) to prevent damage from ice. The water basin to the north of the tailings basin will be lined with a geomembrane liner using the same construction techniques. The maximum height of the tailings basin and polishing pond embankments will be 10 m and 6 m, respectively. The final crest width will be 8.0 m (including 2 m allowance for pipelines) and slide slopes will be 3.0H:1V.

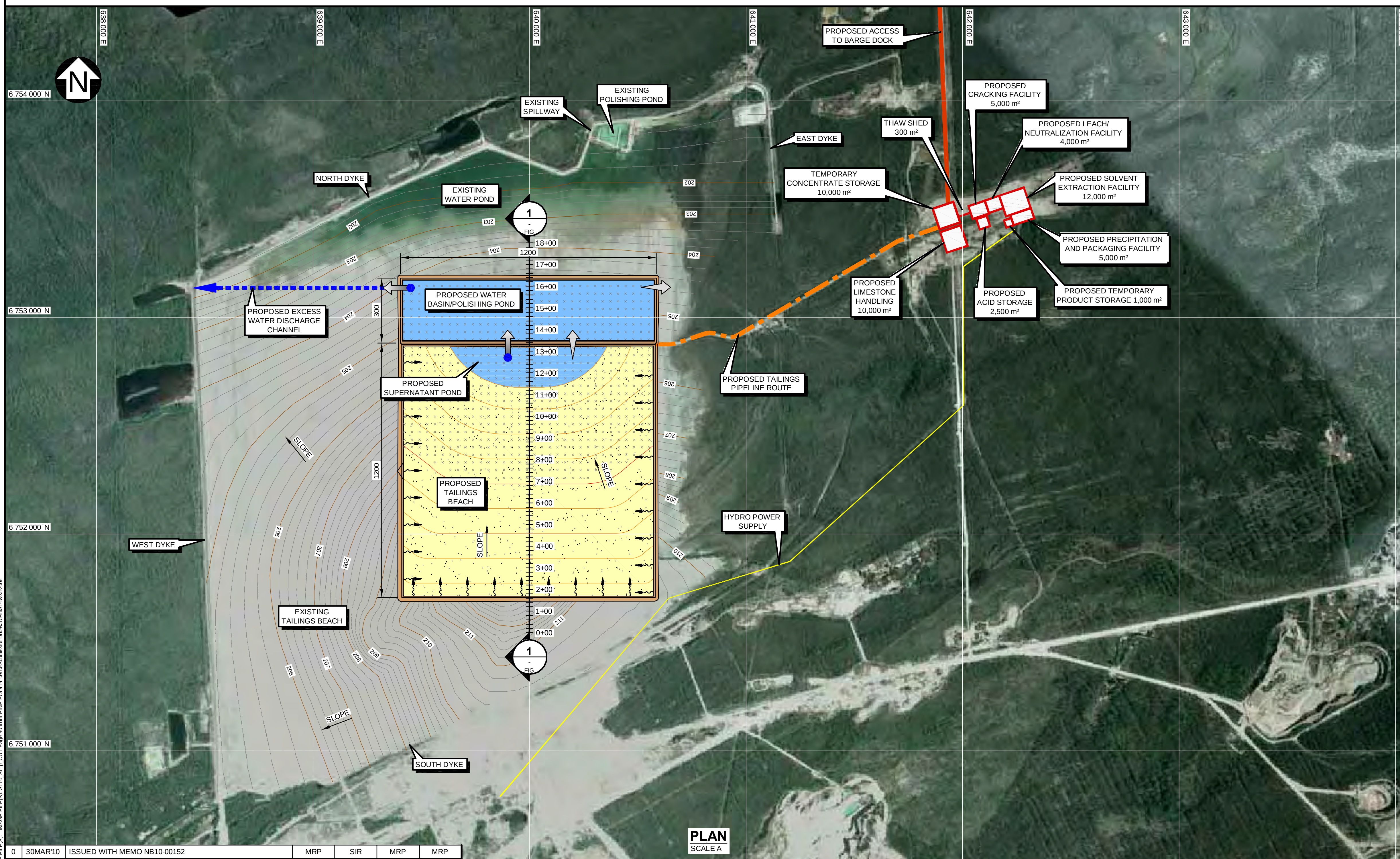
Tailings Delivery and Distribution

Tailings slurry will be pumped from the proposed Hydrometallurgical Plant site to the tailings basin via insulated tailings delivery pipelines located along the existing access road alignment shown on Figure 2.8-6. One pipeline will be installed for initial production while a second pipeline will be installed before year four to account for the increased throughput.

Distribution pipelines will be placed around the east, south and west sides of the tailings basin. Tailings deposition to the basin will consist of single end-of-pipe discharge from the tailings deposition pipeline to reduce icing concerns during the winter months. During the entire operations, 100% of the tailings solids will be pumped to the Tailings Basin at a slurry consistency of 20% solids by weight. Tailings discharge will be rotated between deposition locations to develop a relatively flat tailings beach sloping towards the north and to maintain the supernatant pond in the northern portion of the tailings basin. A polishing pond receiving treated flows will be constructed to the north side of the tailings basin if monitoring and testwork indicate that it is required.



1 SECTION
THROUGH TAILINGS MANAGEMENT FACILITY
HORIZONTAL: SCALE B
VERTICAL: SCALE C



PLAN
SCALE A

LEGEND:

- EXISTING TAILINGS
- PROPOSED WATER
- PROPOSED TAILINGS
- PROPOSED EMBANKMENT
- EXCAVATED TAILINGS
- APPROXIMATE EXTENT OF GEOMEMBRANE LINER
- PROPOSED ACCESS ROAD
- HYDRO POWER SUPPLY
- PROPOSED EMERGENCY OVERFLOW SPILLWAY
- PROPOSED DECANT STRUCTURE
- PROPOSED TAILINGS PIPELINE ROUTE
- PROPOSED EXCESS WATER DISCHARGE CHANNEL
- BITUMINOUS GEOMEMBRANE
- PROPOSED TAILINGS DISTRIBUTION PIPELINE

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 11N.
2. IMAGE PROVIDED BY AVALON METALS INC.
3. TAILINGS BEACH CONTOURS BASED ON FIGURE 2 OF TECKCOMINCO REPORT ENTITLED "PINE POINT MINE – UPDATE TO RESTORATION AND ABANDONMENT PLAN TAILING IMPOUNDMENT AREA" DATED DECEMBER 2006. CONTOUR INTERVAL IS 0.2 METRES.
4. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

SCALE A: 200 100 0 200 400 600 800 1000 m
SCALE B: 50 25 0 50 100 150 200 250 m
SCALE C: 10 5 0 10 20 30 40 50 m

AVALON RARE METALS INC.

THOR LAKE PROJECT

HYDROMETALLURGICAL TAILINGS FACILITY PLAN AND SECTION

Knight Piésold CONSULTING

P/A NO.	REF NO.
NB101-390/1	NB10-00152

FIGURE 2.8-6 REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
0	30MAR'10	ISSUED WITH MEMO NB10-00152	MRP	SIR	MRP	MRP

SAVED: I:\1\01\00390\01\A\Acad\Figs\654_r0 , 3/30/2010 3:48:50 PM , SRICHARD PRINTED: 3/30/2010 4:00:37 PM , Layout1 , SRICHARD

2.8.3.2 Sewage and Greywater

Sewage and greywater waste from the operation will be processed through a standard packaged sewage treatment plant (Rotating Biological Contactor). Treated sewage effluent will report to a tailings sump that will be comingled into the tailings slurry. The slurry will report to the hydrometallurgical tailings facility.

2.8.3.3 Site, Solid and Hazardous Waste

Garbage will be collected daily and incinerated consistent with current industry good management practices. Recyclable materials will be collected separately and shipped out annually for processing. A waste management site will be established on-site for the temporary storage of waste materials prior to removal.

Generated solid wastes will be managed in accordance with NWT regulations and issued licenses or permits similar to Avalon's current management of site solids and wastes. Hazardous materials waste will be disposed of in accordance with current GNWT hazardous waste management guidelines using standard best management practices. Waste will either be disposed of on-site or be shipped to an approved off-site facility designed to handle hazardous wastes.

2.8.4 Water Management

The primary objectives of the Hydrometallurgical Plant site water management plan are to:

- Provide potable water for surface facilities;
- Provide the Hydrometallurgical Plant with a reliable water supply throughout the Project; and
- Contain and manage all discharge water in the proposed hydrometallurgical tailings facility.

2.8.4.1 Water Balance

Water for the Hydrometallurgical Plant site will be sourced from one of the nearby open pits that remain from the historic Pine Point mining activities. The pits' water supply originates primarily from the unlimited groundwater resource that is characteristic of the Pine Point area.

All tailings solids and fluids, as well as, impacted water from the Hydrometallurgical Plant will report to the tailings basin. Excess water from the tailings basin will be treated (if necessary) and discharged from the polishing pond through a lined discharge channel to the northwest corner of the existing tailings facility where it will be discharged to the natural drainage.

Decant pipeworks have been included in the design to transfer water from the tailings basin supernatant pond to the polishing pond, and to transfer water from the polishing pond to a lined discharge channel where it will be discharged to the natural drainage. Any water released from the polishing pond is expected to be in compliance with anticipated MVLWB Water License criteria. Water balance details are found in (Figure 2.8-7)

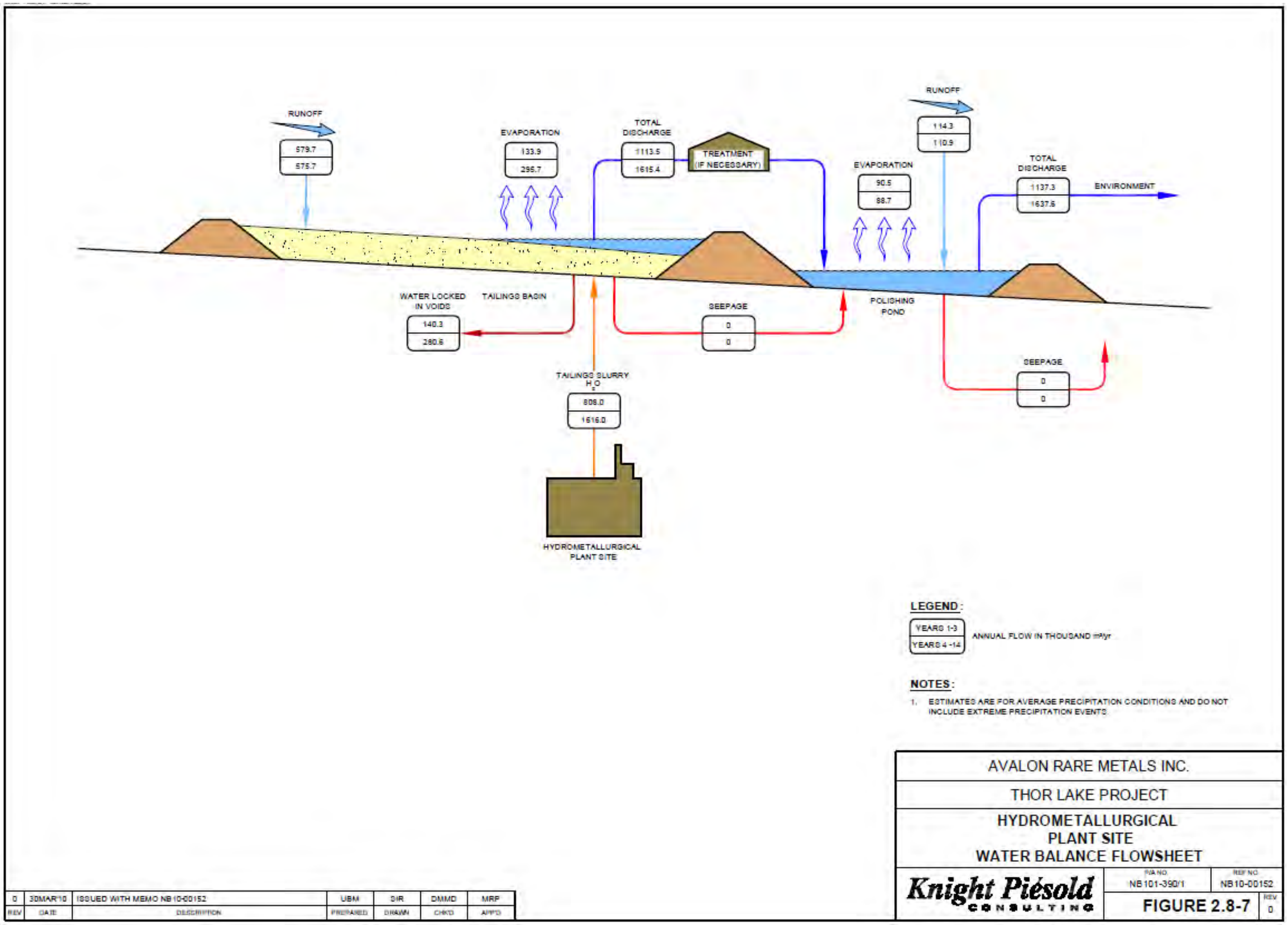


Figure 2.8-7: Hydrometallurgical Plant Site Water Balance Flowsheet

2.8.5 Support Infrastructure

2.8.5.1 Power

Average power consumption for the Hydrometallurgical Plant facility during start-up through year four is estimated at 6 MW. This power will be provided through the existing Northwest Territories Power Corporation (NTPC) power grid and substation located at the former Pine Point Mine site. The substation power feed comes from the NTPC Talston Hydroelectric Dam, located approximately 64 km north of Fort Smith on the Talston River. Additional power will be required during the operations ramp up in year four. Up to 5-10 MW of supplementary power may be required at the Hydrometallurgical Plant during full production. Additional power needs will be obtained either through the Talston Dam expansion or through secondary diesel generated power. Wind and geothermal power are also being investigated as supplementary power sources for the Hydrometallurgical Plant site.

Additional Power

Secondary and backup supply of power will be provided by diesel powered generating units on-site. The diesel power plant will be designed to progressively meet the increased needs of planned Hydrometallurgical Plant production.

2.8.5.2 Site

The Hydrometallurgical Plant will be comprised of a combination of prefabricated and steel structures to house the process components. The structures are planned to be organized into a compact unit to optimize the Hydrometallurgical Plant's operations efficiencies. An uncovered coal and limestone storage and handling area will be located adjacent to the temporary concentrate storage area, southwest of the other Plant structures. The Hydrometallurgical Plant structures are planned to include:

- Cracking Facility; Administration Offices;
- Leach/Neutralization Facility;
- Solvent Extraction Facility;
- Precipitation and Packaging Facility;
- Temporary Product Storage;
- Acid Plant and Storage;
- Limestone Grinding and Kiln;
- Temporary Concentrate Storage; and
- Thaw Shed.

2.8.5.3 Fuel Storage

For phase one of the Project, only limited amounts of fuel will be utilized at the Hydrometallurgical Plant for various personnel vehicles, product transport trucks and other mobile equipment. A small fuel storage area (diesel and gasoline) will be located immediately adjacent to the Plant in an approved and designed cache designed to accommodate 110% of the largest tank capacity in conformance with the CCME environmental code of practice for fuel storage tanks. Avalon estimates that the storage area will contain between 10-20,000 litres of fuel, with resupply obtained from Hay River as needed.

2.8.5.4 Coal and Limestone Storage

Coal is currently planned to be used to generate the balance of heat required for the acid bake and caustic crack methods. The Hydrometallurgical Plant will require 100 tpd of coal during the first three years of operations and will increase to 200 tpd in year four. All coal will be shipped from the south via railway into the transload facility located immediately south of Hay River at the intersections of highway #2 and #5. The coal will be transported by truck 85 km along highway #5 & #6 to the Hydrometallurgical Plant site. It will be stockpiled near the Hydrometallurgical Plant in an open stockpile that will be sloped and lined to prevent water intrusion or seepage. Any water that pools will be collected and recycled for dust control.

Limestone will be used to neutralize the Hydrometallurgical Plant's waste stream prior to discharge to the tailings management facility. The Hydrometallurgical Plant will require 390 tpd of limestone during the first three years of operations and will increase to 780 tpd in year four. The crushed limestone will be supplied by local supply sources and stockpiled in a designated area that is in close proximity to the Hydrometallurgical Plant. Because the limestone is a neutralizing product, no special stockpile considerations will be necessary.

2.8.5.5 Roads

A haul road will be constructed to transport the offloaded concentrate from the dock facility to the Hydrometallurgical Plant. The haul road will be approximately 8.6 km long and will be aligned directly north-south along an existing drainage ditch for approximately 4.9 km prior to connecting to an existing haul road from a former mine pit located to the north of the main Pine Point Mine area. The haul road will be constructed using readily available local road construction material derived from the historic Pine Point Mine operations.

2.8.5.6 Dock Facility

The Great Slave Lake shore topography on the south side of the lake is generally low-lying and the water is relatively shallow (< 2 m). To reach the necessary 3 m minimum water depth required for the seasonal barging operation, the Hydrometallurgical Plant dock facility will consist of two moored barges that will extend offshore and be connected to the shore by a ramp. The ramp will be capable of handling the cargo loading and unloading equipment and associated activities. The seasonal dock will be utilized only during the open water period. The adjacent upland area will be developed into a marshalling yard to receive the concentrate containers from the Nechalacho Mine and Flotation Plant site. The yard will also handle and load/offload the annual consumables needed for the Mine. The conceptual barge configuration for the Hydrometallurgical Plant site dock facility is depicted in Figure 2.8-8.

Figure 2.8-8: Hydrometallurgical Plant Site Dock Facility Layout

2.9 HUMAN RESOURCES

As already noted, Avalon's proposed TLP is comprised of two primary locations: the Nechalacho Mine and Flotation Plant site, and the Hydrometallurgical Plant site. The Nechalacho Mine and Flotation Plant site will be located approximately 100 km southeast of Yellowknife. The proposed base case Hydrometallurgical Plant site will be located at the historic Pine Point Mine approximately 85 km east of Hay River. Human resources considerations for both locations are included in this section.

2.9.1 Work Schedule

2.9.1.1 Nechalacho Mine and Flotation Plant Site

The Nechalacho Mine and Flotation Plant site is planned to operate 365 days per year with a 24/7 schedule. Crews will have 12 hour scheduled shifts. Management and technical personnel may have a varied schedule.

The employment schedule will be based on fly-in/fly-out transportation, onsite camp facilities and a three week in/three week out rotation. The planned rotation will include periods of overlap for key personnel to ensure continuity and safe operations. Avalon will provide employees' flights to the site. Flights are planned to originate from Edmonton, Yellowknife, Lutsel Ku'e and Hay River.

2.9.1.2 Hydrometallurgical Plant Site

The Hydrometallurgical Plant site is planned to operate 351 days per year with a 24/7 schedule. The Plant will shut down for maintenance 14 days every year during the summer. All employees with the exception of staff and contract maintenance will take vacation during the annual shutdown. Crews will have 12 hour scheduled shifts. Management and technical personnel may have a varied schedule.

Avalon will provide employees bus transportation from Hay River and Fort Resolution to the Hydrometallurgical Plant site. The site is accessible year round via Territorial Highways 5 and 6.

2.9.2 Manpower

2.9.2.1 Nechalacho Mine and Flotation Plant Site

Construction of the Nechalacho Mine and Flotation Plant will occur over a period of 16-24 months. Manpower requirements are estimated at 100-200 full-time positions during this period. Current estimates indicate that 75-150 persons will be employed at the site at any given time during construction. An additional 25-50 persons may be employed in prefabrication activities near Hay River at any given time during this period. The construction jobs will include employment generated through the third-party business contract opportunities required to service the Project.

Manpower requirements for operating the Nechalacho Mine and Flotation Plant are estimated at 184 full-time employees. This population is anticipated to include 17 administrative, 107 mine operations, 12 development and 48 flotation plant operations positions (Table 2.9-1).

Following cessation of all operations, approximately 20 positions will be retained for reclamation of the Nechalacho Mine and Flotation Plant site.

2.9.2.2 Hydrometallurgical Plant Site

Construction of the Hydrometallurgical Plant will occur over a period of 16-24 months. Manpower requirements are estimated at 100-200 full-time positions during this period. Current estimates indicate that 75-150 persons will be employed at the site at any given time during construction. An additional 25-50 persons may be employed in prefabrication activities near Hay River at any given time during this period. The construction jobs will include employment generated through the third-party business contract opportunities required to service the Project.

Manpower requirements for the Hydrometallurgical Plant located at the former Pine Point Mine site is estimated at 88 full-time employees. This population is anticipated to include 9 administrative and 79 Hydrometallurgical Plant positions (Table 2.9-2).

Approximately 10 positions will be retained for reclamation of the Hydrometallurgical Plant site following completion of all operations.

2.9.3 Training Programs

Avalon is committed to employee training. The Company recognizes that training initiatives are critical to achieving a healthy, safe and productive workplace. Training initiatives will focus on site-based programs that train employees in specific skills, safety, environmental and administrative subjects.

The Nechalacho Mine and Flotation Plant will employ a full-time trainer and full-time environmental, health and safety (EHS) manager to implement and deliver specific training sessions. The Hydrometallurgical Plant will employ a full-time trainer/EHS manager to deliver training at that location. Support personnel at both locations, including front-line supervisors, security personnel and the human resources manager will assist. Outside help will be arranged from suppliers of equipment and materials used at the sites. Both the temporary office building at the Nechalacho Mine and Flotation Plant site, as well as, the Hydrometallurgical Plant will have a room suitable for conducting training sessions.

Training areas will include:

- Safety systems and safe work practices;
- First aid and emergency response;
- Environmental and waste management;
- Skill specific on-the-job training (supervisor and employee);

- Apprenticeship training programs (skilled employee and employee); and
- Administration functions.

All employee operation training records will be managed by the EHS Manager and stored in a training database. The database will track and monitor employee skill sets and training dates. An annual review of personnel and training records will be conducted to ensure that employees have the proper certification and training required for the tasks they are assigned.

TABLE 2.9-1: NECHALACHO MINE & FLOTATION PROCESS PLANT OPERATIONS MANPOWER - TOTAL 184

Administration	
General Manager	1
HR	1
EHS Manager	1
Trainer	1
Accounting	2
Payroll Administrator	1
Clerk/Switchboard	1
Purchasing Agent	1
Warehouse	2
Security/First Aid	2
Camp	4
Subtotal	**17**

Mine Operations	
Operations Superintendent	1
General Supervisor	2
Engineer	2
Geologist	2
Surveyors/Tech.	2
Shift Supervisor	4
Maint. Superintendent	1
Maint. Supervisor	4
Maint. Planner	1
Drilling	12
Blasting	12
Crusher/Loader Operator	4
Mucking	12
Scaling/Bolting	8
Labourers/Sup. Equip	6
Material Handling	4
Pumping/Sumps	2
Ventilation	2
Road Maintenance	2
Mechanics	12
Maint. Support	4
Maint. Apprentice	4
Electricians	4
Subtotal	**107**

Development	
Miners & Support	12
Subtotal	**12**

Flotation Process Plant Operations	
Superintendent	1
Metallurgist	2
Planner/Clerk	1
Shift Supervisor	4
Crushing/Grinding	4
Control Room Operator	4
Flotation	4
Concentrate Dewatering/Misc.	4
Concentrate Loading	2
Helpers	4
Sample Prep.	2
Assayers	2
Metallurgical Technician	2
Instrument Technician	2
Mechanics	8
Electricians	2
Subtotal	**48**

TABLE 2.9-2: HYDROMETALLURGICAL PLANT OPERATIONS MANPOWER – TOTAL 88

Administration	
Hydrometallurgical Plant Mgr.	1
EHS Manager/Trainer	1
Accounting	1
Clerk/Switchboard	1
Purchasing Agent	1
Warehouse	2
Security/First Aid	2
Subtotal	**9**

Hydrometallurgical Operations	
Superintendent	1
Metallurgist	2
Planner/Clerk	2
Shift Supervisor	4
Limestone Facility Operators	4
Acid Plant	8
Cracking Facility Operators	4
Leach/Neutralization Operators	4
SX Operators	4
Precip & Packaging	4
Product Loading	4
Helpers	8
Concentrate Prep.	2
Tailings	4
Assayers	4
Technicians	4
Mechanics	12
Electricians	4
Subtotal	**79**

2.9.4 Emergency Medical Response

Avalon will comply with all Emergency Medical Response criteria associated with required health and safety acts. An Emergency Response Plan will be developed and distributed to all employees and posted for easy access in the event of an emergency. Selected employees will be trained in First Aid at both sites, and a mine rescue crew will be on-site at the Nechalacho Mine and Flotation Plant site.

A dedicated first aid facility will be located at both sites. Plans at the Nechalacho Mine and Flotation Plant will include a designated ground vehicle for evacuation to the first aid facility then to the air strip. Seriously injured personnel will be evacuated from the site by air to Yellowknife. Plans at the Hydrometallurgical Plant site will include a designated ground vehicle for evacuation to Hay River and may include medical evacuation options.

3.0 PUBLIC ENGAGEMENT AND COMMUNICATIONS

3.1 COMMUNITIES

Avalon supports and practices the core business value that effective and meaningful communication contributes to the development of sound corporate and community relationships. Throughout the baseline data collection, continuous efforts have been made to keep the public, affected First Nations and regulators informed of the Project and its development activities.

3.2 REGULATORY AGENCIES

Meetings and correspondence with the Department of Indian and Northern Affairs (INAC) and the Mackenzie Valley Land and Water Board (MVLWB) were initiated by Avalon in 2005, and continued throughout the baseline data collection period. The engagement provided Avalon the opportunity to share information, coordinate activities and develop relationships in the proposed TLP area. Communications with regulatory agencies are planned to continue throughout the permitting process and the Project's life.

3.3 OTHER STAKEHOLDERS

The Thor Lake Property is situated in the Akaitcho Territory and is subject to a comprehensive land claim negotiation between several communities of the Dene Nation and Canada's federal government. An interim measures agreement is currently in place and includes a land withdrawal that was implemented in 2007. The land withdrawal precludes new mineral title from being granted by the Crown in the Akaitcho territory for a period of up to five years while a land-use planning process is completed. The rights of existing mineral rights holders in this area are unaffected and Avalon is actively consulting with the four nearest Akaitcho Dene communities. Avalon's intent is to implement a co-operative development approach for the TLP.

To this end, continuous and concerted efforts were made to engage affected First Nations throughout the baseline studies and TLP planning. Efforts included ongoing meetings and correspondence with the TLP area First Nations listed below in Table 3.1-1. To date, all issues have been dealt with in a mutually agreeable fashion and have not restricted the Project's design phase. A complete log of Avalon's community engagement activities is found in Appendix A.

TABLE 3.1-1: THOR LAKE PROJECT AREA FIRST NATIONS	
Yellowknives Dene First Nation P.O. Box 2514 Yellowknife, NT X1A 2P8 Dettah Tel: (867) 873-4307, Ndilo Tel: (867) 873-8951 Dettah Fax: (867) 873-5969, Ndilo.Fax: (867) 873-8545	Lutsel K'e First Nation P.O. Box 28 Lutsel K'e, NT X0E 1A0 Tel: (867) 370-3051 F: (867) 370-3010
Deninu K' ue First Nation P.O. Box 1921 Fort Resolution, NT X0E 0M0 Tel: (867) 394-4335 Fax: (867) 394-5122	K' atlodeeche First Nation P.O. Box 3060 Hay River Reserve, NT XOE 1G4 Tel: (867) 874-6701 Fax: (867) 874-3229
North Slave Metis Alliance P.O. Box 2301 Yellowknife, NT X1A 2P7 Tel: (867) 873-6762 Fax: (867) 669-7442	Hay River Metis Council 102-31 Capital Dr. Hay River, NT X0E 1G2 Tel: (867) 874-4470 Fax: (867) 874-4472
Fort Resolution Metis Council P.O. Box 1921 Fort Resolution, NT X0E 0M0 Tel: (867) 394-4151 Fax: (867) 394-3322	

4.0 ENVIRONMENTAL OVERVIEW

The following sections summarize the existing environmental conditions of the Project's proposed Nechalacho Mine and Flotation Plant site and Hydrometallurgical Plant site areas.

4.1 NECHALACHO MINE AND FLOTATION PLANT SITE

4.1.1 Environmental Information Sources

Descriptions of the existing biophysical environmental conditions of the area of interest have been compiled from numerous studies that have been conducted since the late 1980's. Stantec conducted the most recent round of baseline studies in the proposed Nechalacho Mine and Flotation Plant site area starting in 2008. The complete "Stantec Environmental Baseline Reports – Volumes 1-6" are found in Appendices B-G.

4.1.2 General Ecology

The proposed Nechalacho Mine and Flotation Plant site area is located within the Great Slave Upland High Boreal (HB) Ecoregion, which is a subdivision of the more extensive Taiga Shield HB Ecoregion (Ecosystem Classification Group, 2008). The landscape is dominated by subdued topography and fractured bedrock plains. Black spruce, jack pine, paper birch, and trembling aspen form discontinuous forested patches that are interspersed with exposed rock. Wetlands and peat plateaus commonly form around the margins of shallow lakes, as well as in wetter depressions and lowlands.

Lakes cover a substantial portion of the Ecoregion and several major rivers are also present that eventually drain into Great Slave Lake (Ecosystem Classification Group, 2008). Lakes are characterized as transitional between those located within the former basin of Glacial Lake McConnell, which are more shallow and silty, and those occupying areas at higher elevations, which are deeper and clearer.

4.1.3 Climate and Air Quality

Site specific climate monitoring for various parameters (e.g., temperature, rainfall, wind direction and speed, barometric pressure, relative humidity, and snow depth) has been ongoing at the proposed Nechalacho Mine and Flotation Plant site since June 2008, when a meteorological station was installed near the old mine workings southwest of Den Lake (Stantec, 2010a). These data characterize the site-specific climate of the proposed site area, and provide an opportunity to compare observed trends to regional data collected from several longer-running stations in the greater vicinity. The stations at Yellowknife and Lutsel K'e, in particular, were used for comparison of the meteorological data collected from the Nechalacho Mine and Flotation Plant site area.

Regional climate summaries were also compiled for various meteorological parameters from the following long-term monitoring stations: Inner Whalebacks, Yellowknife A, Lutsel K'e A, Fort Resolution A, Fort Reliance (Aut), and Pine Point.

4.1.3.1 Thor Lake Climate

Air temperature at the proposed Nechalacho Mine and Flotation Plant site recorded from June 2008 to October 2009 displayed typical seasonal fluctuations, with warm temperatures occurring during the summer months and cold temperatures occurring during the winter (Stantec, 2010a). The highest mean monthly temperature was recorded in July 2008, at 15.1°C, while the lowest mean monthly temperature was -25.3°C, recorded in December 2008. Minimum temperatures of colder than -40°C were recorded on several occasions during the winter of 2008-2009, as verified by camp personnel, who reported temperatures near -50°C during this time (the current temperature probe records a minimum temperature of -40°C).

Precipitation falls throughout the year at the site (during the winter months, as snow). Rainfall events become more pronounced starting in June and tend to peak in the late summer, early fall (August – September). Relative humidity is generally highest during the winter months, while summers are generally drier.

The dominant wind direction at the proposed Nechalacho Mine and Flotation Plant site is from the east-northeast (ENE) during November to June (Stantec, 2010a). Wind directions had a tendency to be more dispersed from July to October, however, an ENE trend was still evident. Wind speeds were generally <4 m/s throughout the year, with occasional gusts reaching above this level. The maximum wind speed recorded between late June 2008 and October 2009 was 5.5 m/s (19.8 km/h; Stantec, 2010a).

Six snow courses were established throughout the Nechalacho Mine and Flotation Plant site area during the winter of 2008 (Stantec 2010a). Mean snow depths varied from 31.3 cm to 66.6 cm in the vicinity of Thor Lake. Forested areas that were generally less exposed to wind had a tendency to accumulate the thickest snowpacks.

Specific studies characterizing the air quality in the vicinity of the proposed Nechalacho Mine and Flotation Plant site have not been conducted, however, given that the level of industrial activity in the area has been fairly limited, it is expected that current air quality reflects ambient conditions.

4.1.3.2 Regional Climate

Regional mean monthly temperature trends for all six meteorological stations considered are similar, with the lowest temperatures being recorded in January-February, and the highest around July (Stantec, 2010a).

In relation to regional weather patterns documented by the stations at Yellowknife and Lutsel K'e, the temperatures recorded at the proposed Nechalacho Mine and Flotation Plant site during the 2008-2009 period were similar (temperatures in December 2008 at the proposed site were slightly colder).

Regional precipitation trends are also similar across each station. Precipitation is generally lowest from February to April, gradually increasing to maximum levels between July and

September (Stantec 2010a). Rainfall in particular is consistently highest in August for most stations.

Monthly rainfall at the proposed Nechalacho Mine and Flotation Plant site was generally lower compared to levels recorded in Yellowknife in 2008, while in 2009, patterns were more consistent (Stantec, 2010a).

4.1.4 Hydrogeology

4.1.4.1 Background

A hydrogeological study was carried out by Stantec (2010b) during 2008 and 2009 to provide preliminary baseline information related to the proposed Nechalacho Mine and Flotation Plant site. That work consisted primarily of drilling and installing wells, hydraulic testing, determination of groundwater levels, and the analysis of groundwater chemistry. The following section provides a summary of the key results from those investigations.

4.1.4.2 Summary of Results

Surficial Geology

The landscape in the proposed site area is dominated by bedrock outcrops, interspersed with veneers of unconsolidated till overlying bedrock and topographic depressions consisting of organic accumulations of variable depth. The organic rich horizons are poorly drained, which has led to the preponderance of bogs and fens in these areas.

Aquifers

The conceptual hydrogeological model for the area between Thor Lake and Long Lake consists of a shallow and deep aquifer separated by permafrost. It is unlikely that there is any significant connection between these two aquifers. The shallow aquifer is very near the surface, varying from 0.7 to 4.5 m below ground surface (bgs). It is perched on permafrost, which is estimated to be 60-80 m bgs. The deep bedrock aquifer underlies this layer of permafrost and is thought to flow in a southerly direction in fractures and fault zones before connecting with deep sections of Great Slave Lake. It is not known whether the deep aquifer is hydraulically connected to taliks surrounding the deeper lakes (e.g. Thor Lake) in the proposed site area.

Based on preliminary evidence from drilled well measurements, it is probable that groundwater levels are lowest during winter and highest during spring freshet.

Groundwater Chemistry

Near surface groundwater samples reflected an oxidizing environment, compared with the oxygen reducing environment from which deep aquifer samples were collected. Water quality results were consistent over the two years of sampling, and no seasonal trends were apparent. Chemical analyses identified exceedances of guideline[1] levels for aluminum, copper, cadmium, iron, lead, and silver. These analyses represent natural background geologic and hydrogeologic conditions due to the undeveloped nature of the proposed site area.

4.1.5 Surface Hydrology

4.1.5.1 Background

Existing hydrological information for the Thor Lake Property area is described in two reports, Melville et al. (1989) and primarily, Stantec (2010a). In addition, water flow and water balance calculations have been provided in memo form by Knight Piésold Consulting. Melville et al. (1989) described flow patterns and presented selected data on streamflows, focussing on the Cressy, Den, and Thor Lake systems, and not at all on Thor headwater lakes (e.g. Ring, Buck, Drizzle and Murky Lakes), which will be the aquatic area most affected by the Project, based on preliminary Mine plans.

The Stantec (2010a) hydrologic study consisted of the measurement of lake level and streamflow at nine gauged waterbodies, in combination with the monitoring of climatic conditions recorded at a climate station installed in the area in 2008. A snow survey in the proposed site area was also carried out to coincide with a regional snow study being conducted by Environment Canada.

4.1.5.2 Surface Flow Observations

The observed or presumed direction of surface flow within the Thor Lake Property area is shown in Figure 4.1-1. Flows among Ring, Buck, Drizzle, and Murky Lakes require further ground examination. The shorelines of several of the lakes in the area were found to consist of continuous peatland (Melville et al., 1989), with no apparent connecting channels to other lakes. For example, it was suggested by Melville et al. (1989) that: water from Elbow Lake seeps into Great Slave Lake over a distance of 1.1 km; water from Fred Lake eventually reaches Great Slave Lake after flowing through peatland and small streams; and. water from Cressy Lake seeps into Fred Lake through peatland.

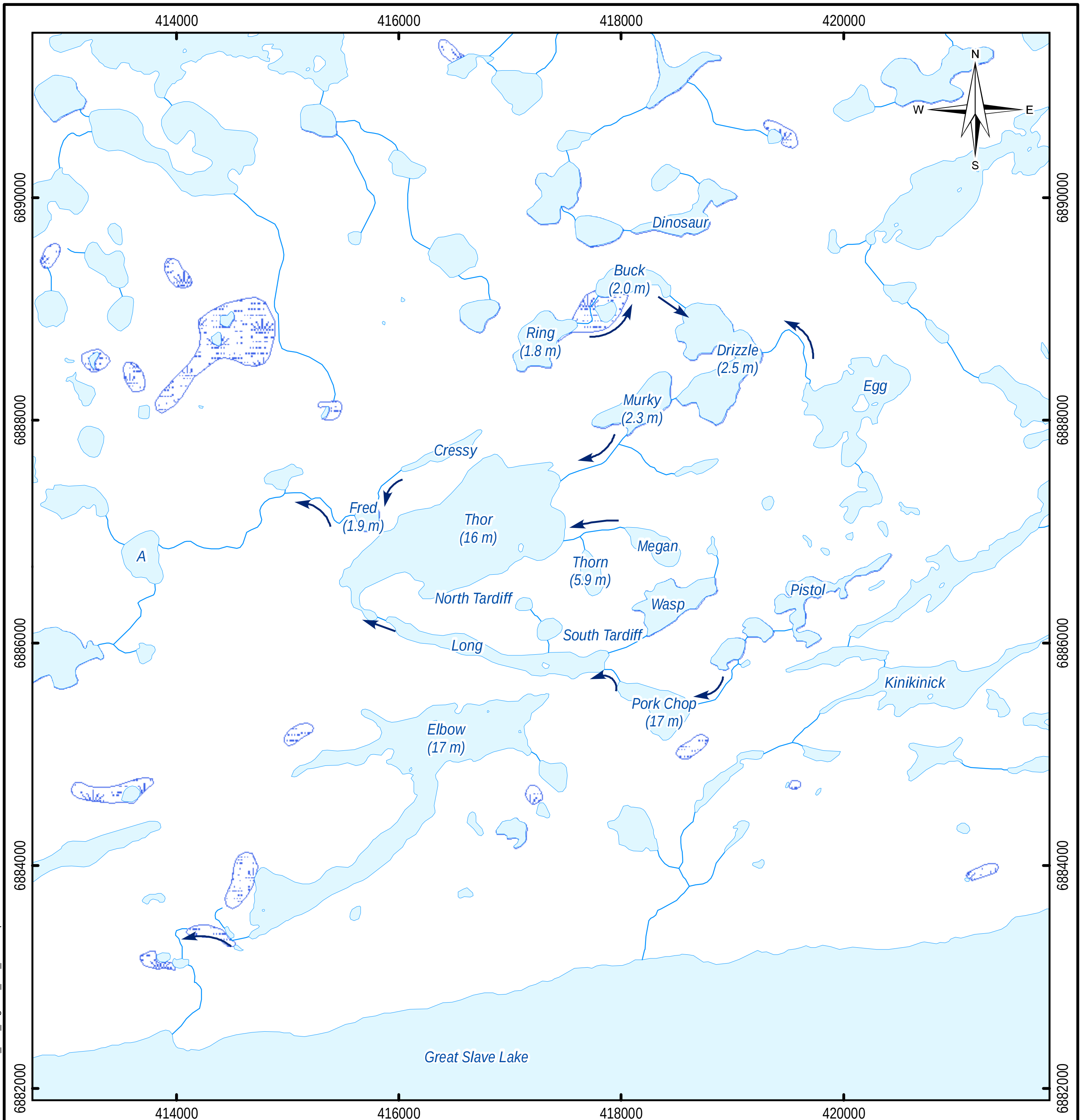
Water velocity measurements carried out by Stantec (2010a) revealed that flow periodically reverses between Thor and Long Lakes in the small channel connecting them, perhaps due to beaver activity or transient changes at the Thor Lake outflow to Fred Lake. As such, it is suggested that Thor and Long Lakes effectively operate as a single lake that is pinched in the middle (Stantec, 2010a).

Water flows from Thor Lake to Fred Lake through a defined channel that contains a 1.5 m waterfall near its outlet.

---

[1] Canadian Council of Ministers of the Environment (CCME) Guidelines for the Protection of Aquatic Life, and BC Contaminated Sites Regulation (CSR), Schedule 6 Generic Numerical Water Standards for the protection of Freshwater Aquatic Life.

The presence or absence of defined channels connecting lakes likely governs the biological characteristics of those lakes. Small, shallow lakes are unlikely to support fish populations if channels are unavailable through which fish can descend to deeper downstream waters for overwintering.



LEGEND

(2.0) Maximum Water Depth
Flow Direction
Watercourse
Waterbody
Wetland

NOTES
Base data sources:
- NTS 1:50,000 (Sheets 85I01 & 85I02)

ISSUED FOR USE

THOR LAKE PROJECT

Thor Lake Property
Area Depths and Flow Direction

PROJECTION	DATUM
UTM Zone 12	NAD83

Scale: 1:50,000
1 0.5 0 1
Kilometers

FILE NO.
V15101007_006_Figure4_1-1_LakeDepth.mxd

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	DM	0

OFFICE	DATE
EBA-VANC	March 22, 2010

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Figure 4.1-1

4.1.5.3 Seasonal Lake Level and Streamflow Trends

Similar seasonal lake level patterns were noted in the four lakes (Thor, Long, Cressy, and Elbow) that were monitored during 2008 and 2009. Water levels rose in June but then fell again before increasing rapidly in July. Lake levels then decreased during summer and then rose moderately in late September due to increased rainfall. The decline in June water levels was attributed to colder temperatures that resulted in the re-freezing of the annual snowpack and melt water.

To date, streamflow measurements for 2008 and 2009 are available for outflows from Murky, Thor, and Fred Lakes (Stantec 2010a). As would be expected, seasonal streamflow patterns closely follow changes in lake levels, which in turn, are governed by snowmelt, runoff, and rainfall characteristics. Streamflows in 2009 (the only year from which data are available for all open water seasons) increased in early June with the beginning of snowmelt. Flows receded due to subsequent re-freezing, and then rose significantly as snow and ice melted.

Recorded streamflows in 2009 averaged less than 0.1 m^3/s for the Murky Lake outlet; between 0.008 and 0.2 m^3/s at the Fred Lake outlet; and, 0.14 and 0.29 m^3/s at the Thor Lake outlet. Flows in the Thor Lake outlet stream in 2008 were extremely low, in part due to a woody debris blockage that was observed at the mouth of the stream. These reduced flows were also reflected in the Fred Lake outlet stream. Fred Lake also receives flow from Cressy Lake and as such, is only partly affected by changes in flows from Thor Lake.

The seasonal changes in lake levels and streamflows reported by Stantec (2010a) are based on only two seasons of measurements. However, it is likely that they reasonably reflect the hydrological characteristics of this region. These characteristics have been studied extensively and are described and explained in Woo (1993):

> *Meltwater fills the many depressions on the land surface and then flows over frozen ground in sheets or rills. Because the shallow, seasonally thawed suprapermafrost layer cannot retain much meltwater or rainwater, the water table rises rapidly so that water is delivered quickly to lower slopes and stream channels. Fairly rapidly, the active layer increases in depth due to increased solar radiation, causing the water table to drop below the surface and a corresponding decline in surface flows.*
>
> *Surface runoff follows pronounced diurnal cycles, reflecting daily variation of snowmelt contribution. The abundance of water at the surface, combined with large amounts of energy available, enables high evaporation in the spring. As summer advances, surface flow declines, because thawing of the active layer provides a thicker zone where suprapermafrost groundwater can be stored, and the water table drops below the surface. Also, most of the snow has been depleted and summer rainfall is the only major source of water-supply. Finally, evaporation and lateral flow continue to withdraw water from the active layer, leaving far less water to sustain surface flow than in the spring. Evaporation also decreases in the Arctic during summer as the surface dries out, while in the subarctic, transpiration of vascular plants speeds evaporation.*

The outlets of many small lakes are blocked by thick snowdrifts accumulated in winter. As lake storage increases, water levels rise until the snow dam is breached. This usually yields the peak annual outflow, accompanied by rapid depletion of lake storage accumulated during melt. Afterward, ice decay enlarges open water areas on the lake where evaporation is effective. Then the slopes gradually become free of snow, exposed ground thaws, and surface runoff diminishes as meltwater supply declines and evaporation increases.

4.1.5.4 Flow Patterns and Volumes

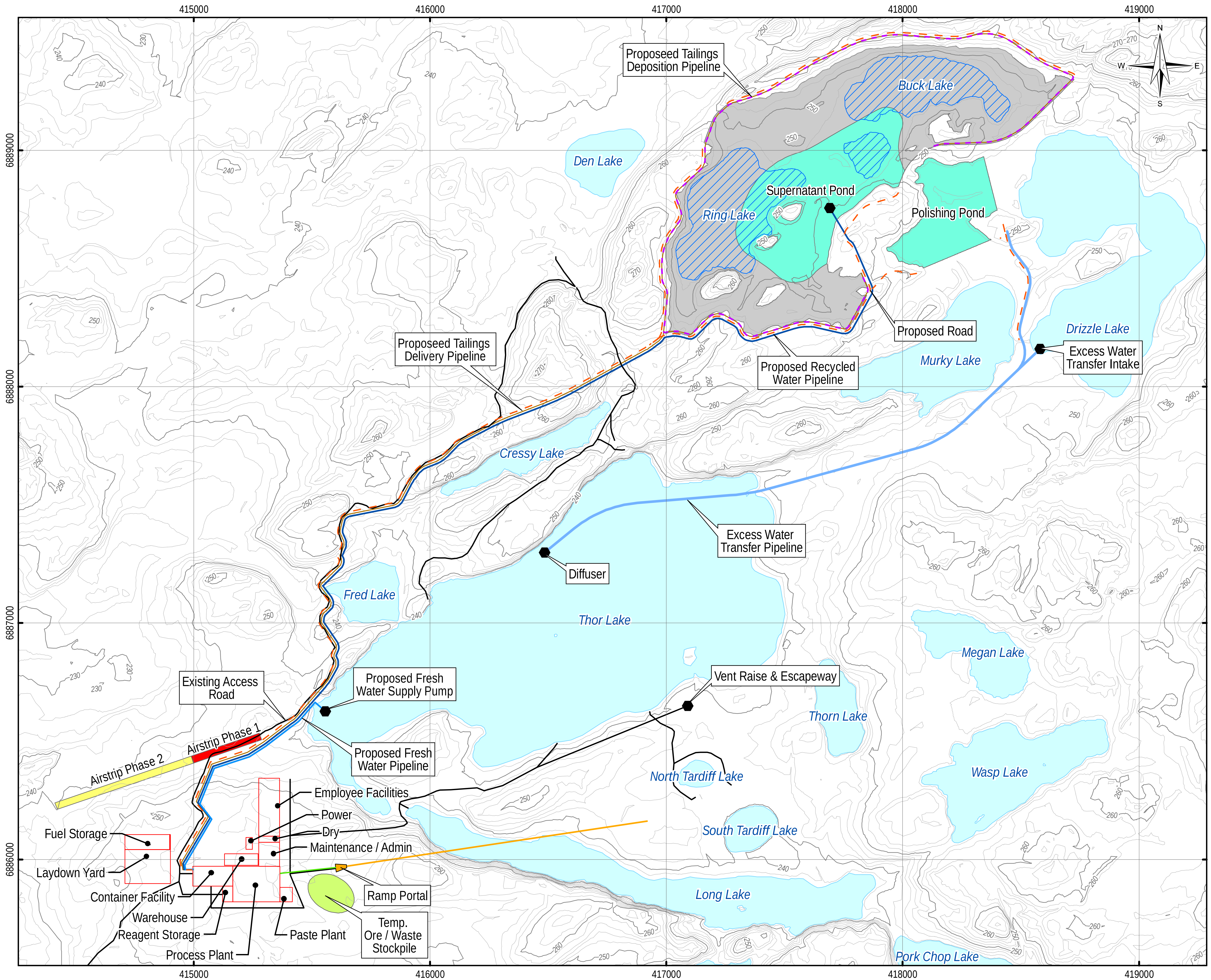
Existing Conditions

The Thor Lake watershed consists of an area of 2100 ha. The Ring Group (Ring, Buck, Drizzle, and Murky Lakes) constitutes 800 ha or 38% of that watershed, and about 19% of the annual Thor Lake discharge (1.8 million m^3/yr). Water discharge from Ring and Buck Lakes alone, which are proposed as the tailings management facility area, make up about 7% of the annual Thor Lake discharge. Figure 4.1-2 identifies lakes within the proposed Nechalacho Mine and Flotation Plant site area and the preliminary site design.

Mine Operations

The preliminary site arrangement identifies the construction of a tailings management facility that would replace Ring and Buck Lakes and result in supernatant decant flow into a polishing pond and then into Drizzle Lake (Figure 4.1-2). As presently conceived, freshwater withdrawn from Thor Lake will be used during ore processing and then discharged to the proposed tailings management facility. A portion of the excess supernatant water will be recycled back to the Flotation Plant to reduce freshwater withdrawal requirements. Overflow water from the tailings management facility polishing pond will drain to Drizzle Lake and then into Murky Lake.

The present design includes a pipeline to direct excess water from Drizzle Lake to Thor Lake, bypassing Murky Lake and its outlet stream. This pipeline is largely intended for intermittent use, primarily in winter, to supplement flows back to Thor Lake in order to minimize lake drawdown. However, it could also be employed during high flow periods to reduce potential high flow effects on Murky Lake and its associated inlet and outlet streams.



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LEGEND

- Existing Access Road
- Proposed Road
- Decline
- Conveyor
- Fresh Water Pipeline
- Excess Water Transfer Pipeline
- Water Recycling Pipeline
- Tailings Delivery Pipeline
- Tailings Deposition Pipeline

Contours

- Index (10m)
- Intermediate (2m)
- Airstrip Phase 1
- Airstrip Phase 2
- Buildings
- Ramp Portal
- Temporary Ore/Waste Stockpile
- Polishing Pond / Supernatant Pond
- Tailings Pond
- Exisiting Waterbody
- Lake

ISSUED FOR USE

NOTES
Base data source: thor_lake_Draft Design 1-4-10 r3.dwg

THOR LAKE PROJECT

Thor Lake Property Area
Lakes and Draft Project Design

PROJECTION	DATUM
UTM Zone 12	NAD83

Scale: 1:16,000
200 100 0 200
Meters

FILE NO.
V15101007_006_Figure4_1-2_Design.mxd

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	RH	0

OFFICE	DATE
EBA-VANC	March 22, 2010

EBA Engineering Consultants Ltd.

Figure 4.1-2

4.1.6 Fisheries and Aquatics

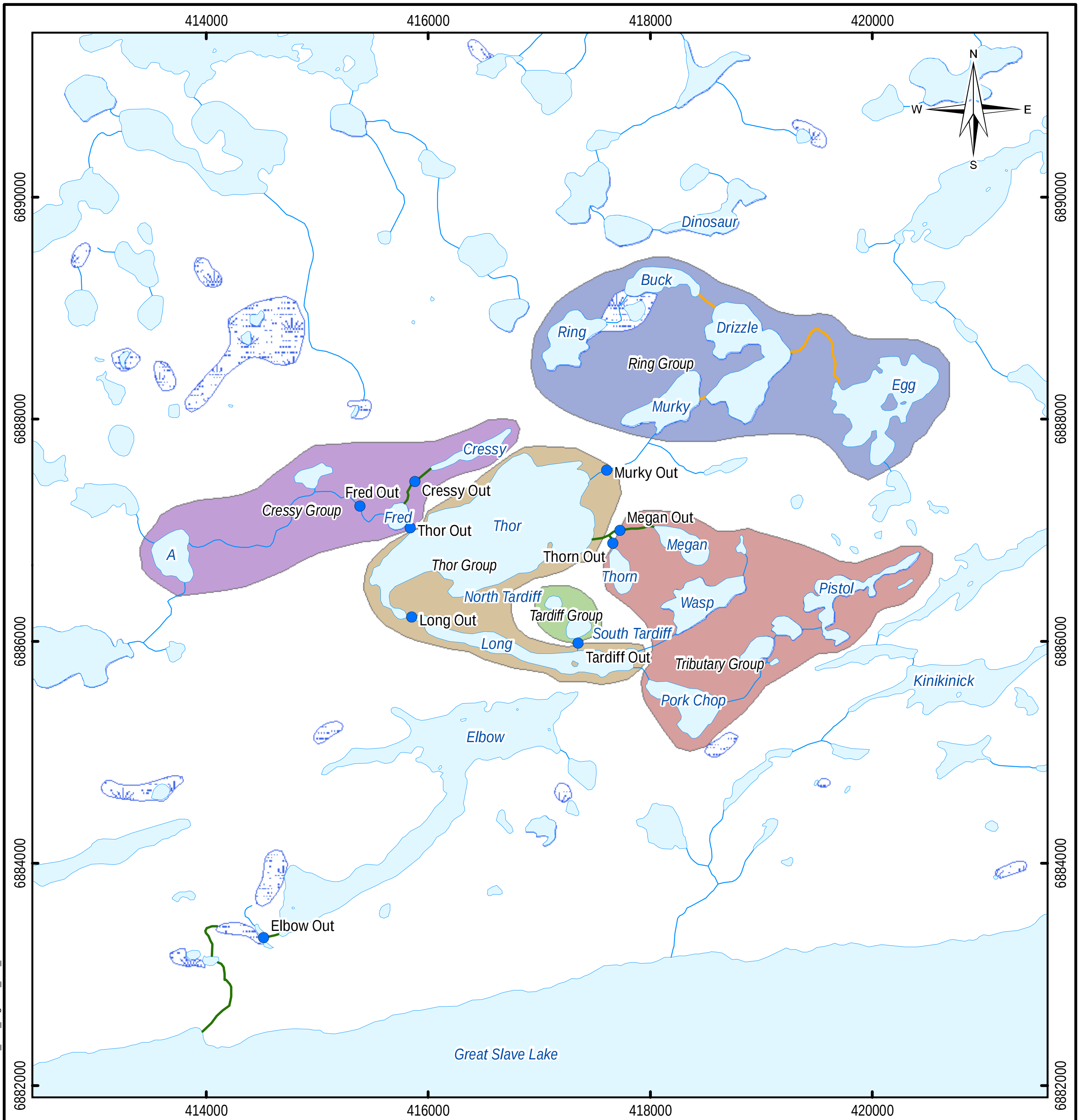
4.1.6.1 Background

Three studies in the vicinity of Avalon's proposed Nechalacho Mine and Flotation Plant site provide information to characterize and quantify the fisheries and aquatic resources that may be affected by proposed mining activities: Melville et al. (1989); Golder Associates Ltd. (1998); and Stantec (2010c). The first two studies were carried out in support of proposed beryllium and rare earth elements mining projects. Both mining projects did not proceed. The Stantec study, which is ongoing, was commissioned by Avalon to provide baseline information to support applications for environmental regulatory approvals.

The three studies collectively investigated fish, fish habitat, water and sediment quality, and aquatic resources (phytoplankton, zooplankton, benthic invertebrates) in numerous lakes and streams within the potential effect footprint of Avalon's proposed mining activities. The studies carried out by Melville et al (1989) and Golder Associates Ltd. (1998), however, did not include the headwater and tributary lakes of the Thor Lake drainage. Stantec (2010c) grouped lakes based on drainages, as shown in Figure 4.1-3[2]. This provides useful categorizations to identify aquatic characteristics, and issues related to potential effluent pathways.

Figure 4.1-1 (in Section 4.1.5.2) identifies water flow direction, which is critical for determining effluent discharge points and areas of potential environmental effects. Flow direction is based on field work described in Stantec (2010c). It should be noted, however, that connections could not be definitively identified between some of the lakes due to the extensive peatland and marsh areas surrounding some of the lakes through which water seeps with no discernable or measurable flow. In these cases, the flow direction shown on Figure 4.1-1 was presumed from topographic characteristics.

[2] Figure 4.1-3 excludes Redemption Lake to the northwest of the Project Area, which is being considered as a far-field reference lake.



LEGEND

- Fisheries Stream Sites (Stantec, 2009)

Channel Presence

- No Apparent Channel
- Channel Presence to be Determined

Lake Groups

- Cressy Group
- Ring Group
- Tardiff Group
- Thor Group
- Tributary Group

- Watercourse
- Waterbody
- Wetland

NOTES
Base data sources:
- NTS 1:50,000 (Sheets 85I01 & 85I02)
- Fisheries Stream Sites approximated from Figure 2-1 of the 2008-2009 Baseline Study (Strantec, 2009)

ISSUED FOR USE

THOR LAKE PROJECT

Lakes and Streams in the Thor Lake Property Area

PROJECTION	DATUM
UTM Zone 12	NAD83

Scale: 1:50,000
1 0.5 0 1
Kilometers

FILE NO.
V15101007_006_Figure4_1-3_Lakes.mxd

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	DM	0

OFFICE	DATE
EBA-VANC	March 22, 2010

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Figure 4.1-3

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4.1.6.2 Valued Ecosystem Components

A Valued Ecosystem Component (VEC), as defined by the Canadian Environmental Assessment Act, is:

> *Any part of the environment that is considered important by the proponent, public, scientists and government involved in the assessment process. Importance may be determined on the basis of cultural values or scientific concern* (CEAA, 1999).

VECs have not been specifically assigned as part of any of the fisheries and aquatic studies conducted previously within the proposed Mine site area. Several aquatic environmental components have been sampled during past field programs. The programs were conducted to provide a broad data baseline to characterize the aquatic environment as a means of identifying environmental sensitivities and for monitoring of adverse effects. Table 4.1-1 provides recommendations for aquatic VECs for the Nechalacho Mine and Flotation Plant site area. The VECs were chosen based on their importance as indicators of environmental effects, socio-economic considerations, and regulatory requirements.

TABLE 4.1-1: RECOMMENDED AQUATIC VECS FOR THE NECHALACHO MINE & FLOTATION PLANT AREA

Recommended VEC	Rationale
Water quality	- Early indicator of contamination - Required by the MMER
Benthic invertebrates	- Required by the MMER
Large bodied fish (lake whitefish, lake cisco, northern pike)	- Socio-economic importance - Indicators of habitat and environmental degradation - Required by the MMER

The following sections provide an overview of the aquatic characteristics of the proposed Nechalacho Mine and Flotation Plant site area.

4.1.6.3 Water and Sediment Quality

In general, waters within the broad footprint of the proposed Nechalacho Mine and Flotation Plant site area have high alkalinity, hardness, and calcium. These characteristics indicate a high acid buffering capacity. Lakes tend to be relatively clear with low suspended sediment levels, and low nutrient and metals concentrations. However, these levels typically rise in shallow lakes (<3 m; identified in Figure 4.1-1) during the winter due to highly reducing, anoxic conditions that develop under the ice, which result in reduced pH and a corresponding increase in the solubility of metals. In particular, levels of iron were many times higher in winter than Canadian Council of Ministers of the Environment (CCME) guidelines. It is important to note that no CCME exceedances were noted for Thor Lake, into which discharges from the tailings area would ultimately drain.

Sediments in many of the lakes within the Nechalacho Mine and Flotation Plant site footprint area were characterized by elevated levels of phosphorous, as well as some metals, in particular arsenic, copper, nickel, and zinc. In some locations, sediment mercury concentrations approached, but did not exceed CCME guidelines.

4.1.6.4 Aquatic Organisms

With only a few exceptions, lakes included in the Stantec (2010c) study were found to have low levels of chlorophyll *a*, which is an indicator of primary production, and were therefore classified as oligotrophic[3]. Murky, Thorn, South Tardiff, and Wasp Lakes (Figure 5.1-3), had seasonally higher concentrations of chlorophyll *a*, and have therefore been classified as mesotrophic, although there is sufficient inter-seasonal variation to put these classifications in doubt. Values for phytoplankton abundance, richness (number of taxa per site), and diversity (index that incorporates the number of species in an area with their relative abundance) have been calculated for most lakes in the proposed site area. However, additional sampling will be required for lakes that have not been sampled (e.g. Buck and Drizzle Lakes), or to increase data reliability. Phytoplankton species diversity and chlorophyll *a* levels were lowest in Great Slave Lake, corresponding to the very low nutrient levels measured during the study.

Zooplankton in freshwater systems are recognized as an essential energy resource for fish of small body size, which then provide energy for larger, piscivorous fish (Medeiros & Arthington, 2008). As such, they provide a link between primary producers and fish production, as well as, being important in the recycling of nutrients within an aquatic system. Zooplankton abundance and taxon richness varied considerably among the lakes sampled by Stantec (2010c) in June, 2009 (the September sampling results are forthcoming). The results likely reflect variability in water chemistry, primary productivity, and predation.

Zooplankton species assemblages can provide an indication of fish presence and abundance in a lake. For example, the phantom midge, *Chaoborus*, is a voracious predator of zooplankton, and is in turn, prey for fish. As such, the presence of large zooplankton such as *Chaoborus* or the copepod, *Heterocope*, particularly in high numbers, may indicate the absence, or low numbers of predatory fish, and may significantly affect zooplankton community structure (Riessen et al., 1984; Vanni, 1988). However, the data reported by Stantec (2010c) were inconclusive in this regard, since fish were found in two of the five lakes in which large predacious zooplankton were sampled, and were absent in four of the nine lakes devoid of these zooplanktors.

The results of benthic invertebrate sampling carried out in September, 2009, have not yet been reported (Stantec, 2010c). Such data are very important as they are integral to Environmental Effects Monitoring (EEM) programs that will be mandated pursuant to the Metal Mining Effluent Regulations (MMER), once mining operations commence.

Because temporal and spatial variability in phytoplankton abundance and richness is often high (Arhonditsis et al., 2004), multi-year sampling is generally necessary to characterize and

[3] Oligotrophic lakes are those with low nutrient levels and correspondingly low organic production.

quantify these communities with a reasonable degree of accuracy. Since zooplankton and benthic invertebrate abundance and composition is highly dependent on primary production (among other variables), it follows that variability within these groups is also likely to be high. Sampling by Stantec (2010c) for aquatic and benthic organisms took place in June and September, 2009. It is suggested that such sampling be repeated in those lakes that may possibly be affected tailings effluent discharge or other mining operations, directly or indirectly.

Sampling for neither phytoplankton nor zooplankton occurred in Buck or Drizzle lakes in the Ring group of lakes (Figure 4.1-3). Preliminary Mine plans indicate that Buck Lake will be included in the area used as a supernatant pond, and Drizzle Lake will likely receive excess water discharge from an upstream polishing pond. As such, baseline characterization of aquatic organisms, particularly in Drizzle Lake, is important since these parameters will be used as indicators of environmental perturbations.

4.1.6.5 Fish and Fish Habitat

Five fish species were sampled during baseline studies carried out by Stantec (2010c) in lakes within the effect footprint of the proposed Nechalacho Mine: lake whitefish (*Coregonus clupeaformis*), lake cisco (*Coregonus artedii*), northern pike (*Esox lucius*), ninespine stickleback (*Pungitius pungitius*), and slimy sculpin (*Cottus cognatus*). Troutperch (*Percopsis omyscomaycus*) were reported from previous studies in Thor Lake (Melville et al., 1989), but were not captured during two seasons of sampling by Stantec (2010c). Sampling in Great Slave Lake also revealed Arctic grayling (*Thymallus arcticus*), burbot (*Lota lota*), longnose sucker (*Catostomus catostomus*), and round whitefish (*Prosopium cylindraceum*).

Table 4.1-2 lists those lakes that have been sampled previously for fish presence (Melville et al., 1989; Stantec, 2010c), the number of sampling occasions, and the number of species of fish captured from each lake.

TABLE 4.1-2: NECHALACHO MINE AND FLOTATION PLANT SITE AREA FISH SAMPLING (1988, 2008, 2009)		
Lake	Sampling Occasions	No. of Fish Species Captured
A	2	5
Buck	1	0
Carrot	1	5
Cressy	3	0
Drizzle	0	-
Elbow	3	5
Fred	3	3
Great Slave	2	8
Kinnikinnick	1	4
Long	2	5
Megan	2	0
Murky	1	1
North Tardiff	2	0
Redemption	1	5
Ring	1	0
South Tardiff	2	0
Thor	3	6
Thorn	2	0
U	1	1

Seven of the sampled lakes were devoid of fish: Buck, Cressy, Megan, North Tardiff, Ring, South Tardiff, and Thorn. All of these are shallow lakes with four having maximum depths of two metres or less. Sampling for fish presence in Drizzle Lake has not been carried out. However, since the maximum depth of Drizzle Lake is 2.5 m, it is not likely to support populations of fish.

The preliminary Nechalacho Mine plan includes the deposition of Mine tailings in the area presently occupied by Ring and Buck Lakes, and the release of supernatant decant into Drizzle Lake, which in turn drains into Murky Lake. No fish were captured in Ring and Buck Lake, and only one northern pike was captured in Murky Lake. These four lakes, which make up the Ring Lake group (Figure 4.1-3) are all very shallow (<2.5 m), and are likely to either freeze completely in winter or have free water that becomes anoxic after freeze-up.

Stream habitats within the entire Nechalacho Mine and Flotation Plant site area effects footprint are either very poor or absent. Fish were only captured in outlet streams of Long Lake (ninespine stickleback) and Murky Lake (northern pike), and only in very limited numbers. No watercourses could be discerned flowing out of Cressy, Elbow, Megan, and Thorn Lakes. Downstream fish passage in a small outlet stream is possible from Thor Lake to Fred Lake, but upstream fish passage back into Thor Lake is prevented by a 1.5 m waterfall. Additional information is necessary to identify surface connections between lakes in the Ring group (Figure 4.1-3). It is speculated that such connections may be restricted to unconfined seepage through the peat bogs and wetlands that dominate this area.

The overall impression from existing information is of low to moderate fish and fish habitat potential in the effects footprint area of the proposed Nechalacho Mine. Several of the lakes in this area are very shallow, and in some cases, isolated due to a lack of channel connections capable of providing fish passage. This is particularly true of the Ring group of lakes (Ring, Buck, Drizzle, and Murky), which will be the most affected by tailings deposition and supernatant discharge.

Thor Lake, and to some extent Long Lake (due to its connection to Thor Lake) are the principal fish habitats in the proposed site area. Both Lakes support significant populations of lake whitefish, lake cisco, and northern pike. These lakes can also be considered to be a closed system from a fish production perspective because immigration is excluded by a natural obstruction at the outlet of Thor Lake and because there are no lakes upstream providing suitable habitats. As such, the fish populations in these lakes are self-sustaining. Fred Lake provides an interesting case where, despite its small size and very shallow depth, summer fish abundance is relatively high. Fred Lake is considered to be a fisheries 'sink', due to an impassable waterfall at the outlet of Thor Lake, and a lack of fish passage at its outlet. It is therefore assumed that all fish migrating into Fred Lake from Thor Lake would not survive the winter due either to complete freezing or anoxic water conditions.

Thor and Long Lakes will be the receiving water bodies for tailings water decant and/or treated waters, as well as, drainage from other mining related activities. Because of the isolated nature and hence vulnerability of the fish populations in these lakes, it is particularly important that degradation of water quality is avoided. This can be assisted by the collection of thorough baseline data related to water quality, aquatic organisms, and fish populations in Thor/Long lakes and in their upstream tributary lakes. Changes in water quality and aquatic organism abundance and community structure are important as "early warning" indicators of aquatic environmental perturbations.

Assuming that further investigations confirm that Ring and Buck Lakes are not fish habitats, and because of the poor quality of habitat in other tributary lakes to Thor and Long Lakes, the Nechalacho Mine and Flotation Plant are expected to have a low risk to identified VECs. Existing information related to aquatic environmental variables and Project design suggests that a HADD is not likely to occur, and as such, compensation will not likely be required.

4.1.7 Landforms and Surficial Geology

The landscape of the Nechalacho Mine and Flotation Plant site area displays evidence of glacial and post-glacial activity (Stantec, 2010d). The gently undulating terrain is composed largely of bedrock, of which several outcrops display grooves, scratches, and striations, all past evidence of glacial activity within the area.

Surficial materials of the Thor Lake area include both glacial and post-glacial deposit types. Of the glacial deposits identified, discontinuous veneers (e.g., <1 m thickness) and blankets

(>1 m thickness) of till material overlying bedrock are most common (Figure 4.1-4; Stantec, 2010d). Glaciofluvial deposits were also described within the area, however, these have a tendency to be very uncommon and form minor components of the mapped polygons. Glaciofluvial landforms commonly associated with these types of deposits (e.g., kames, eskers, and outwash areas) were not observed within the Project area.

Post-glacial deposits identified within the Thor Lake area include lacustrine, fluvial, colluvial, and organic materials, of which, the first three form very minor components of the area overall (Stantec, 2010d). Conversely, organic accumulations are fairly common throughout the area and can be generally found within depressions or overlying fine-grained till deposits and bedrock. Organic thicknesses ranged from thin veneers (e.g., <50 cm) to over 2 m.

4.1.8 Permafrost and Soils

An understanding of the permafrost and soil characteristics of the proposed Nechalacho Mine and Flotation Plant site area was developed through the review of the historical information, detailed mapping, and field inventory. Approximately 1,097 ha of the Thor Lake Property area were mapped for both surficial geology and soils using high resolution digital imagery, and 63 field sites were visited and described in October, 2008. Manual measurements of active layer thickness were taken from several test pits using a graduated steel probe. Core samples were also collected for further analysis, including gravimetric and volumetric water content, pH, conductivity, and grain size distribution (Stantec, 2010d). A thermistor cable installed at a borehole southwest of Thor Lake also provided temperature data of the active layer and upper permafrost zone. Soils were also described in the field, and samples were collected for physical and chemical characterization. Full details are provided in Stantec (2010d).

4.1.8.1 Permafrost

The proposed Nechalacho Mine and Flotation Plant site area is located within the discontinuous permafrost zone, which results in the spatial distribution of permafrost being highly dependent on local factors (e.g., thin snow cover, northern exposure, presence of fine-grained sediments like silt and clay) (Stantec, 2010d).

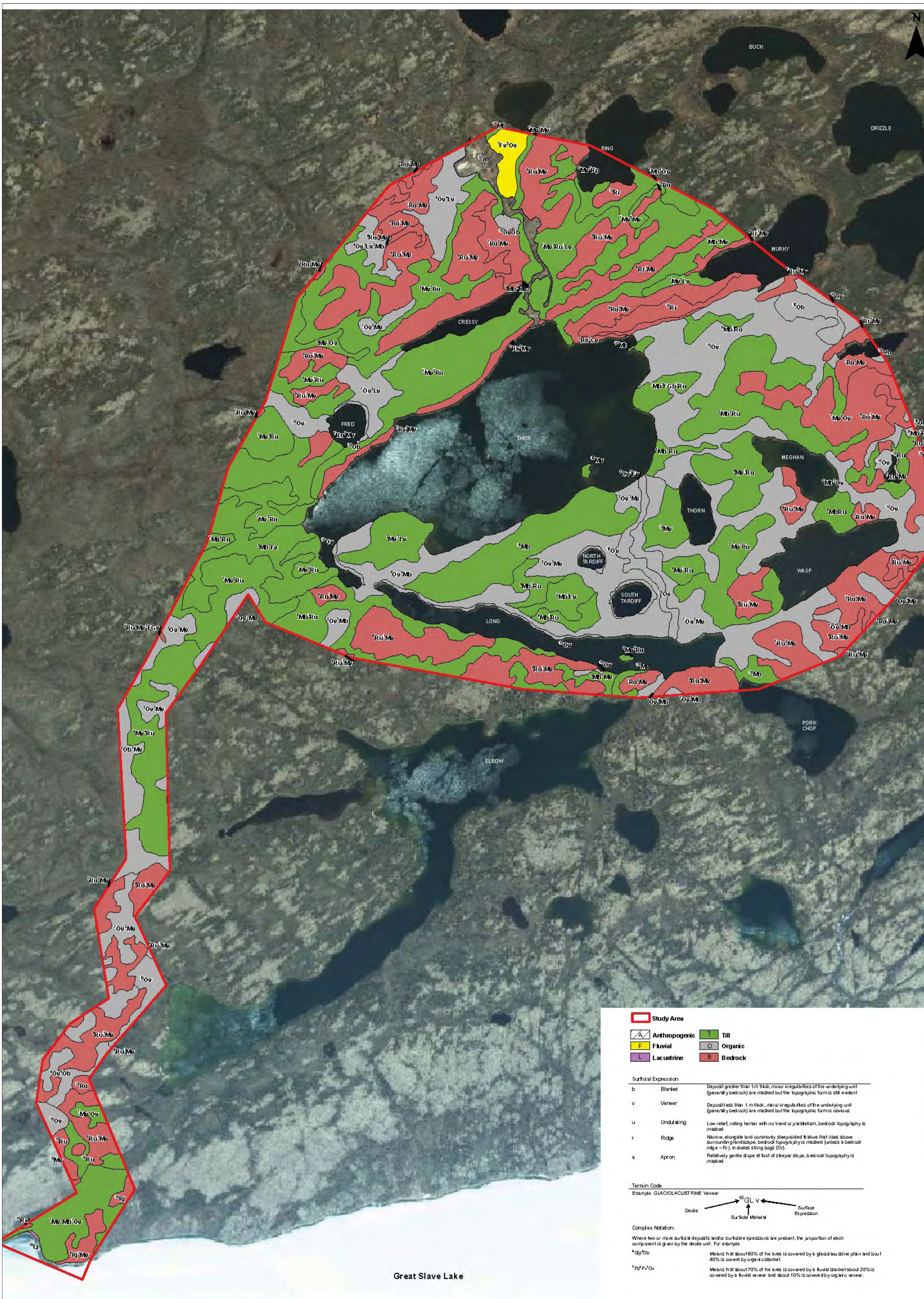
Within the proposed site area, landforms associated with permafrost consist mainly of frost-shattered bedrock and frost-heaved sediments that form small raised peat plateaus (Figure 4.1-5; Stantec, 2010d). Areas represented by permafrost degradation include thermokarst pits, collapsed fens and bogs, and thaw lakes.

In general, the active layer thickness within the proposed site area ranges between 40 – 200 cm, with variability being attributed to local terrain features (Stantec, 2010d). Areas with thick (e.g., 10 cm – 1 m) peat accumulations were usually found to support permafrost.

4.1.8.2 Soils

Soils within the Nechalacho Mine and Flotation Plant site area are generally complexes of moderately well, poorly, and very poorly drained materials, often consisting of organics, peaty Regosols, Gleyed Regosols, Brunisols, and Cryosols (Stantec, 2010d). The complexity of soil patterns observed is largely attributed to the lack of well-established drainage pathways throughout the area.

The majority of the soils present are mineral in nature (403 ha or 37% of the Thor Lake Property area), and predominantly fine-textured (Stantec, 2010d). The Thor Lake Property area is also largely represented by bedrock (296 ha or 27%), organic soils (148 ha or 13%), and water (242 ha or 22%) (Stantec, 2010d). A total of eight soil units were identified and mapped based on soil order and texture, the distribution of which are shown in Figure 4.1-6.



NOTES

Figure Source: Figure 2-2, *Thor Lake Rare Earth Metals Baseline Project, Environmental Baseline Report: Volume 4 - Terrain, Soils and Permafrost, Final Interim Report*, Stantec (January 15, 2010)

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THOR LAKE PROJECT

Surficial Geology of Thor Lake Study Area

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	RH	0
OFFICE	DATE		
EBA-VANC	March 22, 2010		

Figure 4.1-4

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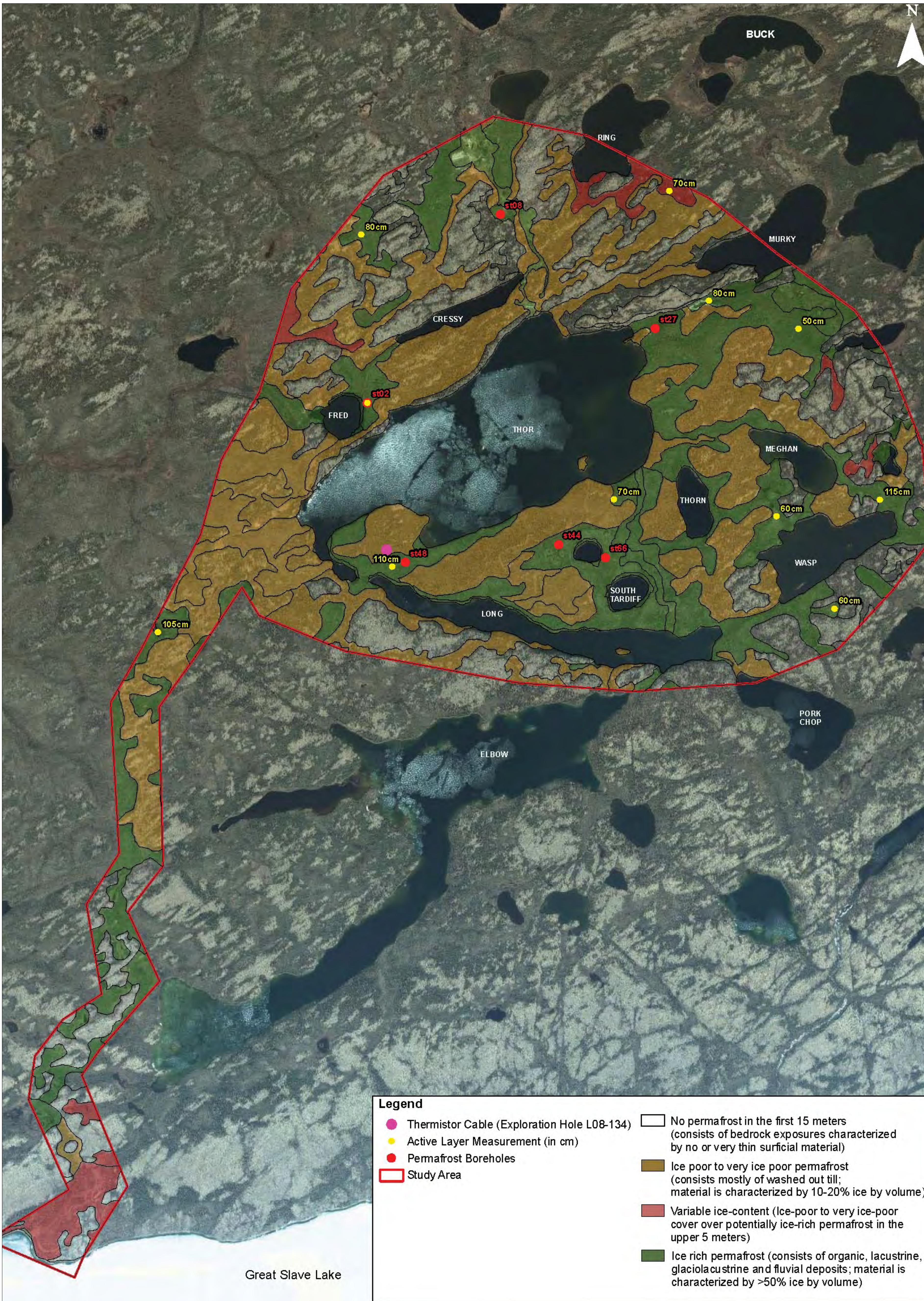

NOTES

Figure Source: Figure 2-7, *Thor Lake Rare Earth Metals Baseline Project, Environmental Baseline Report: Volume 4 - Terrain, Soils and Permafrost, Final Interim Report*, Stantec (January 15, 2010)

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THOR LAKE PROJECT

Permafrost Distribution

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	RH	0
OFFICE	DATE		
EBA-VANC	March 22, 2010		

Figure 4.1-5

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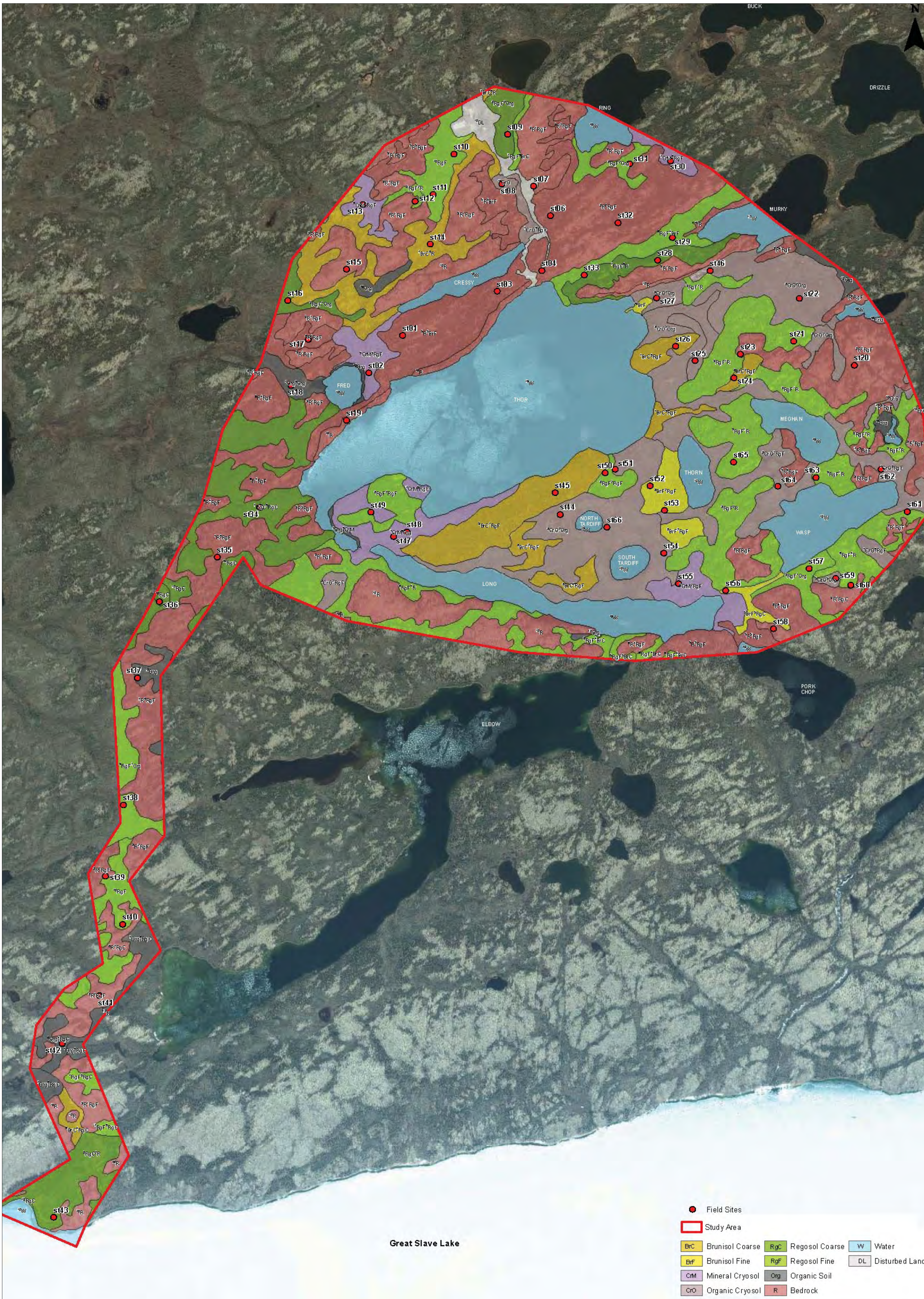

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NOTES

Figure Source: Figure 2-12, *Thor Lake Rare Earth Metals Baseline Project, Environmental Baseline Report: Volume 4 - Terrain, Soils and Permafrost, Final Interim Report*, Stantec (January 15, 2010)

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THOR LAKE PROJECT

Soils of Thor Lake Study Area

PROJECT NO.	DWN	CKD	REV	
V15101007.006	MEZ	RH	0	**Figure 4.1-6**
OFFICE	DATE			
EBA-VANC	March 22, 2010			

4.1.9 Ecosystems and Vegetation

Descriptions of the ecosystems and vegetation present within the Nechalacho Mine and Flotation Plant site area were developed using a combination of ecosystem mapping, field surveys, and the compilation of historical information (Stantec, 2010e). Ecosystem maps were developed for a local study area (LSA), which covered approximately 1,797 ha and a regional study area (RSA), which covered approximately 44,030 ha (Figure 4.1-7). Digital air photo interpretation and satellite image classification techniques were used to map ecosystems within the LSA and RSA, respectively. A total of 163 field inspections were completed within the Thor Lake Property area overall (79 within the LSA and 84 within the RSA). A rare plant study was also initiated in the LSA in 2010. Specific details are provided in Stantec (2010e).

4.1.9.1 Local Study Area

A total of 20 different ecosystem units were mapped within the LSA, four of which are non-vegetated and were characterized as lakes, ponds, shallow open water, and bedrock. Two units were characterized as anthropogenic, represented by past and current development activities on-site (e.g., camp and mine) (Figure 4.1-8; Stantec, 2010e).

The LSA is primarily treed and is represented by plant communities exhibiting a range of moisture regimes, from very dry to very wet. The ecosystems mapped most extensively within the LSA are represented by drier lichen – bearberry woodland and moist spruce – paper birch – toadflax forest, which cover approximately 291 ha (16% of the total LSA) and 255 ha (14%), respectively (Stantec, 2010e). Other less common ecosystem types within the LSA include water sedge – buckbean – arrowgrass fen, paper birch – aspen – willow forest, and white spruce – horsetail – glow moss forest.

4.1.9.2 Regional Study Area

Eleven broad mapping units were identified within the RSA (Figure 4.1-9; Stantec, 2010e). Bedrock – lichen and spruce upland units are most common overall, covering approximately 7,310 ha (16%) and 6,770 ha (15%), of the RSA, respectively. The remaining mapping units are represented by treed or wetland plant community types.

4.1.9.3 Rare Plant Study

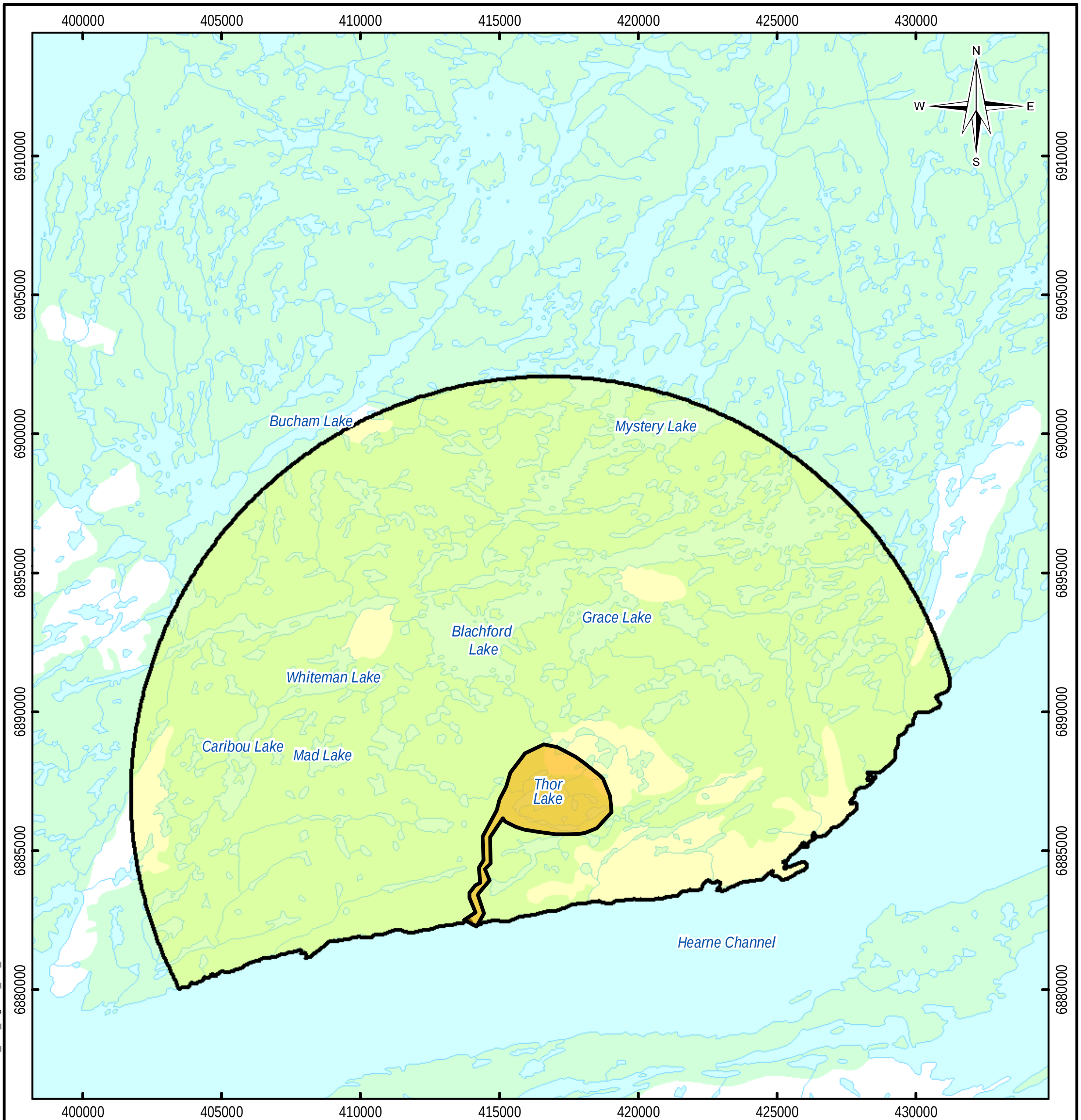
A rare plant study was conducted in 2009 and involved both desktop research and a field assessment. Prior to the conduct of field work, a preliminary plant species list was compiled from various sources (see list provided in Stantec, 2010e) in an effort to identify which species might have a higher potential to occur within the Nechalacho Mine and Flotation Plant site area. The habitat requirements of the initial species identified were researched and the species list subsequently refined based on the types of habitats typically associated with the Taiga Shield. The end result was a list of 25 plant species that had a higher potential to occur within the Taiga Shield, as well as, the Project area (Stantec, 2010e).

The field surveys focused on the habitat types of the 25 species identified from the desktop study, as well as, areas that are often thought to have a higher potential of supporting rare plant habitat (e.g., rock outcrops, wetlands, drainage channels). A total of 56 field plots were assessed for rare plants, 48 of which were combined with the surveys being conducted for the development of the ecosystem map (Stantec, 2010e).

One rare plant, rock polypody (*Polypodium virginianum*) (plot RPE 15 on Figure 4.1-8; Photo 1) was identified east of Long Lake on a north facing granite outcrop (Stantec, 2010e). A voucher specimen was collected but has not been sent in for confirmation.

Rock polypody is an evergreen fern with a circumpolar distribution (Porsild & Cody, 1980). Its status ranking within the NWT is "undetermined", and as such is not necessarily "rare." Not enough is known about its frequency or abundance, however, to treat it as secure.

Photo 1: *Polypodium virginianum* on Granite Outcrop East of Long Lake (Stantec, 2010)



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LEGEND

- Local Study Area (Stantec, 2009)
- Regional Study Area (Stantec, 2009)
- Watercourse
- Waterbody
- Wetland
- Vegetation

NOTES
Base data source:
NTS 1:250,000 (Sheet 85I)
Figure 1 of the 2009 Baseline Study, Volume 5 (Stantec, 2009)

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THOR LAKE PROJECT

Local and Regional Study Areas

PROJECTION: UTM Zone 12
DATUM: NAD83

Scale: 1:200,000
4 2 0 4
Kilometres

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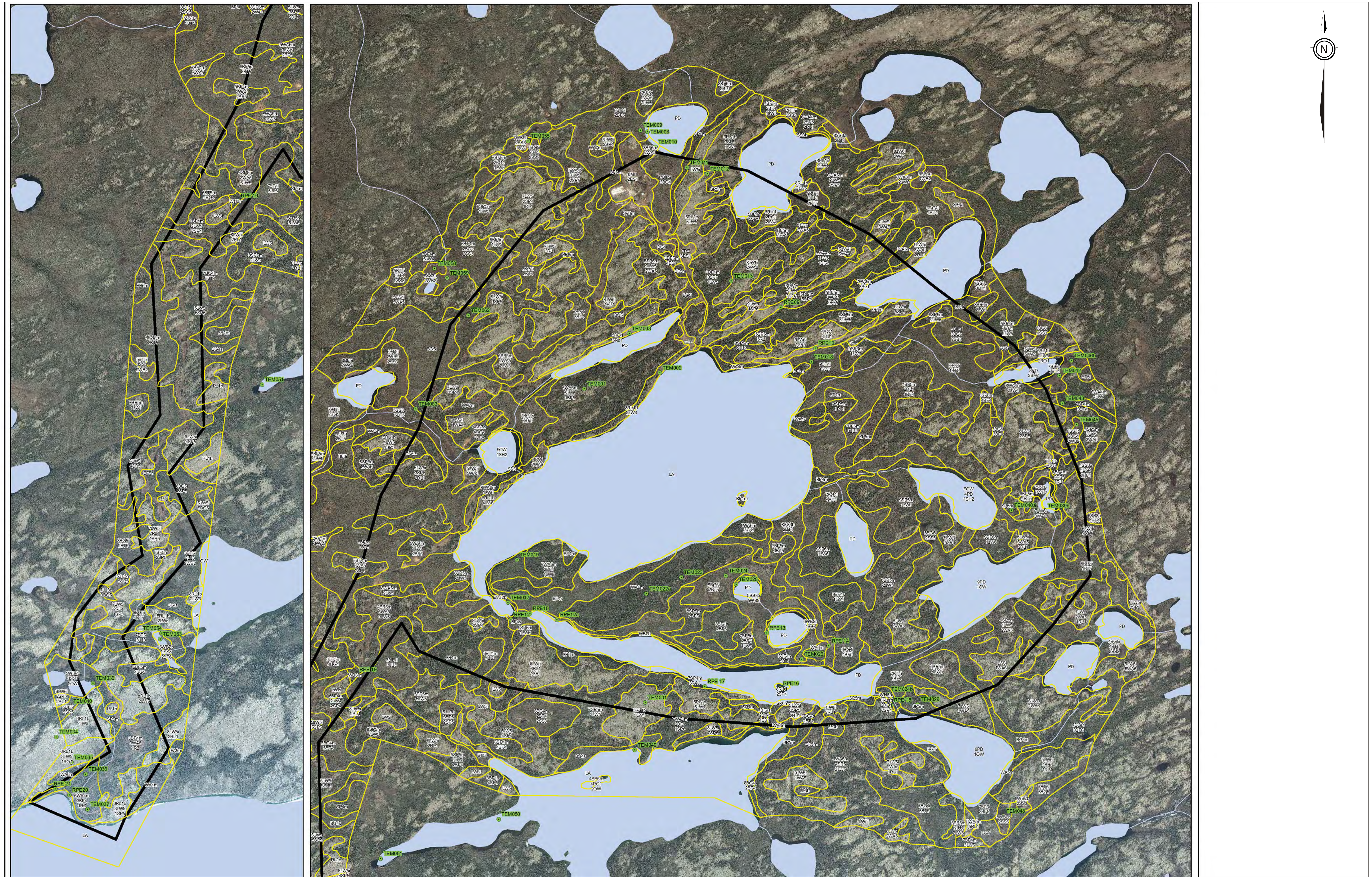
FILE NO.: V15101007_006_Figure4_1-7_SA.mxd

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	DM	0

OFFICE	DATE
EBA-VANC	March 22, 2010

Figure 4.1-7



LEGEND

- Survey Locations
- Ecosystem Polygons
- LSA
- RSA (15km buffer)

Structural Modifier

e.g. 6WA4m

a = low shrub
b = tall shrub
i = irregular canopy
m = multistoried canopy
s = single storied canopy
t = two storied canopy

NOTES

Figure Source: Appendix C, *Thor Lake Rare Earth Metals Baseline Project: Environmental Baseline Report: Volume 5 - Vegetation Resources, Final Interim Report,* Stantec (January 15, 2010)

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THOR LAKE PROJECT

Terrestrial Ecosystem Map

PROJECT NO.	DWN	CKD	REV	
V15101007.006	MEZ	RH	0	Figure 4.1-8
OFFICE: EBA-VANC	DATE: March 22, 2010			

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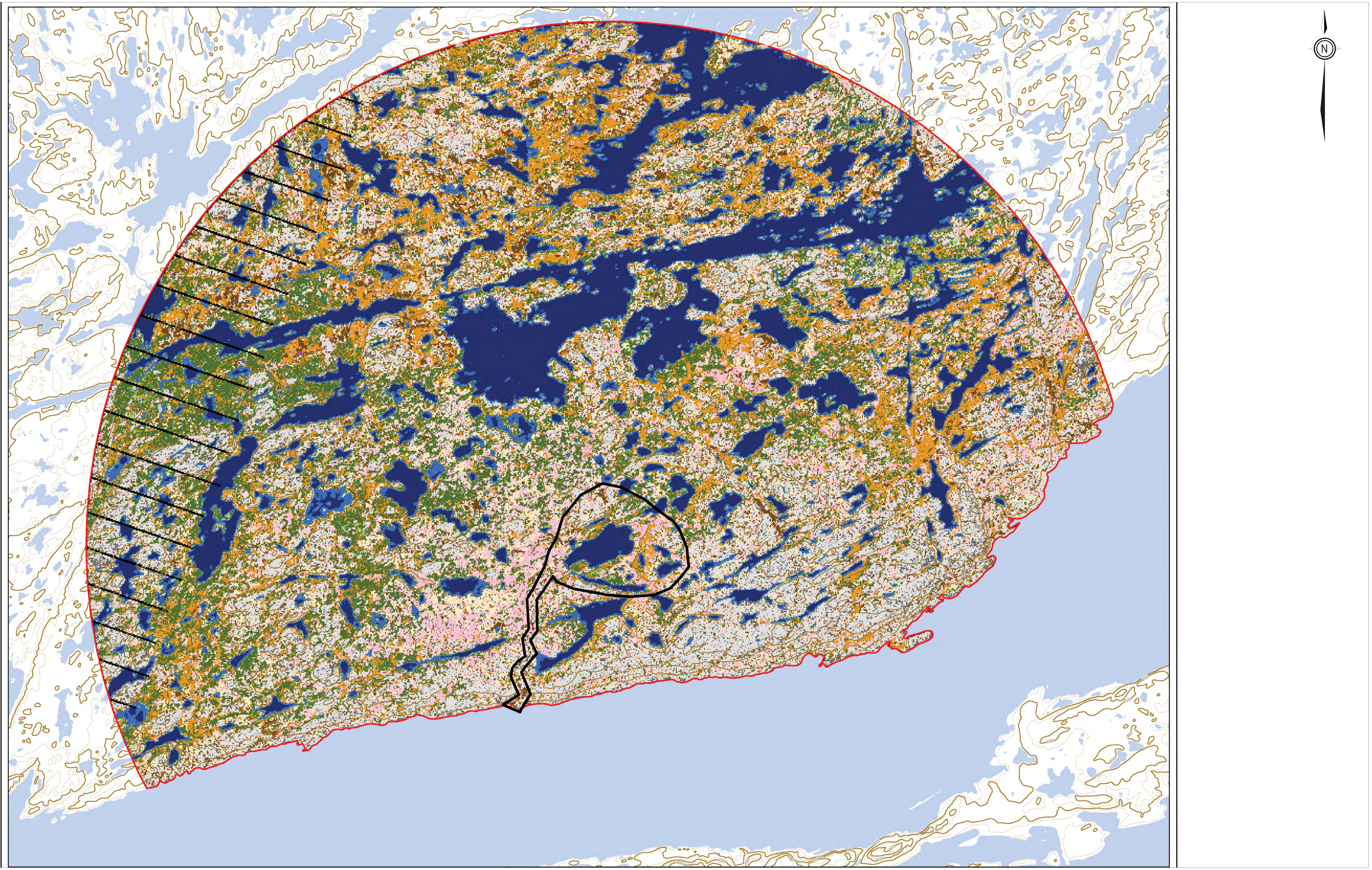

LEGEND

- Regional Study Area (15km buffer)
- LSA Boundary
- Contour - Intermediate
- Contour - Index (50 Feet)

Class

- Open Water
- Shallow Water
- Spruce Wet
- Sedge Fen
- Shrub Fen
- Treed Fen
- Broadleaf Upland
- Mixed Upland
- Spruce Upland
- Bedrock Lichen
- Bedrock
- No Data

NOTES

Figure Source: Appendix A, *Thor Lake Rare Earth Metals Baseline Project: Environmental Baseline Report: Volume 5 - Vegetation Resources, Final Interim Report,* Stantec (January 15, 2010)

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THOR LAKE PROJECT

Vegetation Classification for the RSA 2009

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	RH	0
OFFICE: EBA-VANC	DATE: March 22, 2010		

Figure 4.1-9

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4.1.10 Wildlife

4.1.10.1 Mammals

The study area lies within the boreal forest of the Taiga Shield Ecoregion. However, both boreal and tundra animal species frequent the area. Approximately 26 species of mammals may frequent this region (Table 4.1-3). Tundra species, such as barren-ground caribou are typically found within this Ecoregion during the winter months only, spending the summers on the tundra. Other species, such as gray wolf, grizzly bear, and wolverine are residents of both tundra and boreal forest, and frequent the transitional Ecoregion to the north throughout the year. Boreal species such as mink and beaver are reaching their northern limit at this latitude and are seldom found beyond the treeline.

TABLE 4.1-3: MAMMALS FOUND IN PROJECT AREA OR HAVE THE POTENTIAL TO OCCUR

COMMON NAME	SCIENTIFIC NAME
Barren-ground Caribou*	*Rangifer tarandus groenlandicus*
Beaver*	*Castor Canadensis*
Black Bear*	*Ursus americanus*
Gray Wolf*	*Canis lupus*
Moose*	*Alces alces*
Red Squirrel*	*Tamiasciurus hudsonicus*
Snowshoe Hare*	*Lepus americanus*
(***Bold**: Mammal species observed/known to occur)	
Masked Shrew	*Sorex cinereus*
American Marten	*Martes Americana*
Brown Lemming	*Lemmus sibiricus*
Chestnut cheeked Vole	*Microtus xanthognathus*
Common Porcupine	*Erethizon dorsatum*
Deer Mouse	*Peromyscus maniculatus*
Ermine	*Mustela ermine*
Grizzly Bear	*Ursus arctos*
Least Weasel	*Mustela nivalis*
Meadow Vole	*Microtus pennsylvanicus*
Lynx	*Lynx canadensis*
Mink	*Mustela vison*
Muskrat	*Ondatra zibethicus*
Northern Bog Lemming	*Synaptomys borealis*
Northern Red-backed Vole	*Clethrionomys rutilus*
Pygmy Shrew	*Sorex hoyi*
Red Fox	*Vulpes vulpes*
River Otter	*Lutra canadensis*
Wolverine	*Gulo gulo*

Species distributions were evaluated using range maps posted on NatureServe (Patterson et al. 2003) and the GNWT (2009f) website (Stantec 2010f).

4.1.10.2 Birds

The Taiga Shield Ecoregion is home to approximately 150 species of birds, the majority of which are seasonal migrants. However, considerably fewer species are expected to occur in the study area. The lakes and wetlands of the north provide habitat for a wide variety of waterbirds and shorebirds. A number of birds of prey, or raptors, utilize this region, either as residents or migrants.

Passerines

Passerines (upland nesting birds) are a specific group of birds belonging to the largest avian order, Passeriformes. The passerines are also known as perching or songbirds. Approximately 49 species may potentially occur in the study area, as summer or year-round residents (Table 4.1-4).

Some passerines are year-round residents, while the majority are migratory and are present only during their reproductive phase. Studies indicate upland nesting birds are very common in the study area during spring, summer and fall, and are expected to occur in all habitat types. Most species in this group have relatively small home ranges or territories, and are generally good indicators of local and regional habitat change (i.e., conversion or fragmentation; Stantec, 2010f). All of the species listed in Table 4.1-4 are potentially present during the summer. Nine species may be present during the winter within the boreal forest and transition portions of the study area.

TABLE 4.1-4: UPLAND NESTING BIRDS FOUND IN PROJECT AREA OR HAVE THE POTENTIALTO OCCUR

Common Name	Scientific Name
American Robin*	*Turdus migratorius*
Common Raven*ʷ	*Corvus corax*
Dark-eyed Junco*	*Junco hyemalis*
Gray Jay*ʷ	*Perisoreus Canadensis*
Hermit Thrush*	*Catharus guttatus*
Northern Flicker*	*Colaptes auratus*
Olive-sided Flycatcher*	*Contopus cooperi*
Red-winged Blackbird*	*Agelaius phoeniceus*
Ruby-crowned Kinglet*	*Regulus calendula*
Snow Bunting*	*Plectrophenax nivalis*
Tree Swallow*	*Tachycineta bicolor*
Yellow-rumped Warbler*	*Dendroica coronate*
Yellow Warbler*	*Dendroica petechia*
(***Bold**: Passerine species observed/known to occur)	
Alder Flycatcher	*Empidonax alnorum*
American Redstart	*Setophaga ruticilla*
American Tree Sparrow	*Spizella arborea*

TABLE 4.1-4: UPLAND NESTING BIRDS FOUND IN PROJECT AREA OR HAVE THE POTENTIALTO OCCUR

Common Name	Scientific Name
Bank Swallow	*Riparia riparia*
Barn Swallow	*Hirundo rustica*
Black-capped Chickadee[w]	*Parus atricapillus*
Blackpoll Warbler	*Dendroica striata*
Blue-headed Vireo	*Vireo solitarius*
Bohemian Waxwing	*Bombycilla garrulus*
Boreal Chickadee[w]	Parus hudsonicus
Chipping Sparrow	*Spizella passerina*
Cliff Swallow	*Hirundo pyrrhonota*
Common Raven[w]	*Corvus corax*
Common Redpoll[w]	*Carduelis flammea*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Phoebe	*Sayornis phoebe*
Fox Sparrow	*Passerella iliaca*
Hoary Redpoll[w]	*Carduelis hornemanni*
Least Flycatcher	*Empidonax minimus*
Magnolia Warbler	*Dendroica magnolia*
Northern Shrike	*Lanius excubitor*
Northern Waterthrush	*Seiurus noveboracensis*
Orange-crowned Warbler	*Vermivora celata*
Palm Warbler	*Dendroica palmarum*
Pine Grosbeak[w]	*Pinicola enucleator*
Pine Siskin	*Carduelis pinus*
Purple Finch	*Carpodacus purpureus*
Red Crossbill[w]	*Loxia curvirostra*
Red-eyed Vireo	*Vireo olivaceus*
Rusty Blackbird	*Euphagus carolinus*
Swainson's Thrush	*Catharus ustulatus*
Tennessee Warbler	*Vermivora peregrina*
Warbling Vireo	*Vireo gilvus*
White-crowned Sparrow	*Zonotrichia leucophrys*
White-winged Crossbill[w]	*Loxia leucoptera*
Wilson's Warbler	*Wilsonia pusilla*

[w] Winter residents in the region (Bromley and Trauger ND)

Source: Species list based on Godfrey 1979 and Sibley 2000

Raptors

Raptors, also known as "Birds of Prey," make up a small but important group of birds frequenting the study area (Table 4.1-5). Although this group covers a small number of species, it is diverse and includes hawks, osprey, falcons and owls. A total of 16 raptor species (Table 4.1-5) may potentially occur within the study area. Raptors may breed throughout the study area, with select areas attracting higher breeding densities (i.e., riparian zones) than other areas (i.e., jack pine stands). Raptors can be expected to breed wherever their habitat requirements are met. Some species are year-round residents, while others are transient migrants. Little is known about the population status of individual species. Seasonally and locally, they can be abundant, common, or occasional. Some are migratory, appearing as early as mid-April and departing in October, while others overwinter in the region (Clark & Wheeler, 2001; DRWED, 2001; Sibley, 2000).

TABLE 4.1-5: RAPTORS FOUND IN PROJECT AREA OR HAVE THE POTENTIAL TO OCCUR

Common Name	Scientific Name
Bald Eagle*	*Haliaeetus leucocephalus*
Common Nighthawk*	*Chordeiles minor*
Osprey*	*Pandion haliaetus*
Peregrine Falcon*	*Falco peregrinus anatum*
Red-tailed Hawk*	*Buteo jamaicensis*
Short-eared Owl*	*Asio flammeus*
(***Bold**: Raptor species observed/known to occur)	
American Kestrel	*Falco sparverius*
Barred Owl	*Strix varia*
Boreal Owl	*Aegolius funereus*
Great Gray Owl	*Strix nebulosa*
Great Horned Owl	*Bubo virginianus*
Merlin	*Falco columbarius*
Northern Goshawk	*Accipiter gentilis*
Northern Harrier	*Circus cyaneus*
Northern Hawk Owl	*Surnia ulula*
Sharp-shinned Hawk	*Accipiter striatus*

Species list based on Godfrey (1979) and Sibley (2000)

Waterbirds

Waterbirds are typically used in the context of swans, geese and ducks; however, for this report it also includes loons and grebes. A total of 35 waterbird species may occur within the study area (Table 4.1-6). Waterbirds breed throughout much of North America with select areas attracting high breeding densities. Within the study area, waterbirds breed throughout the boreal forest to varying densities. Waterbirds can be expected to breed wherever their habitat requirements are met.

Studies have shown waterbirds in the Yellowknife region begin to return as early as mid-April and may continue until the last week of May, depending on the weather. Birds follow a progression that indicates a sequence of early, mid-season and late nesters. The chronology of arrivals from mid April to late May are: Mallard, Northern Pintail, Green-winged Teal, American Wigeon, Common Goldeneye, Horned Grebe, Red-necked Grebe, Canada Goose, Northern Shoveler, Ring-necked Duck, Canvasback, Greater Scaup, Bufflehead, Long-tailed Duck, Greater White-fronted Goose, White-winged Scoter, and Blue-winged Teal (Bromley & Trauger. n.d.). Arrival dates for each species occurring in the study area are expected to be similar to those experienced in the Yellowknife region. Most species of waterbirds remain in the north as long as food and open water are available.

TABLE 4.1-6: WATERFOWL FOUND IN PROJECT AREA OR HAVE THE POTENTIAL TO OCCUR

Common Name	Scientific Name
American Coot*	*Fulica americana*
American Wigeon*	*Anas americana*
Blue-winged Teal*	*Anas discors*
Bonaparte's Gull*	*Larus phildelphia*
Bufflehead*	*Bucephala albeola*
Canada Goose*	*Branta canadensis*
Canvasback*	*Aythya valisineria*
Common Goldeneye*	*Bucephala clangula*
Common Loon*	*Gavia immer*
Common Merganser*	*Mergus merganser*
Greater Scaup*	*Aythya marila*
Greater White-fronted Goose*	*Anser albifrons*
Green-winged Teal*	*Anas crecca*
Horned Grebe*	*Podiceps auritus*
Lesser Yellowlegs*	*Tringa flavipes*
Long-tailed Duck*	*Clangula hyemalis*
Mallard*	*Anas platyrhynchos*
Northern Pintail*	*Anas acuta*
Northern Shoveler*	*Anas clypeata*
Pacific Loon*	*Gavia pacifica*
Red-breasted Merganser*	*Mergus serrator*
Red-necked Grebe*	*Podiceps grisegena*
Ring-billed Gull*	*Larus delawarensis*
Ring-necked Duck*	*Aythya collaris*
Sandhill Crane*	*Grus Canadensis*
Semipalmated Plover*	*Charadrius semipalmatus*
Snow Goose*	*Chen caerulescens*
Sora Rail*	*Porzana carolina*
Surf Scoter*	*Melanitta perspicillata*

TABLE 4.1-6: WATERFOWL FOUND IN PROJECT AREA OR HAVE THE POTENTIAL TO OCCUR	
Common Name	Scientific Name
Tundra Swan*	*Cygnus columbianus*
White-winged Scoter*	*Melanitta fusca*
Wilson's Snipe*	*Capella gallinago*
(***Bold**: Waterbird species observed/known to occur)	
Redhead	*Aythya americana*
Red-necked Phalarope	*Phalaropus lobatus*
Red-throated Loon	*Gavia stellata*
Ruddy Duck	*Oxyura jamaicensis*
Yellow Rail	*Coturnicops noveboracensis*

Species list based on Godfrey (1979) and Sibley (2000).
Species distributions were evaluated using range maps posted on NatureServe (2008).

4.1.10.3 Amphibians and Reptiles

There are five amphibian and one reptile species that occur regularly in the Northwest Territories (Table 4.1-7; WGGSNWT, 2006). Only Boreal Chorus Frog and Wood Frog have a high probability of occurrence in the Nechalacho Mine and Flotation Plant area and they are considered "secure" by WGGSNWT (2006).

TABLE 4.1-7: AMPHIBIANS AND REPTILES HAVING THE POTENTIAL TO OCCUR IN THE PROJECT AREA	
Common Name	Scientific Name
Boreal Chorus Frog	*P. t. maculate*
Canadian Toad	*Bufo hemiophrys*
Common Garter Snake	*Thamnophis sirtalis*
Northern Leopard Frog	*Rana pipiens*
Western Toad	*Bufo boreas*
Wood Frog	*Rana sylvatica*

Species distributions were evaluated using range maps posted on NatureServe (Patterson *et al.*, 2003).

4.1.10.4 Protected Species

Mammals

Three species of mammals with the potential to occur in the study area are listed as "Sensitive" in the NWT (WGGSNWT, 2006; Table 4.1-8). These species are listed as of "Special Concern" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2009). None are listed under the *Species at Risk Act* (SARA).

TABLE 4.1-8: MAMMAL SPECIES OF CONSERVATION CONCERN IN THE NORTHWEST TERRITORIES AND MAY POTENTIALLY OCCUR IN THE STUDY AREA			
Species	NWT Status1	COSEWIC2	SARA3
Caribou (R.t. groenlandicus)	Sensitive	Special Concern	
Grizzly Bear	Sensitive	Special Concern	
Wolverine	Sensitive	Special Concern	

NOTE: 1 "Sensitive" or "May be At Risk" (WGGSNWT, 2006); 2 "Endangered", Threatened", or "Special Concern" (COSEWIC, 2009) 3 "Threatened" (SRPR, 2008). Species distributions were evaluated using range maps posted on NatureServe (Patterson *et al.*,. 2003) and the GNWT (2009f) website (Stantec, 2010f).

Birds

Four species of birds are listed by all three agencies: Peregrine Falcon, Yellow Rail, Eskimo Curlew, and Ivory Gull. Only Yellow Rail has a medium probability of occurrence in the Nechalacho Mine and Flotation Plant site area. Peregrine Falcon and Ivory Gull have a low probability of occurrence, (however a peregrine was observed during Stantec's 2009 surveys), and Eskimo Curlew is probably extinct. Among species listed only by WGGSNWT (2006) and COSEWIC (2008), Red Knot may occur only during migration, and Short-eared Owl, Common Nighthawk, Olive-sided Flycatcher, and Rusty Blackbird are probably regular summer visitants that likely breed. Among species listed only by WGGSNWT (2006), Surf Scoter, Northern Pintail, Lesser Yellowlegs, Barn Swallow, Boreal Chickadee, White-throated Sparrow, and Harris's Sparrow have a high probability of occurrence in the Nechalacho Mine and Flotation Plant area; and Trumpeter Swan, Lesser Scaup, White-winged Scoter, Long-tailed Duck, Semipalmated Sandpiper, Least Sandpiper, Long-billed Dowitcher, Red-necked Phalarope, American Pipit, Blackpoll Warbler, and American Tree Sparrow have a medium probability of occurrence. Table 4.1-9 provides a summary of protected bird species with potential to occur in the Thor Lake study area.

TABLE 4.1-9: BIRD SPECIES OF CONSERVATION CONCERN IN THE NORTHWEST TERRITORIES THAT MAY POTENTIALLY OCCUR IN THE STUDY AREA			
Species	NWT Status1	COSEWIC2	SARA3
American Pipit	Sensitive		
American Tree Sparrow	Sensitive		
Bank Swallow	Sensitive		
Barn Swallow	Sensitive		
Blackpoll Warbler	Sensitive		
Boreal Chickadee	Sensitive		
Common Nighthawk	Secure	Threatened	
Harris's Sparrow	Sensitive		
Least Sandpiper	Sensitive		
Lesser Scaup	Sensitive		
Lesser Yellowlegs	Sensitive		

TABLE 4.1-9: BIRD SPECIES OF CONSERVATION CONCERN IN THE NORTHWEST TERRITORIES THAT MAY POTENTIALLY OCCUR IN THE STUDY AREA

Species	NWT Status1	COSEWIC2	SARA3
Long-billed Dowitcher	Sensitive		
Long-tailed Duck	Sensitive		
Northern Pintail	Sensitive		
Olive-sided Flycatcher	Sensitive	Threatened	
Peregrine Falcon (*F.p. anatum*)	Sensitive	Special Concern	Threatened
Red-necked Phalarope	Sensitive		
Rusty Blackbird	May Be At Risk	Special Concern	
Semipalmated Sandpiper	Sensitive		
Short-eared Owl	Sensitive	Special Concern	
Surf Scoter	Sensitive		
Trumpeter Swan	Sensitive		
White-throated Sparrow	Sensitive		
White-winged Scoter	Sensitive		
Yellow Rail	May Be At Risk	Special Concern	Special Concern

NOTE: 1 "Sensitive" or "May be At Risk" (WGGSNWT, 2006); 2 "Endangered", Threatened", or "Special Concern" (COSEWIC, 2009) 3 "Threatened" (SRPR, 2008). Species distributions were evaluated using range maps posted on NatureServe (Patterson *et al*.,. 2003) and the GNWT (2009f) website (Stantec, 2010f).

4.1.10.5 Valued Ecosystem Components (or Key Indicator Species)

Recent baseline studies conducted by Stantec on the Nechalacho Mine and Flotation Plant site area employed the term 'Wildlife Key Indicators'. Within the context of this Project Description Report, Wildlife Key Indicators and VECs may be considered synonymous.

VECs or Key Indicators will be used as the primary focus for the subsequent environmental assessment phase of the TLP review process. The assessment of potential environmental effects will be based on a review of Project components that might cause environmental affects. The future environmental assessment phase will examine all components of the proposed TLP including construction, operation, decommissioning, reclamation and abandonment. The likely interactions, both direct and indirect, between Mine-related activities and the selected VECs/Key Indicators will be assessed and described.

Stantec (2010) used the following criteria to identify key indicator species: conservation status, known or likely occurrence in the Nechalacho Mine and Flotation Plant site area, sustenance (subsistence) value, socio-economic value, and ecological value. Species that met one or more of these criteria were selected as candidate key indicator species. Wildlife key indicators selected for the Nechalacho Mine and Flotation Plant site area are summarized in Table 4.1-10.

TABLE 4.1-10: SELECTED WILDLIFE KEY INDICATORS

Key Indicator	Conservation Status	Sustenance	Socio-economic	Ecological value	Susceptible to Project Effects	Taxonomic Group
Moose		✓	✓		✓	Mammal
Caribou	✓	✓	✓		✓	Mammal
Marten			✓		✓	Mammal
Beaver					✓	Mammal
Wetland-nesting waterbirds		✓	✓	✓	✓	Bird
Upland-nesting waterbirds		✓	✓		✓	Bird
Shorebirds					✓	Bird
Bald Eagle					✓	Bird
Osprey					✓	Bird
Songbirds (communities)						
Wetland/Wooded Bog					✓	Bird
Coniferous Forest					✓	Bird
Mixed and Deciduous forest					✓	Bird
Open Shrubs/Sparsely Forested					✓	Bird
Olive-sided Flycatcher	✓				✓	Bird
Rusty Blackbird	✓				✓	Bird

Source: Stantec, 2010f

Stantec's Environmental Baseline Report: Volume 6 – Wildlife Resources (2010f) provides an overview of the baseline conditions for the 15 key wildlife indicators they identified for the Nechalacho Mine and Flotation Plant site area (Table 4.1-10). Stantec's results are summarized below along with results of previous baseline studies.

Moose

Relative to the proposed Nechalacho Mine and Flotation Plant site area, the nearest home range size estimates for moose are from the Mackenzie Valley (NWT) at 174 km^2 (±31 km^2) (Stenhouse et al., 1995), and from northeast Alberta at 97 km^2 (range: 60–183 km^2) (Hauge & Keith, 1981). Correspondingly, moose densities estimates for the NWT are relatively low, and range from 0.02 to 0.35 individuals per km^2 (Cluff, 2005; GNWT, 2009a). The estimated total population size for the NWT is 20,000 animals (GNWT, 2009a).

During aerial waterbird surveys in 2009, five incidental moose observations were made, and all observations were associated with recently-thawed wetlands. Based on an analysis of moose pellet group density in the proposed Nechalacho Mine and Flotation Plant site area, densities were highest in the rock-lichen woodland, and then in the alder-heath woodland and bog forest (Golder et al., 1998). Overall browse rates, however, were generally low, with fewer than 10% of all shrubs in each broad vegetation community being browsed by Moose and Caribou combined (Golder et al., 1998).

Caribou

On December 17, 2009, the Minister of Environment and Natural Resources, NWT, announced all barren-ground caribou hunting would be cancelled for an area covering approximately 70,000 square km. The ban went into effect January 1, 2010. Due to the proposed Nechalacho Mine and Flotation Plant site's peripheral location in relationship to historic winter range utilization, and reports from the Thor Lake exploration camp that confirm no caribou sightings in the proposed site area from July 2007 until the present time, Avalon is evaluating all aspects of these recent developments. The Company feels that with a cooperative approach involving First Nations and wildlife regulators, this issue can be effectively addressed.

Barren-ground caribou are a significant social and cultural resource for the people of the NWT and Nunavut. Caribou hunting is a vital component of Dene, Métis, and Inuit cultures and is the most important factor in a lifestyle largely dependent on natural resources (Case et al., 1996; Yellowknives Dene, 1999; Nunavut Planning Commission, 1998; North Slave Métis Alliance, 1999). Caribou found in the Avalon Nechalacho Mine and Flotation Plant site area are part of the Bathurst herd. Bathurst caribou are accessible to more people than any other herd (Case et al., 1996) and are ranked as "Sensitive" under the general status program (Working Group on General Status of NWT Species, 2006) and assessed by COSEWIC as "Special Concern" (COSEWIC, 2009).

The population size of the Bathurst herd has been estimated fairly regularly since 1970 (Figure 4.1.10; ENR, 2009a, b). The herd reached a peak size of 472,000 ± 72,900 in 1986, and has declined approximately 5% per year since peak size. Following completion of the survey in 2009, the estimated size of the herd is considerably lower, at 31,900 ± 11,000. The number of animals in a caribou herd naturally fluctuates over a 40 to 60 year cycle. The distribution and density varies from year to year, with the herd rarely using the same area for more than two or three years out of ten (Case et al., 1996).

The Bathurst caribou herd has an annual home range of approximately 354,000 km^2 (Gunn & Dragon, 2000), which generally spans from the major spring calving areas near Bathurst Inlet to wintering habitat within the boreal forest. All of the existing diamond mines, ongoing mineral exploration projects in the Slave Geological Province, and the existing Tibbitt to Contwoyto winter road, fall within this home range. Figures 4.1-11 to 4.1-16 illustrate the seasonal distribution of the Bathurst caribou herd. Studies on caribou habitat and migration patterns using radio telemetry and traditional ecological knowledge studies were initiated in 1996, and continue to provide information on caribou movements and behaviour (Ferguson, Simek & Clark et al., 1999; Thorpe, 2000).

Caribou spring migration begins along broad corridors within forested winter ranges and becomes more directed as movements coalesce towards calving areas (Figure 4.1-11). Frequently used migration corridors follow the drainages of major rivers such as the Hood and Burnside, funnelling animals toward Bathurst Inlet (Kelsall, 1968; Calef, 1981). The intensity of use of known corridors during spring migration depends largely on the late winter distribution of the herd in any given year. Major crossings include Lac de Gras, Point Lake, and Contwoyto Lake.

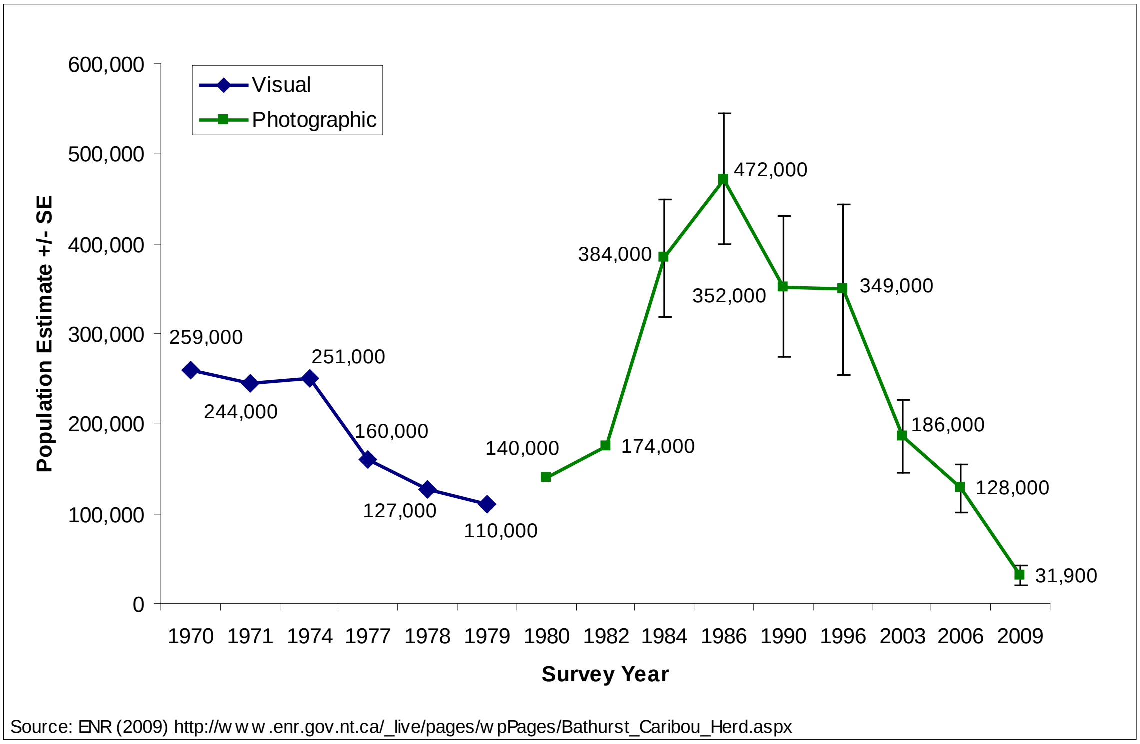
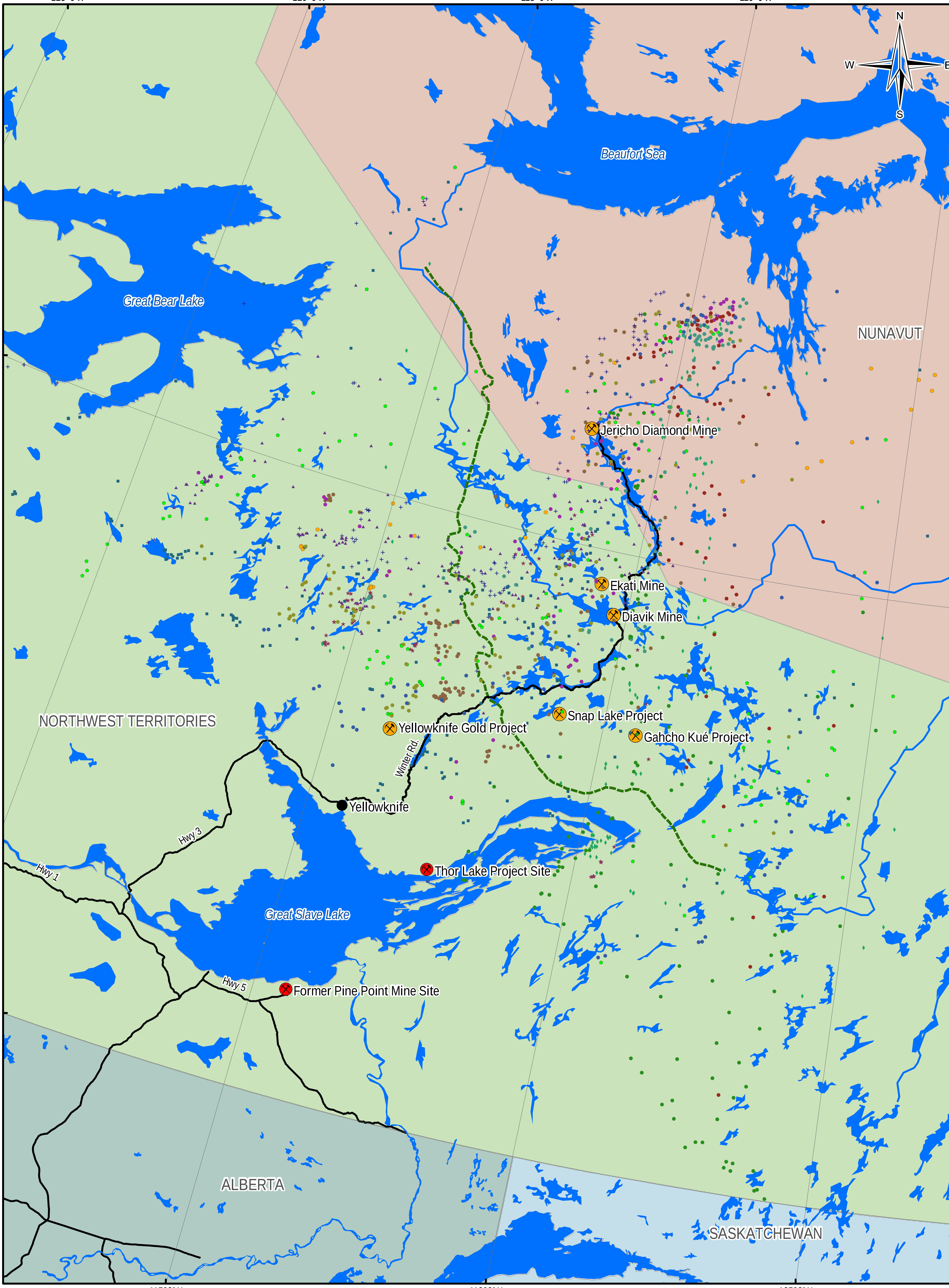


Figure 4.1-10: Bathurst Caribou Herd Population Estimates, 1970 – 2009

Satellite tracking of collared Bathurst caribou since 1997 has confirmed that wintering areas are variable and include areas south of the tree line, from the Coppermine River to Great Slave Lake, extending in some years as far south as the Saskatchewan border (Gunn & Dragon, 2000; Kelsall, 1968; Figures 4.1-11 to 4.1-16). According to Aboriginal Traditional Knowledge, some caribou have been observed at the north end of Contwoyto Lake during winter, but these individuals are few in number and may have migrated south from Victoria Island.

During 1999 to 2000, the winter distribution of the collared cows was split northwest and southeast of Great Slave Lake, similar to the winter of 1998 to 1999. In contrast, all collared cows were located southeast of Great Slave Lake in 1997 to 1998, and northwest of Great Slave Lake in 1996 to1997.

Relative to the proposed Nechalacho Mine and Flotation Plant site area, several winter observations of collared caribou were recorded in the area between 1996 and 2003 (Boulanger et al., 2004) and 2000 and 2007 (Gunn et al., 2008). However, no caribou sightings in the proposed site area have occurred since July 2007.



LEGEND

- Yellowknife
- Existing Mine/Project
- Thor Lake Project
- Road
- Tree Line
- Watercourse
- Waterbody

Bathurst Caribou Spring Migration by Year

1996	2002	2008
1997	2003	2009
1998	2004	
1999	2005	
2000	2006	
2001	2007	

NOTES
1. Some locations seen on the map may represent Caribou from other herds.
2. Base data sources: GNWT ENR (November, 2009), ESRI

ISSUED FOR USE

THOR LAKE PROJECT

Distribution of Satellite-Collared Bathurst Caribou: Spring Migration (April 15 to May 31)

PROJECTION	DATUM
Canada Albers	NAD83

Scale: 1:3,500,000
50 25 0 50
Kilometres

AVALON RARE METALS INC.

EBA Engineering Consultants Ltd.

FILE NO.			
V15101007_006_Figure4_1-11_CarSpring.mxd			
PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	GC	0
OFFICE	DATE		
EBA-VANC	March 22, 2010		

Figure 4.1-11

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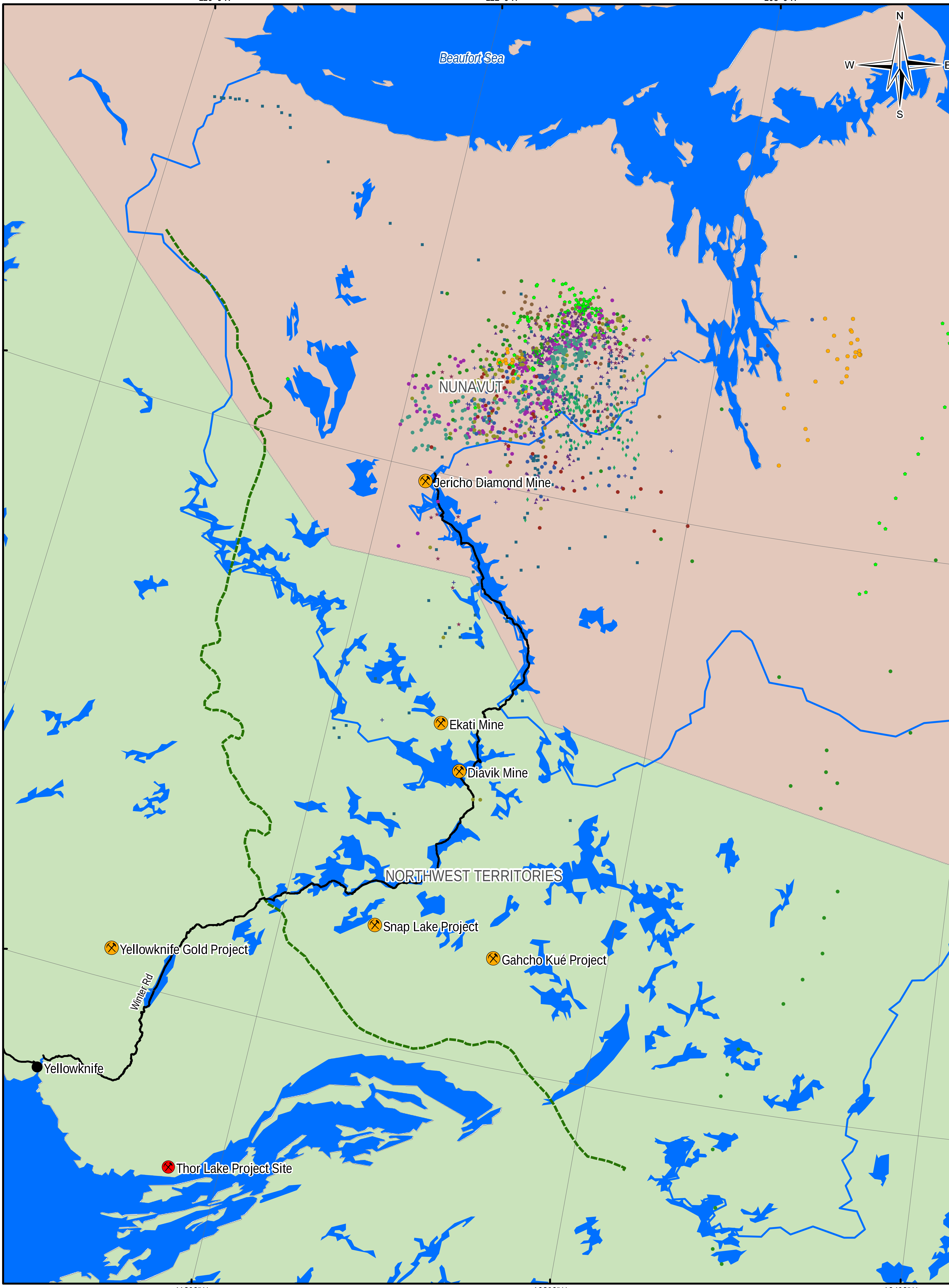

LEGEND

- Yellowknife
- Existing Mine/Project
- Thor Lake Project
- Road
- Tree Line
- Watercourse
- Waterbody

Bathurst Caribou Calving Period by Year

- 1996
- 1997
- 1998
- 1999
- 2000
- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009

NOTES
1. Some locations seen on the map may represent Caribou from other herds.
2. Base data sources: GNWT ENR (November, 2009), ESRI

ISSUED FOR USE

THOR LAKE PROJECT

Distribution of Satellite-Collared Bathurst Caribou: Calving Period (June 1 to June 25)

PROJECTION	DATUM
Canada Albers	NAD83

Scale: 1:2,250,000
40 20 0 40
Kilometres

AVALON RARE METALS INC.

EBA Engineering Consultants Ltd. eba

FILE NO.
V15101007_006_Figure4_1-12_CarCalving.mxd

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	GC	0

OFFICE	DATE
EBA-VANC	March 22, 2010

Figure 4.1-12

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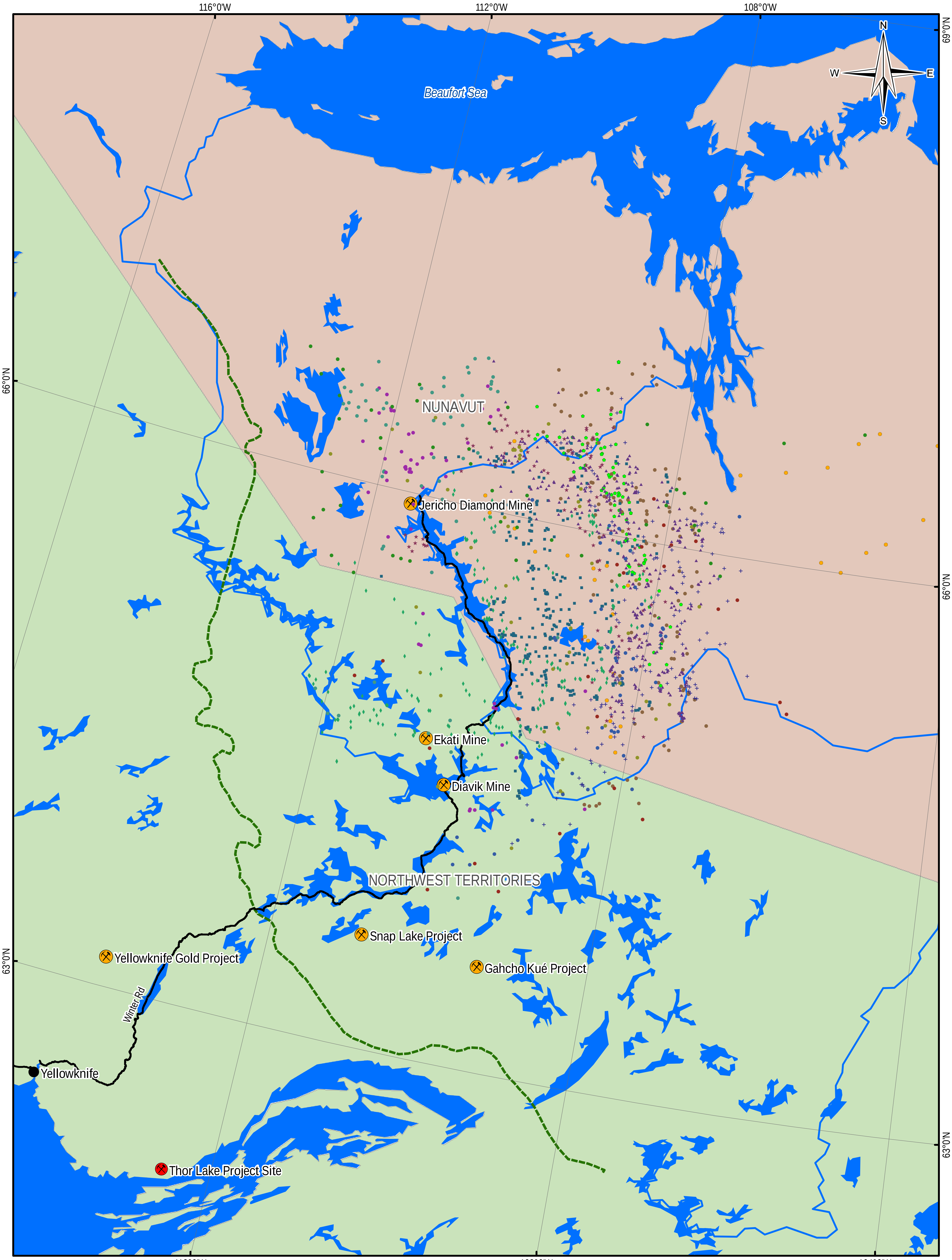

LEGEND

- Yellowknife
- Existing Mine/Project
- Thor Lake Project
- Road
- Tree Line
- Watercourse
- Waterbody

Bathurst Caribou Post Calving Movement by Year

1996	2002	2008
1997	2003	2009
1998	2004	
1999	2005	
2000	2006	
2001	2007	

NOTES

1. Some locations seen on the map may represent Caribou from other herds.
2. Base data source: GNWT ENR (November, 2009), ESRI

ISSUED FOR USE

THOR LAKE PROJECT

Distribution of Satellite-Collared Bathurst Caribou: Post-Calving Movement (June 26 to July 15)

PROJECTION	DATUM
Canada Albers	NAD83

Scale: 1:2,250,000

40 20 0 40

Kilometres

FILE NO.
V15101007_006_Figure4_1-13_CarPostCalving.mxd

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	GC	0

OFFICE	DATE
EBA-VANC	March 22, 2010

AVALON RARE METALS INC.

EBA Engineering Consultants Ltd.

Figure 4.1-13

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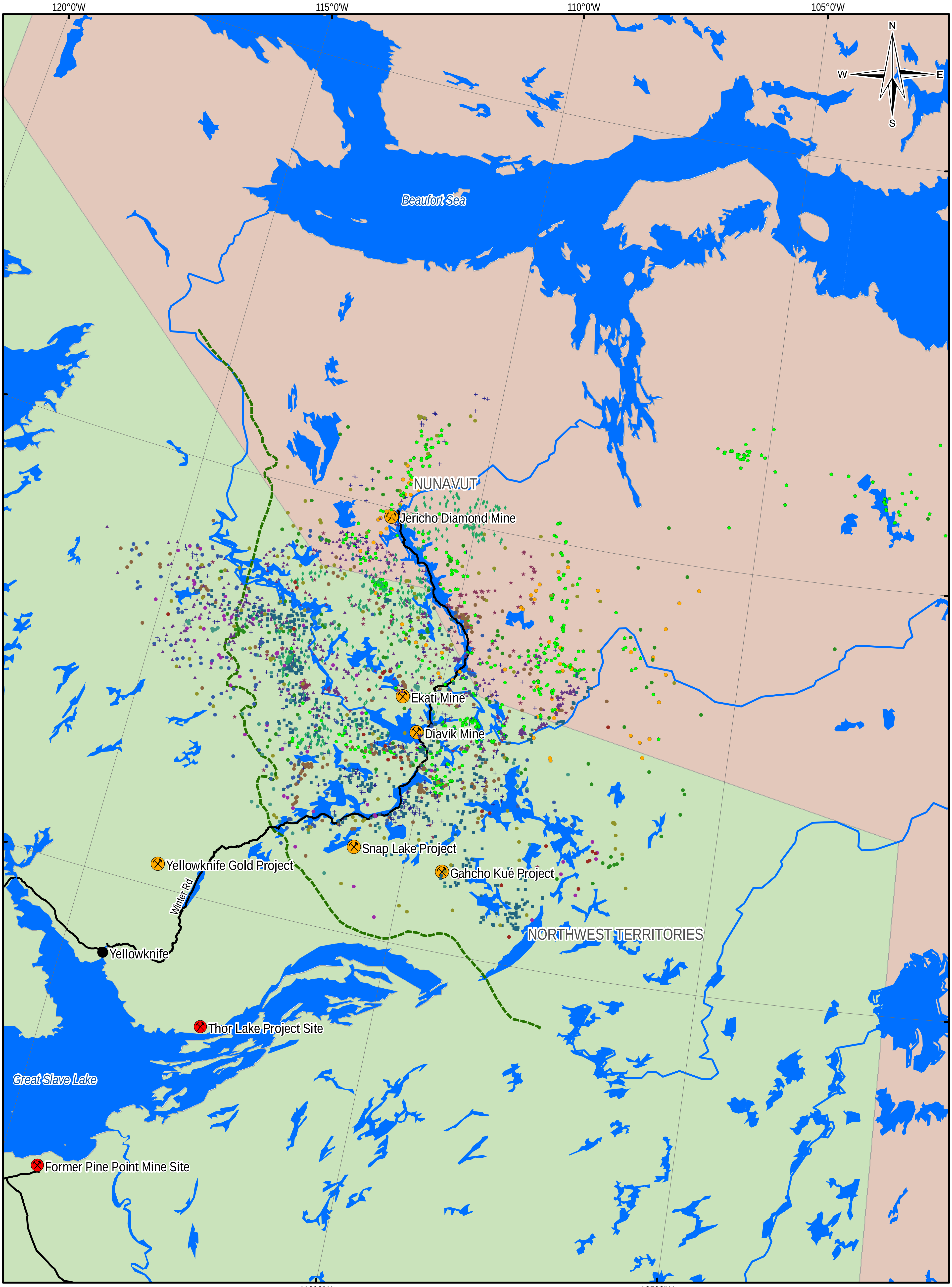

LEGEND

- Yellowknife
- Existing Mine/Project
- Thor Lake Project
- Road
- Tree Line
- Watercourse
- Waterbody

Bathurst Caribou Summer Range by Year

1996	2002	2008
1997	2003	2009
1998	2004	
1999	2005	
2000	2006	
2001	2007	

NOTES
1. Some locations seen on the map may represent Caribou from other herds.
2. Base data source: GNWT ENR (November 2009), ESRI

ISSUED FOR USE

THOR LAKE PROJECT

Distribution of Satellite-Collared Bathurst Caribou: Summer Range (July 16 to September 10)

PROJECTION	DATUM
Canada Albers	NAD83

Scale: 1:3,000,000

50 25 0 50

Kilometres

FILE NO.
V15101007_006_Figure4_1-14_CarSummer.mxd

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	GC	0

OFFICE	DATE
EBA-VANC	March 22, 2010

AVALON RARE METALS INC

EBA Engineering Consultants Ltd.

Figure 4.1-14

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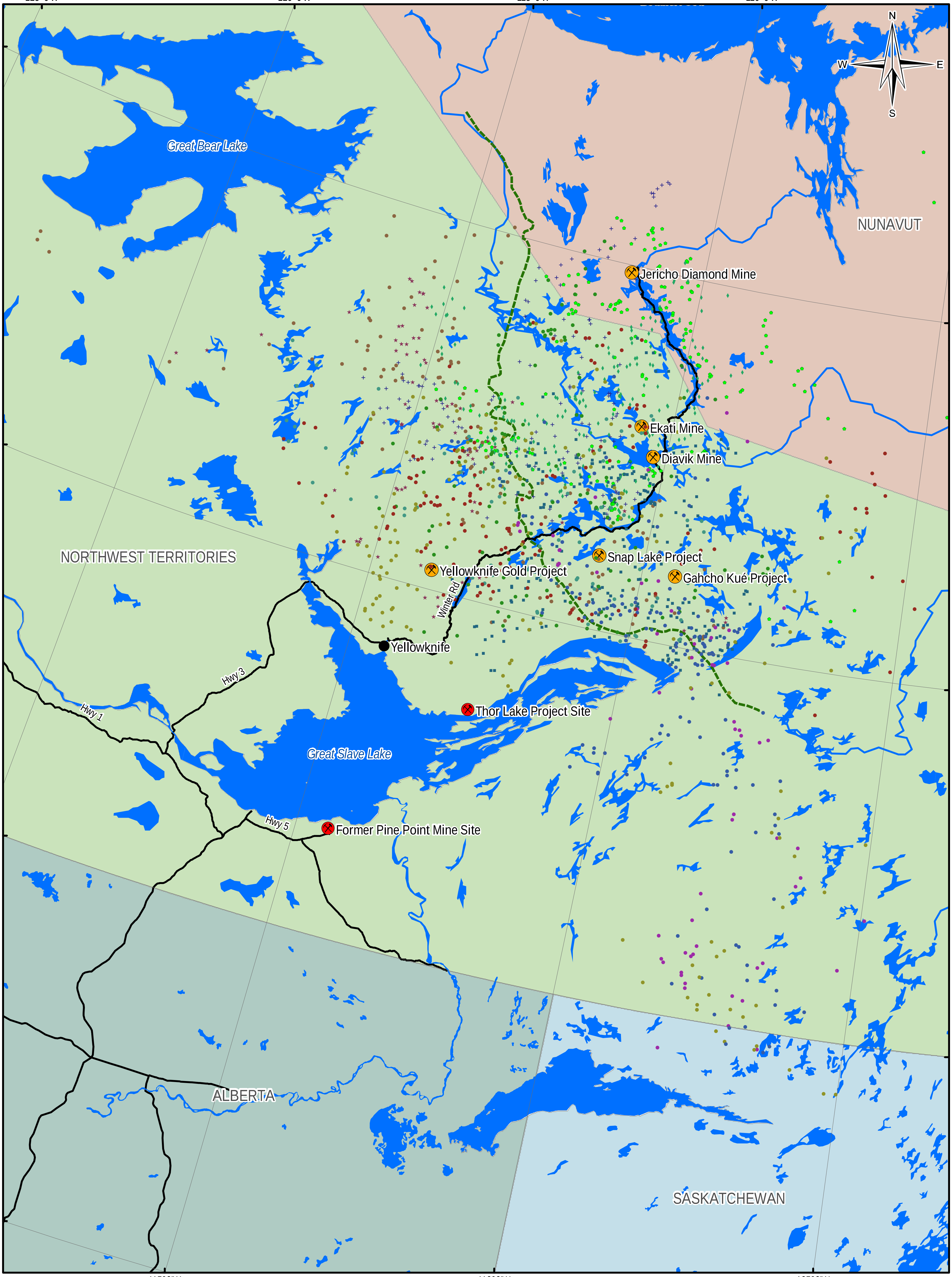

LEGEND

- Yellowknife
- Existing Mine/Project
- Thor Lake Project
- Road
- Tree Line
- Watercourse
- Waterbody

Bathurst Caribou Fall Migration by Year

1996	2002	2008
1997	2003	
1998	2004	
1999	2005	
2000	2006	
2001	2007	

NOTES
1. Some locations seen on the map may represent Caribou from other herds.
2. Base data source: GNWT ENR (November 2009), ESRI

ISSUED FOR USE

THOR LAKE PROJECT

Distribution of Satellite-Collared Bathurst Caribou: Fall Migration (September 11 to November 20)

PROJECTION: Canada Albers	DATUM: NAD83

Scale: 1:3,500,000
50 25 0 50
Kilometres

FILE NO. V15101007_006_Figure4_1-15_CarFall.mxd

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	GC	0

OFFICE	DATE
EBA-VANC	March 22, 2010

AVALON RARE METALS INC.

EBA Engineering Consultants Ltd.

Figure 4.1-15

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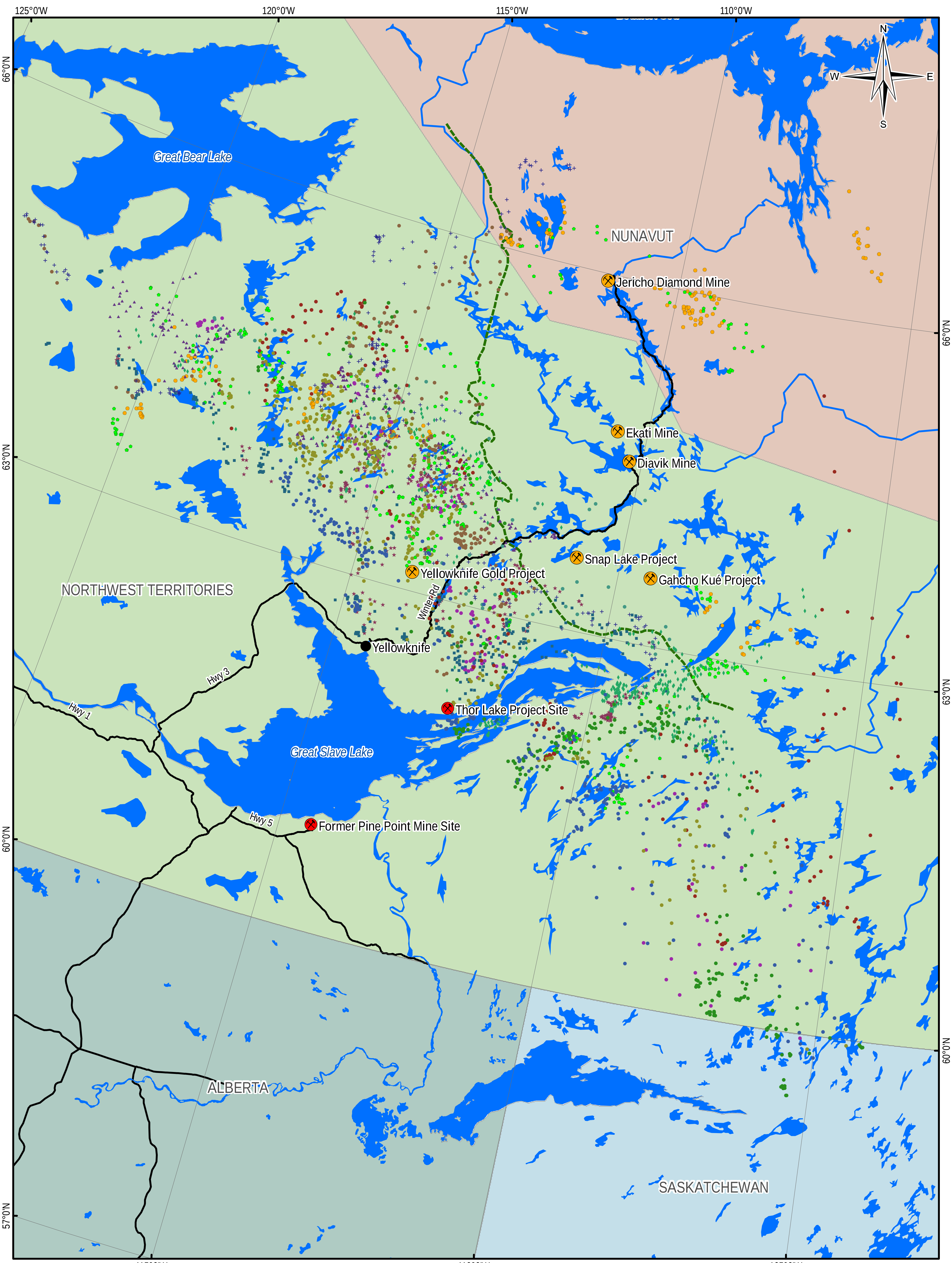

LEGEND

- Yellowknife
- Existing Mine/Project
- Thor Lake Project
- Road
- Tree Line
- Watercourse
- Waterbody

Bathurst Caribou Winter Range by Year

1996	2002	2008
1997	2003	2009 (January to March only)
1998	2004	
1999	2005	
2000	2006	
2001	2007	

NOTES
1. Some locations seen on the map may represent Caribou from other herds.
2. Base data source: GNWT ENR (November 2009), ESRI

ISSUED FOR USE

THOR LAKE PROJECT

Distribution of Satellite-Collared Bathurst Caribou: Winter Range (November 21 to April 15)

PROJECTION: Canada Albers
DATUM: NAD83

Scale: 1:3,500,000
50 25 0 50
Kilometres

AVALON RARE METALS INC.

EBA Engineering Consultants Ltd.

FILE NO.: V15101007_006_Figure4_1-16_CarWinter.mxd

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	GC	0

OFFICE: EBA-VANC
DATE: March 22, 2010

Figure 4.1-16

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American Marten

Marten are managed as an important furbearer in the NWT and comprise approximately half the fur trade value of NWT harvesters (GNWT, 2009c).

Average marten home range size in the Mackenzie Valley and Yukon is 5.8 km^2 for males, and 3.9 to 4.8 km^2 for females (Latour et al., 1992; Archibald & Jessup, 1984). Up to 30% of habitat selection by marten at the landscape level may include forest cover openings (Chapin et al., 1998; Hargis et al., 1999; Potvin et al,. 2000).

It should be noted that no baseline data are available for the proposed site area for this species.

Beaver

Year-round living habitat of beaver is often in close proximity to a beaver lodge, and their densities in the Northwest Territories are low. A beaver lodge survey in 2009, combined with historical information, was used to identify the spatial distribution of beaver activity in relation to the proposed Nechalacho Mine and Flotation Plant site area. In 2009, beaver lodge density for the proposed site area was 0.23 lodges/km^2 (Stantec, Consulting 2010f), and was within the range of values observed elsewhere for northern boreal regions (e.g., 0.17 lodges/km^2 (Dennington & Johnson, 1974), 0.10–0.38 lodges/km^2 (Fuller & Keith, 1980), 0.26 lodges/km^2 (Poole & Croft, 1990). In 1989, in the vicinity of Thor Lake, the density estimate for both active and inactive lodges combined was 0.14 lodges/km^2 (SRC, 1989). Additionally, Beaver lodge density in 1989 was notably higher to the west of the proposed Nechalacho Mine site, and was consistent with results from Stantec Consulting (2009). The closest reported active beaver lodge to the proposed Mine site is at Ring Lake (SRC 1989), although there did not appear to be an active lodge there in 2009.

Upland and Wetland Nesting Waterbirds

There are 25 species of waterbird and shorebird confirmed as occurring within 10 km of Thor Lake. Four species of loon and two species of grebe are expected to breed in the proposed site area. All loons breed at the margins of small wetlands and lakes, often on hummocky clumps of grass, floating vegetation mats, or on partially submerged rotting logs. Occasionally, loons will nest on small islets in wetlands and lakes, and generally, the Common Loon avoids breeding on lakes that have predatory fish. Lake disturbance may cause nest abandonment, nest destruction, or separation of adults from young that can lead to predation. This applies especially to those species that nest on or along the shore (e.g., loons), among emergent vegetation (e.g., Horned Grebe), or on floating nest mounds either in exposed or concealed locations (e.g., Red-necked Grebe). In addition to breeding pairs, loons and grebes breeding in other areas likely migrate through the regional and local study areas.

There are four species of goose that either occur, or may occur, in the proposed Nechalacho Mine and Flotation Plant area. Canada Goose is the only goose species expected to breed, with nests typically positioned on grassy hummocks, beaver lodges and dams, mossy mounds, cattail beds, or rock piles that provide reasonable isolation from land-based predators (Mowbray et al., 2002). Occasionally, Canada Goose will nest on the broken tops of large tree trunks, or in unused, but exposed hawk or raven nests. The occurrence of Canada Goose in the proposed site area is apparently not very common, as the only known observations are from an aerial survey in 1987 where 2 and 55 birds were observed on May 26 and June 2 respectively (Sirois, 1987), and from the 2009 aerial survey when 150 birds were observed migrating north (Stantec, 2010f). Breeding is expected to occur throughout the entire area, and although density estimates are not known, it is expected to be low compared to areas further south in Alberta.

The expected residency period for Canada Goose in the proposed site area is mid-May through early October. Snow Goose and Greater White-fronted Goose are not expected to breed in the area, although potentially thousands of birds may migrate over in spring and autumn. During the 2009 spring aerial waterbird surveys, 396 Snow geese were observed migrating over the proposed Nechalacho Mine and Flotation Plant site area (Stantec 2010f), and 10 Snow geese and 70 Greater-white-fronted geese were observed migrating in the spring of 1986 (Sirois and McCormick 1987). No additional reports are known for these species, and if Ross's Goose occurs in the area, it would be considered a rare visitor.

There are 16 species of duck known to occur in the proposed site area (Stantec, 2010f), and most are expected to breed in the area. Based on CWS aerial surveys in the late 1980s, and on the 2009 surveys, both Lesser and Greater scaup appear to be the most numerous migratory duck with substantial stopover abundance. Large numbers of Mallard, Surf Scoter, Northern Pintail, and American Wigeon also use the area for stopover during migration. Surf Scoter is considered a common breeder on small lakes surrounding Great Slave Lake (Sirois, 1994), and it is likely that species such as American Wigeon, Northern Pintail, Lesser Scaup, Ring-necked Duck, Bufflehead, and Common Merganser are relatively common nesting species. Species that may nest in lower relative densities include White-winged Scoter, Red-breasted Merganser, and Long-tailed Duck.

Among the various waterbird species that occur in the region, preferred breeding locations can be generalized into two broad categories: 1) wetland-nesting species, and 2) upland-nesting species. Wetland nesting species include Canvasback, Long-tailed Duck, and Ring-necked Duck. Upland nesting species include American Wigeon, Blue-winged Teal, Bufflehead, Common Merganser, Common Goldeneye, Green-winged Teal, Mallard, Northern Pintail, Northern Shoveler, Red-breasted Merganser, Scaup sp., Surf Scoter, and White-winged Scoter. Several of the upland nesting species may also nest on shrubby or heavily vegetated islands within wetland and lake habitats. For generalization, the three cavity nesting species (Bufflehead, Common Goldeneye, Common Merganser) are included in the upland nesting category, as they are dependent on larger trees in close proximity to open water. The only confirmed breeding record of any waterbird species is for Common Merganser, which nested under the Thor Lake exploration camp office in 2008 (Bill Mercer, pers. comm.).

Shorebirds

Several species of shorebird may occur in the proposed Nechalacho Mine and Flotaiton Plant site area, but only six are expected to breed regularly, and none of these are of conservation concern. The potential breeding species include Semipalmated Plover, Killdeer, Wilson's Snipe, Lesser Yellowlegs, Solitary Sandpiper, and Spotted Sandpiper. All are summer visitants to the proposed site area from mid-May through late August. All species breed in close proximity to wet habitats, with Wilson's Snipe mainly in bogs and shallow marsh vegetation, Solitary Sandpiper and Lesser Yellowlegs in spruce bogs, and Killdeer and Semipalmated Plover on gravel or rocky shorelines.

During aerial waterbird surveys in late May, 2009, Lesser Yellowlegs was the most frequently encountered shorebird, with individuals being detected from several survey transects (Stantec, 2010f). On May 23 and 27, respectively, one Killdeer and one Greater Yellowlegs were observed. A flock of 20 Calidris sp. was observed migrating north on May 27, 2009 and a flock of 35 Dowitcher sp. was observed migrating north on May 31, 2009. Small wetlands may be collectively important for small flocks of migrating shorebirds, but traditional stopover sites elsewhere along the migration route (e.g., Boundary Bay, BC, Quill Lakes, SK) support flocks numbering into the tens-of-thousands of individuals. In June and August, 2008, Golder (1998) reported the occurrence of Wilson's Snipe and Semipalmated Plover in the proposed Nechalacho Mine and Flotation Plant site area.

Bald Eagle

Of seven nests observed in the proposed site area, all were situated in spruce, either at the edge of a small lake, or on an island. Bald Eagle occurs year-round in the Northwest Territories, although there is also a substantial migratory population. Among migrants, birds arrive in the proposed site area in early April and depart in November. Telemetry data from a single bird that departed northern California on March 14 arrived in the proposed Nechalacho Mine and Flotation Plant site area on April 12, and in autumn was first recorded in northern Alberta on November 15.

During a reconnaissance-type aerial survey for raptor nests in the Project area on May 31, 2009, six of seven observed nests were within the proposed site area, and five of these were active with adults and eggs present.

Osprey

The first reported occurrence of an Osprey from the proposed Nechalacho Mine and Flotation Plant site area was from August, 1998 (Golder, 1998), and the first confirmed breeding occurrence was June 1, 2009 during an aerial raptor nest survey (Stantec, 2010f). The nest, located atop a large spruce, was approximately 3 km from Thor Lake and situated within the local study area (Stantec, 2010f). Relative to Bald Eagle, Osprey is not expected to be a common nesting species in the proposed site area, mainly because of interspecific competition with Bald Eagle. Generally, Bald Eagle arrives on its breeding territory earlier than Osprey, and may occupy nests previously built by Osprey (Poole et al., 2002). Additionally, Bald Eagle is known to occasionally steal fish from Osprey and kill nestlings, which can limit Osprey population growth where Bald Eagle densities are high (Poole et al., 2002).

Songbirds (Passerines)

Songbirds are widespread throughout the proposed Nechalacho Mine and Flotation Plant site area and likely occur in all broad habitat types. However, responses by songbirds to changes within and among broad habitat types varies considerably among species, and thus describing which species occur predominantly in each broad habitat type can be useful for estimating relative project effects. The songbirds are grouped into four communities on the basis of habitat preference: 1) wetland/wooded bog, 2) coniferous forest, 3) mixed and deciduous forest, and 4) open shrub/sparsely forested. The expected common or regularly occurring species in each habitat type for the proposed site area are described in the following sections. Most songbird species in these groups are migratory, although some forest-dependent species are year-round residents (e.g., Gray Jay, Black-capped Chickadee). Among the migratory species, most occur in the proposed site area from late spring (May) through mid-autumn (September). For species of conservation concern, such as for Rusty Blackbird and Olive-sided Flycatcher, baseline conditions are provided separately.

Rusty Blackbird

There is no population data available for Rusty Blackbird in the proposed Nechalacho Mine and Flotation Plant site area, however, the Breeding Bird Survey suggests that Rusty Blackbird populations have declined at an average annual rate of -10.1% per year in Canada, and by -8.8% per year in closed boreal forest, for the period 1980 to 2007 (Sauer et al., 2008).

Olive-sided Flycatcher

Olive-sided Flycatcher is a species of conservation concern in Canada, and is presently designated as Threatened (COSEWIC, 2009) because of long-term population declines throughout much of the species' range. Throughout its breeding range the species is tied to the distribution of older, taller coniferous forests. In the vicinity of Thor Lake, Olive-sided Flycatcher occurs at the northern limit of its range. Breeding density in this area is expected to be low compared to areas further south. Olive-sided Flycatcher arrives in the Northwest Territories in late May and early June, and departs in late July and early August. During its brief visit, breeding pairs generally establish territories at forest edges adjacent to clearings, especially where scattered tall trees or snags are available for perching on, or foraging from. There is no population data available for Olive-sided Flycatcher in the proposed Nechalacho Mine and Flotation Plant site area, however, the Breeding Bird Survey suggests that Olive-sided Flycatcher populations have declined at an average annual rate of -4.4% per year in Canada, and by -3% per year in British Columbia, for the period 1980 to 2007 (Sauer et al., 2008).

4.2 HYDROMETALLURGICAL PLANT SITE

4.2.1 Environmental Information Sources

This section presents a description of the existing biophysical environmental conditions present in the terrestrial area of interest located between the south shore of Great Slave Lake and the proposed location of the Hydrometallurgical Plant site to be located at the site of the former Pine Point Mine (Figure 4.2-1). Information included in this section has been drawn from various environmental baseline studies undertaken in the general area over the past 35 years, resource agency information sources, and studies conducted by EBA Engineering Consultants Ltd. (EBA) for the Tamerlane Pilot Project in 2005 and 2006 (as cited in EBA, 2009). The complete EBA summary document "EBA Thor Lake Pine Point Area Environmental Considerations" is found in Appendix H.

4.2.2 General Ecology

The area of interest is located in the Great Slave Lowlands Mid-Boreal Ecoregion of the Taiga Plains Ecozone (Figure 4.2-2) (Ecosystem Classification Group, 2007, as cited in EBA, 2009). The area is characterized by short, cool summers and long, cold winters. The mean annual temperature is -17.5 ºC, and annual precipitation ranges from 300 to 400 mm. This ecoregion is classified as having a subhumid mid-boreal eco-climate.

Nearly level lacustrine and alluvial deposits with a mosaic of sedge wetlands and grass meadows, diverse forests and wetlands typify the Slave Lowland MB Ecoregion. The vegetation of this Ecoregion is characterized by medium to tall, closed stands of jack pine and trembling aspen. White spruce and black spruce dominate later successional stands. Poorly drained fens and bogs in this region are covered with low, open stands of larch, black spruce and ericaceous shrubs.

Moose, woodland caribou and occasionally wood bison are the main ungulates found in the area of interest, although none are considered common. The bird life present is typical of the boreal forest, and the south shore of Great Slave Lake is considered to be an important concentration site for birds during their annual migrations.

THOR LAKE PROJECT

Proposed Road Corridor Between Great Slave Lake and the Former Teck Cominco Pine Point Mine Site, NWT

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:70,000

1 0.5 0 1

Kilometres

AVALON RARE METALS INC

EBA Engineering Consultants Ltd.

FILE NO.
V15101007_006_Figure4_2-1_RoadCorridor.mxd

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	RH	0

OFFICE	DATE
EBA-VANC	March 22, 2010

Figure 4.2-1

ISSUED FOR USE

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4.2.3 Surface Hydrology

The area of interest is flat to gently sloping and a considerable portion of the area is covered by poorly drained muskeg ranging up to 3 m deep. The area also contains several generally east-west low ridges, which are considered to have been formed by old lake-level beaches. Extensive wetland areas and small lakes are located in the area (Figure 4.2-3). No streams are present in the proposed haul road alignment.

Great Slave Lake is the final receptor of all surface water draining from the area of interest. Historic data available on lake levels at the Water Survey of Canada recording station at Hay River (Station 0708002) indicate that the mean lake level has been 156.7 metres above sea level (masl) with normal seasonal variations between 156.6 and 156.9 masl and extreme variations recorded of 157.3 and 156.2. Highest water levels typically occur in mid-summer (Beak, 1980, as cited in EBA 2009).

4.2.4 Soils

The general area is described in the Soils of the Slave River Lowland as low-lying flat land with numerous lakes and abandoned stream channels. The soil climate is subarctic (humid) with some discontinuous permafrost. In much of the area, soil development has been influenced by the presence of water for much of the year. The dominant soils are Humic Gleysols and Regosols (Day, 1972, as cited in EBA, 2009). There is little relief, and changes in vegetation communities are not followed with a characteristic change in surface elevation, but rather, a change in the depth to mineral soil (EBA, 2005a, as cited in EBA, 2009).

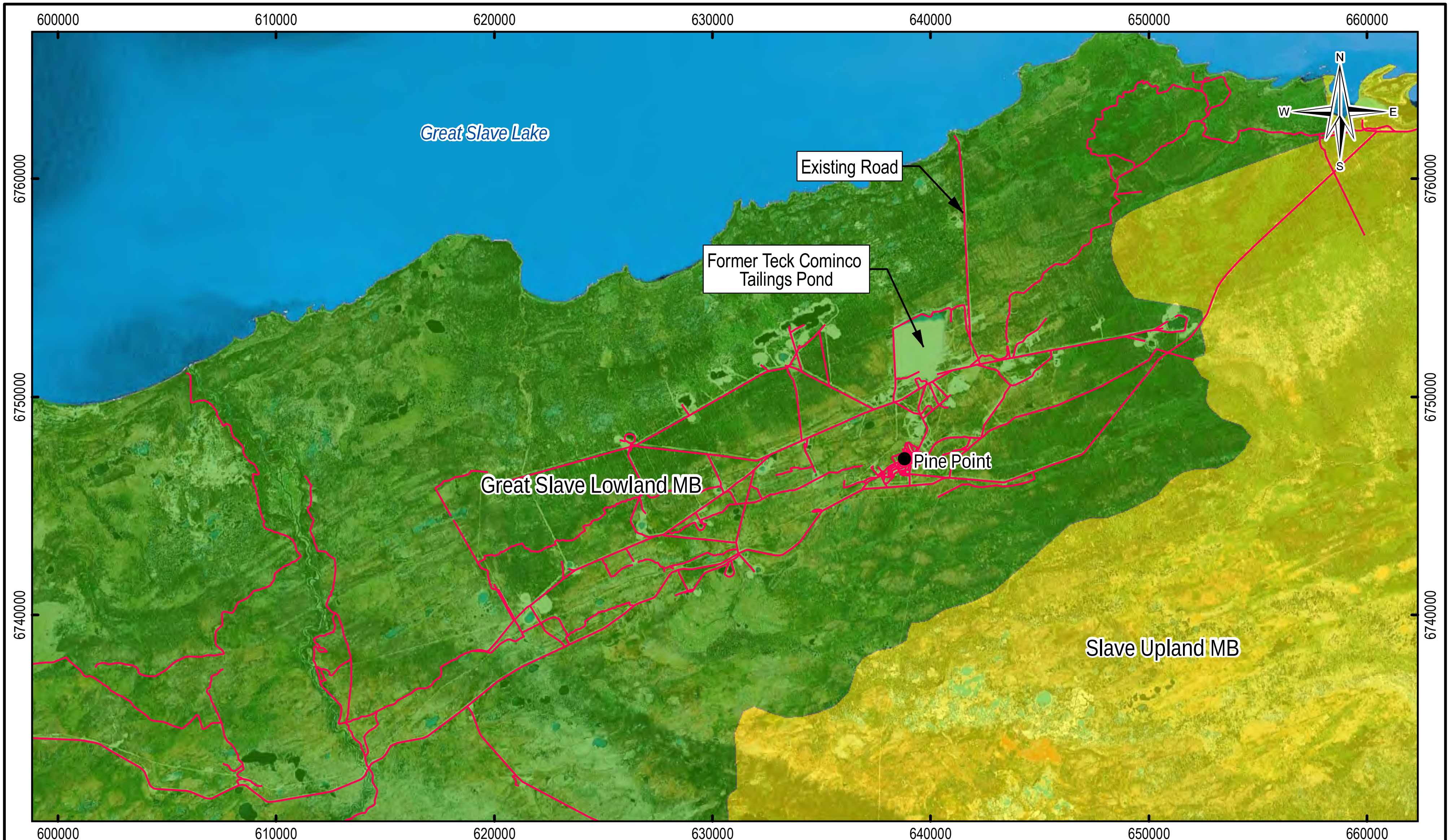
The soils in the study area are primarily Eluviated Eutric Brunisols in upland areas and Terric Organics and Gleysols in lowland areas. Cumulo Organics were encountered; most likely a result of the formation and flooding regimes of Glacial Lake McConnell. The cumulo layers are remnants of past glaciation. These soils will become Terric and Typic organics with the passage of time. Mineral soils vary in texture from gravel to clay. Sand is most common (EBA, 2005a, as cited in EBA, 2009).

Discontinuous permafrost has been reported in some localized areas within the overburden, but is not common and is unlikely to occur in the area of interest due to its proximity to Great Slave Lake.

4.2.5 Vegetation

Vegetation mapping of the general Pine Point area was first undertaken in 1977 by BC Research using black and white aerial photographs and fieldwork. Mapping of the area was carried out again using aerial photographs taken in June 1979 by Beak Consultants Ltd. The plant communities identified from these studies were: jack pine, aspen, mixed jack pine/black spruce, white spruce, black spruce, shrub, fen, muskeg and burn, for a total of nine distinct types (EBA, 2009).

Q:\Vancouver\GIS\ENGINEERING\V151\V15101007_ThorLake\Maps\006_PDR\V15101007_006_Figure4_2-2_Ecoregions.mxd



LEGEND

- Pine Point
- Road

Ecoregions

- Great Slave Lowland MB
- Slave Upland MB

NOTES

Base data source:
- Google Earth Pro
- Ecosystem Classification Group. 2007. Ecological Regions of the Northwest Territories – Taiga Plains. Department of Environment and Natural Resources, Government of the Northwest Territories, Yellowknife, NT, Canada. vii + 209 pp. + folded insert poster map.

ISSUED FOR USE

Scale: 1:250,000

4 2 0 4

Kilometres

PROJECTION	DATUM
UTM Zone 11	NAD83

FILE NO.
V15101007_006_Figure4_2-2_Ecoregions.mxd

AVALON RARE METALS INC.

EBA Engineering Consultants Ltd.

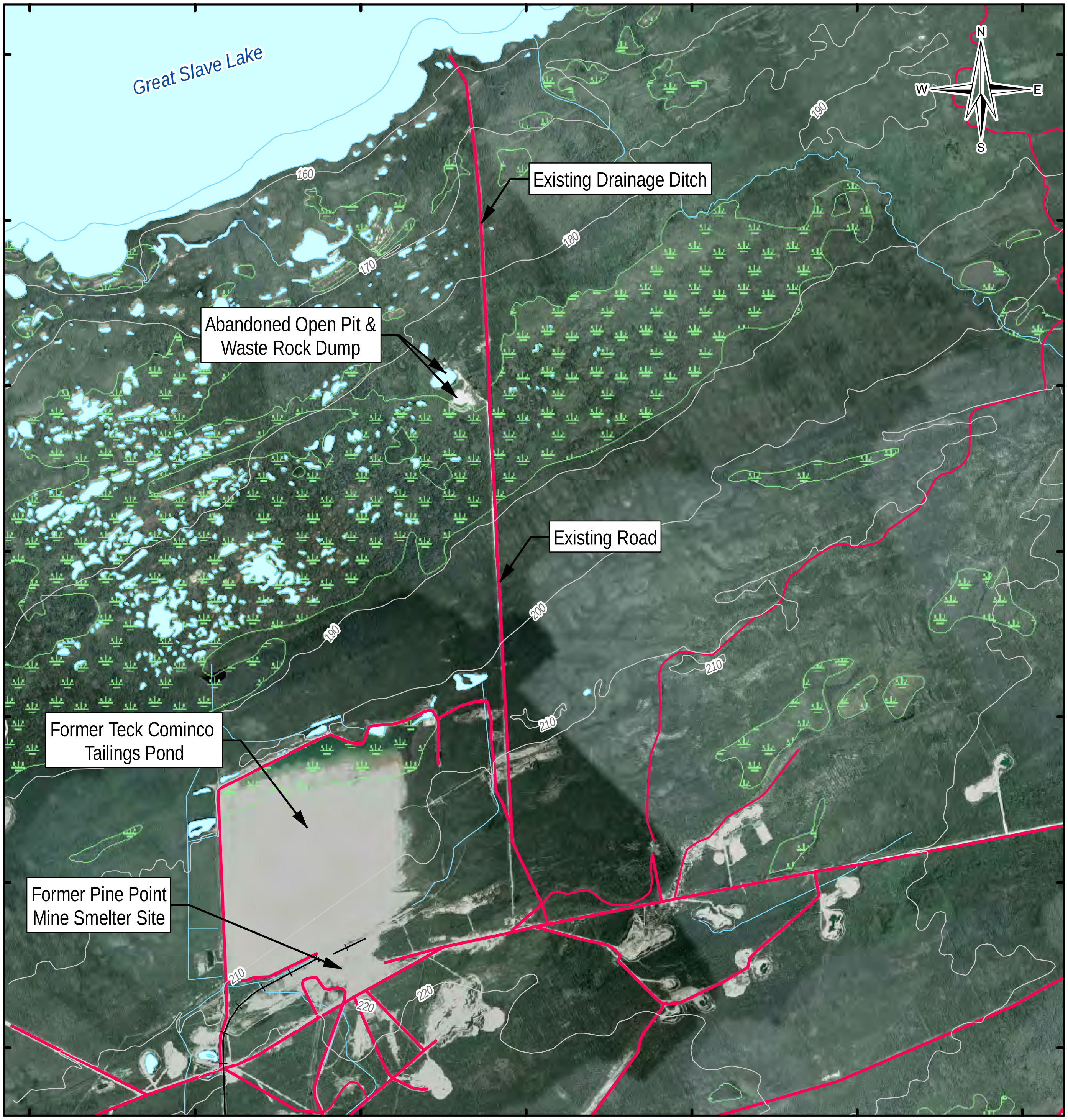
THOR LAKE PROJECT

Ecoregions in the Vicinity of the Former Pine Point Mine, NWT

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	RH	0

OFFICE	DATE
EBA-VANC	March 22, 2010

Figure 4.2-2



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LEGEND

- Contour (10m)
- Road
- Limited Use Road
- Railway
- Watercourse
- Waterbody
- Wetland

THOR LAKE PROJECT

Wetlands and Lakes
North of the Former Pine Point Mine, NWT

PROJECTION	DATUM
UTM Zone 11	NAD83

Scale: 1:70,000

1 0.5 0 1

Kilometres

FILE NO.
V15101007_006_Figure4_2-3_PPLakes.mxd

PROJECT NO.	DWN	CKD	REV
V15101007.006	MEZ	RH	0

OFFICE	DATE
EBA-VANC	March 22, 2010

AVALON RARE METALS INC

EBA Engineering Consultants Ltd.

Figure 4.2-3

ISSUED FOR USE

In September 2005, EBA collected new baseline vegetation and ecosystem data for the proposed Tamerlane Pilot Project Regional Study Area located immediately to the west of the current area of interest.

Eight naturally vegetated ecosystem units were classified within the Pine Point Regional Study Area. The most common ecosystem was the upland, Labrador Tea – Mesic ecosite (28.3 %). The Shrubby and Treed fens, characteristic of lowland landforms, were second and third in area (24.6 % and 24.3 %) (EBA, 2005a, as cited in EBA, 2009).

Based on the information reported in EBA 2005a and our understanding that the area of interest to the north of the former Pine Point Mine consists primarily of lowland landforms draining towards Great Slave Lake as illustrated in Figure 4.2-3, wetland ecosystems dominate the land in this area.

The main wetland ecosystems present in the area of interest include Graminoid, Shrubby and Treed Fen ecosites. The fens are generally restricted to areas of poorly drained organic soils. Soils tend to be rich in nutrients. Stand composition in the region varies due to the fire regime. Early successional stands are dominated by an open canopy of bog birch, while mature stands have a closed canopy of black spruce and larch.

The limited upland landforms in the area of interest include Bearberry Pj, Canada Buffalo – Green Alder, Labrador Tea – Mesic, and Labrador Tea – Subhygric ecosites. They are dominated by jack pine, aspen and paper birch in seral communities, and black and white spruce in climax communities. Immediately after fire, the communities are dominated by fast growing deciduous seral species such as paper birch and alder (Alnus species). The slower growing jack pine becomes the dominant species a few years after fire.

4.2.6 Wildlife

Early science-based wildlife studies of the Pine Point area were first conducted during the period 1976 to 1980 by BC Research to evaluate the environmental consequences of Cominco's mining operation at Pine Point (BC Research, 1983, as cited in EBA 2009). Large mammal surveys (i.e. caribou, moose, bison) were first conducted using fixed-wing aircraft in March 1976. The survey covered the area between Buffalo River and Little Buffalo River north to the shores of Great Slave Lake. The southern boundary of the survey area was Wood Buffalo National Park. All large mammal tracks and sightings were recorded (BC Research, 1983, as cited in EBA, 2009). A second survey was carried out by BC Research by helicopter, followed by a ground survey in the summer of 1977. All observations of wildlife were recorded.

These early studies indicated that:

> *"large mammals may be less common than in the past due to habitat removal and people pressure, such as vehicular traffic and hunting, whereas there appeared to be little impact on upland furbearers".*

BC Research (1983) (as cited in EBA 2009) also reported that:

> *"the most productive furbearer habitat near Pine Point appeared to be located outside the areas of direct mining activity. Aquatic furbearers may have benefited from the creation of additional habitat, due to discharge of water from the open pits. However, the relatively low temperature of pit water may have reduced the productivity of their habitat, and thus may have degraded habitat that existed before the discharge of pit water began".*

During the bird-nesting season in 1978, BC research conducted a bird census study. The primary objective of that study was to provide a baseline inventory of aquatic birds which breed north of the Pine Point tailings area, along the shore of Great Slave Lake from Sulfur Point to Paulette Creek, and at several small islands and reefs near Paulette Island (BC Research, 1983, as cited in EBA, 2009).

The most abundant aquatic birds observed during the 1978 survey were: Mallard, herring gulls, other unidentified gulls, shorebird species, scaup species, pintail, red-breasted and common merganser, Arctic terns and American wigeon. Effects of the tailings water discharge on the avifauna of the Pine Point region appeared to be minimal and confined to a relatively small area immediately adjacent to the north edge of the Pine Point Mine tailings area (BC Research, 1983, as cited in EBA 2009).

In 1980, Mr. Jim Beaulieu of the former NWT Wildlife Service indicated that moose and woodland caribou were the principal ungulates found in the Pine Point area although neither species was believed to be very abundant (Beak, 1980, as cited in EBA, 2009). BC Research (1977) (as cited in EBA, 2009) concluded that densities were low in the Pine Point area on the basis of winter surveys between Buffalo and Little Buffalo rivers, and browse and pellet group surveys in summer.

BC Research (1977) (as cited in EBA, 2009) determined that carnivores in the study area included black bear, coyote, wolf and red fox. Black bears were reported to be particularly common in the Pine Point area by BC Research. Lynx, marten, fisher, ermine, least weasel, mink, wolverine and river otter were also reported to occur in the area.

Aquatic furbearers such as muskrat and beaver were also reported to be common in the area (BC Research, 1977, as cited in EBA, 2009).

More recent wildlife studies of the Tamerlane Regional Study Area (RSA) were carried out by EBA in September 2005 and during the spring, summer and fall of 2006 (EBA, 2006a, 2006b, as cited in EBA, 2009).

A total of 187 wildlife observations were recorded during the September 2005 field survey. Approximately 43 % of the observations consisted of birds (identified through song, nests, or other sign), and 56 % of the observations consisted of mammals (primarily through tracks, scat/pellets, and evidence of browsing).

Within the different habitat types, a total of 80 bird observations were recorded, comprising 32 different species, including the Whooping Crane and Peregrine Falcon (both of which have special status designations). A single Whooping Crane was recorded in a Treed Fen habitat, and the Peregrine Falcon was noted in a Shrubby Fen.

In addition, a total of 104 mammal observations, comprising 13 different mammal species were documented as occurring in the RSA, including woodland caribou and wood bison (both which have special status designations). Woodland caribou sign was documented in Labrador-tea subhygric and Treed Fens, and wood bison sign was recorded in Shrubby Fen and Treed Fen. Other species of special designation that could occur in the study area but were not recorded were northern leopard frog, Yellow Rail, Short-eared Owl, and wolverine.

Habitat types that exhibited the highest species diversity included Treed Fen and Labrador-tea Subhygric habitat units which are also present in the area of interest to the north of the former Pine Point Mine area.

4.2.6.1 Mammals

A preliminary list of all mammal species known or suspected to occur in the Pine Point area (i.e. within 200 km of the Tamerlane Pilot Project Regional Study Area) was generated by EBA using Banfield (1977) Mammals of Canada and Beak (1980). A total of 40 mammal species were determined to occur or potentially occur in the Pine Point Mine area (Table 4.2-1) (EBA, 2005b, as cited in EBA, 2009).

As previously indicated during EBA's 2005 field study, a total of 104 mammal observations, including actual sightings or sign, were recorded. Based on the experience of the EBA wildlife study team, and these observations, evidence of 13 different mammal species were documented as occurring in the RSA (Table 4.2-2) (EBA, 2005b, as cited in EBA, 2009).

The most notable mammal observations during the September survey included evidence of woodland caribou and wood bison sign (hair, pellets, tracks, and feeding areas).

TABLE 4.2-1: MAMMAL SPECIES OCCURRING OR POTENTIALLY OCCURRING IN THE PINE POINT AREA, NWT

Scientific Name	Common Name	Scientific Name	Common Name
Sorex cinereus	Masked Shrew	*Microtus xanthognathus*	Chestnut-cheeked (Taiga) Vole
Sorex monticolus	Dusky Shrew	*Zapus hudsonius*	Meadow Jumping Mouse
Sorex palustris	Water Shrew	*Erethizon dorsatum*	Common Porcupine
Sorex arcticus	Arctic Shrew	*Canis latrans*	Coyote
Sorex hoyi	Pigmy Shrew	*Canis lupus*	Gray Wolf
Myotis lucifugus	Little Brown Bat (Myotis)	*Vulpes vulpes*	Red Fox
Myotis septentrionalis	Northern myotis	*Ursus americanus*	Black Bear
Lepus americanus	Snowshoe Hare	*Martes americana*	American marten
Eutamias minimus	Least Chipmunk	*Martes pennanti*	Fisher
Marmota monax	Woodchuck	*Mustela erminea*	Ermine (Stoat)
Tamiasciurus hudsonicus	Red Squirrel	*Mustela nivalis*	Least Weasel
Glaucomys sabrinus	Northern Flying Squirrel	*Mustela vison*	Mink
Castor Canadensis	American beaver	*Gulo gulo*	Wolverine
Peromyscus maniculatus	Deer Mouse	*Mephitis mephitis*	Striped skunk
Clethrionomys rutilis	Northern Red-backed Vole	*Lutra canadensis*	River Otter
Clethrionomys gapperi	Southern Red-backed Vole	*Lynx canadensis*	Lynx
Synaptomys borealis	Northern Bog Lemming	*Rangifer tarandus caribou*	Woodland Caribou
Phenacomys intermedius	Heather Vole	*Odocoileus hemionus*	Mule Deer
Ondatra zibethicus	Muskrat	*Alces alces*	Moose
Microtus pennsylvanicus	Meadow Vole	*Bison bison athabascae*	Wood Bison

Source: EBA, 2005b, as cited in EBA, 2009

TABLE 4.2-2: MAMMAL SPECIES RECORDED IN THE TAMERLANE RSA BY EBA – SEPTEMBER 2005	
Common Name	Scientific Name
Snowshoe Hare	*Lepus americanus*
Red Squirrel	*Tamiasciurus hudsonicus*
American beaver	*Castor Canadensis*
Common Porcupine	*Erethizon dorsatum*
Coyote	*Canis latrans*
Gray Wolf	*Canis lupus*
Black Bear	*Ursus americanus*
Ermine (Stoat)	*Mustela ermine*
Mink	*Mustela vison*
Lynx	*Lynx Canadensis*
Woodland Caribou	*Rangifer tarandus caribou*
Moose	*Alces alces*
Wood Bison	*Bison bison athabascae*

Source: EBA, 2005b, as cited in EBA, 2009

4.2.6.2 Birds

In preparation for the 2005 wildlife survey conducted by EBA for the Tamerlane RSA, a list of bird species known to occur or those that potentially occur in the study area was developed using Sibley (2003) (as cited in EBA, 2009) and government reports. All bird species occurring within a 200 km radius of the study area were included. A total of 210 bird species were identified as confirmed or potentially occurring in the study area, either as breeders or during migration.

As previously indicated during EBA's 2005 field study, a total of 80 different bird observations were recorded during this study, comprising 32 different species (Table 4.2-3). These observations included actual sightings, bird calls, or sign. Ten of the most frequently seen bird species observed include the following: American Robin, Tundra Swans, White-winged Scoter, Gray Jay, Common Raven, Spruce Grouse, and Bohemian Waxwings (EBA, 2009).

Bird species observed were classified as migrant, breeding, transient, resident, or accidental. A migrant occurs regularly as it passes through during spring or fall migration. A breeder is a species that breeds in the area and is usually present during the spring, summer and fall. A transient is a species that can occur irregularly at any time of the year. A resident is a species that occurs in the area throughout the year.

The most notable bird observations during the September survey included a visual recording of a single non-breeding Whooping Crane in a recently flooded beaver pond within the study area and two sightings of Peregrine Falcons. One of the Peregrine Falcon observations occurred along Provincial Highway 5 near the eastern boundary of Hay River Reserve, while the second observation occurred along a dirt road where the falcon was feeding on a recently killed snow goose (approximately 13 km southwest of the former Pine Point town site.

TABLE 4.2-3: BIRD SPECIES RECORDED IN THE TAMERLANE RSA – SEPTEMBER 2005

Common Name	Scientific Name	Classification
Greater White-fronted Goose	*Anser albifrons*	Migrant
Snow Goose	*Chen caerulescens*	Migrant
Canada Goose	*Branta canadensis*	Breeder
Tundra Swan	*Cygnus columbianus*	Migrant
Lesser Scaup	*Aythya affinis*	Breeder
White-winged Scoter	*Melanitta fusca*	Breeder
Ruffed Grouse	*Bonasa umbellus*	Resident
Spruce Grouse	*Falcipennis canadensis*	Resident
Ptarmigan species	*Lagopus lagopus*	Winter Resident
Common Loon	*Gavia immer*	Breeder
Bald Eagle	*Haliaeetus leucocephalus*	Breeder
Northern Harrier	*Circus cyaneus*	Breeder
Rough-legged Hawk	*Buteo lagopus*	Migrant
American Kestrel	*Falco sparverius*	Breeder
Peregrine Falcon	*Falco peregrinus (anatum)*	Migrant or Transient
Whooping Crane	*Grus americana*	Transient
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Breeder
Black-backed Woodpecker	*Picoides arcticus*	Resident
Northern Flicker	*Colaptes auratus*	Breeder
Pileated Woodpecker	*Dryocopus pileatus*	Resident
Gray Jay	*Perisoreus canadensis*	Resident
Common Raven	*Corvus corax*	Resident
Horned Lark	*Eremophila alpestris*	Breeder
Bank Swallow	*Riparia riparia*	Breeder
Boreal Chickadee	*Parus hudsonicus*	Resident
American Robin	*Turdus migratorius*	Breeder
Bohemian Waxwing	*Bombycilla garrulus*	Breeder
Orange-crowned Warbler	*Vermivora celata*	Breeder
Yellow-rumped Warbler	*Dendroica coronata*	Breeder
Dark-eyed Junco	*Junco hyemalis*	Breeder
Rusty Blackbird	*Euphagus carolinus*	Breeder
Pine Siskin	*Carduelis pinus*	Breeder

[1] Species organized in phylogenetic order. Source: EBA, 2005b, as cited in EBA, 2009

The majority of bird species occurring in the Pine Point area are migratory and are present only during their reproductive phase. However, some are year-round residents. Bird species are widely distributed throughout all terrestrial habitat types present in the area.

During the 2006 breeding bird survey conducted by EBA for the Tamerlane Pilot Project RSA, a total of 195 birds were recorded at point count stations, including 31 different passerine species, one upland nesting bird, and four shorebird species (EBA, 2006b, as cited in EBA 2009). White-winged Crossbill, Ruby-crowned Kinglet, Hermit Thrush, White-throated Sparrow, Yellow-rumped Warbler, Palm Warbler, and Chipping Sparrow were the most common species. The number of individual birds that were recorded in each habitat type and species richness was calculated. Results from these analyses must be interpreted with caution since sample sizes were low, particularly for bearberry – Jack pine, graminoid fen, and human disturbed/upland complex habitats.

Bearberry – Jack pine habitat had the highest average number of birds, followed by shrubby fens, upland/lowland complex, graminoid fen and disturbed/upland complex, treed fen, and Labrador-tea – mesic (Table 4.2-4). The Labrador-tea – subhygric habitat had the lowest average number of bird observations.

The highest average number of species (species richness) was found in graminoid fens, followed by upland/lowland complex, shrubby fen, bearberry – Jack pine and disturbed/upland complex, Labrador-tea – mesic and Labrador-tea – subhygric. Treed fen habitats had the lowest average species richness (Table 4.2-4).

TABLE 4.2-4: ANALYSIS OF BREEDING BIRD OBSERVATIONS BY EACH HABITAT TYPE – 2006

Habitat (Number of Survey Stations in Each Habitat Type)	Total Number of Observations per Station	Average Number of Observations per Station	Total Species Richness per Station	Average Species Richness per Station
Labrador-tea – Mesic	37	7.4	15	3
Labrador-tea – Subhygric	9	4.5	6	3
Bear-berry – Jack Pine	39	39	6	6
Treed Fen	42	8.4	14	2.8
Shrubby Fen	26	13	13	6.5
Graminoid Fen	9	9	9	9
Upland and Lowland Complex	24	12	15	7.5
Human Disturbed and Two Different Uplands Complex	9	9	6	6

Source: EBA, 2006b, as cited in EBA, 2009

4.2.6.3 Amphibians

The NWT and the Pine Point area are in the extreme northern limit of amphibian species ranges. Four amphibian species potentially occur within the Regional Study Area: Boreal Chorus, Wood, and Northern Leopard frog, and Canadian Toad. Little information currently exists on amphibian populations within the NWT; however, there is particular interest in Northern Leopard Frog and Canadian Toad populations due to their uncommon occurrence and restricted distributions within the NWT and southern Canada.

Boreal Chorus and Wood frogs are the most commonly observed frogs within the NWT. These species occur in shallow areas of lakes, rivers, ponds, wetlands, woodlands, and even temporary waterbodies, including roadside ditches and open meadows. In Alberta, Boreal Chorus Frogs may breed from mid April to mid June in small ponds or temporary pools, and Wood Frogs may breed in a short week to two week period from mid April to June in shallow, clear, permanent or temporary ponds (SRD, 2005, as cited in EBA, 2009).

Northern Leopard Frogs are classified as a species of Special Concern by SARA and Sensitive in the NWT. The Canadian Toad is listed under the NWT as May Be At Risk. Northern Leopard Frogs are predominantly found in or near permanent waterbodies including lakes, rivers, streams, and wetlands, although they can be found a long distance from water, particularly after a rain. After hibernating at the bottom of ponds, Northern Leopard Frogs emerge and begin mating in early spring; some years prior to complete ice-melt. In Alberta, breeding may occur from early April to early June (SRD, 2005). Northern Leopard frogs have been documented near Fort Resolution (Ecology North, n.d., as cited in EBA 2009).

To enhance the limited available information on amphibian distribution and breeding behaviour within the Tamerlane PPPP area, EBA completed a pilot survey during 2006 to better understand breeding and/or calling behaviour of the four amphibian species hypothetically occurring within the 16,551 ha 2006 survey area (EBA, 2006b, as cited in EBA, 2009). The work program included a single auditory survey at selected habitats in May, 2006 and documentation of incidental amphibian observations and calling indexes in conjunction with owl surveys in April and May, and the breeding bird survey in June.

Infrequent calls of both Wood and Boreal Chorus frogs were heard during the April owl survey conducted by EBA. In April, Wood Frogs were reported at five sites (calling frequency ranged from 1 – 3 at these five sites; average 1.6) and Boreal Chorus Frogs were recorded at four sites (calling indexes reported as 1 and 3; average 1.2). During the May owl survey, Boreal Chorus Frogs were the most commonly heard amphibian species. During the May owl survey, Wood Frogs were not heard; however, a single Wood Frog was observed within a treed fen. Boreal Chorus Frogs were heard at eight sites during the May Owl survey. Calling indexes of the Boreal Chorus Frogs appeared higher during the May Owl survey, than compared to the April Owl survey (calling indexes ranged between 1 and 3; average 2.5).

During the auditory survey, a total of 12 stations were surveyed between May 16 – 18 in the 16,551 ha 2006 survey area Auditory stations included a variety of breeding habitats, including: roadside ditches, temporary pools, wetlands, ponds, streams, and lakes that were accessible from the highway, cutlines, and trails. During the auditory surveys, Boreal Chorus Frogs were documented at all of the twelve auditory stations, and a Wood Frog was recorded at two auditory stations (total of two Wood frogs). Boreal Chorus Frog calling indexes at eleven of the stations was at a level where individual frogs could not be counted (calling index 3), and at one station calling indexes were at a level where individuals are distinguishable, but overlap slightly (calling index 2). The Northern Leopard Frog and Canadian Toad were not documented in the study area during the 2006 surveys.

Based on these results it is very likely that Boreal Chorus frogs and Wood frogs, in particular, would be expected to be present in the lowland and wetland areas that characterize the area of interest between Great Slave Lake and the former Pine Point Mine site.

5.0 POTENTIAL ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES

The application of sound engineering, environmental planning and best management practices, including compliance with existing environmental regulations and guidelines, will ensure that all of the environmental issues associated with the development and operation of Avalon's TLP can be effectively addressed and managed.

The major environmental pathways include air, water and terrestrial resources. The following sections summarize the types of potential effects that may result from the Project, and typical mitigation measures that will be applied to ensure that environmental effects are minimized and effectively managed.

5.1 NECHALACHO MINE AND FLOTATION PLANT SITE

This section identifies potential environmental concerns and mitigation options related to the Nechalacho Mine and Flotation Plant. These proposed components will be located at the Thor Lake Property, on the north side of the Great Slave Lake about 5 km north of the Hearne Channel.

Table 5.1-1 summarizes the primary project components and Valued Ecosystem Components (VECs) identified that may be impacted by the development of the Nechalacho Mine and Flotation Plant site.

TABLE 5.1-1: THOR LAKE PROJECT: NECHALACHO MINE & FLOTATION PLANT SITE ENVIRONMENTAL ISSUE MATRIX					
Project Component	Air Quality	Water Quality	Fish	Wildlife	Vegetation
Site Preparation and Construction	✓	✓	✓	✓	✓
Underground Mining	✓	✓			
Mine Rock Storage		✓	✓	✓	✓
Acid Rock Drainage (ARD) if present		✓	✓		
Thor Lake Flotation Plant	✓	✓	✓	✓	✓
Power Generation	✓			✓	✓
Sewage		✓	✓		
Tailings Containment		✓	✓	✓	✓
Water Supply/Water Management		✓	✓		
Solid and Hazardous Waste Management	✓	✓	✓	✓	
Airstrip	✓			✓	✓
Access Roads	✓	✓	✓	✓	✓
Temporary Docking Facility		✓	✓		✓
Seasonal Barge Traffic	✓	✓	✓		

5.1.1 Air Quality and Noise

Potential Effects

The Nechalacho Mine and Flotation Plant will have several components that may affect air quality or ambient noise levels. These effects will be mainly related to the construction phase, power generation, and traffic. Aside from fuel combustion for power generation, vehicles and other Mine equipment, which will produce most of the carbon dioxide and monoxide, sulphur dioxide, nitrous oxides and particulates; the majority of potential effects on air quality will be associated with the generation of particulates (dust) relating to transportation activities.

Mitigation

Avalon is committed to employing an adaptive management approach including a number of mitigation measures. To minimize potential effects on local and regional air quality, the existing noise environment and to control greenhouse gas emissions, mitigation measures that will be employed will include:

- Full compliance with Land Use Permit and Water License and license conditions to be issued by the MVLWB;
- Conformance with the Guidelines for Ambient Air Quality Standards in the NWT;
- Use of low sulphur diesel fuel and regular equipment and engine maintenance;

- Conformance with GNWT Guideline for Dust suppression through the application of dust suppressants - e.g. water or approved dust suppressant products;
- Conformance with GNWT and WCB standards for mine air quality; and
- Disposal of all hazardous wastes in an approved manner.

5.1.2 Surface Hydrology

Potential Effects

- Reduction in water discharges from Thor Lake due to losses in the tailings management facility resulting from capture within tailings voids, evaporation, and escape to groundwater;
- Annual flow increases of 6-12 times through Drizzle and Murky Lakes compared with pre-development base flows;
- Spring discharge increases of 10-20 times through Drizzle and Murky Lakes compared with pre-development base flows; and,
- Potential free water drawdown in Thor Lake during winter in excess of regulatory limits.

Mitigation

- Compliance with MVLWB Water Licence terms and conditions;
- Conformance with DFO Protocol for Winter Water Withdrawal in the NWT; and,
- Recycling of water to reduce process water requirements from Thor Lake, and hence, potential effects on the existing hydrologic regime. Increases in the level of recycling beyond the 50% that has initially been proposed will be investigated and will likely further reduce these effects.

5.1.3 Fisheries and Aquatics

Potential Effects

- Changes in flow volumes and patterns that could result in increased flushing of water from small upstream lakes through to Thor Lake, with potential effects on water quality and aquatic organisms;
- Changes to input/output volumes in Thor lake could affect lake level, with consequent effects on available fish habitat;
- Exceedance of water withdrawal volumes permitted under the DFO Protocol for Winter Water Withdrawal in the NWT (2005)[4];

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[4] The exceedance limit of 5% of available water volume has been increased to 10% since publication of the Protocol (B. Hanna, DFO, Western Arctic Region, Pers. Comm.)

- Direct habitat loss due to the establishment of the tailings management facility over the present location of Ring and Buck Lakes *if* further investigation reveals these to be frequented by fish[5];
- Indirect habitat alterations or disruptions due to changes in flow volumes or patterns, obstruction of fish habitat, erosion and sedimentation, blasting, or loss of riparian vegetation;
- Water quality (other than sediment) in known fish bearing waterbodies may be affected by the discharge of tailings, or by inadvertent spills or leaks of concentrate, fuels, or lubricants; and,
- Use of a seasonal barge-dock system for loading concentrate containers onto barges and the installation of associated dolphins may result in temporary or small scale disruptions to fish habitat.

Mitigation

- Maximization of water recycling to reduce water requirements from Thor Lake and discharges from the tailings management facility. Flow volumes and lake levels will need to be monitored to identify significant changes from background levels and to make adjustments as may be necessary;
- Construction and seasonal use of a pipeline from Drizzle Lake to Thor Lake to supplement winter water levels in Thor Lake and to reduce high storm event discharges through Murky Lake and the Murky Lake outflow stream;
- Possible aeration of water piped in winter from Drizzle Lake, since it is likely that water under the ice in Drizzle Lake may be anoxic;
- Utilization of a seasonal barge-dock arrangement for loading and offloading concentrate is designed to minimize the disruption of fish habitat in the littoral zone of Great Slave Lake. The installation of mooring dolphins to permit barge tie-up will be carried out using appropriate Best Management Practices and mitigation measures to minimize sediment releases and habitat losses;
- Application of available guidelines and Best Management Practices to avoid or minimize risks to water quality and aquatic resources including:
  - Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al., 1993);
  - GNWT Guidelines for Dust Suppression;
  - Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright & Hopky, 1998); and

[5] Existing information from fish sampling in Ring Lake, and depth soundings in Ring, Buck, and Drizzle lakes suggest that these waterbodies are not fish bearing.

  - DFO Protocol for Winter Water Withdrawal in the Northwest Territories (DFO 2005).
- Compliance with MVLWB Land Use Permit and Water Licence terms and conditions;
- Conformance with Metal Mining Effluent Regulations (MMER);
- Aquatic Effects Monitoring Program (AEMP) terms and conditions;
- Regular inspection and maintenance of pipelines and machinery;
- Effective implementation of a Project spill response plan as may be required; and,
- Development of a construction phase Environmental Management Plan (EMP) that would be included in construction tender documents. The EMP would serve as a comprehensive guide to avoid or mitigate water quality and habitat disturbances.

5.1.4 Ecosystems and Vegetation

Potential Effects

- Disturbance and removal of ecosystems and vegetation in areas proposed for Nechalacho Mine and Flotation Plant infrastructure;
- Alteration of soil and permafrost conditions, particularly in the vicinity of the proposed site footprint, resulting in effects that could result in changes to ecosystem structure and species composition;
- Changes to ecosystem composition due to fugitive dust deposition originating primarily from Nechalacho Mine and Flotation Plant road traffic; and,
- Changes to ecosystem composition due to the release and deposition of air emissions that may include nitrogen oxides, sulphur dioxide, potential acid inputs, particulate matter, and carbon monoxide.

Mitigation

- Compliance with MVLWB Land Use Permit and Water Licence terms and conditions;
- Minimization of proposed site development footprint area;
- Avoidance of development on rare ecosystem types (none are anticipated to be present);
- Implementation of erosion control measures if and as warranted;
- Application of dust suppressants (e.g. water or approved dust suppressant products); and
- Utilization of low-sulphur diesel fuel, and state-of-the-art process plant and energy reduction technologies.

5.1.5 Wildlife

Potential Effects

- Direct loss or degradation of habitat due to the proposed site footprint, construction and longer term operation of the Nechalacho Mine and Flotation Plant;
- Dust generation due to proposed site construction and operation, including access and haul roads;
- Physical and behavioural disturbance;
- Displacement and habituation;
- Attraction of wildlife to food wastes; and
- Increased hunting in the Nechalacho Mine and Flotation Plant site area.

Mitigation

- Compliance with MVLWB Land Use Permit and Water Licence terms and conditions;
- Minimization of proposed site development footprint area;
- Avoidance of development on rare ecosystem types (none are anticipated to be present);
- Implementation of erosion control measures if and as warranted;
- Application of dust suppressants (e.g. water or approved dust suppressant products);
- Implementation of no hunting policy for all site employees and contractors;
- Adoption of a cooperative approach involving First Nations and wildlife regulators, to effectively protect wildlife populations;
- Staff training and effective food waste management; to mitigate potential wildlife attraction and habituation; and
- Effective reclamation, including re-contouring, scarification, and re-vegetation of the development footprint surface during future closure.

5.2 HYDROMETALLURGICAL PLANT SITE

This section identifies potential environmental concerns and mitigation options related to the Project's proposed Hydrometallurgical Plant at the former Pine Point Mine. Activities will include establishing a Hydrometallurgical Plant site, constructing an associated tailings containment area, and constructing and operating an 8.6 km haul road. The haul road will be located adjacent to an existing drainage ditch that connects to an existing haul road. The existing haul road extends south from a former mine pit that is located north of the main Pine Point Mine area. Table 5.2-1 summarizes the primary Hydrometallurgical Plant site components and Valued Ecosystem Components (VECs) that may be affected by the development of the Hydrometallurgical Plant site.

TABLE 5.2-1: THOR LAKE PROJECT: HYDROMETALLURGICAL PLANT SITE ENVIRONMENTAL ISSUE MATRIX					
Project Component	Air Quality	Water Quality	Fish	Wildlife	Vegetation
Site Preparation and Construction	✓			✓	✓
Hydrometallurgical Plant	✓	✓	✓	✓	✓
Power Generation (back up)	✓			✓	✓
Sewage		✓			
Tailings Containment		✓	✓	✓	
Water Supply/Water Management		✓			
Solid and Hazardous Waste Management	✓			✓	
Haul Road and Site Access Roads	✓	✓		✓	✓
Dock Facility		✓	✓		✓

The following items are existing site characteristics and mitigation/management measures that will result in the avoidance or mitigation of effects on the natural terrain, vegetation, wildlife habitats, surface and groundwater quality, and air quality of the Avalon Hydrometallurgical Plant site. The measures will also mitigate any effects on the natural resources of the Pine Point area beyond the limits of the existing brownfields site.

- The proposed Nechalacho Mine and Flotation Plant site will be located on the essentially pristine north side of Great Slave Lake about 5 km north of the Hearne Channel of the lake. Locating the proposed Hydrometallurgical Plant at the brownfields site of the former Pine Point Mine site will effectively reduce the overall physical footprint of the TLP;
- The Hydrometallurgical Plant will utilize the existing power grid and reduce the need for diesel power generation at the Nechalacho Mine and Flotation Plant site;
- Full compliance with MVLWB Land Use Permit and Water Licence terms and conditions;
- Conformance with the Guidelines for Ambient Air Quality Standards in the NWT;
- Use of low sulphur diesel fuel and regular equipment and engine maintenance;
- Use of high quality, low sulphur coal to generate high heat fuel for the Hydrometallurgical Plant boilers;
- Application of clean coal technologies, stack testing and air quality monitoring to ensure that federal and territorial ambient air quality objectives are met;
- Conformance with GNWT Guideline for Dust suppression through the application of dust suppressants - e.g. water or approved dust suppressant products;

- Secure containment of rare metals products during transportation to the Hay River railhead;
- Disposal of all hazardous wastes in an approved manner;
- Development on rare ecosystem types will be avoided (none are anticipated to be present within the Hydrometallurgical Plant components of the overall Project footprint);
- Re-contouring, scarification, and reseeding of the haul road surface during future closure and reclamation of the road will be carried out, if warranted;
- The seasonal barging dock will be designed and constructed to meet the requirements of Transport Canada and conditions of the NWPA approval to be issued pursuant to the Navigable Waters Protection Act; and
- Conformance with a DFO Authorization or Letters of Advice to avoid the harmful alteration, disruption, or destruction (HADD) of fish habitat due to seasonal dock installation.

6.0 CLOSURE AND RECLAMATION

6.1 NECHALACHO MINE AND FLOTATION PLANT SITE

Reclamation and closure of all the Nechalacho Mine and Flotation Plant facilities will be conducted in accordance with the terms and conditions of the future MVLWB Land Use Permit and Water Licence, the "Mine Site Reclamation Policy for the Northwest Territories" and the "Mine Site Reclamation Guidelines for the Northwest Territories and Nunavut" (INAC, 2007).

Reclamation and closure will be based on the following general objectives:

- Reclamation goals and objectives will be considered during design and planning of construction and operations;
- Progressive reclamation will be implemented where possible;
- Upon cessation of operations, the areas will be decommissioned and rehabilitated to allow for future land use as guided by the federal and territorial regulatory agencies; and
- Reclamation and closure will ensure that long-term physical and chemical stability is provided.

The initial reclamation and closure plan prepared for the Nechalacho Mine and Flotation Plant site will be a living document that will be updated throughout the Project's life to reflect changing conditions and the input of the applicable federal and territorial regulatory agencies.

The primary reclamation activities will involve the removal of surface facilities and infrastructure, the re-contouring and scarification of the footprint area, the application of stockpiled organics, and re-vegetation to the extent possible.

Specifically for the tailings management facility, the main objective of the closure and reclamation initiatives will be to transform the tailings management facility area to its pre-mining usage and capability to the greatest degree possible. Closure and reclamation strategies will focus on stabilizing and covering the exposed tailing surfaces and re-establishing surface flow patterns, while ensuring that acceptable downstream water quality is maintained. Specific reclamation activities pertaining to the tailings management facility area will include the following:

- The downstream face of the embankments will be reclaimed as the final downstream slope is constructed. Progressive reclamation will be implemented to the greatest degree possible;
- The exposed tailings surface will be capped with stockpiled organics and re-vegetated;
- Surface runoff control channels and permanent spillways will be constructed as required to provide sustainable surface runoff conditions; and
- Infrastructure not required beyond Mine closure will be dismantled and removed.

The tailings management facility will be designed and reclaimed to maintain long-term physical and geochemical stability, protect the downstream environment and effectively manage surface water. A post-closure monitoring program will include an annual inspection of the tailings management facility for a prescribed period to confirm the completed closure measures are meeting permit and licence conditions.

6.2 HYDROMETALLURGICAL PLANT SITE

Consistent with the approach to reclamation of the other TLP site facilities, the Hydrometallurgical Plant facilities located at the former Pine Point Mine site will be conducted in accordance with the terms and conditions of the future MVLWB Land Use Permit and Water Licence, the "Mine Site Reclamation Policy for the Northwest Territories" and the "Mine Site Reclamation Guidelines for the Northwest Territories and Nunavut" (INAC, 2007).

Reclamation and closure will be based on the following general objectives:

- Reclamation goals and objectives will be considered during design and planning of construction and operations;
- Progressive reclamation will be implemented where possible;
- Upon cessation of operations, the areas will be decommissioned and rehabilitated to allow for future land use as guided by the federal and territorial regulatory agencies; and
- Reclamation and closure will ensure that long-term physical and chemical stability is provided.

The primary Hydrometallurgical Plant site reclamation activities will involve the removal of surface facilities and infrastructure, the re-contouring and scarification of the footprint area, and where appropriate, the application of stockpiled organics, and re-vegetation to the extent possible.

As previously noted, the Pine Point area is unique in that the area is a very large brownfields site, having been previously reclaimed by industry and government since closure of the mine in 1987. As a result, it is anticipated that closure and reclamation activities associated with the main facilities to be located at the former Pine Point Mine site (Hydrometallurgical Plant and tailings containment area), will be limited to those associated with returning these areas to the previously existing brownfields condition.

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APPENDIX A

AVALON RARE METALS INC. COMMUNITY ENGAGEMENT LOG

APPENDICES B-H

Appendices B-H are found on the CD located on the inside back cover of this document:

Appendix B	Stantec Environmental Baseline Report: Volume 1 – Climate & Hydrology
Appendix C	Stantec Environmental Baseline Report: Volume 2 – Hydrogeology
Appendix D	Stantec Environmental Baseline Report: Volume 3 – Aquatics & Fisheries
Appendix E	Stantec Environmental Baseline Report: Volume 4 – Terrain, Soils, & Permafrost
Appendix F	Stantec Environmental Baseline Report: Volume 5 – Vegetation Resources
Appendix G	Stantec Environmental Baseline Report: Volume 6 – Wildlife Resources
Appendix H	EBA Thor Lake Pine Point Area Environmental Considerations