Mackenzie Valley Review Board

Report of Environmental Assessment and Reasons for Decision

EA1011-001
Avalon Rare Metals Inc.
Nechalacho Rare Earth Element Project

July 26, 2013

Review Board decision

To make its decision in this environmental assessment, the Mackenzie Valley Environmental Impact Review Board (Review Board) has relied upon all the evidence and information on the public record. After considering this evidence, the Review Board has made its decision in accordance with Section 128 of the *Mackenzie Valley Resource Management Act.*

Based on the evidence and information on the public record, the Review Board finds that the Nechalacho Rare Earth Element Project (the Project) proposed by Avalon Rare Metals Inc. (the Developer) is likely to cause significant adverse impacts to the environment including water, wildlife and the social and economic environment. The Review Board has set out measures that:

- ensure that the water released from the Project into the receiving environment does not cause significant impacts;
- require the development and implementation of a wildlife and wildlife habitat protection plan and monitoring programs and if required appropriate mitigation; and
- require that a socioeconomic agreement is in place before construction begins.

These measures will mitigate the predicted impacts so that they are no longer significant.

The Review Board therefore recommends, under subparagraph 128 (1)(b)(ii) of the *Mackenzie Valley Resource Management Act*, that this Project be approved, subject to the implementation of the measures and commitments set out in this Report.

July 26, 2013

Richard Edjericon
Chairperson
Mackenzie Valley Environmental Impact Review Board

Executive Summary

This report describes the environmental assessment process, summarizes the evidence and sets out the conclusions and decision of the Mackenzie Valley Environmental Impact Review Board (the Review Board) on the Nechalacho Rare Earth Element Project (the Project), an underground rare earth element mine. The developer for this Project is Avalon Rare Metals Inc. (the Developer).

The Review Board considered all evidence and information on the public record in reaching its decision according to Section 128 of the *Mackenzie Valley Resource Management Act*. The Review Board finds that the Project is likely to cause significant adverse impacts on the environment and has prescribed measures to mitigate adverse environmental impacts from the Project so that they are no longer significant.

The Review Board's decision depends on the implementation of the commitments made by the Developer and the measures set out in this Report of Environmental Assessment (REA). In the Review Board's opinion, it is therefore important that the Developer, appropriate regulatory authorities and government agencies ensure that the commitments listed in Appendix C and described throughout this document and the measures listed in Appendix A are all fulfilled.

Proposed Development

The Nechalacho Rare Earth Element Project (the Project) consists of two distinct sites: the Nechalacho mine site, on the North shore of the East Arm of Great Slave Lake, and the Hydrometallurgical plant site at Pine Point, approximately 85 km east of Hay River on the South shore of Great Slave Lake.

The Developer proposes to build an underground mine at the Nechalacho mine site, near Thor Lake, and to extract and process the ore that is enriched in rare earth elements. It also proposes to:

- process ore to create a rare earth element concentrate;
- dispose of tailings on site;
- release treated effluent;
- construct an 8 km road from the mine site at Thor Lake to the shore of Great Slave Lake;
- construct seasonal docking facilities on Great Slave Lake;
- barge the concentrate across Great Slave Lake to Pine Point; and

- close and reclaim the site.

The Hydrometallurgical plant site located at Pine Point will further process the rare earth element concentrate. At this site, the Developer proposes to:

- construct and operate a Hydrometallurgical facility to extract the rare earth elements from the concentrate;
- construct a five kilometre access road from Great Slave Lake to the plant site;
- construct seasonal docking infrastructure on Great Slave;
- deposit tailings to existing open pits;
- release effluent to the Presqu'ile aquifer;
- transport the concentrate by rail to the United States; and
- close and reclaim the site.

Review Board findings

The Review Board carefully considered evidence from Parties to the assessment including: the Yellowknives Dene First Nation, the Lutselk'e Dene First Nation, the Deninu Kue First Nation, the Akaitcho IMA Office, the North Slave Metis Alliance, the NWT Metis Nation, the Fort Resolution Metis Council, Blachford Lake Lodge, Federal Government departments and the Government of the Northwest Territories. The Review Board finds that the Project is likely to cause three different significant adverse environmental impacts:

- water quality impacts to the local water shed at the mine site;
- wildlife impacts; and
- socio-economic impacts.

The Review Board provided a series of measures and suggestions to mitigate significant adverse environmental impacts and public concern, and improve the monitoring and management of potential impacts.

The Review Board heard other concerns by parties about radiation, barging, fish habitat, atmospheric discharges, Blachford Lake Lodge and closure. The Review Board finds that the Developer's commitments and the existing regulatory framework will adequately address these other concerns.

Water Quality Impacts

The Review Board heard from parties about potential impacts from the Nechalacho mine site to water quality in the downstream environment. In order to reduce the likelihood of significant impacts to water quality the Review Board requires a measure to protect water quality for use by humans, fish and wildlife.

The Review Board agrees with parties that the site specific water quality objectives proposed by the Developer must be further refined during the water licencing phase. But in order to ensure that significant adverse impacts to water quality do not occur, and that parties' expectations regarding water quality and use in the Project area are met, the Board has recommended the imposition of water quality objectives expressed as narrative statements. These water quality objectives define the level of change to water quality that can take place without significant impacts occurring.

The Board has also prescribed a measure regarding water quality and monitoring at the Hydrometallurgical plant site which will ensure that impacts to water quality from the Project are not significant.

Wildlife

The Review Board heard concerns about caribou from many parties throughout the course of this environmental assessment. The Review Board is mindful that barren ground caribou are currently at low population levels and that harvest restrictions to Aboriginal and non-Aboriginal people are in force to address the decline in the number of Bathurst caribou over the last decade. The Review Board finds that the Project is likely to cause significant adverse impacts to caribou and has recommended measures requiring the Developer prepare and implement a wildlife habitat protection plan and a monitoring program for wildlife. These plans and associated best practices and mitigation will reduce the predicted adverse impacts so that they are no longer likely to be significant.

Socio-economic

The Developer made efforts to engage communities and Aboriginal organizations throughout this environmental assessment, and has supported traditional knowledge studies. The Board heard concerns from parties who were uncertain about how the Developer would ensure that Aboriginal people and NWT residents would benefit from the Project and how it would reduce adverse social impacts. Key issues for parties were employment and training. The Developer has made commitments to address these concerns but has not committed to entering into a socio-economic agreement with the GNWT.

Therefore, even with these commitments, the Review Board finds that significant adverse social and economic impacts from the Project are likely. In order to address these impacts, the Review Board requires that the Developer sign a socio-economic agreement with the GNWT to formalize its commitments and other mitigation measures and ensure they are implemented and reported.

Barge Operations

The Review Board heard concerns from parties that proposed barging operations, and accidents related to barging, could impact the waters of Great Slave Lake and affect traditional use of the area. These concerns centered on the impacts from spills of fuel and rare earth element concentrate.

The Review Board finds there is a risk of fuel spills, but it is mitigated through the existing regulatory framework that requires the barging contractor to have a spill response plan. The risk of significant impacts is further mitigated by the spill response capabilities of the Canadian Coast Guard.

With regards to spills of concentrate, the Review Board accepts the Developer's evidence that the material is inert and does not pose a risk to the environment. Regardless, the Review Board heard that if concentrate is spilled into Great Slave Lake, it would cause public concern. The Review Board notes that the Developer has committed to clean up any spills of concentrate. The Review Board provides a suggestion for a spill contingency plan to address a spill of concentrate.

The Review Board also provides suggestions for the Developer to describe proposed barging activities each spring before operations begin and to report on annual barging activities each fall.

Radiation

The Review Board heard concerns from parties regarding the presence of low levels of uranium and thorium associated with the rare earth element deposit and the potential impacts on the environment and people. The evidence indicates that the levels of radiation resulting from the presence of uranium and thorium at the Project sites and in the concentrate are expected to be too low to pose any significant risk to the environment or people.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

AANDC	Aboriginal Affairs and Northern Development Canada
AEMP	Aquatic Effects Management Plan
CAC	Criteria Air Quality Contaminant
DAR	Developer's Assessment Report
DKFN	Deninu Kue First Nation
DFO	Department of Fisheries and Oceans Canada
EA	Environmental assessment
GNWT	Government of the Northwest Territories
IMP	Incineration Management Plan
LKDFN	Lutsel K'e Dene First Nation
MMER	Metal Mining Effluent Regulations
MVEIRB	Mackenzie Valley Environmental Impact Review Board
NSMA	North Slave Metis Alliance
NWT	Northwest Territories
PR	Public registry
REA	Report of Environmental Assessment
REE	Rare Earth Elements
SARA	*Species at Risk Act*
SSWQOs	Site specific water quality objectives
TMF	Tailings Management Facility
WEMP	Wildlife Effects Monitoring Program
WWHPP	Wildlife and Wildlife Habitat Protection Plan
YKDFN	Yellowknives Dene First Nation

1. Introduction

This is the Mackenzie Valley Environmental Impact Review Board's (Review Board) *Report of Environmental Assessment and Reasons for Decision* (REA) for Avalon Rare Metals Inc.'s (the Developer) proposed Nechalacho Rare Earth Element Project (the Project). The purpose of this report is to:

a) review the relevant evidence;
b) document the environmental assessment process;
c) convey the Review Board's reasons for decision by addressing whether the proposed development is likely to be the cause of significant adverse impacts on the environment or be a cause for significant public concern; and
d) satisfy the reporting requirements of the *Mackenzie Valley Resources Management Act* (the *Act*) sections 121 and 128.

This report includes 12 sections and four appendices, set out as follows:

- **Section 1** - provides background information on the regulatory history and referral of this development to the Review Board. This section also sets out the requirements of the *Act* and provides a brief description of the proposed development.
- **Section 2** - describes the environmental assessment process for the proposed project. This section provides information about the parties to this process and the steps the Review Board has taken to identify (under *MVRMA* section 128) any potential significant adverse impacts or public concern. Section 2 also describes the scope of the assessment and sets out the Review Board's determination [under *MVRMA* subsection 117(1)] of the scope of development. This scope of development includes the changes to the project design that occurred during the assessment.
- **Sections 3 to 11** - outlines selected environmental components that the Review Board examined during the process. These sections include a summary of the evidence, the Review Board's analysis and conclusions, and any measures or suggestions the Review Board has deemed necessary. These sections also contain the Review Board's determinations of likelihood and of significance for adverse impacts and/or public concern potentially resulting from the proposed development.
- **Section 12** – describes the Review Board's overall conclusion for this environmental assessment.
- **Appendix A** - summarizes the Review Board's recommended measures and suggestions to avoid or reduce significant adverse impacts from the project.
- **Appendix B –** lists site specific water quality objectives**.**
- **Appendix C** – lists the Developer's commitments in relation to the environmental assessment.
- **Appendix D -** list of public registry documents.

1.1 Requirements of the Mackenzie Valley Resource Management Act

The Review Board administers Part 5 of the *Mackenzie Valley Resource Management Act* (the *Act*) and therefore has the responsibility to make decisions in relation to the proposed Project. Under *MVRMA* sections 114 and 115 the Review Board is responsible for conducting an environmental assessment that considers this Project's impacts on the environment, including the biophysical, socio-economic and cultural environment. The Review Board has conducted this environmental assessment in accordance with its *Rules of Procedure* and *Environmental Impact Assessment Guidelines*.

The Review Board must determine [under *MVRMA* subsection 117(1)] the scope of the development for the environmental assessment, and consider the factors set out in subsection 117(2) of the *Act*. The *Act* also requires the Review Board to determine whether the proposed development is likely to cause a significant adverse impact on the environment or to be a cause of significant public concern.[1] The Review Board must then prepare a *Report of Environmental Assessment.*[2]

1.2 Regulatory history

The assessment for the Nechalacho Rare Earth Element Project started on June 11th, 2010 when the Mackenzie Valley Land and Water Board (MVLWB) referred water licence application MV2010L2-005 and land use permit application MV2010D0017 to the Review Board.

The Developer filed these two applications on April 26, 2010. They included both the Nechalacho mine site and the Hydrometallurgical plant site. The MVLWB received comments on the licence applications from reviewers on May 28, 2010. The MVLWB considered the comments received and noted concerns regarding potential environmental impacts and public concern. Based on these concerns the MVWLB determined that the proposed development might have significant adverse impacts on the environment and might be of public concern. It then referred the proposed project to the Review Board pursuant to paragraph 125(1)(b) of the MVRMA for environmental assessment.

[1] Subsection 128(1)
[2] Subsection 128(2)

Concurrent activities

Since the 2010 referral to environmental assessment the Developer has been continuing its exploration activities at the Nechalacho mine site. This exploration activity is occurring under a June 23, 2011 MVLWB land use permit (permit number MV2011C0006) and is not part of this environmental assessment.

1.3 Environmental setting

This section provides a brief summary of the existing environment for the Project. This includes the Nechalacho mine site, the Hydrometallurgical plant site, and the barging route. The Developer's Project Description Report (PR# 7) and Developer's Assessment Report (PR# 76) both contain sections with greater detail on the existing environment.

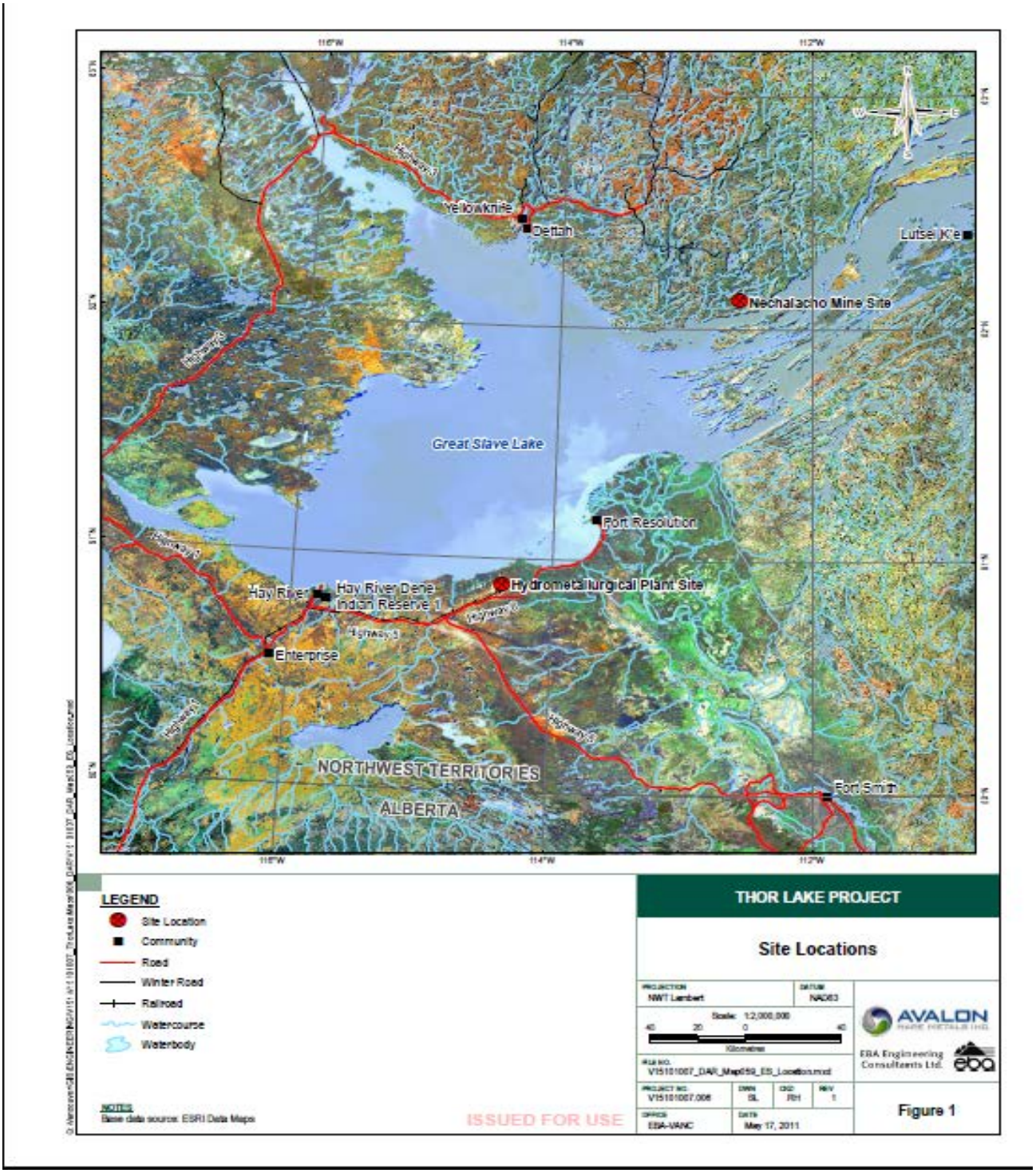

Figure 1: Nechalacho mine site and the Hydrometallurgical plant site locations. (PR#76 p. 2)

Nechalacho site

The first part of the Developer's three-part proposal includes various infrastructure within and above its deposit located at the Nechalacho mine site, an ore body lying roughly 100 kilometres southeast of Yellowknife, Northwest Territories (Figure 1). The proposal also includes an eight-kilometre road connecting the mine infrastructure to the north shore of Great Slave Lake's Hearne Channel, in addition to seasonal barging infrastructure on and around the Great Slave Lake shoreline.

The Nechalacho mine site location is 230 meters above sea level and sits in an area known as the Taiga Shield High Boreal - Great Slave Upland High Boreal Ecoregion. This setting consists of fractured bedrock plains of subdued topography with discontinuous forested patches, peat plateaus and many shallow lakes. Key lakes around the mine site include Thor, Drizzle, Murky, Ring, Buck and Long Lakes. The Thor Lake watershed covers 21 square kilometres and from Thor Lake water flows 18 kilometres to Great Slave Lake (PR# 7, p. v).

A polar continental climate dominates the region, delivering moderate precipitation with long cold winters and short moderate summers (PR# 76, p. 18). The mean summer temperature is 15°C, while the mean winter temperature is -25°C (PR#76, p. 26-27). In the Developer's Assessment Report (DAR), the Developer did not report snowfall, but did report annual rainfall over a two-year period as a mean of 160 mm (PR# 76, p. 21).

Key wildlife for the Nechalacho mine site include barren ground caribou of the Bathurst herd, grizzly bear, black bear, wolverine, moose, lynx, marten, and beaver (PR# 76, p. 274). Upland breeding birds using the area include the common nighthawk, rusty blackbird and olive-sided flycatcher (PR# 76, p. 302-304). Thor Lake is among the largest fish-bearing water bodies in the Thor lake watershed, while Ring, Ball, and Buck Lake are not fish-bearing. Drizzle and Murky Lake are both potentially fish-bearing on a seasonal basis (PR# 128, p. 2). Fish species in the Nechalacho mine site area include lake whitefish, lake cisco, and slimy sculpin. Great Slave Lake fish species in the Nechalacho mine site barge-docking area include Arctic grayling, burbot, and lake trout (PR# 76, p. 140).

Dene and Metis people have used the Nechalacho mine site area for harvesting fish and wildlife as well as other uses (PR# 292, p. 63; PR# 231; PR# 287, p. 119).

Hydrometallurgical plant site

The second part of the Project is a Hydrometallurgical plant site at the former Pine Point mine site, located 85 km east of Hay River and 102 km west of Fort Resolution

on the south shore of Great Slave Lake (Figure 1). A five-kilometre access road would connect seasonal barging infrastructure to the processing plant. The Developer also proposes to use the existing highway system for transport of personnel, rare earth element concentrate and supplies to and from this plant/barging area. This plant site sits in the Great Slave Lowlands Mid-Boreal Ecoregion of the Taiga Plains Eco-zone (PR# 76, p. vii).

This area has fairly level topography with many wetlands and bogs but few large water bodies. Great Slave Lake sits to the north, while the Hay River (west) and Slave River (east) distantly flank the project site. Jack pine, trembling aspen, white and black spruce forest the area (PR# 76, p. vii).

For the Hydrometallurgical plant site, the Developer used climate data from the nearby community of Hay River. Average temperatures in Hay River range from -21.7°C in winter to 16.1°C in summer (PR# 76, p. 39). Mean precipitation totals 335 mm with 65% falling as rain, and 35% falling as snow. A large underground saline aquifer, the Presqu'ile aquifer, flows beneath the Pine Point area (PR# 76, p. 107), and forms a significant aspect of the Developer's proposed water management plan for the Hydrometallurgical plant site.

Wildlife around the southern shores of Great Slave Lake include species such as boreal woodland caribou, wood bison, moose, black bear, and beaver among many others (PR# 76, p. 267-300). The whooping crane, peregrine falcon, tundra swan, white-winged scoter are bird species that are potentially found in the vicinity of the Hydrometallurgical plant site (PR# 76, p. 301-342).

Barging route – Great Slave Lake

The third aspect of the Project involves a 120-day summer shipping window of which the Developer would need 60 days to transport barge trains containing concentrate across Great Slave Lake. The Developer proposes to install seasonal barging infrastructure on the shores of Great Slave Lake to facilitate this part of the project (PR# 7, p. iv).

With a length of 456 kilometres and widths from 19 to 109 kilometres Great Slave Lake has an area of 28,400 square kilometres. At 614 metres, Great Slave Lake is the deepest lake in North America and the second largest lake in the Northwest Territories (PR# 76, p. 206). The proposed barging route has water depths approaching 315 m near the Nechalacho mine site. Depths of 95 m occur along the barging route, and water depths become shallower with the approach to the Pine Point area. Great Slave Lake contains up to 27 fish species (PR# 76, p. 210), and the barging route passes various bird nesting colonies on Great Slave Lake (PR# 219, p. 28-30).

1.4 Description of development

This section of the REA provides the recent history of the lands associated with the Project and the specific history of the Developer at both Project sites. This section also describes what the Developer proposes at the Hydrometallurgical plant site and Nechalacho mine site.

Pine Point history

The area proposed for use for the Hydrometallurgical plant is located on a site that was once mined but no longer has mining or other industrial activity occurring. The previous mining activity was an open pit lead zinc mine operated by Cominco. Exploration activities occurred as early as 1928 with major activities commencing in the 1950s. Cominco, in conjunction with the Canadian government, constructed a town site in the early 1960s. The town became a territorial settlement in the 1970s with a population of 1,200. Production at the mine occurred from 1964 to 1988. The town was removed at mine closure.

Nechalacho mine site development history

The Nechalacho mine site rare earth mineral potential was first identified by Highwood Resources Ltd. in 1976. Exploration activities occurred from 1976 until 2004 and included mapping, sampling, geophysical surveys, and drilling approximately 200 holes. In 2005, this exploration work was followed up with bulk underground sampling and metallurgical work on a specific portion of the area called the North "T" deposit.

In 2005, the property was acquired by Avalon Rare Metals ltd. (the Developer) who continued exploration activities at the site.

Existing infrastructure

The area proposed for the Hydrometallurgical plant site and associated infrastructure at Pine Point is a brownfield site. There are no other land uses permitted in the vicinity of the Project. Previous mining activities left behind:

- roads,
- open pits, and
- tailings piles.

The Developer has an active presence at the Nechalacho mine site for the purposes of continued exploration and delineation of the mineralization in the area. This includes:

- airstrip,
- camp,
- waste management – incinerator, grey water sump, sewage treatment,
- road from the camp to the docking facility on Great Slave Lake,
- fuel storage,
- docking area, and
- remediation and reclamation activities.

1.4.1 Proposed development

The first stage in the Project consists of the construction of an underground rare earth element mine located at Thor Lake on the north shore of Great Slave Lake called the Nechalacho mine. The Developer will mine, mill and produce rare earth carbonate and oxides, zirconium, niobium and tantalum oxides from the Nechalacho deposit. It is expected that approximately 14 million tonnes of mineral resources will be mined from the Nechalacho deposit over a 20-year period of operations. Ore from the underground mine will be milled and concentrated at the Nechalacho flotation plant. The concentrate will be stored and shipped across Great Slave Lake by barge during the summer months to the Hydrometallurgical plant site at Pine Point. After further processing at the Hydrometallurgical plant, the final rare earth element products will be trucked to Hay River and transported south by rail (PR#165).

1.4.2 Nechalacho mine and floatation plant site

Primary components at the Nechalacho mine 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 seasonal dock facility. The general arrangement of the site is shown in Figure 2.

The ore zone of the underground mine is located approximately 200 m below surface and will be accessed by a 15% grade ramp. Ore will be crushed underground and both ore and waste rock will then be conveyed to the surface. The flotation plant will use conventional grinding and flotation techniques to produce a rare earth element concentrate. Fresh water for the plant will be sourced from Thor Lake. Wastewater and tailings from the flotation plant will be sent to the tailings management facility, located at a distance of 2 km to the northeast in the catchment of Ring and Buck Lakes. Employees will be accommodated in a 150-person camp. Power requirements during operations will average 8.4 MW supplied by diesel powered generators (PR#76 p. 466).

Construction

The construction phase at the Nechalacho mine site is expected to occur over 16 to 18 months (PR#165 p. 1). Site preparation activities and construction activities for the Project at Nechalacho include upgrading of existing access roads to the flotation plant and mine portal and construction of new access roads to the tailings management facility, water reclaim area, airstrip and dock facility at Great Slave Lake. The existing airstrip will be extended. A rock quarry will be developed to supply construction materials, in particular a quarry within the southern-most portion of tailings facility for tailings embankment construction (PR#165). The barge landing site at Great Slave Lake will be upgraded. Construction of surface facilities will include a combination of steel, stick-built and pre-fabricated structures (PR#76 p. 472-473).

Construction of embankments for the tailings management facility will begin with several small dams in phase one, followed by raising of these embankments in phase two to contain the tailings and establish a downstream polishing pond if required. In a Project Update (PR#165) the Developer stated that Buck and Ball Lakes will act as the polishing pond from years 1-9 and the east end of Buck Lake will act as the polishing pond in years 10-20. The embankments will be constructed of mine waste rock or quarried rock. Foundation preparation for the embankments will consist of removing the organics, overburden and any frozen soils with high ice content or other unsuitable material. A geo-membrane will be placed on the upstream slope of the embankment to reduce seepage (PR#76 p. 496-498).

Structures to be built on-site include the flotation plant, reagent storage, paste backfill plant, warehouse, maintenance shop and administration offices, employee camp facilities, a dry, power plant and container loading facility. Fuel tanks will be constructed at the dock site consisting of two 1.5 million litre tanks. Fuel will be transported by truck to the main fuel storage facility located near the flotation plant. At this facility, four fuel storage tanks with a capacity of 4.5 million litres each will be enclosed in a berm in accordance with CCME Code of Practice. Approximately 21 million litres of fuel will be consumed per year at the mine (PR#76 p. 502-503).

Barging activities will occur over a 60-day period during the summer out of the average 120-day barging season. The airstrip will be upgraded to 1,000 m in length and will accommodate medium to heavy lift aircraft for the transport of employees and supplies year-round (PR#76 p. 467, 507).

Operations

The mine plan for the Project uses underground mining methods, accessed by a single decline ramp 1,600 m in length, with the portal located near the flotation plant. Mining will occur in stopes using rubber-tired mechanized equipment. Backfill of mined-out stopes is planned after year five of operations followed by pillar extraction. Primary, secondary and tertiary crushing and screening of material will take place underground and ore will be conveyed up the main decline to the flotation plant. Waste rock will be diverted to mined-out stopes as fill and combined with paste backfill.

During decline construction, 400,000 tonnes of waste rock plus low and high-grade ore will be hauled to surface and segregated in temporary storage areas. The majority of this waste rock will be used for surface construction activities including dam building for the tailings management facility, extending the airstrip and upgrading roads. Ore temporarily stockpiled on surface during decline and initial mine construction will be used for start-up of the mill. Run-off from ore stockpiles will be collected in a settling pond. During operations, ore will be stockpiled underground (PR#76 p. 476, 491).

Paste backfill will be used to maximize ore recoveries by filling in stopes after year five of operations. Paste backfill will have the added benefit of reducing the amount of tailings reporting to the surface tailings management facility. The paste plant will be installed in the flotation plant and incorporate cement and fly ash into the paste.

The underground facilities will include ventilation, mine air heating and electric power distributed from surface. Water for underground use will be taken from Thor Lake. The Developer predicts that it will be relatively dry underground with ground water inflows in the range of 11-36 m3/hour. Waste water from underground will collect in an underground sump and be pumped to surface where it will either be mixed with tailings thickener as mill recycle water or discharged to the tailings management facility. The Developer will use ammonium nitrate fuel-oil and detonators for blasting rock underground. Explosives as well as some stick powder will be stored on surface and underground according to federal regulations. Approximately 671 kilograms of ammonium nitrate fuel oil will be used for blasting each day during full operations (PR#76 p. 479, 503-505).

Mine production during early mine operations will begin at 1,800 tonnes per day increasing to a maximum of 2,000 tonnes per day for the 20 year mine life. The flotation plant includes rod/ball mill grinding, de-sliming, magnetic separation, dewatering, and flotation to recover concentrate, gravity separation and concentrate

dewatering. The final concentrate product from the flotation plant represents 18% of total ore fed into the mill (PR#76 p. 479-81).

Tailings from the flotation plant will be transported by pipeline to the tailings management facility, located in the Ring and Buck Lake catchment area. Discharge from the tailings management facility will be directed to Drizzle Lake, which flows into Murky Lake, which in turn flows into Thor Lake. For the first five years of operation, all of the flotation plant tailings will report to the tailings management facility, after which up to 62% of tailings will be deposited underground as engineered backfill (PR#165 p. 2, PR#76 p. 498). Water management on site includes potable water for surface facilities, water for underground operations and the capture and management of waters and effluent directed to the tailings management facility. Water for the flotation plant consists of 50% from Thor Lake and 50% recycled water from the tailings management facility (PR#76 p. 499).

Sewage and grey water will be processed in a sewage treatment plant and treated effluent will report to the tailings management facility. Garbage will be incinerated daily in accordance with best practices and regulatory requirements. There will not be a landfill on site (PR#279) and solid waste and any hazardous waste will be managed according to GNWT regulations and directed to an approved off-site facility (PR#76 p. 499).

The flotation plant will produce approximately 360 tonnes per day of concentrate, which will be loaded into half height intermodal containers (Figure 8). The containers have a capacity of 40 tonnes and can be stacked four containers high. The containers will be trucked along a 5 km access road and be stored near the seasonal docking facility to await summer transport across Great Slave Lake to the Hydrometallurgical facility at Pine Point. Fuel will be transported by 1 million litre capacity barges from the south side of Great Slave Lake at Hay River to the dock at the Nechalacho mine site. Fuel will be offloaded and stored at a fuel storage facility near the dock site and transferred by truck to the main fuel storage facility at the flotation plant site (PR#76 p. 467).

A seasonal dock facility will be constructed of a single barge connected to the shore and used during the open water season. The docking facility is for the loading of barges with containers of concentrate for shipment south to Pine Point and for unloading incoming barges carrying mine and mill consumables, including fuel. A storage area of approximately 1.6 ha is required for container storage near the dock site. A total of 4,200 containers will be needed during mine operations (PR#76 p. 467). A reconfigured seasonal floating dock (barge) site and storage area was

described in correspondence to the Board July 3, 2012. The position of the barges was re-oriented from the original design perpendicular to the shore to the current alignment parallel to shore (Figure 3) (PR#165 p. 4, 9).

Closure

Closure activities are expected to occur over a three to five year period (PR#279 p. 41). Underground infrastructure will be salvaged to the extent possible and underground workings will be backfilled with paste backfill and waste rock. Inert waste and scrap materials that are not salvageable will be disposed of underground. At closure the engineered tailings management facility will permanently store 3.5 million tonnes of tailings. Progressive reclamation will be implemented to the greatest extent possible. Exposed tailings will be capped with overburden and previously stockpiled organics and re-vegetated. Surface runoff control channels and spillways will be constructed to control runoff and re-establish flow patterns for sustainable runoff conditions. Monitoring and inspections will be required to ensure acceptable downstream water quality is maintained (PR#76 p. 932).

All surface infrastructure at the flotation plant and concentrate storage area site that can be salvaged will be removed from the site. Stockpiled overburden and fill will cover the infrastructure footprint and the areas will be re-vegetated. The area used for temporary waste and ore stockpiles will be progressively reclaimed within the first year of operations. The airstrip, roads and trail network will be reclaimed. Site preparation at closure will be carried out in a way that facilitates the natural re-establishment of vegetation (PPR#76 p. 934-938).

Post-closure

Post-closure monitoring includes annual inspection of the tailings management facility to ensure that closure predictions and expectations are being met. Acceptable water quality downstream of the tailings facility will need to be maintained (PR#76 p. 933).

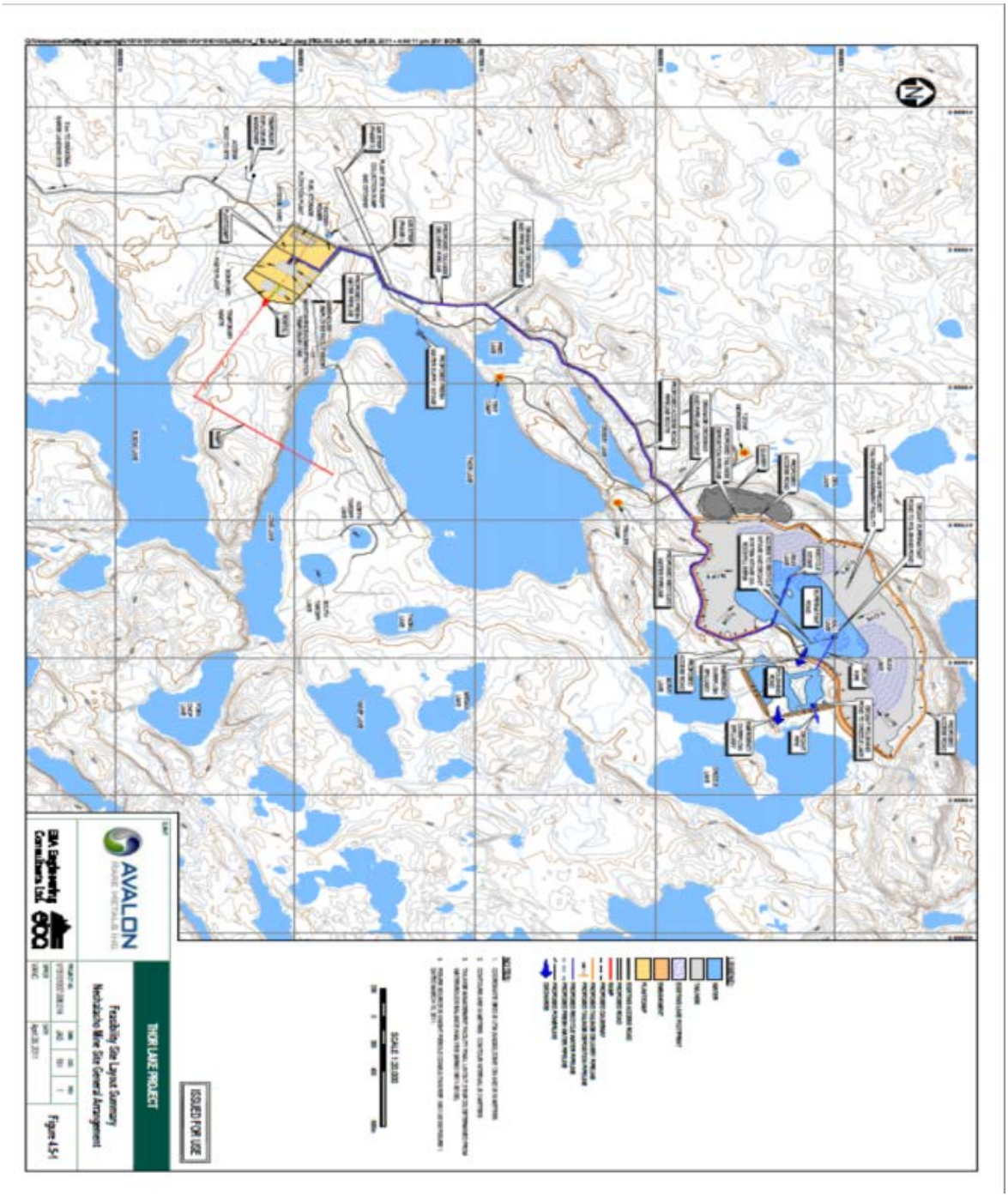

Figure 2: Nechalacho mine site layout. (PR#76 p. 469)

Figure 3: Nechalacho dock site showing original and modified footprint. (PR#165 p. 9)

1.4.3 Hydrometallurgical plant site

At the Hydrometallurgical plant site, primary components include the plant itself, water supply, tailings facility, concentrate storage and loading sites, a power supply, limestone storage, the haul road, seasonal docking facility and transport of the final product to the railhead at Hay River. The general site layout of the Hydrometallurgical plant site is shown in Figures 4-6.

Construction

The rare earth element concentrate will be further processed at the Hydrometallurgical plant site. The Plant is located on a previously disturbed area immediately to the southeast of the Teck-Cominco tailings facility. The various land tenures at the former mine site are shown Figure 6. The Hydrometallurgical plant includes a thaw shed and dump station, sulphuric acid plant, acid baking, water washing, filtration, bulk concentrate loadout, neutralization, product drying and mixed light rare earth packaging facilities (PR#76 p. 468). Water to supply the plant will be sourced from the open pit lake from the former Pine Point mine called the J-44 pit (PR#185).

Tailings from the Hydrometallurgical plant will be deposited in a former Pine Point Mine open pit called the L-37 open pit, located approximately 500 m southeast of the plant. Excess tailings water that builds up in this pit during operations will be discharged into another old open pit called the N-42 pit, located 1.5 km to the southwest of the L-37 pit (Figure 6).

Concentrate storage containers arriving by barge from across the lake will be unloaded at the Pine Point dock site on the south side of Great Slave Lake, placed on trucks and driven to the plant site. The seasonal dock facility at Pine Point will consist of barges creating a dock site for berthing and unloading of concentrate containers (Figure 4). The haul road from the dock site on the lake shore to the plant is approximately 8.6 km long and will follow existing roads. Once at the Hydrometallurgical plant site, concentrate containers may need to be thawed before the concentrate can be removed. The containers are cleaned before being shipped back to the Nechalacho mine site. The docking site may also be used to ship mining consumables and fuel to the Nechalacho mine site.

Limestone will be required to neutralize the waste stream from the Hydrometallurgical plant prior to discharge into the tailings management facility and will be stockpiled near the plant site. No special stockpiling considerations are considered necessary. During operations the Hydrometallurgical plant will produce

418 tonnes per day of acid-baked concentrate and light rare earth products. The final products will be dried to 10-12% moisture content, hauled by truck to Hay River and shipped south by rail.

Structures proposed for the site include an acid bake facility, administration offices, a leach/neutralization facility, precipitation and packaging facility, temporary product storage, acid plant and storage, limestone grinding, temporary concentrate storage and a thaw shed. Power, to meet an estimated 3.5 MW demand, will be supplied through the existing hydroelectric substation at the site. A backup diesel generator will be required (PR#76 p. 468-71). A small fuel storage area for between 10,000-20,000 litres of diesel and gasoline will be located adjacent to the Plant (PR#76 p. 526).

Operations

The Hydrometallurgical plant will operate for 351 days per year. Process steps at the plant include, pre-leach and acid bake where the concentrate is mixed with diluted acid in the pre-leach operation, filtered, mixed with concentrated sulphuric acid and heated to 200 degrees Celsius. The acid baked product is quenched with water, filtered, washed and dried. Test work on the recovery of light rare earths and rare metals is ongoing (PR#76 p. 511). The final products will be two separate precipitates. A preliminary incomplete list of reagents provided in the DAR include elemental sulphur, H^2SO^4 (sulphuric acid), flocculant, sodium sulphate, limestone and lime. Material Safety Data Sheets for the various other reagents used in the plant were provided as undertakings after requests for information during the technical sessions in August 2012 (PR#189, 190, 191, 192, 193). A total of 27,000 tonnes per year of limestone will be required and will be supplied by a third party contractor. It will be stored close to the plant. A sulphuric acid plant will be installed at the site and will need 30,000 tonnes per year of elemental sulphur to produce 79,000 tonnes of sulphuric acid per year as well as some sulphur dioxide needed in the process. Sulphuric acid will be stored in a tank prior to use in the Hydrometallurgical plant (PR#76 p. 513-514).

Excess solution from the acid bake, leaching and product recovery steps will be neutralized with limestone in a series of tanks. The final tailings from the Hydrometallurgical plant will predominantly consist of gypsum and will be in a slurry with about 40% solids content by weight. Tailings from the Plant will be deposited via pipeline into the historic L-37 open pit. The L-37 pit will have a temporary separator dyke to allow supernatant water to collect separate from the tailings. Excess supernatant (liquid tailings) water will be pumped from the L-37 pit to the N-42 infiltration pit. There will be no reclaim water from the tailings open pits back to the Plant. The use of both open pits for tailings storage is based on a 20-year design

life. Design of both tailings pits includes a minimum of 2 meters of freeboard to accommodate storm events (PR#76 p. 515-520).

There will be no accommodations at the Hydrometallurgical facility. Sewage and grey water will be treated in a packaged sewage treatment plant and the effluent will report to the tailings facility. Garbage will be incinerated and waste materials will be temporarily stored on site prior to removal. Solid waste and hazardous waste will be managed in accordance with NWT regulations. Water for the Hydrometallurgical plant will be sourced from the historic J-44 open pit (Figure 6).

Closure

At closure, structures at the site will be dismantled and removed. Since the plant site will be constructed on a historically disturbed and non-reclaimed site, there is a lack of suitable growth media (organics) to stockpile during construction for eventual reclamation. Re-vegetation will be considered but it is unlikely that it can be extensively applied. At closure the tailings will be covered with overburden and re-vegetation may be considered if site conditions are suitable. The tailings facility (L-37 pit) will not contain open water at closure (PR#76 p. 943-945).

Post Closure

Post-closure monitoring will include water quality, physical stability, erosion protection, re-vegetation success and key environmental quality indicators. Post-closure monitoring will continue until licence and permit criteria have been met. Post-closure monitoring is expected to take place for five years after closure.

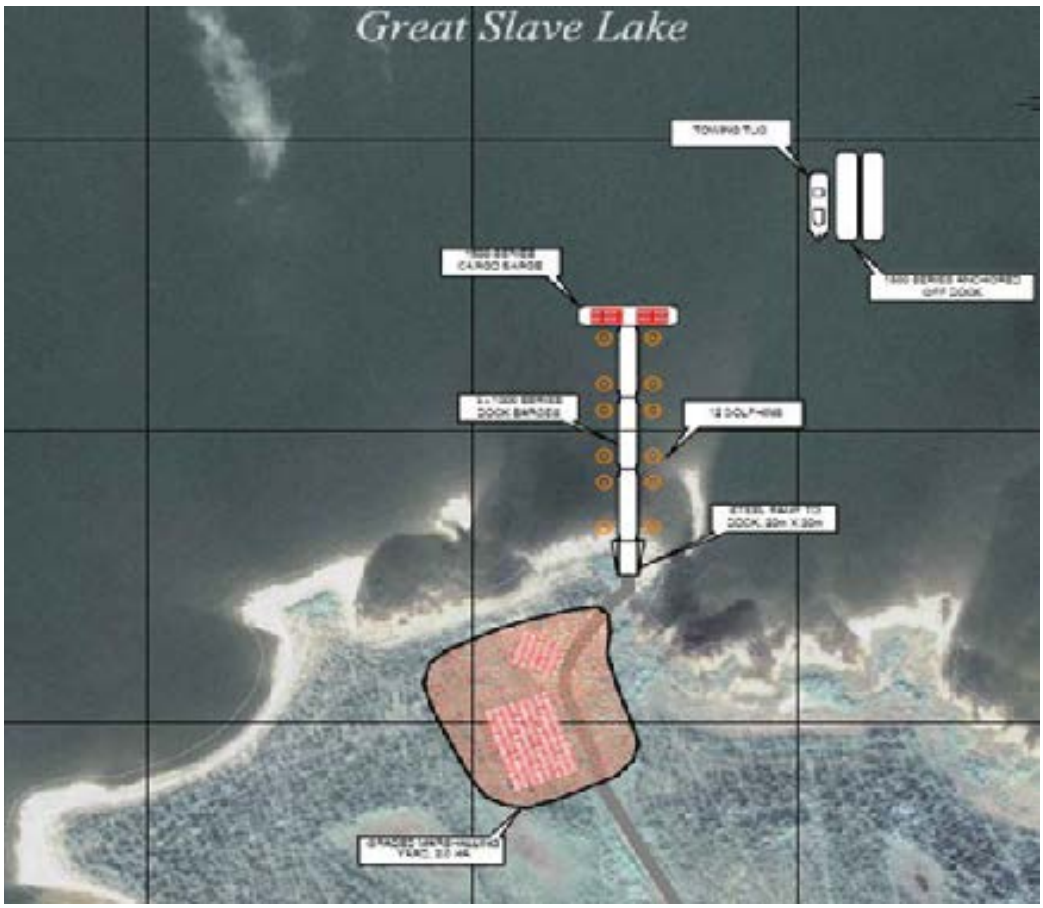

Figure 4: Site layout of Pine Point seasonal barge dock. (PR#171 p. 43)

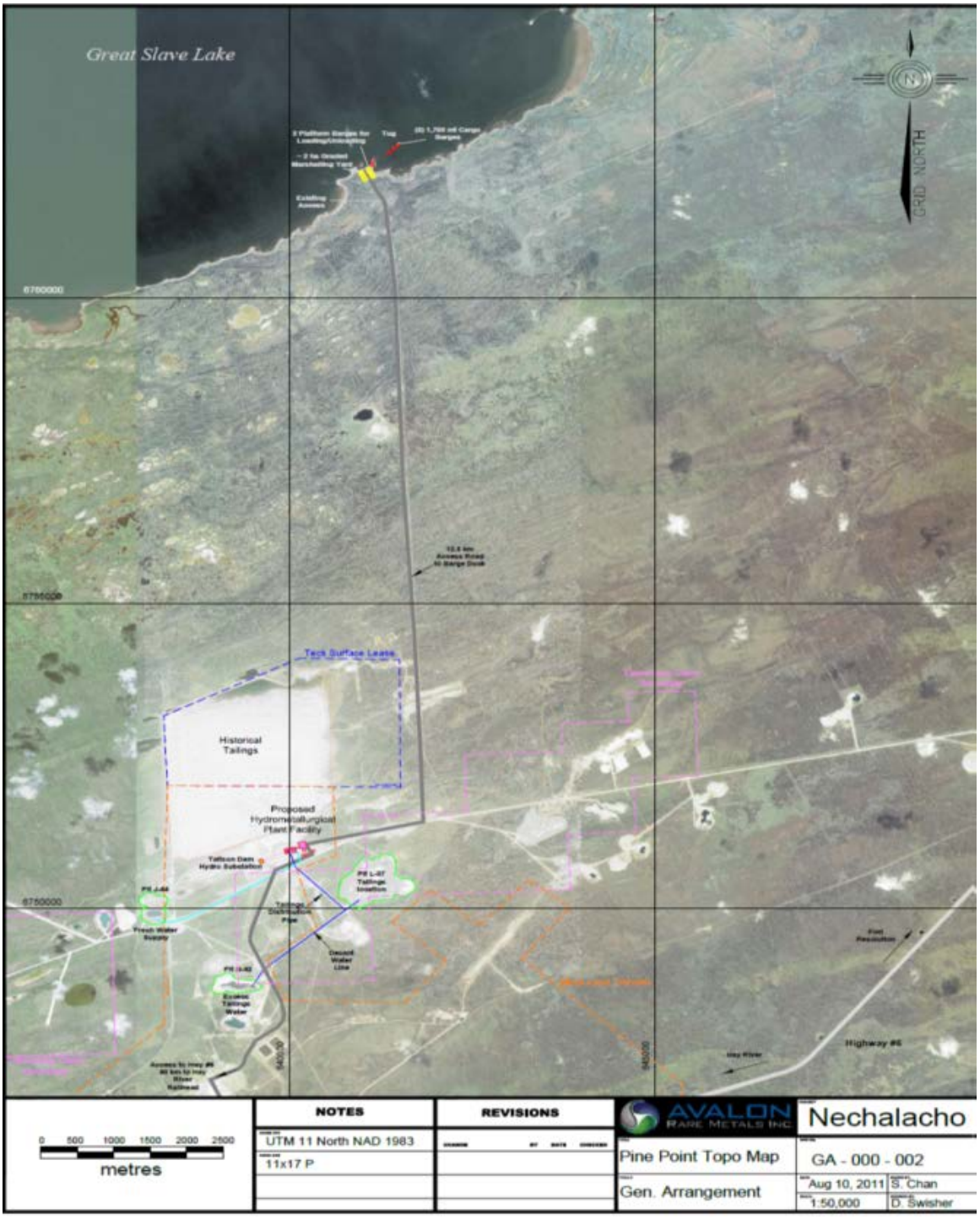

Figure 5: General site layout of Hydrometallurgical plant. (PR#78)

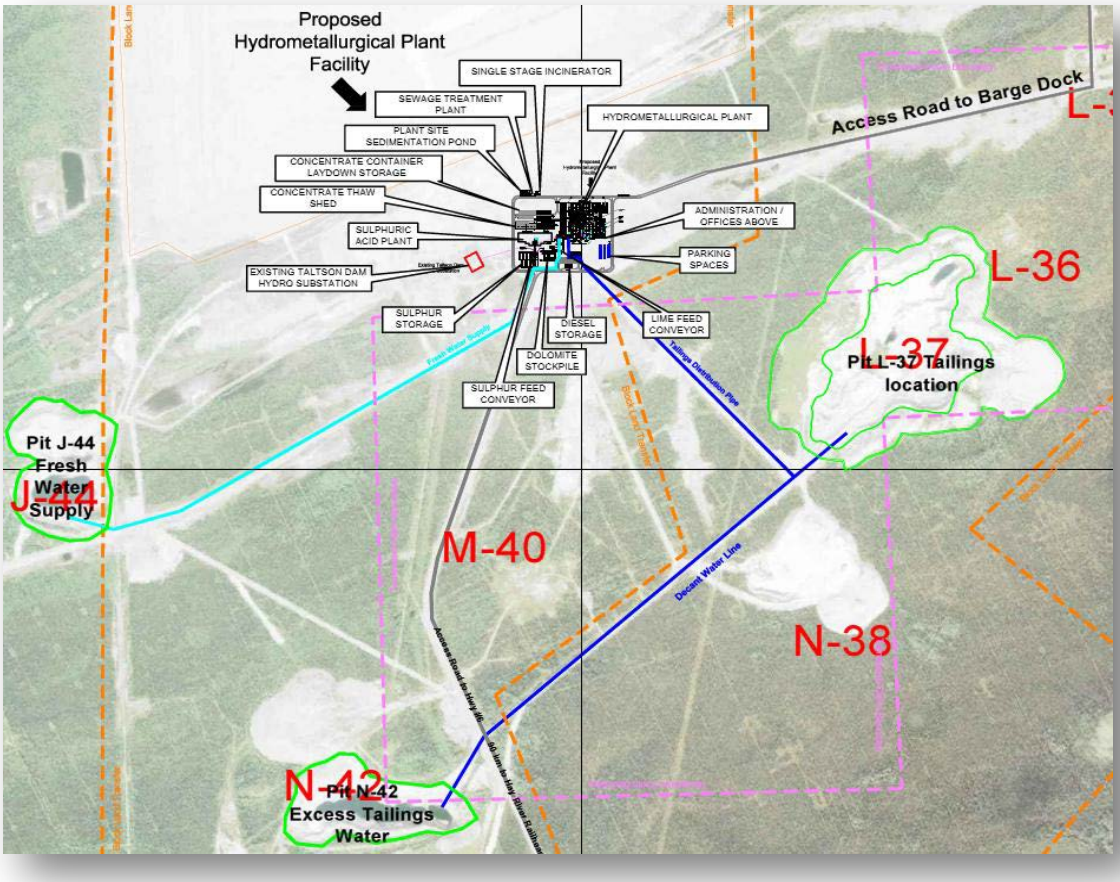

Figure 6: Hydrometallurgical plant detail showing tailings pits and fresh water supply, from August 2012 Technical Session presentation (PR#177 p. 46).

Development schedule

The construction phase for the Project is expected to take 18-30 months. The operations phase at both sites is 20 years. Closure and post-closure will take between three to five years (PR76 p. 471, 950).

2 Environmental assessment process

This section describes the Review Board's environmental assessment process for this Project. It provides information about the parties to this assessment and the steps of the process the Review Board took to identify any significant adverse impacts or public concern. This section also describes the scope of the assessment and the changes to the Project's design that occurred during the assessment.

2.1 Parties to the environmental assessment

Fourteen organizations participated as registered parties in this environmental assessment. According to the Review Board's *Rules of Procedure*, the Developer is a registered party. The other registered parties were:

- Fort Resolution Metis Council;
- Transport Canada;
- Blachford Lake Lodge;
- Yellowknives Dene First Nation;
- North Slave Metis Alliance;
- Tlicho Government;
- Lutsel K'e Dene First Nation;
- Fisheries and Oceans Canada;
- Deninu Kue First Nation;
- Government of the Northwest Territories;
- Aboriginal Affairs and Northern Development Canada;
- K'atlo'deeche First Nation;
- Environment Canada; and
- Akaitcho IMA Office.

During the environmental assessment process, representatives of government departments and other interested groups had the opportunity to identify their interests and to seek the Review Board's approval to participate in the proceeding as an interested party. Parties to the environmental assessment had the opportunity to attend and actively participate throughout the process although some parties did not actively participate in all the stages. All information exchanges between the Developer and parties can be found on the public registry. Table 1 below illustrates the involvement of the parties throughout this environmental assessment process.

Table 1: Participation of the parties

Party	Scoping	Terms of Reference	Information requests	Technical Session	Technical Report	Hearing	Closing comment
AANDC	✓	✓	✓	✓	✓	✓	✓
Akaitcho IMA Office				✓	✓	✓	✓
Blachford Lake Lodge	✓			✓		✓	
DKFN		✓	✓	✓		✓	
EC	✓	✓	✓	✓	✓	✓	✓
DFO	✓	✓	✓	✓	✓		
FRMC	✓					✓	
GNWT	✓	✓	✓	✓	✓	✓	✓
KTFN	✓	✓				✓	
LKDFN		✓	✓	✓		✓	
NSMA	✓		✓	✓	✓	✓	✓
NWT Metis Nation				✓		✓	
Tlicho Government							
TC	✓		✓	✓	✓	✓	✓
YKDFN	✓	✓	✓	✓		✓	✓

✓ = actively participated in this phase of the environmental assessment

The Terms of Reference for the DAR outlined the parties' roles and responsibilities. The Developer was responsible for producing the information necessary to meet its burden of proof and to satisfy the Review Board's and parties' queries in order to evaluate the potential impacts that the Project might have on the environment.

2.2 Environmental assessment phases

After the referral to the Review Board on June 11, 2010 and the initial environmental assessment start-up activities, the Review Board conducted this environmental assessment in three phases: a scoping phase, an analytical phase, and a decision

phase. See Table 2 for tasks associated with each phase of the environmental assessment.

Table 2: Nechalacho Project environmental assessment process

Scoping Phase	• Workplan	Aug 25, 2011 *updated Nov 24, 2011 and Sept 10, 2012*
	• Terms of Reference	Feb 14, 2011
Analytical Phase	• Developer's Assessment Report	May 20, 2011
	• 1st information requests	Dec 31, 2011
	• Technical meeting	Aug 14, 2012
	• 2nd information requests	Sept 21, 2012
	• Technical reports	Nov 29, 2012
Decision Phase	• Pre-hearing conference	Feb 1, 2013
	• Public hearing	Feb 18 - 20, 2013
	• Undertakings	Mar 12, 2013
	• Final submissions from Parties	Mar 19, 2013
	• Final submission from developer	Mar 21, 2013
	• Closure of public record	Apr 3, 2013

Development of Work Plan and Terms of Reference

The Review Board issued a draft Work Plan on August 25, 2010. This document established milestones and identified the Review Board's timelines and expectations for the completion of the environmental assessment.

The Review Board distributed the draft Terms of Reference (PR#38) for comment in November 2010. The Review Board considered all comments from parties and issued the final Terms of Reference in Feb 2011 (PR#73). The Terms of Reference set out the scope of development, the scope of assessment and provided direction to the Developer and the parties about their roles and responsibilities in the environmental assessment process.

Developer's assessment report

The Developer submitted its Developers Assessment Report (DAR) to the Review Board (PR# 76), according to the Terms of Reference, in May 2011. On November 3, 2011, the Review Board issued a conformity statement (PR#112) to the Developer stating that the DAR and associated appendices were in conformity with the Terms of Reference.

Information requests and technical sessions

In November 2011, the Review Board asked parties to provide written information requests that outline their questions for clarification of the DAR (PR#112). The Developer was requested to respond to the parties' information requests and to provide reasons to the Review Board in the event that they could not answer any given request. In January and February 2012, the Developer provided the responses to the information requests.

On August 14-17, 2012 Review Board staff hosted a four-day technical session in Yellowknife so that parties to the environmental assessment could seek clarification on responses to the information requests and discuss remaining issues face-to-face with the Developer's representatives and consultants. The Developer responded to undertakings from the technical session on August 17, 2012.

After the technical session, the Review Board set a deadline of November 29, 2012 for parties to submit their final technical reports. The Review Board also set out public hearing schedule for February 18-22, 2013.

Pre-hearing conference

Review Board staff hosted a pre-hearing conference on January 25, 2013 and invited parties to participate. The purpose was to discuss hearing procedures and to set an agenda for public hearings in Yellowknife and Fort Resolution.

Public hearings

On February 18-20, 2013, the Review Board held a public hearing in Yellowknife; on February 22, 2013, the Review Board held a community hearing in Fort Resolution. Radio, posters, newspapers and webpage announcements notified the public prior to the hearings. The main purpose of the hearing was to allow the public an opportunity to hear and participate in a discussion of the issues related to the Project. The community hearing provided an opportunity for residents of Fort Resolution to bring forward concerns directly to the Review Board.

The Developer and several other parties made presentations to the Review Board. All parties had the opportunity to question both the Developer and any other parties which made presentations. The parties' submissions highlighted their views about

direct and indirect impacts of the proposed development and presented final impact predictions and mitigation recommendations to the Review Board.

Hearing follow-up, final submissions and closure of the public record

During the hearings, a number of undertakings for submission of additional information were required from parties. Responses to these undertakings were submitted to the Review Board by March 12, 2013.

The Review Board received final argument from the parties on March 19, 2013 and reply argument from the Developer on March 21, 2013. The Review Board closed the public record on April 3, 2013.

Environmental assessment decision

After the closing of the public record, the Review Board considered all the evidence and submissions on the public record in order to arrive at its decision. The Review Board has prepared this Report of Environmental Assessment & Reasons for Decision for submission to the Minister of Aboriginal Affairs and Northern Development as required by subsection 128(2) of the Mackenzie Valley Resource Management Act.

2.3 Making decisions about significance

Section 128 of the Mackenzie Valley Resource Management Act requires the Review Board to decide, based on all the evidence on the public record, whether or not, in its opinion, the proposed development (the Project) will likely have a significant adverse impact on the environment or be a cause for significant public concern.

During the course of the environmental assessment, the Review Board asked the registered parties to assist in this determination by providing their own views about the predicted impacts and their significance. The Review Board considered the following characteristics of all environmental impacts identified:

- magnitude
- geographic extent
- timing
- duration
- frequency
- nature of the impact
- reversibility of the impact
- probability of occurrence
- predictive confidence level

Sections 3-11 of this report describe the Review Board's analysis and the reasons for its decisions on the significance of adverse impacts that are likely to result from the proposed development.

2.4 Scope of the development and assessment

It is necessary during an environmental assessment for the Review Board to make decisions about the scope of the development (the Project) and the scope of the assessment. The scope of development includes the physical works and activities required for the Project to proceed that will be assessed in order to determine their impact on the environment. The scope of assessment includes the identification of the valued components of the biophysical and human environment that may be affected by the Project. The impacts of the Project on the valued components are assessed as are the impacts of the Project in relation to other past, present and reasonably foreseeable developments. The following sections provide greater detail on these matters.

2.4.1 Scope of development

The scope of development outlined in this Report of Environmental Assessment (REA) describes the elements of the Project that the Review Board considered in the environmental assessment. The scope of development identifies and takes into account both principal and accessory development activities. It is the responsibility of the Developer to provide the information necessary to describe the proposed development. The impact of these physical works and activities are then assessed. The scope of development thus influences the scope of assessment. Future activities cannot exceed the scope of development without a requirement for further preliminary screening.

The scope of development was initially based on information provided by the Developer in water licence and land use permit applications submitted by the Developer to the Mackenzie Valley Land and Water Board during preliminary screening. This information formed the basis for the project description included in the Terms of Reference issued by the Review Board in February 14, 2011 (PR#72). The scope of development was updated several times during the course of the environmental assessment by the Developer as improvements in Project design took place. Section 2.4.2 of this report describes some of the more important changes. The final scope of development identified in section 2.4.3 includes all relevant changes and, in the Review Board's opinion, accurately reflects the Project as currently proposed.

2.4.2 Development description amendments

During the analytical phase of the environmental assessment, the Developer proposed several Project modifications which changed the scope of development and

its potential impacts on the environment. A summary of the key project modifications is set out in Table 3 below.

Table 3: Key beneficial modifications to the development description

Original Developer's Assessment Report component	**Alternative chosen component**	**Benefits of chosen alternative in relation to the likelihood of significance of adverse impacts**
Nechalacho mine site flotation plant, no water treatment	The Developer committed to treat mine water and tailings effluent water	This commitment will reduce impacts to water.
Truck materials to Pine Point	Barge material	This should mitigate dust and noise impacts along the road connecting the Hydrometallurgical plant site to Hay River
Deposit tailings at the mine site to the tailings management facility	Place approximately 62% of tailings back in the underground mine workings, referred to as paste backfill (PR#165)	This will reduce the size of the tailings management facility from 149.3 ha to 121 ha and thereby reduce impacts to local area. The embankment crest elevation at the eastern end of the facility reduced from an elevation of 256 m to 252 m and this will reduce the visibility of the tailings facility. The need for a separate constructed polishing pond at the TMF is eliminated.
Above ground crusher at the mine site	Underground crushing	This will reduce noise and dust emissions
Flotation plant area, 17.5 ha	Reduced to 16.7 ha (PR#165)	Footprint reduced
DAR proposed a site for the Hydrometallurgical plant	The site was moved to a more central location (PR#165)	Reduction in power lines by 2km Reduced piping requirement from Hydrometallurgical site to fresh water supply.

Original Developer's Assessment Report component	Alternative chosen component	Benefits of chosen alternative in relation to the likelihood of significance of adverse impacts
Barge container lay down area at the mine site. The DAR proposed 2.7 ha	The area has been reduced to 2.0 ha. (PR#165)	Footprint reduced

The Review Board accepts the Developer's rationale for these Project modifications and includes them in the final scope of development. The Review Board's conclusions about the impacts of the Project, and the Review Boards determination pursuant to Section 128 of the *Mackenzie Valley Resource Management Act*, are based on the inclusion of these design changes in the scope of development.

The following section sets out the final scope of development.

2.4.3 Final scope of development

The Review Board identified the principal scope of development to include any and all physical works and activities required to extract, concentrate, further process, store and transport concentrates or other product out of the Mackenzie Valley, as well as to close and reclaim any and all aspects of the Project in the Mackenzie Valley.

The initial project scope was altered during the assessment process by the Developer through Project changes, which, in the Review Board's opinion reduce the likely adverse impacts of the Project. The scope of development also includes commitments made by the Developer that are described in Appendix C.

Table 4 and 5 contain the scope of development for the Nechalacho mine site and flotation plant and the Hydrometallurgical plant site and include the beneficial changes listed in table 3.

Table 4: Final scope of development – Nechalacho mine site and floatation plant

Phase	Components/Activities
Construction	Tailings management facility and water management systems
	Temporary ore and waste rock management area
	Underground mine and support structures
	Waste disposal facility

Phase	Components/Activities
	Flotation plant facilities for milling, initial separation and concentration of ore
	Power generation and heat recovery facilities
	Construction and upgrade of roads at the mine site to the dock facility
	Construction of water management facilities, including the pump house and water intake, water discharge system (including seasonal water storage areas, all drainage ditches and discharge points), potable water supplies for the camp, a sewage treatment plant
	Construction of fuel storage facilities at the flotation plant site and at the dock facility
	Construction of the permanent camp, a dry, administration office, warehouse, maintenance shop, container loading facility and other associated structures
	Construction of drainage control structures, process pipelines and wastewater pipelines from mine to surface, on surface at the mine site, run-off collection trenches and sedimentation ponds
	Expansion or any other modification to the existing airstrip
	Development of borrow sources for aggregate production at the mine site, near the tailings management facility or along the access road to Great Slave Lake
	Seasonal construction and demobilization of the barge-docking facility at Great Slave Lake
	Construction of the concentrate and supply storage/laydown area
Mining and materials storage	Development of underground workings
	Extraction and crushing of ore-bearing rock
	Transport, storage and use of explosives, fuel and reagents
	Mine dewatering and deposit of mine water to surface
	Transportation of materials, management of ore and tailings
	Operations of tailings management facility, including waste management systems
	Construction and use of paste backfill plant
	Operation of mining equipment, including vehicles and conveyance system(s)

Phase	Components/Activities
	Construction of any associated foundations, buildings and water treatment and management systems
Milling	Use of facilities for milling, initial separation and concentration of ore including: • conventional concentrator with ball mills; • initial flotation, secondary flotation of bulk rougher concentrate, bulk cleaner flotation and any other processing; • extraction, transportation, consumption, recycling, treatment and discharge to the environment of mine water and process water; • storage, handling, use and disposal of milling process additives and chemicals; and • thickening, filtration and packaging of concentrate for transportation.
Other on-site facilities and activities	Power generation and heat recovery facilities
	Use of waste incinerator
	Use of airstrip
Support/ancillary facilities and activities	Transportation activities by air and road that support the Project's operation, including transportation of goods, fuel, contractors and employees in to and out of the mine
	Barging of concentrate from the Nechalacho mine site to the Hydrometallurgical plant site
	Removal and disposal of wastes or other materials
	Barging of material from Hay River to both the Nechalacho mine site and the Hydrometallurgical plant site
	Use of borrow sources for aggregate production at the mine site or along the access road
Closure and reclamation	Removal or stabilization of all structures and equipment
	Reclamation of tailings management area, and all other site water management facilities
	Progressive reclamation of temporary ore and waste stockpiles during early operations
	Reclamation of infrastructure foundations, piping, and all built structures at the mine site
	Reclamation of any stockpiles and materials storage locations
	Re-vegetation of areas affected by mining, access road or support activities

Phase	Components/Activities
	Bulkhead installation and other capping of the underground works

Table 5: Final scope of development – Hydrometallurgical plant site

Phase	Components/Activities
Construction	Hydrometallurgical plant including thaw shed, dump station, sulphuric acid plant, acid baking facility, water washing and filtration facility, bulk concentrate loadout, neutralization facility, drying facility and packing facility
	Project related buildings such as garages, maintenance and administration
	Waste disposal facility
	Power generation and heat recovery facilities
	Storage facilities for fuel, elemental sulphur, limestone, lime, flocculant and other reagents
	Sewage treatment facility
	Construction and/or upgrade to the 12 km road from the Hydrometallurgical facility to the dock facility on Great Slave Lake and any other roads
	Seasonal construction and demobilization of the barge-docking facility on Great Slave Lake
	Concentrate storage and laydown area at the barge docking facility
	Construction of any drainage control structures, process pipelines and waste water pipelines
	Construction of water management facilities, including pump house and water intake, water discharge, sewage treatment facilities
Concentrate processing	Hydrometallurgical facility equipment operations, including vehicles and material conveyance systems
	Transport, storage and use of fuel, reagents, and other materials
	Transport and storage of concentrate
	Operation of the sulphur acid bake facility, leach/neutralization facility, precipitation and packaging facility, product storage facility, acid plant, and storage, limestone grinding, temporary concentrate storage and thaw shed
	Limestone stockpile

Phase	Components/Activities
	Use of existing open pit (L-37) as tailings management facility
	Use of existing open pit (N-42) as exfiltration facility for excess tailings water
	Use of existing pit (J-44) as water supply for plant and potable water
	Use of existing hydroelectric substation for power requirements
Other on-site facilities and activities	Dismantle structures and remove from the site
Closure and reclamation	Cover tailings with overburden and re-vegetate if conditions are suitable
	Consider re-vegetation of reclaimed areas recognizing that the plant and other structure are constructed on historically disturbed areas

2.4.4 Scope of the environmental assessment

The scope of the environmental assessment includes all potential impacts on valued components of the biophysical and the human environment (e.g. wildlife species, public concern or heritage resources) from the Project. These potential impacts are also assessed in combination with other past, present and reasonably foreseeable future developments. Finally, other factors listed under subsection 117(2) of the *Mackenzie Valley Resource Management Act* are addressed in scope of assessment.

To determine the scope of assessment the Review Board:

- reviewed information supplied by the Developer for the initial water licence and land use permit application referred to environmental assessment;
- the project description report submitted by the Developer to the Review Board;
- hosted scoping sessions during August, September and October in Dettah (PR#23), Fort Resolution (PR#36), Lutsel K'e (PR#35), Yellowknife (PR#24), and Hay River (PR#40); and
- requested comments from parties on the scope of the assessment.

After considering the relevant information available on the scope of assessment, the Review Board made decisions on the scope of assessment in relation to the geographic, temporal, biophysical, and human environment scope to be considered in

the assessment. A summary of these determinations is provided below and a full description can be viewed in the Final Terms of Reference (PR#72).

Geographic scope

The geographic scope of assessment includes all areas within the Mackenzie Valley that may be affected by project related activities. This includes impacts that occur within the geographic study areas for the Project as proposed by the Developer but may also include impacts that occur outside those areas. For example, consideration of impacts on water should reflect the mobility of contaminants in the watershed, not just impacts that occur within the Project footprint. Likewise, impacts on wildlife should include consideration of Project impacts at a range scale when considering cumulative effects.

At the Nechalacho mine site the geographic scope of assessment includes:

- the Nechalacho mine and flotation plant including surface and subsurface workings and a reasonable impact footprint radius;
- access road and barge docking facility including a reasonable impact footprint corridor; and
- the watershed from Ring and Buck Lakes to Thor Lake and downstream to Great Slave Lake.

At the Hydrometallurgical plant site this scope includes:

- the Hydrometallurgical facility and access roads to the docking facility;
- the roads from Hay River to the Hydrometallurgical plant site, the road from the plant site to seasonal docking facility, as well as the road between Fort Resolution and Fort Smith
- the rail line between Hay River and the NWT-Alberta border; and
- any watershed (including aquifers) into which the Developer proposes to discharge water from the Hydrometallurgical facility to a point were project impacts cease to occur.

At the docking facilities this includes:

- the habitat of potentially affected species, inducing migratory species; and
- Great Slave Lake related to any potential impacts on water quality, fisheries and human environment.

Temporal scope

For Project specific (that is, non-cumulative) impacts, the temporal scope will include all phases of the Project lifespan including construction, operation, closure and reclamation, and extends until such time as no further potentially significant adverse impacts are predicted. The Developer's prediction for the temporal scope is:

- construction of new mine facilities (2 years);
- mine operations (20 years);
- closure activities (2 years); and
- post-closure monitoring (5 years)

For cumulative impacts, the temporal scope includes the period of the effects of past, present and reasonably foreseeable future projects that are predicted to combine with the impacts of the Project.

Valued components

Based on its scoping activities and input from communities and parties, the Review Board identified the following potentially affected valued components for the Terms of Reference:

Key lines of inquiry

- water quality,
- barging,
- radiation,
- caribou and caribou habitat,
- closure and reclamation, and
- monitoring.

Subjects of note (biophysical)

- air quality – both sites,
- noise and light impacts,
- fish and aquatic habitat,
- terrain, and
- wildlife.

Subjects of note (socio-economic)

- human environment.

2.4.5 Traditional knowledge

The Review Board recognizes the important role that Aboriginal cultures, values and traditional knowledge play in its decision-making. In accordance with the requirements of subsection 115(1) of the *Mackenzie Valley Resource Management Act*,

the Review Board considered all traditional knowledge that parties shared during the environmental assessment.

Both the DKFN and the North Slave Métis Alliance prepared traditional knowledge and use studies and submitted reports to the Review Board.

The traditional knowledge and use studies provide an overview of available knowledge and land use data in the vicinity of the Project within the traditional lands of the Dene and Metis. Baseline summaries and assessments of anticipated Project effects on site-specific and non-site-specific valued components and residual effects are presented.

Section 10 of this Report describes how traditional knowledge was incorporated into the various phases of this environmental assessment.

2.5 Assessment of Impacts

Sections 3-11 of the Report of Environmental Assessment (REA) consider specific impact concerns that arose during the environmental assessment. For each area of concern the Review Board describes:

- the Developer's submissions and predictions, based on the DAR, responses to information request documents, hearing statements, final submissions and other evidence from the Developer on the public record;
- the submissions from parties to the environmental assessment;
- other relevant items on the public record;
- the analysis and conclusions of the Review Board pertaining to each issue; and
- any measures or suggestions by the Review Board.

The Review Board has considered all issues that parties and the public raised in this environmental assessment, pursuant to the requirements of *s.117 of the Mackenzie Valley Resource Management Act*. The Review Board considered evidence from the hearings as well as written evidence on the public record.

However, this report does not discuss issues that the Review Board has decided were fully resolved by reference to the evidence on the public record. For example, in the opinion of the Review Board, the only areas where accidents and malfunctions and cumulative effects needed to be addressed were in relation to barging and caribou respectively.

The issues discussed in detail in this REA are those that the Review Board decided warranted further consideration for the purposes of its decision under section 128 of *the Act* because of impact significance and public concern. The Review Board notes that within the framework of *the Act,* the significance determinations described in this report are not intended to limit regulators from drawing their own conclusions in relation to specific regulatory requirements.

3 Impacts on water quality

The Review Board identified water quality as a key line of inquiry in the Terms of Reference based on information gathered during the Dettah, Fort Resolution, Lutsel K'e, Yellowknife and Hay River Reserve scoping sessions and from parties to this environmental assessment. During public hearings in Yellowknife and Fort Resolution, Aboriginal leaders confirmed in their statements to the Review Board the high value placed on clean water for drinking, fishing and other traditional uses.

This section of the REA examines the evidence on the potential impacts to water quality and the aquatic environment downstream of the Project including Drizzle Lake, Murky Lake, Thor Lake, and Great Slave Lake.

The Terms of Reference (PR#72, p. 8) identifies potential impacts on water quality as a key line of inquiry, particularly in relation to the quality of mine water and tailings effluent released to groundwater and surface waters and related impacts to human health and aquatic life, downstream from the Nechalacho mine site, downstream from the Hydrometallurgical plant site, and resulting from barging accidents on Great Slave Lake.

The Terms of Reference required the Developer to specifically address the potential impacts from the Project on water quality including[3]:

- Nechalacho mine site (up to the confluence with Great Slave Lake)
    - the water quality resulting from processing ore to concentrate, including an analysis of pathways and destinations for the end-products of all products used at the mine site that enter the water treatment stream;
    - mine water quality and quantity from interaction with underground operations;
    - interaction of water with paste backfill and resulting effects to water quality;
    - the mine rock management area runoff water quality and quantity;
    - any other site runoff;
    - the tailings management facility supernatant water quality and quantity; and
    - the effects from groundwater loss through inflows to the underground mine.

[3] The list below is a summary of the specific water quality concerns listed in the Terms of Reference. (PR#72, p. 19-23)

- The Hydrometallurgical plant site (up to the confluence with Great Slave Lake)
    - the water quality resulting from processing concentrate, including an analysis of pathways and destinations for all products used at the Project site that enter the water treatment stream;
    - the tailings management facility supernatant water quality and quantity;
    - runoff from the sulphur, limestone or other material storage areas;
    - any other site runoff;
    - impacts to groundwater flows and water quality in the Presqu'ile Aquifer;
    - the immediate effects of drawdown of water sources;
    - the long-term effects of drawdown of water sources; and
    - how the above changes may translate into surface water impacts, groundwater impacts or effluent water quality.

- Both sites (after mitigation and the Developer's last point of control)
    - impacts to water quality and quantity from final effluent discharged to the environment;
    - identification of the constituents and quantity of each on-site water source;
    - method and location of effluent discharge;
    - predicted changes over time in the amount or quality of Project water outflows;
    - all relevant water quality parameters; and
    - plume behaviour of effluent in the lakes.

- Great Slave Lake
    - impacts to water quality from routine operations, including barging fuel and concentrate across the lake; and
    - impacts to water quality from barging accidents.

Impacts to water quality

The Review Board considered changes to water quality resulting from the construction, operation and closure of the Project. Submissions from parties and the Developer during information requests, at technical sessions, in technical reports, at the public hearings, and in final submissions focused on impacts to water quality of Drizzle Lake, Murky Lake, Thor Lake, and Great Slave Lake. The following is a summary of the sources of potential impacts to water quality from the proposed Project:

- Nechalacho mine site
  - discharge of tailings slurry water from the flotation plant to the tailings management facility (TMF);
  - seepage losses from the paste backfill in the underground mine;
  - discharge of underground mine water after treatment in the flotation plant and transfer to the TMF;
  - plant site runoff collected in the plant site runoff collection pond and transferred to the TMF;
  - seepage losses from the plant site runoff collection pond;
  - discharge of the combined effluent from the TMF to Drizzle Lake;
  - seepage losses from the TMF; and
  - discharge from Drizzle Lake to Murky Lake and downstream to Thor Lake.

- Hydrometallurgical plant site
  - discharge of tailings slurry water to the Hydrometallurgical tailings facility (HTF), pit L-37;
  - plant site runoff collected in the settling pond;
  - seepage losses from the settling pond;
  - discharge of the tailings supernatant from the L-37 pit to the infiltration pit N-42;
  - infiltration from the L-37 and N-42 pits to the Presqu'ile Aquifer; and
  - groundwater migration from the Pine Point site toward Great Slave Lake.

- Great Slave Lake (in addition to sources noted above)
  - spills from the Hay River barge base (operated by others) during routine operations;
  - spills from the Hydrometallurgical plant dock site during routine operations;
  - spills from the barging facility at during routine operations; and
  - spills from barging accidents.

The Review Board has considered all of the evidence relating to impacts of the Project on water quality and reviewed the various mine components and Project design elements individually and in combination. In its review of impacts to water quality, the Review Board has considered Project design mitigations proposed by the Developer and commitments from the Developer related to water quality. The Review Board's conclusions set out below address:

- water quality objectives during mine operations; and
- water quality monitoring and management at mine site during operations.

The following subsections consider water quality objectives as well as operational aspects of the Project and mine components that are relevant when considering the impacts of mine effluent on water quality. This approach addresses the issues separately, while recognizing that they are inter-connected. These Project components are viewed collectively in the Review Board's consideration of the impacts to water quality from the Project.

3.1 Objectives for water quality in the receiving environment

The term "water quality objective" is defined by the Canadian Council for the Ministers of the Environment (CCME) as "a numerical concentration or narrative statement that has been established to support and protect the designated uses of water at a specified site."[4] In the environmental assessment of a project, water quality objectives for the receiving environment are compared to the predicted impacts to water quality. If project-related water quality changes in the receiving environment are predicted to be better than water quality objectives, then it is likely that the project will have no significant effect with respect to water quality impacts. If predicted impacts are worse than some or all of the water quality objectives, then further information gathering and risk assessments may be necessary to determine significance.

As explained above, water quality objectives can be either numeric or narrative. The CCME has defined numeric water quality objectives for Canadian waters for different uses including the protection of aquatic life as well as agricultural and recreational uses of water. The CCME guideline values for aquatic life are derived from an extensive amount of existing toxicity data from tests performed on laboratory strains of various aquatic organisms (e.g., benthic invertebrates, fish, aquatic plants etc.) and "are meant to protect all forms of aquatic life and all aspects of the aquatic life cycles, including the most sensitive life stage of the most sensitive species over the long term." [5]

Guideline values are considered generic and useful for all water bodies; however, the CCME also defines methods for modifying water quality objectives to reflect site-specific considerations including baseline concentrations, toxicity modifying factors and resident species of aquatic organisms. These site-specific water quality

[4] Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life: Introduction. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.
[5] Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life: Introduction. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

objectives (SSWQOs) are used in the regulatory phase to assess and/or calculate effluent discharge limits (i.e., effluent quality criteria or EQC) for a project as per the Mackenzie Valley Land and Water Board's Water and Effluent Quality Management Policy.

As discussed below, both numeric and narrative water quality objectives have been proposed by parties during this environmental assessment. These objectives are intended to protect identified current and future water uses in downstream water bodies including Drizzle Lake, Murky Lake, Thor Lake, and Great Slave Lake.

3.1.1 Site specific water quality objectives

Site specific water quality objectives (SSWQOs) apply to the concentration of a chemical in a receiving water body and are not normally regulatory limits. During the regulatory approvals phase, the Mackenzie Valley Land and Water Board (MVLWB) will use SSWQOs to calculate effluent quality criteria in a water license. Effluent quality criteria are end-of-pipe discharge limits. When making the determination on water quality objectives, the Review Board considers the acceptability of SSWQOs to decide on the significance of impacts. The Review Board will not provide a recommendation on effluent quality criteria because it is the responsibility of the Mackenzie Valley Land and Water Board.

3.1.2 Developer's submission – site specific water quality objectives

This section describes the methodology used by the Developer to derive SSWQOs for water bodies downstream of the mine site.

On April 2, 2012, the Developer committed to meeting CCME guideline values for the protection of freshwater aquatic life for those elements that have applicable CCME parameters except for aluminum and iron. Baseline values for aluminum and iron exceed CCME guideline values in Drizzle and Murky Lakes, among others, so the Developer proposed SSWQOs tied to the natural baseline values measured in the area. At the Nechalacho mine site, the Developer proposed that these SSWQOs apply at the outlet of Drizzle Lake (PR#156, p. 3). No specific points of compliance were proposed for the Hydrometallurgical plant site or for Great Slave Lake.

The Developer proposed SSWQOs for nutrients based on CCME guidelines except for ammonia and phosphate for which the Developer proposed the SSWQOs be based on the existing background concentrations (PR#171, pp. 53-54).

The CCME guidelines do not include concentration values for the rare earth elements. The Developer has proposed SSWQOs based on CCME protocols for establishing such parameters for the suite of rare earth elements associated with the Project, i.e. by using the Environment Canada methodology of taking the lowest effect level identified and dividing it by 10 (PR#162, p. 1)[6]. The Developer identified the lowest effect level from the available toxicity literature on REEs.

The Developer also performed chronic and acute toxicity testing to support the development of water quality objectives. Acute toxicity testing (LC_{50}) was performed in 2010 on several organisms, Daphnia (*Daphnia magna*) and rainbow trout, with simulated Day-5 decanted effluent from pilot plant testing[7] (LC_{50} > 100%)[8] (PR#82, p. 41, 58). The Developer performed chronic (sub-lethal) toxicity testing[9] (IC_{25}) in 2012 for larval growth and survival on the Fathead minnow (IC_{25}>100%), for reproduction and survival using the invertebrate *Ceri-odaphnia dubia* (water flea) (IC_{25}>100%), for growth inhibition using freshwater algae *Pseudokirchneiriella subcapitata* (IC_{25} >90.91%), and for growth inhibition using freshwater macrophyte *Lemna minor* (duck weed) (IC_{25} >97%) using treated effluent from flotation pilot plant testing (PR#161, p. 2). Acute toxicity testing was also performed on *Daphnia magna* (water flea), rainbow trout, fathead minnow, and *Ceodaphnia dubia* all of which had a 100% survival rate (PR#161, p. 2).

The Developer's proposed SSWQOs were presented to the Review Board during the public hearing February 18, 2013 (PR#279 p. 7-8) and are listed in Appendix B.

3.1.3 Parties' submissions and recommendations – site specific water quality objectives

AANDC

In its technical report, AANDC concludes that toxicity derived concentrations for rare earth elements should not automatically become the default "pollute up to" limits, but that reasonably achievable concentrations that still allow for operational flexibility should be considered (PR#222, p.5).

---

[6] It should be noted that the table of SSWQOs for REEs in PR#162 contains errors for hafnium, holmium, thulium, and zirconium. These errors have been corrected in PR#203 (PR#203, p. 13-16).
[7] PP1 Tls Decant Solution
[8] LC_{50} is the concentration at which 50% of the test organisms die within the first 48 hours of exposure.
[9] IC_{25} is the concentration at which there is a 25% impairment of the monitored biological response, e.g. reproduction or growth rate.

AANDC recommended that the Developer's proposed SSWQOs should be adopted on a provisional basis subject to the results of aquatic monitoring data and impact assessments. In particular, the Developer should specifically derive the SSWQO for mercury to account for bioaccumulation and bio-magnification in the downstream environment and to account for potential impacts through pathways other than direct aquatic exposure. (PR#222, p.5) However, AANDC's closing comments state that AANDC "does not believe the evidence is clear enough to set specific SSWQO concentrations ... given the recent and ongoing changes ..." (PR#304, p. 3). AANDC's closing comments present particular concerns regarding nutrients, major ions, aluminum, copper, mercury, calculation of background concentrations, chromium, nitrate, nitrite, total phosphorus, chloride, and sulphate (PR#304, pp. 4 and 5).

AANDC made the following recommendation related to SSWQOs in its technical report (PR#222, p. 8) and reaffirmed the recommendation in its Closing Comments:

> *SSWQOs for cadmium, iron, zinc and mercury should be set based on background concentrations and, where appropriate, include consideration of seasonality. SSWQOs for Rare Earth Elements should be set at the limits proposed by Avalon unless further investigation and assessment of toxicity becomes available during the life of mine. SSWQOs for other parameters should be "provisionally" based on CCME Guidelines for the Protection of Aquatic Life or future updates to such guidelines. All SSWQOs should be assessed during operations to ensure that the level of protection ... is maintained*. (PR#304, p.1)

Environment Canada

In its technical report (PR#219), Environment Canada states a number of concerns regarding water quality and the Developer's proposed SSWQOs. The specifics of some of the concerns are no longer current due to changes in the Developer's proposed process and additional commitments. The relevant remaining concerns from Environment Canada's technical report related to SSWQOs are listed below (with some rewording to reflect the current understanding of the Developer's proposed process):

- many of the proposed SSWQOs are much higher than both the predicted values for treated discharge to the TMF and the existing background values in Drizzle Lake, suggesting that the Developer could achieve lower SSWQOs;
- the proposed SSWQO for iron is stated as the background concentration which is subject to wide seasonal fluctuations. Environment Canada suggests developing seasonal objectives for under ice and open-water conditions; and

- the Developer should propose objectives for ammonia, nitrate, nitrite, phosphorus, and sulphate which are reflective of background conditions and CCME, keeping the approach that the CCME guidelines are not to be used as "pollute up to" numbers.

In its technical report (PR#219), Environment Canada recommends that:

- where proposed objectives are based on toxicological derivation, and represent increases over baseline concentrations, ongoing monitoring and periodic toxicity testing should be used to identify any potential changes to the aquatic ecosystem before they become impacts;
- the SSWQO for iron should be revised to reflect seasonal concentrations; and
- objectives for ammonia, nitrate, nitrite, phosphorus and sulphate should be identified, and should represent concentrations which are based on preventing toxicity and eutrophication.

Environment Canada reiterated several concerns in its closing comments (PR#300, pp. 1-2), including the following:

- the proposed SSWQOs for nutrients, sulphate, chloride, and some of the REEs may be higher than necessary; the SSWQOs should not be construed as "pollute up to" values. Environment Canada suggests that the Review Board draft a measure that requires further development of the SSWQOs at the regulatory stage and that the SSWQOs be subject to ongoing validation and improvement; and
- the Developer should monitor changes to water and sediment quality, benthic invertebrates, plankton, and fish to evaluate whether SSWQOs are protective. Environment Canada recommends defining concentration levels that would trigger mitigation actions by the Developer.

3.1.4 Review Board's analysis and conclusions – site specific water quality objectives

The Board agrees with the Developer and with parties that the ultimate goal is to ensure protection of the water quality in the receiving environment during development, operations, and post-closure.

The Board recognizes that the Developer has proposed SSWQOs (PR#279 p. 7-8). However, AANDC and EC made detailed recommendations about how final numeric SSWQOs should be set during the regulatory phase, including what factors should be considered, e.g., background values and seasonal variations. The Review Board concurs that the SSWQO for each parameter must be based on the best available toxicity and site data.

The Developer commits to meeting the SSWQOs at the outlet of Drizzle Lake (PR#286 p. 238). The Review Board accepts this commitment and concurs with the Developer and AANDC that use of Drizzle Lake as a mixing zone is appropriate, provided the water quality in downstream water bodies is maintained as described by the narrative statements (See measure 1).

The Review Board finds that numeric (quantitative) water quality objectives could not be confirmed during the environmental assessment. Therefore, the Review Board finds that the use of narrative (qualitative) water quality objectives is appropriate during the environmental assessment. The following section discusses additional issues related to the Review Board's determining that the use of narrative water quality objectives is warranted.

3.2 Nechalacho mine site – Narrative water quality objectives

3.2.1 Developer position and submissions

The Developer's description of the proposed development has evolved since MVLWB's June 2010 decision to refer the application to the Review Board for an environmental assessment and the submission of the DAR (PR#76). For each of the sources of potential impacts to water quality listed above in Section 3.0, this section describes the Developer's position for the Nechalacho mine site presented in the DAR and identifies the significant changes in the Developer's position up to the most current information in the registry.

In the DAR, the Developer proposed a "closed loop system" that obtained water for flotation plant processing by recycling water from the TMF and by withdrawing water from Thor Lake. Mine water and plant site runoff would also be directed into the process at the flotation plant as appropriate. Tailings slurry water would be discharged from the flotation plant to the TMF. Effluent from the TMF would be treated if necessary, passed through a polishing pond, and discharged to Drizzle Lake in a manner to mimic natural flows. Water from Drizzle Lake would flow through Murky Lake and then into Thor Lake.

In addition to the discharge of tailings slurry water to the TMF and the discharge of effluent from the TMF, the DAR water balance (PR#76, p. 501) identifies additional pathways for Project discharges to enter surface or ground water including seepage from the TMF, seepage from the polishing pond, and fluid losses from the paste backfill in the underground mine.

The Developer's current plans for water management at the Nechalacho mine site differ in a number of significant ways from the project proposed in the DAR. The Developer has eliminated recycling of the tailings supernatant from the TMF back into the flotation plant (PR#286, p. 90). The estimated discharge from the TMF has increased from 184,700 m^3/yr in the DAR (PR#76, p. 501) to 324,100 m^3/yr (PR#218, p.8). The Developer has committed to treating the water from the underground mine in the water treatment system at the flotation plant (PR#286, p. 224). The treated mine water would normally be pumped to the TMF but the plant would have the capability to divert the treated water into the process if necessary (PR#286, p. 224). The tailings slurry would be partially dewatered or thickened within the plant and the extracted water would be treated (PR#286, p. 93). Treated water would be added to the thickened tailings to create a slurry that would be pumped to the TMF (PR#286, p. 93, p. 230), (PR#307, p. 2). The separate, constructed polishing pond has been eliminated by adding an integrated polishing area at the east end of the TMF basin (PR#165, p. 2), (PR#175, p. 1).

In its presentation at the public hearing on February 18, 2013, the Developer presented a table that included the expected concentrations in treated flotation plant effluent and treated mine water for metals and rare earth elements (REEs)[10] (PR279, pp. 7-8). The discharge from the flotation plant to the TMF would consist largely of this treated water (PR#286, p. 230), but would also include some percentage of untreated effluent that would not be removed in the tailings dewatering process (PR#286, p. 93). The concentrations of metals and REEs in the treated water (before considering the residual untreated effluent) are lower than the proposed SSWQOs[11] for the outlet of Drizzle Lake even before any decantation in the TMF, dilution by precipitation into the TMF, or dilution within Drizzle Lake itself except for aluminum, mercury, zinc, and thulium (PR#279, p. 8). The Developer has committed to additional water treatment at the outlet of the TMF if necessary to meet the SSWQOs (PR#286, p. 87-88).

In the DAR, the Developer presented the results of tracer modelling to calculate the ratio of the input concentration of any constituent in the discharge from the TMF to the concentration after dilution and mixing in Drizzle Lake, Murky Lake, and Thor Lake (PR#76, pp. 690-701) for each year of operation. Following evaluation of the results by the Review Board and other parties, the Developer acknowledged that the

[10] Note: The REE table (PR#279, p. 8) contains errors in the proposed SSWQO values for hafnium, holmium, thulium, and zirconium. These errors have been previously addressed and corrected in PR#203 (PR#203, p. 13-16).
[11] Using the corrected values for hafnium, holmium, thulium, and zirconium (PR#203, p. 13-16).

results in the DAR were incorrect and submitted corrected ratio results in (PR#123. p. 6-8).[12] The Developer also presented modelling results that incorporated background concentrations (PR#171, pp. 49, 51) (PR#203, Attachment 1, pp. 2-3), but the TMF source concentrations and flow volumes used are no longer current.

The Developer describes the flowsheet process, design criteria and equipment specifications, and basic engineering design in a *Feasibility Study for Paste Backfill* document dated July 30, 2012 (PR#174). The Developers has not reported the estimated quantity or quality of the bleed water from the paste backfill, but the bleed water would generally be collected with other underground mine water and pumped to the surface for treatment in the flotation plant (PR#181, pp. 34-35).

The Developer predicts that seepage quantities from the TMF to groundwater will be small (about 0.6%) relative to the surface discharge to Drizzle Lake (PR#218, p. 8).

3.2.2 Parties' submissions and recommendations

AANDC

In its technical report, AANDC recommends that the concentrations within the TMF and within Drizzle Lake must be monitored to assess changes and trends in order to provide early warning in the event that SSWQOs can no longer be met at the Drizzle Lake outlet and to act as a trigger for implementing effluent quality enhancements (PR#222, p.6).

AANDC made eight recommendations related to water quality in its technical report (PR#222, pp.7, 8, and 12) and reaffirmed them in it closing comments (PR#304, p.1), as follows:

1. The outlet of Drizzle Lake should be the assessment point for meeting the SSWQOs.
2. Water quality in TMF, Drizzle Lake and Murky Lake should be monitored year round to assess the average condition and trends during open water and under ice. If trends indicate the proposed SSWQOs will not be achieved, water treatment options should be implemented.

[12] Note that the tracer modeling results in Avalon's response to AANDC's January 2012 IRs (PR#148, p. 11-12) and in Avalon's response to the MVEIRB 16 April 2012 Clarification Letter (PR#161, p.12-14) used the erroneous results from PR#76 instead of the corrected results from PR#123.

3. Dissolved oxygen and metal concentrations under ice must be regularly assessed to ensure they do not become harmful to aquatic life in Drizzle, Murky and/or Thor Lake.
4. If conditions in the receiving environment become detrimental to aquatic organisms during operations, the Developer must implement mitigation options.
5. AANDC recommends that the Report of EA should include as measures the following narrative statements describing the level of protection to be afforded to the aquatic receiving environment in Thor Lake:
    - water quality changes due to mining activities will not significantly affect benthic macro-invertebrate and plankton abundance, taxonomic richness or diversity;
    - water quality changes due to mining activities will not significantly alter fish abundance or diversity, and fish consumption at current levels;
    - water quality changes due to mining activities will not negatively affect areas utilized as traditional drinking water sources; and
    - water quality changes due to mining activities will not significantly affect mammals or wildfowl using the area as a drinking water, food source or habitat, or the current ability for people to harvest these animals;
6. SSWQOs for cadmium, iron, zinc and mercury should be set based on background concentrations and, where appropriate, include consideration of seasonality. SSWQOs for rare earth elements should be set at the limits proposed by the Developer unless further investigation and assessment of toxicity becomes available during the life of mine. SSWQOs for other parameters should be "provisionally" based on CCME Guidelines for the Protection of Aquatic Life or future updates to such guidelines. All SSWQOs should be assessed during operations to ensure that the level of protection as described in Recommendation #5 is maintained.
7. The contaminant loading limits should be evaluated, and if necessary established, if impacts to the downstream environment are driven by both contaminant concentrations and loadings.
8. The Developer should be required to follow the “Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the Northwest Territories, June 2009" in the development of its Aquatic Effects Monitoring Program, effects levels, action levels or triggers, and related Management Response Framework.

Environment Canada

In its technical report (PR#219), Environment Canada states a number of concerns regarding water quality resulting from the Developer’s proposed operations at the Nechalacho mine site. The specifics of some of the concerns are no longer current due to changes in the Developer’s proposed process and additional commitments. The relevant remaining concern from Environment Canada’s technical report related to the Nechalacho mine site, excluding concerns related to the SSWQOs previously discussed, is listed below.

- The Developer's modeling of maximum concentrations in Drizzle and Thor Lakes has not been updated to reflect treatment of the flotation plant effluent prior to discharge to the TMF.

In its technical report, Environment Canada recommends that water treatment at the discharge from the TMF be retained as a contingency to ensure the proposed objectives can be met (PR#219 p. 12).

Environment Canada reiterated the following concern related to the Nechalacho mine site in its closing comments:

> *The tracer modelling presented by Avalon in the DAR (PR#76, pp. 690-701) and subsequently updated (PR#123. p. 6-8; PR#171, pp. 49, 51; PR#203, Attachment 1, pp. 2-3) is obsolete due to changes in Avalon's proposed discharge water quality and quantities. Environment Canada recommends that Avalon be required to update and calibrate the water quality modelling with operational data to provide more accurate predictions, to track performance, and to inform management decisions.* (PR#300, pp. 1-2)

Yellowknives Dene First Nation

In its presentation at the Yellowknife public hearings on February 19, 2013, the Yellowknives Dene First Nation stressed the importance of water resources to their traditional culture and the risks posed by mining projects and stated,

> *Members of the Yellowknife Dene First Nation are descendants of people whose very existence depended on utilization of the rich resources of the lands and waters north of Great Slave Lake, known as the Chief Drygeese Territory. The Yellowknives Dene continue to practiced traditional, constitutionally enshrined rights, as they have for generations, to hunt, trap, travel and enjoy what is one of the most environmentally intact places in the world. Since 1935 the environment and traditional use of the Chief Drygeese Territory has been threatened by mineral exploration and mining.* (PR#285, p. 2)

Deninu Kue First Nation

In its presentation at the Fort Resolution public hearings on February 2, 2013 the Deninu Kue First Nation (DKFN) stated their spiritual connection to the water and the importance of the water resources to their members as:

> *The Deninu Kue First Nation people have a spiritual relationship with the water and land that surrounds them. Deninu Kue First Nation members*

> *obtain their livelihood using the resources of the water and the land.*
> (PR#291, p. 6)

The DKFN presentation also stated the importance of monitoring the water quality and states, "The Deninu Kue First Nation believes that monitoring of the land and water is essential." (PR#291, p. 8)

3.2.3 Review Board's analysis and conclusions

Project design improvements to the Project during the course of the environmental assessment have been important to various parties and have been critical in the Review Board's findings. The Review Board notes in particular that the Developer has modified and dramatically improved its processes by including treatment of the water pumped from the underground mine and treatment of some of the tailings slurry water.

The Developer's modelling of parameter concentrations in the TMF, Drizzle Lake, Murky Lake, and Thor Lake has not been updated to incorporate the changes that the Developer has made to the Project and therefore cannot be used to predict those parameter concentrations in the receiving environment over the life of the mine. The Review Board accepts the arguments of the parties that predictions of the concentrations by location and time are necessary to evaluate whether the discharge criteria and SSWQOs are apt to be protective and are of paramount importance in determining whether the trends in concentrations measured during operations are within acceptable limits or additional mitigation efforts should be triggered.

Therefore the Review Board suggests the following.

Suggestion #1

The Developer should update the modelling of discharges at the Nechalacho mine site during the water licensing phase for the floatation plant processes and effluent treatment system, effluent discharge concentrations, effluent discharge rates, and TMF geometry for the simulated duration of mine operation. The model will be calibrated and updated periodically with operational data to track performance and to improve the model's accuracy and manage the project accordingly.

Suggestion #2

The Developer should run the predictive model for the duration of the Nechalacho mine site operation and for a sufficiently long period following closure to allow for an estimate of how long it will take Drizzle Lake to return to background conditions and provide this data to the Mackenzie Valley Land and Water Board during the water licensing phase.

The Review Board suggests, as part of the permit process before the Mackenzie Valley Land and Water Board, that the Developer clarify the predicted concentration of the effluent to be discharged to the TMF. The Review Board understands that both the mine water and the liquid dewatered from the tailings slurry will be treated, but the Developer has not presented data on the amount and chemical composition of the fluid remaining within the tailings after dewatering or on the predicted chemical composition of the water to be transferred from the plant site runoff collection pond to the TMF. This information is an important input to the modelling discussed above.

Suggestion #3

The Review Board suggests that the Developer provide data to the Mackenzie Valley Land and Water Board during the water licensing phase on:

- the amount of the untreated tailings fluid remaining within the tailings after dewatering;
- the chemical composition of the untreated tailings fluid remaining within the tailings after dewatering; and
- the predicted chemical composition of the water to be transferred from the plant site runoff collection pond to the TMF.

The Review Board further suggests that the Developer calculate the consolidated flow rate and chemical composition of all of the flows from the Nechalacho floatation plant to the TMF. i.e. the treated mine water, the treated water from tailings slurry dewatering, the untreated slurry water remaining with the tailings solids, and the untreated plant site runoff collection pond water.

In the Review Board's opinion, use of narrative statements to describe the level of protection required downstream of the mine is appropriate for environmental assessment purposes. The Review Board heard from Aboriginal parties about the

importance of waters to them for traditional and spiritual purposes. The Review Board agrees with the AANDC closing comments that it should use narrative statements that "describe the level of protection to be afforded to the aquatic receiving environment" (PR#304, p. 2). The Review Board notes, but disagrees with the Developer's closing comments which state that in its view, narrative statements should be subject to further refinement during water licensing.

The Review finds that the Developer has provided insufficient evidence to convince the Review Board that significant adverse environmental impacts on water quality downstream of the Project will not occur. The Review Board notes that the Developer has made significant project changes but has not updated the modeling of effluent from the TMF to Drizzle, Murky, and Thor Lakes. The burden of proof lies with the Developer to convince the Review Board that significant environmental impacts will not occur. In the absence of sufficient evidence the Review Board finds that the precautionary approach should be applied through setting narrative objectives for water quality. The narrative objectives describe the level of protection required downstream of Drizzle Lake in order to avoid adverse impacts to fish, aquatic habitat, wildlife and people and will ensure that downstream changes to water quality are no longer likely to be significant.

After considering the evidence on the public record, including information about Aboriginal use of the Project area, the Review Board finds that there is likely to be significant adverse impacts from the Project to water quality in downstream water bodies unless the following measure related to the Nechalacho mine site are adopted.

Measure #1

The Mackenzie Valley Land and Water Board will set effluent quality criteria as required during the water licensing phase for the Nechalacho mine site for all of the parameters listed in Appendix B and for ammonia, nitrate, nitrite, phosphorus and sulphate. These criteria will satisfy the following narrative statements in order to protect the aquatic environment downstream of Drizzle Lake during construction, operations, closure and post-closure phases of the Project:

- Water quality changes due to mining activities will not significantly alter benthic macro-invertebrate and plankton abundance, taxonomic richness or diversity;
- Water quality changes due to mining activities will not significantly alter fish abundance or diversity or impact the ability of traditional users to harvest or consume fish;
- Water quality changes due to mining activities will not significantly alter

areas utilized as traditional drinking water sources;
- Water quality changes due to mining activities will not significantly alter the use by mammals or wildfowl of the area for drinking water, food source or habitat, or the current ability for people to harvest these animals for consumption.

3.3 Hydrometallurgical plant site

3.3.1 Developer position and submissions

For each of the sources of potential impacts to water quality listed above in Section 3, this section describes the Developer's position for the Hydrometallurgical plant site presented in the DAR and identifies the significant changes in the Developer's position up to the most current information in the registry.

In the DAR, the Developer proposed extracting water for the Hydrometallurgical plant from existing pit T-37 at the Pine Point site. Tailings from the Hydrometallurgical plant would be discharged to the Hydrometallurgical tailings facility (HTF), i.e. existing pit L-37, with any excess supernatant water pumped to existing pit N-42 for infiltration into the Presqu'ile aquifer. The Developer predicts that the infiltrated effluent would mix and disperse with the existing groundwater flow, eventually reaching Great Slave Lake in approximately 80 years. The Developer's groundwater modeling assumed that the areas near Great Slave Lake were groundwater discharge zones (PR#76, pp. 717-720).

Plant site runoff would be collected in the settling pond and used for processing within the Hydrometallurgical plant (PR#76, p. 525). Possible pathways not identified in the water balance include seepage from the settling pond, any uncontrolled runoff, or leaks in pipelines. As long as best industry practices are followed, these other possible pathways are considered to be of sufficiently low quantity or chemical loading as to not present a significant adverse impact on water quality and are not discussed further in this environmental assessment.

At the Hydrometallurgical plant site, there would be no direct discharge of any wastewater to natural surface waters (PR#76, p. 452).

The Developer subsequently modified the proposed layout at the Pine Point site, changing the water source from pit T-37 to existing pit J-44 (PR#148, p. 9) (See Figure 6). The Developer subsequently updated the groundwater modelling to reflect this change and incorporated more recent effluent concentration data (PR#209, p.1).

During the public hearings in February 2013, the Developer presented a table that listed the expected parameter concentrations in the Hydrometallurgical plant tailings water. The table presented estimated concentrations in the groundwater plume when it reached Great Slave Lake based on dilution only, neglecting any retardation, sorption, dilution by precipitation, or chemical reactions. The discharge concentrations at Great Slave Lake were estimated to equal 10% of the concentrations tailings water (PR#290, pp. 1-3). The Developer has committed to establish groundwater monitoring wells around the L-37 and N-42 pits to determine the baseline water quality and to monitor changes during operation (PR#297, p.16).

3.3.2 Parties' submissions and recommendations

AANDC

In its technical report, AANDC notes that the Developer has committed to monitoring the tailings effluent plume during operations to detect if water quality concentrations in the Presqu'ile Aquifer are in line with model predictions and that if conditions deviate from the model the Developer has indicated it would conduct mitigation. AANDC makes the following recommendations regarding water quality at the Pine Point site (PR#222, p. 15-16):

- *Avalon should be required to implement monitoring during operations to verify the modeling predictions of the effluent plume down gradient of the L-37 tailings facility, assess the modeling parameters and initiate mitigation, if required; and*
- *AANDC recommends that the proponent be required to conduct post closure monitoring until such time as closure goals, objectives and criteria are achieved and maintained.*

Environment Canada

In its technical report (PR#219, p. 15), Environment Canada discussed the Developer's updated groundwater monitoring results presented in October, 2012 (PR#209) and made the following recommendations:

- *Avalon should install monitoring wells downstream of the L-37 and N-42 pits; compare the groundwater data to the model predictions; and review, calibrate, and update the model during operations;*
- *additional monitoring wells should be installed to confirm the boundaries of the plume have been defined and to monitor background groundwater quality; and*

- *the monitoring well samples should be analyzed for the full suite of parameters.*

3.3.3 Review Board's analysis and conclusions

The Review Board recognizes the Developer's attempts to minimize the impacts to water quality by allowing all project effluents at the Hydrometallurgical plant site to infiltrate the Presqu'ile Aquifer, a non-potable groundwater regime. However, the Review Board concurs with AANDC and Environment Canada that additional monitoring during and after operations is warranted to confirm the Developer's predictions of groundwater quality and to allow time to implement additional mitigation measures if necessary, to avoid unexpected discharges of waste from groundwater in or near Great Slave Lake.

The burden of proof lies with the Developer to convince the Review Board that significant environmental impacts to groundwater and Great Slave Lake from tailings water disposal into the Presqu'ile aquifer will not occur. The Board finds that the modelling provided by the developer is insufficient to give confidence to the Board that there will not be significant adverse environmental impacts to Great Slave Lake. Therefore, the Review Board finds that in the absence of sufficient evidence, significant adverse impacts are likely and that monitoring is required to verify these predictions and implement mitigation if necessary.

Measure #2

The Developer will install groundwater monitoring wells prior to mine construction in the vicinity of the Pine Point site to monitor the baseline and affected groundwater concentrations until such time as closure goals, objectives and criteria are achieved and maintained. The monitoring wells should be placed in sufficient number and appropriate locations to monitor background concentrations, delineate the plume, and provide comparisons to the Developer's modeled plume. The monitoring well samples should be analyzed for the full suite of parameters of concern.

3.4 Aquatic effects monitoring plan

3.4.1 Developer's position and submissions

The Developer briefly describes its approach to aquatic effects monitoring, including monitoring for water quality in Section 6.14 of its DAR (PR#76 p. 834-836). Subsequently, the Developer submitted a *Conceptual Aquatic Effects Monitoring Plan* in December 2011 in response to an information request from the Review Board and Environment Canada. This report generally follows AANDC's *Recommended Procedures for Developing Data Quality Objectives and a Conceptual Study Design (INAC 2009)*, one of a series of guidelines for preparing and implementing an Aquatic Effects Monitoring Plan (AEMP) (PR#124, 153).

During the February 18, 2013 public hearings, the Developer stated in response to questioning from AANDC, that it would develop its water quality monitoring program in accordance with AANDC's AEMP guidelines (PR#286 p. 100-101). This commitment by the Developer is also included in its updated commitments table (PR#297 p. 16).

3.4.2 Parties' submissions and recommendations

In its technical report, AANDC states that an AEMP is required for the Project and notes that the Developer has indicated a willingness to develop a suitable monitoring program. AANDC noted the Developer's commitment to prepare its AEMP according to AANDC guidelines during the public hearings and added that the guidelines work to harmonize the requirements under the M*etal Mining Effluent Regulations* and include traditional knowledge in the monitoring program. In addition, AANDC indicates that the guidelines details how the monitoring program and its results feed into an Adaptive Management Response Framework. ANNDC describes the AEMP steps in its technical report (PR#222 p. 9-10, PR#286, p. 101).

Environment Canada observed in its technical report that the conceptual AEMP submitted by the Developer needs more detail, in particular on how biological monitoring requirements under the M*etal Mining Effluent Regulations* will integrate with AEMP monitoring. Environment Canada recommends in particular that action levels as a result of monitoring in the AEMP should be tied to biological indicators as well as water quality and water quantity indicators (PR#219 p. 13-14).

3.4.3 Review Board's analysis and conclusions

The Review Board believes that preparation and implementation of an AEMP for the Project is important in order to test predictions made by the Developer on impacts to water and aquatic life during the course of this EA and to identify changes in the aquatic environment due to mining.

The Board acknowledges that the Developer has committed to develop its AEMP in accordance with AANDC guidelines. The Review recognizes that an AEMP is a requirement of a water license and that the AEMP will be further developed during the regulatory phase of the Project. The incorporation of traditional knowledge in development of the monitoring program is viewed as important by the Board and is part of the guidelines for AEMP preparation that the Developer has committed to use.

The Board finds that there will not be significant adverse impacts to water provided the Developer follows its commitment to use the AANDC guidelines for preparation and implementation of an AEMP and the measures set out in this Report are implemented.

4 Impacts from radiation on the environment and people

Deposits of rare earth metals are commonly mixed with uranium and thorium and this is a concern because uranium and thorium produce radiation (PR#19, p. 15, 16, 23). The Thor Lake deposit is expected to contain 24 parts per million uranium and 130 parts per million for thorium. For context, the Developer provided evidence that the Thor Lake ore body has one of the lowest levels of uranium and thorium of known rare earth deposits (PR#286, p. 69).

The extraction process will concentrate the rare earth metals but also the uranium and thorium. Consequently the radiation concerns will follow the rare earth element (REE) concentrate to the final processing step, proposed for a plant in the southern United States. However, because of these low levels of uranium and thorium, the Developer does not intend to process, refine or sell uranium or thorium as part of the proposed operation.

The Review Board heard public concern about radioactivity from the beginning of this assessment process during scoping (PR# 24, p. 5, 6; PR# 27, p. 2, 3; PR# 30, p. 4; PR# 35, p. 1, 2, 7; PR# 36, p. 1, 2; PR# 40, p. 1, 3; PR# 41, p. 2, PR# 19, p. 15, 16, 23). Based on these concerns the Review Board requested that the Developer produce information about the risk associated with the radioactive materials in the Nechalacho deposit in the Terms of Reference (PR# 72, p. 13). In particular, the Terms of Reference requests that the Developer describe:

> *Terrain, surficial geology, structural geology, mineralogy, bedrock geology (type, depth, composition, and permeability)... In particular:*
>
> > *c. identify the chemical composition of host rock and ore bodies at the mine site including:*
> >
> > *ii. uranium, thorium and beryllium content in ore.* (PR#72 p. 13)

Following the submission of the DAR in May 2011 (PR# 76), the Review Board requested additional information regarding the ore deposit mineralogy in order to adequately address the information requirements set out in the Terms of Reference (PR# 72, p. 7, 18, 19). On October 18, 2011 the Developer produced additional information to the satisfaction of the Review Board (PR# 102 - PR#107).

4.1 Nechalacho project and radioactive material

The DAR describes the Project across three main environmental settings: the Nechalacho mine site, the barge route, and the Hydrometallurgical plant site. This section discusses radiation concerns across these settings.

At the Nechalacho mine site the Developer proposes an underground mine below Thor Lake. The ore body contains rare earth elements (REE) and also uranium and thorium. The mined ore requires crushing and processing at the mine site to extract the REE. The final stage of processing at the mine site is a flotation circuit that extracts REE, along with uranium and thorium, to produce a REE concentrate. This REE concentrate contains the majority of the uranium and thorium found in the ore and consequently the radiation concerns follow the REE concentrate (PR#279, p. 32).

The by-products of ore processing are called tailings and are proposed for onsite disposal at the tailings management facility and by infilling the underground mine workings. The Developer predicts that the levels of uranium and thorium in the tailings are expected to be lower than the original ore and at levels similar to those found in average exposed bedrock (PR#76, p. 490).

The Developer proposes further processing of the REE concentrate at the Hydrometallurgical plant where it will refine the REE concentrate into several products. The processing creates tailings that are proposed for onsite disposal. However, according the Developer no uranium and thorium are predicted to be present in these tailings (PR#279, p. 33).

The REE concentrate produced at the Hydrometallurgical plant site requires still further processing. The Developer proposes this processing will occur at a plant in the United States. Because this stage of the project is not within the jurisdiction of this Review Board it is not included in the environmental assessment and is not discussed in this Report.

4.1.1 Concentrate storage and transport

Since the primary path for the uranium and thorium is with the concentrate, the barging portion – and to a lesser extent the southbound rail shipments – of the project are also potential pathways for environmental exposure to radioactivity. For further information on the barging of concentrate see Section 5.

The Developer proposes to operate the mine continuously; meaning that at the mine site the REE concentrate is stockpiled at the proposed Great Slave Lake laydown area for ten months of the year until the start of the proposed 60-day summer barging window. Consequently, there is the potential for radiation concerns at this site.

4.2 Developer's submission

The Developer recognizes the concerns from parties about radiation associated with uranium and thorium and states that the ore body has low levels of uranium and thorium. For context, the Developer provided average uranium concentrations for the Nechalacho mine and other sources (PR#76, p. 547):

- background – uranium 1-10 ppm
- the Nechalacho mine– uranium 24 ppm and thorium 144 ppm
- low grade uranium mine - uranium 1000 ppm

In order to provide a better understanding of what these numbers mean the Developer provided a report that identifies potential for radiation exposure associated with mining and processing the Thor Lake ore (PR#76, app G). This report characterized the primary risks to workers through inhalation or inadvertent ingestion of radioactive materials, or radon gas associated with uranium. The report also assessed whether there are any potential environmental pathways for radiological exposure to vegetation, wildlife, fish or fish habitat.

The report estimates that a worker at the proposed mine would receive an incremental dose over and above the existing background radiation of 1.4 mSv/year while the average person in Yellowknife receives 3.1 mSv/year from natural background radiation (PR#277, p34).[13] The Developer also compared the expected dose of 1.4 mSv/year to the Health Canada dose limit of 20 mSv/year for people who work around naturally occurring radioactive materials. However, a dose of more than 1 mSv/year does trigger the requirement under Health Canada for a radiation protection program (PR#76, p. 544). This radiation protection program would include monitoring, training and the development of emergency preparedness programs.

The report also concluded that the release of low levels of radionuclides would have no adverse effect on terrestrial or aquatic biota (PR#76, p. 549).

[13] How radiation affects human or other living organisms depends on the type of radiation, how much exposure is received over a specific time period and what part of the body receives the radiation, also called the dose and measured in Sievert units. One Sievert measures a large dose of radiation so the measuring unit is broken down into smaller units called the millisievert (mSv).

4.3 Parties' submissions

During scoping in the communities of Lutsel K'e, Fort Resolution and Yellowknife, community members expressed concern over potential effects from radioactivity associated with rare earth element mining and processing (PR# 24, p. 5, 6; PR# 27, p. 2, 3; PR# 30, p. 4; PR# 35, p. 1, 2, 7; PR# 36, p. 1, 2; PR# 40, p. 1, 3; PR# 41, p. 2).

These concerns continued into the first round of information requests from:

- The Lutsel K'e Dene First Nation requested radiation-related information (PR# 130, p. 5, p. 7, p. 10) from both the Developer and the Government of the Northwest Territories.
- The Deninu Kue First Nation requested additional details concerning radioactivity (PR# 135, p. 1).
- Government of the Northwest Territories requested further information regarding the potential dispersion of radioactive elements (PR# 131, p. 28).
- Environment Canada requested further information regarding potential impacts from potentially radioactive dust. (PR# 134, p. 5)

In the four-day August 2012 technical session that followed, parties raised radiation concerns again (PR# 180, p. 74, 162, 163). The North Slave Metis Alliance also discussed radioactivity in one of several technical report submissions (PR# 231, p. 7, 12, 18, 28).

At the public hearing the LKDFN expressed concern that although radiation is present at low levels there is no regulatory requirement associated with it and stated:

> *Because the mine is not a nuclear plant or a uranium mine, it is not regulated for potential radiation impacts; for example, by the Canadian Nuclear Safety Commission. With the -- with the apparent lack of regulatory oversight, there is a heightened concern.* (PR#292 p. 60)

In response the Developer agreed that there is no direct regulatory oversight of radiation associated with the project but emphasized that this is because radiation is not an issue; there is no need for concern because the levels are so low and stated:

> *The concentrations of uranium and thorium, they're sufficiently low. And because they're so low, basically they're considered naturally occurring radioactive materials. They are not regulated under CNSC, the Canadian Nuclear Safety Commission, and they are not subject to the transportation of dangerous goods or the US transportation regulations***.** (PR# 286, p. 74)

The Developer gave further context for considering radioactive material:

> *...[concentrate] get put into the container. They contain between five (5) and seven hundred (700) parts per million of uranium plus thorium. And the Transportation of Dangerous Goods and Regulation (sic) Acts require that if you go above -- over I think it's thirty-one hundred (3,100) parts per million combined, then that's when you actually have to start taking steps to notify the general public, meaning you placard all of your -- all of your containers that you're shipping that in. But it doesn't mean you have to take additional steps beyond that.* (PR# 286, p. 75)

The Developer went on to describe a commitment to implement a Radiation Protection Program that applies to both the Hydrometallurgical plant and the mine site (PR#297 p. 3). This plan will include training, monitoring, and providing the results of monitoring to employees (PR#143, p 8, 18) (PR#143, p 7).

The Developer states:

> *Based on the uranium levels in the ore, personnel monitoring for radon is not anticipated to be an on-going requirement. However, to confirm the expected levels, the exposures of a representative group of underground workers to radon will be measured using monitors called PADs (personal alpha dosimeters). These monitors are the same devices used to monitor the exposures of uranium miners and are certified for such measurements by the Canadian Nuclear Safety Commission (CNSC).* (PR#227, attachment 3)

4.4 Review Board analysis and conclusion

The Review Board considered evidence from the Developer that the levels of uranium and thorium in the ore body, tailings and REE concentrate are expected to be low and therefore radiation levels are expected to be very low and not pose a threat to workers or the environment.

The Review Board considered the amount of radiation a worker is expected to be exposed to from the proposed project, estimated to be 1.4 mSv/year. In comparison the average Yellowknifer receives 3.1 mSv/year and the average Canadian receives 1.8 mSv/year from natural sources of radiation. Further, the Review Board considered the Health Canada dose limit of 20 mSv/year which is well above what is expected from the proposed Project. The Review Board concludes that the expected dose of radiation from the proposed Project does not pose a risk to human health or the environment.

The Review Board considered the evidence provided by the Developer, specifically the report, *Radiation Protection Program in Support of the Thor Lake Project* (PR#76, app G), and accepts the conclusions of this report that the release of low levels of radionuclides would have no adverse effect on human health or terrestrial and aquatic biota.

Regardless of the expected low levels of radiation from the project the Review Board heard that radiation is still a concern for many parties including the LKDFN, YKDFN, DKFN, and Akaitcho. The Review Board considered the Developer's responses to these concerns which included a commitment to implement a radiation protection and monitoring plan. The Review Board supports this commitment and the outline of the plan found in the Radiation Protection Program report that includes (PR#76, app G, p. 4-8):

- clear statements of purpose and objectives of plan;
- administration (clear definition of responsibilities and roles);
- training;
- monitoring:
    - personal,
    - area (workplace),
    - contamination;
- dosimetry;
- personal protective equipment;
- transportation requirements; and
- radiation emergency preparedness and other requirements.

The Review Board understands that the Developer intends to apply this plan at both sites and notes the following Developer commitments:

> *A Radiation Protection Program, which will include any necessary monitoring requirements and worker training, will be developed for the hydrometallurgical plant.* (PR#297 p. 3)

And,

> *Based on the uranium levels in the ore, personnel monitoring for radon is not anticipated to be an on-going requirement. However, to confirm the expected levels, the exposures of a representative group of underground workers to radon will be measured using monitors called PADs (personal alpha dosimeters) The results from any monitoring of the workers will be*

> *given to the workers. The frequency and necessity for any ongoing radon monitoring will be determined as part of the overall environmental monitoring program for the proposed mine.* (PR#297 p. 3)

Based on commitments made by the Developer to mitigate impacts from radiation on the environment and people, the Review Board does not anticipate significant adverse impacts to the environment provided the Developer's commitments are followed.

5 Barging

This section discusses the Developer's proposed barging activities and the potential for this activity to impact Great Slave Lake including water quality, traditional lifestyles, and public safety. Through the assessment process the Review Board reached the understanding that the impacts to Great Slave Lake of greatest concern to the parties are from spills of fuel and concentrate. Each of these topics is discussed separately in this section.

5.1 Barging – accidents and malfunctions

The transportation of fuel, concentrate, and other consumables was identified early in the assessment process by parties as a concern during the Dettah, Fort Resolution, Lutsel K'e, Yellowknife and Hay River Reserve scoping sessions. The Board set the terms of reference to reflect those concerns and to provide guidance to the Developer on the level of detail required to describe and assess the proposed barging operations. This includes direction on:

- accidents and malfunctions;
- environmental effects on birds, fish and wildlife;
- traditional use; and
- public safety.

In order characterize the risks from barging, the Terms of Reference requested the Developer to:

- predict the effects to water quality from a complete overturning of all barges during a typical Great Slave Lake transit of a barge train, fully-loaded with concentrate, at various points along the barge corridor between Thor Lake and the delivery point on the south shore of Great Slave Lake;
- describe the impacts of any other potential accidents or malfunctions not listed here; and
- describe contingency plans for accidents, malfunctions or unforeseen impacts including emergency response plans that will be in place during the construction phase and operations phase. This discussion should include the required circumstances for a failure to occur, and what monitoring, evaluation and adaptive management systems will be in place to identify, proactively avoid and rectify them (PR#72, p. 35).

5.1.1 Developer's submission

The Developer proposes to barge materials during the open water season along an approximately 155 km route running north east from Hay River to the Nechalacho mine site (Figure 7). As noted, this will involve approximately 30 round trips per season, or a barge train comprised of three barges and one tug every other day during the open water season.

Barging is required to move the rare earth concentrate from the Nechalacho mine site to the Hydrometallurgical plant site. Further, barge trains will enable mine resupply and will include, but is not limited to:

- fuel;
- explosives;
- construction materials; and
- other consumables.

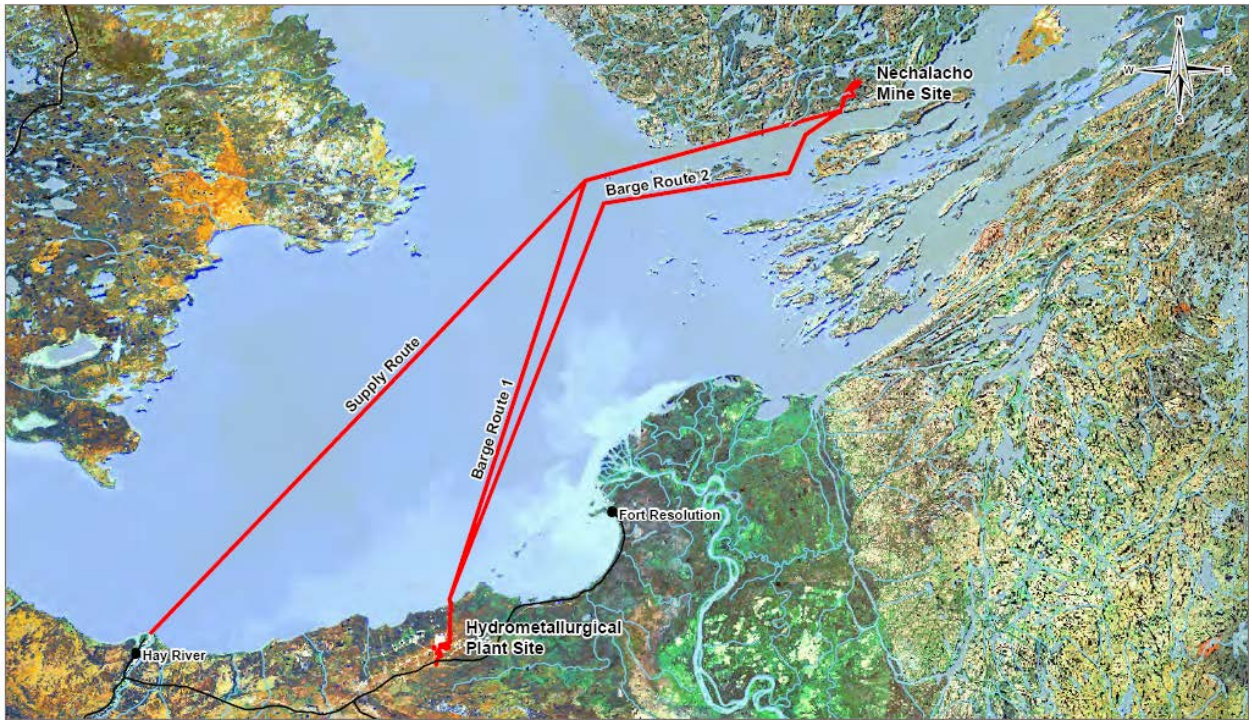

Figure 7: Proposed Barging routes from Hay River and the Hydrometallurgical Plant Site to the Nechalacho Mine site (PR#186)

Concentrate

The rare earth element concentrate will be placed in sealed metal containers (Figure 8) and stored at the docking facility. During the open water season, 38 concentrate containers will be loaded on each of the three barges in the barge train, for a total of 114 containers per trip. As discussed in greater detail in the radiation section of this report (section 4) it is not anticipated that radiation from the concentrate will pose a risk of significant adverse environmental impacts.

Figure 8: Proposed concentrate container. (PR#76)

Fuel

The same barges used to transport concentrate will be used for bulk fuel resupply. Fuel will be loaded into barges at Hay River and barged across Great Slave Lake to the Nechalacho mine site. The Developer provided an example of a typical barge train with a capacity of one million litres fuel per barge (Figure 9). It is expected that four resupply runs would be required per season (PR#76, p. 828).

Figure 9: Example of a barge train (PR#76)

Accidents and malfunctions

A key line of inquiry regarding barging resulted from concerns raised about accidents and malfunctions. The Developer states that the proposed barging operation will not likely cause significant adverse impacts (DAR p. 884) provided barging operations comply with applicable laws and implement mitigations committed to during the EA process and described in the DAR.

The DAR lists mitigation measures that reduce the risks associated with accidents and malfunctions from barging (PR#76, Section 9) as follows:

- low rate of speed of the barge 5-6 knots;
- no barging if wave height over 3 feet;
- follow Transport Canada regulations;
- fuel barges will not be loaded to full capacity;
- barging schedule allows for contingencies days for bad weather; and
- the barging contractor has the Shipboard Oil Pollution Plan required by Transport Canada regulations that provides a response framework for oil spills during transport, loading, and offloading.

One of the main concerns heard by the Review Board was whether the Developer would clean up concentrate and other materials lost overboard as a result of a barging accident. During the environmental assessment the Developer committed to clean up this material and stated "(i)n the most unlikely event of a barging incident that could involve the loss of containers filled with concentrate into Great Slave Lake, the Developer is committed to recovering the containers and contents in a timely manner." (PR#307)

Regarding a spill of concentrate into Great Slave Lake, the Developer provided a response scenario to show that clean-up is technically feasible. In summary, the response would involve using barges with cranes to retrieve intact containers of concentrate assisted by remote operated vehicles. Should containers spill any of the content the Developer describes the use of a suction system to vacuum the concentrate from the bed of Great Slave Lake. Section 9.1.2 of the DAR provides further details on the response scenario.

5.1.2 Parties' submission

Parties to the environmental assessment expressed concern regarding the safety of barging in general, and spills of rare earth element concentrate, fuel, and other consumables in particular. The DKFN (PR#135) and YKDFN (PR#119) expressed concerns regarding:

- catastrophic loss of a barge and potential impacts on the environment from concentrate and associated radionuclides;
- safety of barging in general; and
- recovery and salvage of lost equipment and materials.

The YKDFN states,

> *One of the major concerns of the Yellowknives Dene First Nation is the use of Great Slave Lake as a transportation route for concentrate between the mine site and the Hydrometallurgical Plant at Pine Point and for the transport of equipment, construction materials and supplies, and especially fuel in the opposite direction.* (PR#119)

Barge Safety

During the assessment process parties raised the issue of how safe the practice of barging is. This question was raised during scoping, information requests, technical sessions, and public hearings.

Parties raised concerns that barging activities may pose a risk and that the Developer had not provided evidence to clearly show that barging is safe. The Yellowknives Dene First Nation (YKDFN) submitted an information request early in the environmental assessment process requesting further information on the historic safety record of barging and stated,

> *Avalon Rare Metals Inc. must provide additional details on the reasons for its decision concerning the barging option and must include in this an analysis of the historic safety record of barging on Great Slave Lake. While Section 9.1.1 [of the DAR] states that barging has taken place on Great Slave Lake since 1934 but does not state the number and nature of barge accidents during that time.* (PR#119)

The Developer responded to the YKDFN information request by providing information on incidents of barges sinking on Great Slave Lake. The Developer states that according to the Canadian Coast Guard and NTCL, only one barge and tug sank in 1956 (PR#126, p. 4). The Developer states,

> *Avalon contacted NTCL and the Canadian Coast Guard to identify if any barges have sunk on Great Slave. The Coast Guard confirmed that a tug boat and barges, owned by Yellowknife Transportation, sunk during a big storm in 1956 while traveling between Hay River and Yellowknife (Mr. Ken Cooper, Senior Response Officer, Canadian Coast Guard, pers. comm. December 21, 2011). No other knowledge or records of barges sinking in Great Slave Lake were located. According to a tugboat captain that worked for NTCL for 42 years, no barges sunk in Great Slave Lake between 1973 to 2011 (Captain David Day, pers. comm. December 20, 2011.* (PR#126, p. 4)

The Review Board notes that the Developer did not fully address the specific request of the YKDFN regarding the issue of the overall historical safety record of barging which may include other incidents, not just incidents of barge sinking, such as groundings or spills.

During the technical hearing the issue of barging safety was brought up once more by the Akaitcho IMA office. The Akaitcho IMA office representative spoke to the issue of safety and barging in the East Arm of Great Slave Lake and spoke to a specific incident of a barge running aground during re-supply at Lutsel K'e and of a barge puncturing its hull (PR#182, p. 144).

In order to clarify the difference of opinion between the Developer and parties about how safe barging is, the Review Board contacted federal and territorial agencies

involved in management, regulation and oversight of marine activities on Great Slave Lake (PR#254) including:

- Canadian Coast Guard;
- Transportation Safety Board;
- Environment and Natural Resources, GNWT; and
- Transport Canada.

The Canadian Coast Guard has operated the Marine Pollution Incident Reporting system since 2000. The data provided to the Board by the Canadian Coast Guard includes incidents occurring on Great Slave Lake from 2002 through to the present day.

The Transportation Safety Board of Canada is an independent agency that investigates accidents occurring during marine transportation and other modes of transportation. The Transportation Safety Board provided the Board with information of reportable incidences from 1975 to the present for Great Slave Lake.

Environment and Natural Resources is a Division of the Government of the Northwest Territories that administers the spills database which lists reportable spills within the NWT. Environment and Natural Resources supplied the Review Board with a list of 175 reportable spills reported by NTCL from 1972 to the present.

A review of the information supplied by the three agencies shows that spills of fuel do occur predominantly during loading and offloading. Further, the data indicate that other incidences such as groundings and punctures to barges and tugs do occur. However, the severity of the incidences and frequency of spills are low. Based on the evidence, the Review Board is of the opinion that accidents and malfunctions are possible from barging but the significance of the incidents reported to date is low.

Regulation of barging

Regulatory oversight ensures that barge operations are safe and well-managed. Barging activities are regulated by Transport Canada through the *Canada Shipping Act* and Regulations and the *Marine Liability Act*. The *Canada Shipping Act* is administered by Transport Canada (TC) and Fisheries and Oceans Canada (DFO) which also oversees the Canadian Coast Guard.

The marine regulatory regime ensures that shipping is conducted safely and with minimal risk of accidents and malfunctions, such as oil spills, and includes the following:

- ensures the vessel is fit for its intended purpose and voyage (*Canada Shipping Act*);
- ensure the mitigation measures and response plans are in place (Vessel Pollution and Dangerous Chemicals Regulations); and
- ensure the liability for clean-up rests with the owner of the vessel (*The Marine Liability Act*).

Transport Canada legislation covers preventative measures and ensures that vessels are appropriate for their intended use and are operated by competent personnel.

Fisheries and Oceans Canada legislation ensures adequate emergency response to a spill. For vessels such as a barge operating on Great Slave Lake the shipper is ultimately liable for a spill and must report it as soon as possible after it happens. The Coast Guard monitors the shipper's spill response, and if the shipper is unable to respond adequately the Coast Guard will take over the spill clean-up operations.

Oil spills and the regulatory regime

The Review Board heard concerns from parties about the potential for oil spills from barges. For example, during the public hearing the Akaitcho IMA office representative asked Transport Canada about oil spills and who pays to clean them up (PR#288, p.171). Transport Canada stated that under the *Marine Liability Act*, it is the polluter's responsibility to clean up and pay for oil spills (PR#288, p.172). Should the spill occur during loading or offloading, the clean-up responsibility and costs are shared between the owner of the facility that is receiving the oil and the shipper (PR#288, p.182).

During the public hearing the North Slave Metis Alliance asked Transport Canada,

> *… can Transport Canada confidently say that Avalon and its contractors has a systematic and integrated safety management plan that is suitable for identifying all possible operational risks associated with barging across Great Slave Lake?* (PR#288, p.179)

In response Transport Canada stated:

> *Yes, with an explanation. For the existing barge operations, yes. The vessels already have a SOPEP [Shipboard Oil Pollution Emergency Plan] approved by Transport Canada]… If the project is given approval, the Proponent will have an oil pollution emergency plan required by the regulations for preventative maintenance and for emergencies at the oil-handling facility during transfers.* (PR#288, p.179)

The Review Board understands that each tug carries a Shipboard Oil Pollution Emergency Plan, which, under the Vessel Pollution and Dangerous Chemical Regulations, is a requirement for all vessels of over 400 gross tonnes that carry oil as a cargo. However, the Review Board notes that Transport Canada did not fully answer the question by the NSMA which asked whether there was a plan for "all possible operation risks" and not just risks associated with oil spills. Hence, it is not clear whether other cargo, such as concentrate, would be covered by the plan.

In the event of an oil spill, the Canadian Coast Guard stated that they would be onsite and monitoring the response by the tug operator. In the case where the tug operator was unable to properly respond to an oil spill the Coast Guard would take over the response with equipment and personnel stationed in Hay River and Yellowknife (PR#288, p.183).

The Yellowknives asked Transport Canada and the Coast Guard whether they could respond to a spill of five million litres. In response Transport Canada and the Coast Guard replied that yes they could respond with equipment stockpiled in Hay River and Yellowknife (PR#288, p.188). Transport Canada advised in response to a question from Board member Sunny Munroe during the public hearing in Yellowknife that a spill of five million litres is highly unlikely as a single barge has a capacity of one million litres, and that each barge contains multiple segregated cells so spilling the entire contents of a barge is also unlikely (PR#288, p.196).

The Review Board heard from Arthur Beck at the Fort Resolution hearing who raised concerns about relying on spill response equipment in Yellowknife and Hay River which is likely located far from a potential spill. Mr. Beck expressed concern that should a spill occur it could take considerable time to mobilize equipment to site and that people should be prepared to respond (PR#292, p.117).

The Developer stated:

> *And what we've committed to do, and certainly through the barge company that we'll be working with, is follow the Transport Canada marine guidelines. And we'll have our own spills contingency play, but there [are] requirements for the barging company to have their spills contingency plan [SOPEP]. And we'll make sure the greatest of the two is followed for the barging of the products.* (PR#292, p. 33)

Based the evidence on the record the Review Board is of the understanding that the regulation and oversight of the transport of fuel and the response to any spill is well

regulated and well understood. However, it is unclear to the Review Board whether other materials carried by barges, such as concentrate or reagents used at the mine site, would have a spill contingency plan.

Concentrate Spills and the regulatory regime

The Review Board heard concerns from parties about the potential environmental impacts a spill of concentrate could cause and the need to ensure that these spills are cleaned up.

During the community hearing in Fort Resolution, the Fort Resolution Metis Council and Deninu Kue First Nation expressed concerns about a spill of concentrate. The Deninu Kue First Nation stated their concern "about the potential effects of the radiation exposure resulting from … a major accident, such as a barge spilling into the lake, for example, impacts on water quality, and safety of the fish to eat." (PR#292 p. 59)

The Developer states that the rare earth element concentrate is not likely to pose a risk to the environment or to water quality. The Developer states that in the unlikely event of a spill that the concentrate would rapidly sink to the lake bottom and is not expected to dissolve in the water. To support this conclusion the Developer conducted a shake flask test, which determined that the concentrate did not dissolve in lake water during a 24-hour period. Of particular interest, the tests showed that radionuclides were below detection limits and are not likely to pose a significant risk to the environment (PR#76, p. 882).

During the public hearing in Yellowknife, the Yellowknives Dene First Nation asked Transport Canada if the Developer would be required to clean up a spill of concentrate and whether Transport Canada and the Coast Guard have the necessary equipment to do this (PR#288, p.180).

In response, Transport Canada indicated that they would not likely require the cleanup of concentrate because it does not pose an environmental risk and stated "Under the current legislations, if the barge is not posing a environmental risk, a risk to pollute, or if the barge or equipment is not posing a navigational hazard, then Transport Canada has no mechanism to have the owners do anything with that vessel." (PR#288, p.181)

During the public hearing in Yellowknife, Review Board legal counsel asked Transport Canada, "…whether any of the regulatory framework that you've discussed applies to - non-hydrocarbon cargo" (PR#288, p. 190). In response Transport Canada stated, "I believe the materials are inert and wouldn't be considered a pollutant that would be environmentally -- affect the environment in such a way that we have to

respond" (PR#288, p. 191). The Developer responded to these concerns and committed to clean up a spill of concentrate and stated "we've committed to do everything we can to recover those containers, not because we believe they're a hazard to the water, but because they're valuable." (PR#286, p. 34)

5.1.3 Board analysis and conclusion

The Review Board is of the opinion that the transport of fuel does not pose a risk of significant adverse environmental impacts because it is well regulated and the response framework in the event of a spill is well understood. However, in the unlikely event of a spill of concentrate and other consumables the Review Board is of the opinion that spill response and the regulatory framework for these materials is not well understood.

The Review Board heard concerns from parties during all stages of the assessment process that if concentrate is spilled in Great Slave Lake it would be a cause of significant public concern and may be a cause of significant adverse environmental impacts.

With respect to the environmental impacts of a spill of concentrate the Review Board weighed the concerns against the Developer's evidence that the concentrate is expected to be inert and insoluble and therefore should not be a cause of significant adverse impacts to the waters of Great Slave Lake. The Review Board accepts the Developer's findings that the concentrate is expected to be inert and is of the opinion that a spill of concentrate is not likely cause significant adverse environmental impacts.

With respect to public concern related to cleaning up a spill of concentrate the Review Board considered the Developer's commitment to respond to and clean up a spill of concentrate, but understands that there is no regulatory requirement to clean up a concentrate spill because it is inert and therefore not likely to be a hazard. The Review Board finds that public concern is sufficiently mitigated by the Developer's commitments and understands that the Developer will honour these commitments.

The Review Board also understands that other material may be barged such as, reagents, explosives, lubricants, and other consumables and that the spill response for these materials, similar to concentrate, is not covered by the spill response plan required of the barge operator, the Ship Oil Pollution Emergency Plan. However, in the unlikely event of a spill the cleanup and any liabilities for these material are covered by the by the *Vessel Pollution and Dangerous Chemical Regulations* and *the*

Marine Liability Act. These authorities mandate that the polluter pays to ensure proper clean-up of any such spills.

At the public hearing in Yellowknife, the Review Board heard YKDFN's closing statements and the concern surrounding the roles and responsibilities for spill response:

> *YKDFN still requires assurance that, should a spill occur, Avalon will not shirk responsibility of clean-up, relying solely on the operator for spills resulting from barging operations. Understanding how the responsibility is shared between Avalon and the contractor is imperative for YKDFN to be conformable with the process.* (PR#306, p. 4)

The Review Board heard from the LKDFN that any incidents on Great Slave Lake are of great concern. The LKDFN stated in their presentation at the public hearings "We want to ensure that the Developer is aware of the gravity of any significant barge incidents for the Dene people." (PR#284)

The YKDFN and the LKDFN have concerns regarding spill responses for all materials proposed for barging. The following suggestion is intended to help address this concern, by helping ensure that the Developer and its contractors can safely transport fuel, concentrate, and other consumables across Great Slave Lake and can effectively respond in the unlikely event of a spill.

Suggestion #4

The Review Board suggests that the Developer should prepare a comprehensive spill contingency plan prior to commencement of mine construction for all materials to be transported by barge, including concentrate. This plan could incorporate any applicable spill contingency plans of contractors. The Developer should share this plan with Aboriginal groups and organizations in the Project study area and to the communities on Great Slave Lake including: Lutsel K'e, Hay River, Fort Resolution, Yellowknife, Dettah and N'dilo.

5.2 Barging - public engagement

The Review Board heard concerns from parties about barging and how it may impact traditional activities on Great Slave Lake. Further, parties are concerned that proposed barging could result in an unprecedented level of barging in the East Arm and that this is cause of public concern (PR#284, 285).

The Review Board heard concerns from many parties, including LKDFN (PR#284), YKDFN (PR#285) and the Akaitcho IMA, which said "The unprecedented increase in

barge activity on the lake in the summer months and the relatively unknown nature of rare earth element mining in the north are causes of uncertainty in the community."(PR#287, p.211)

The Review Board understands that the Developer recognizes this and similar concerns and in their closing comments state, "Avalon is highly aware of the current perception of risk about barging" (PR#307, p.3) and, "Avalon will continue to share information and be transparent as part of its community engagement activities." (PR#307, p.3)

5.2.1 Conclusion

The Review Board finds that the Developer's proposed barge activities are a source of public concern. The Review Board understands that the Developer has committed to share information with communities about barging activities. The following suggestions are intended to provide details to build on the Developer's commitment

Suggestion #5

The Developer should provide annually, before each barging season, notice of all barging activities associated with the Nechalacho mine operations to Aboriginal groups and organizations in the Project study area and to the communities on Great Slave Lake including: Lutselk'e, Hay River, Fort Resolution, Yellowknife, Dettah, and N'dilo.

Suggestion #6

The Developer should provide a report of seasonal barging activities upon the conclusion of each barging season including:

- the date of each trip;
- the total number of trips;
- the list of materials shipped;
- any reportable spills; and
- any other accidents (ie. "incidents", as defined by the Transportation Safety Board).

This Report should be sent to Aboriginal groups and organizations in the Project study area and to the communities on Great Slave Lake including: Lutselk'e, Hay River, Fort Resolution, Yellowknife, Dettah, and N'dilo.

5.3 Additional barge related concerns

Some issues raised by parties during the environmental assessment process related to barging which, in the opinion of the Review Board, do not pose a risk of significant impacts are not discussed in detail in this report. However, the Review Board understands that these topics are important to parties and therefore provides a brief description and rationale of some of these concerns in order to allow parties to better understand how the Review Board reached certain conclusions.

The Review Board heard concerns about the dock facilities at both sites and impacts to the local area, primarily to fish and fish habitat. The Review Board heard these concerns from the Department of Fisheries and Oceans and Aboriginal parties and considered the response from the Developer to these concerns. Based on the evidence on the record the Review Board is of the opinion that there is not likely to be significant adverse impacts to fish and fish habitat from the construction and operation of seasonal dock facilities and hence, this topic is not discussed in this REA in further detail. For further information please see Developer's response to a DFO information request (PR#128, p. 15) and (PR#163, p. 2).

The Review Board heard from parties that barging may interfere with or alter Aboriginal use of Great Slave Lake. The Review Board considered all the evidence on the record, including parties' submissions and the Developer's position, and is of the opinion that there is not likely to be significant impacts from the Developer's proposed barging activities on traditional uses of Great Slave Lake. The Review Board reached this conclusion based on the nature of the proposed barging activities and commitments from the Developer which includes:

- tug and barge speed of 5-6 knots;
- 60-day operating window during the 120-day barging season;
- number of barge round trips per season is expected to be 30, which amounts to one barge trip every other day;
- the time of day barges could be viewable by someone on land or on the water;
- a tug and barges will generate a small wake of 1 to 2 feet;
- temporary and low magnitude impacts from noise; and
- clean-up and salvage of spills of concentrate.

6 Impacts on fish

This section provides a summary of baseline information about fish and fish habitat at the Nechalacho Mine site as prepared by the Developer and presents the Developers' assessment of impacts from the Project on fish and fish habitat. Views of the Parties on impacts to fish and fish habitat are then discussed followed by Review Board analysis and recommendations.

6.1 Developer's submission

Fish species sampled by the Developer during baseline studies in lakes within the affected footprint of the proposed Nechalacho mine site include:

- lake whitefish,
- lake cisco,
- northern pike,
- ninespine stickleback, and
- slimy sculpin.

In addition, fish sampling in the gravel bay on Great Slave Lake in the vicinity of the proposed barge loading dock at the Nechalacho site revealed:

- Arctic grayling,
- burbot,
- longnose sucker,
- lake trout, and
- round whitefish.

It is likely that several other fish species could be found within this area at various times of the year due to the diversity and abundance of fish in Great Slave Lake. No fish species at risk, listed in the *Species at Risk Act* or by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), were found within the study area (PR#76, p. 140).

To avoid the potential disturbance or destruction of fish or fish habitat in constructing barge landings, the Developer has committed to adhere to the BC Marine and Pile Driving Contractors Association and Fisheries and Oceans BMP (2003) for pile driving.

Of the 18 lakes included in the fisheries study, field studies show nine are known to be fish-bearing and one (Drizzle Lake) may be fish-bearing only due to its limited connection to Murky Lake (PR#76, p. 148).

In its DAR, the Developer identifies three possible pathways for effects on fish and fish habit during the construction phase of the Project:

1. Vegetation clearing – riparian vegetation clearance is to be restricted to the stream crossing area on the Cressy Lake outlet stream. The Developer has committed to clear riparian vegetation according to the DFO Land Development Guidelines and concludes that there will be no residual effects as a result of riparian vegetation clearing because of its very limited application.
2. Use of industrial equipment – areas of soil exposure will be limited and exposed areas will be stabilized or protected as soon as practical. The Developer has committed to follow the erosion and sediment control measures according to the DFO Land Development Guidelines and concludes that there will be no residual effects on fish or fish habitat.
3. Use of explosives – The Developer has committed to adhere to DFO Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters, including setback distances and appropriate containment of potentially toxic by-products and concludes that no residual effects from blasting activities are expected (PR#76, p. 734, 824).

Four possible pathways were also identified for the operations phase of the Nechalacho mine site:

1. Water extraction from Thor Lake – Fish entrainment or impingement will be addressed and mitigated using the DFO Freshwater Intake End-of-Pipe Fish Screen Guidelines as well as through the maintenance of low flow for intake. The Developer has committed to maintain winter water withdrawal well below the 10% limit established by DFO to protect against the loss of habitat beyond natural variation. The Developer acknowledges a 9% reduction in discharge from Thor Lake watershed as a result of the Project. This reduction is expected to manifest as a 0.1m reduction in water levels at Thor Lake during January and February that may result in a small subsidence in the ice cover. The Developer concludes that this change would not be sufficient to affect deposited eggs or overwintering habitat and that the proposed water management regime for the Thor Lake Project is anticipated to prevent adverse effects on Thor Lake water levels and therefore on fish and fish habitat, and as such, further mitigation is not deemed to be necessary.
2. Tailings management facility - The tailings management facility (TMF) will be constructed within the footprints of Ring, Buck, and Ball lakes. No fish have been captured or observed in these lakes and as a result, the Developer

concludes that there will be no residual effects on fish or fish habitat in these water bodies due to placement of the TMF in this location. Flow volumes and timing will also be modified due to the development of the TMF, recycling of TMF decant water to reduce the need for water extraction from Thor Lake, and pumping of water from Thor Lake for operations purposes. The Developer contends that its tailings and water management strategy for the Thor Lake mine and flotation plan is composed of a closed loop system that should minimize effects on the natural hydrologic flows within the Thor Lake watershed. The Developer has also stated that, to the extent possible, water discharges from the TMF will simulate pre-development flow volumes and seasonal patterns to minimize possible effects on the local hydrological regime. As a result, the Developer concludes that there should be no residual effects on fish or fish habitat.

3. Barge operations – Barge operations are proposed to take place during the summer months, ending prior to spawning for fall-spawning species such as lake whitefish and lake cisco, which predominate in the Thor Lake area. This operational schedule limits the possibility of adverse effects on fish production since it will occur after hatching and prior to spawning. Fish habitat within the nearshore area at the south of Great Slave Lake would be poor to moderate due to shallow depths (< 3 m). These nearshore areas would not provide suitable spawning habitats for fall spawning fish (e.g., lake whitefish, lake cisco, lake trout) due to ice depths of about 1-1.5 m. The Developer concludes that migrating fish may move to avoid moving tugs, some may exhibit short-term "startle reactions" but that their movements and behaviour would return to normal once the tugs had passed.
4. Water quality effects – The Developer predicts that MMER effluent criteria will be met for all parameters and that all parameters will be within CCME guideline values within the Thor Lake system. As a result, the Developer concludes that no adverse effects or additional mitigation measures will be required (PR#76, p. 736, 824).

The Developer also commits to following the requirements of the *Metal Mining Effluent Regulations* (MMER), as well as other monitoring requirements provided for through foregoing approvals. The MMER requires periodic aquatic environmental effects monitoring to evaluate the effects of mining on fish, fish habitat, and fisheries resources. Monitoring studies for the Project will consist of:

- effluent and water quality monitoring studies;
- sub-lethal toxicity testing; and

- biological monitoring studies. (PR#76, p. 834)

With respect to cumulative effects, the Developer concluded that since no residual effects on fish or fish habitat are anticipated due to Project activities, and no other developments or activities are proposed within the Thor Lake area that could affect fisheries values, no residual or cumulative effects on fish and fish habitat are predicted to occur. (PR#76, p. 906)

6.2 Parties' submissions

Based on responses provided from the Developer during the information request phase, no parties, including the Department of Fisheries and Oceans had issues or questions for the Developer during the technical sessions in August 2012 (PR#181, p. 176).

The Developer plans to construct its tailings management facility over the current location of Ring, Buck, and Ball Lakes. In its technical report, the Department of Fisheries and Oceans Canada confirmed and concurred with the Developer`s assessment that these three lakes are unlikely to support fish populations, and are therefore not subject to the Metal Mining Effluent Regulations. DFO did not provide any further recommendations regarding the impacts of the tailings management facility on fish. (PR#220, p. 2)

The construction of access roads will involve several watercourse crossings including the construction of arch culverts. In an effort to ensure the protection of fish habitat, DFO requests that the Developer provide it with final plans prior to the construction of the water crossings (PR#220, p. 4).

Two dock structures are also required as part of the Project. The Developer has incorporated some modifications into the design of the dock structures throughout the environmental assessment resulting in the need for minimal in-water works and footprint. These changes and the work required are in compliance with the Best Management Practices for Pile Driving and Related Operations prepared by the BC Marine and Pile Driving Contractors Association (March 2003). As such, DFO has concluded in its technical report that impacts to fish and fish habitat can be adequately mitigated. DFO does not anticipate any harmful alteration, disruption or destruction of fish habitat but does recommend that any construction work near water bodies be included under the scope of a sediment and erosion control plan (PR#220, p. 7).

In its technical report, DFO stated that fish are highly susceptible to effects of sedimentation and erosion. It acknowledged the Developer`s work throughout the

environmental assessment process to develop a conceptual sediment and erosion control plan. DFO recommends that once a final plan is completed, which includes all activities and structures that might potentially impact water, that it be submitted to DFO for review prior to implementation. DFO states that provided the sediment and erosion control plan is developed and implemented as discussed above, there would be no impacts to fish and fish habitat (PR#220, p. 8).

Water for the Project is proposed to be withdrawn from Thor Lake which is known to be a fish-bearing waterbody. In order to protect the fish living in Thor Lake, the Developer has committed to follow the DFO Protocol for Winter Water Withdrawal from Ice-Covered Waterbodies in the NWT and Nunavut (June 2010) and the DFO Freshwater Intake End-of-Pipe Screen Guidelines. DFO therefore concludes that the likelihood of impacts to fish and fish habitat from water withdrawals in Thor Lake are negligible (PR#220, p. 5).

In its technical report, Aboriginal Affairs and Northern Development Canada (AANDC) recommends that the REA for the Project include narrative statements that describe the level of protection to be afforded to the aquatic receiving environment including the fish, mammals and waterfowl that use the area. AANDC recommends that the Review Board include measures stating that,

> *water quality changes due to mining activities will not significantly alter fish abundance or diversity or fish consumption at current levels… or the current ability for people to harvest these animals*. (PR#222, p. 8)

As described in more detail in the water quality section, AANDC also recommends that:

> *Avalon be required to follow the "Guidelines for designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the Northwest Territories, June 2009" in the development of its Aquatic Effects Monitoring Program, effects levels, action levels or triggers, and related Management response Framework for the Thor Lake Rare Earth Element Project.* (PR#222, p. 12)

In its technical report, DFO states that impacts to fish and fish habitat can be fully mitigated based on information provided by the Developer and provided standard operational statements and protocols are followed. Further, DFO state that they had no recommendations for the Review Board on the Project. (PR#220 p. 1) Accordingly,

DFO did not participate in the public hearings in February 2013 and did not submit closing comments to the Review Board.

6.3 Board analysis and recommendations

The Review Board acknowledges that discussions occurred between the Developer and DFO to address fish and fish habitat issues during the course of this EA. As a result of these discussions and commitments made by the Developer, DFO states clearly that impacts to fish and fish habitat from the Project have been fully mitigated and that there are no remaining impacts that need to be addressed.

Since DFO has the mandate to protect fish and fish habitat in the NWT and is the regulator responsible for fisheries management, the Review Board accepts this evidence from DFO. The Review Board notes that measures intended to protect water quality and aquatic life in water bodies downstream from Drizzle Lake are described in the water quality section of this REA.

The Review Board therefore finds that significant adverse impacts to fish or fish habitat from the Project are not likely provided the measure recommended by the Review Board and described in the water quality section of this Report is followed.

7 Impacts to wildlife

7.1 Introduction

The Terms of Reference for the environmental assessment required the Developer to describe the effects that the Project may have on wildlife and wildlife habitat including any species at risk and known species of concern including woodland and barren ground caribou. For each species, and/or species group, the Developer was instructed to consider the following (PR#76, p. 761):

- *potential effects to habitat, including degradation and fragmentation, with a focus on important wildlife habitat. Include a discussion on effects occurring during vulnerable periods including but not limited to nesting or rearing;*
- *potential for increased attraction to both Project sites, risk of bear-human encounters, risk to people and associated carnivore mortality;*
- *potential for increased sensory disturbance from all sources (e.g., noise, odours, activity, vibrations from blasting, over flights, dust, transports trucks, locomotives, barge traffic). Predict effective habitat loss resulting from changed behaviour;*
- *potential for disruption of movement and migration patterns;*
- *potential for increased contamination of food and water, including bio-accumulation, from all sources and from the effects of tailings ponds on waterfowl, other aquatic birds and furbearers; and*
- *potential for increased sources of direct or indirect mortality including from vehicle collisions on the Pine Point-Hay River road, the Nechalacho Lake airstrip, as well as the increased rail traffic through woodland caribou habitat and changes to hunting access.*

This section describes the Developer`s assessment of the impacts of both Project sites on wildlife, presents the views and recommendations of parties and concludes with the Review Board's analysis and determination on the significance of adverse impacts on wildlife.

7.2 Developers' submission

In the DAR, the Developer identified a local and regional study area for considering impacts to wildlife at the Nechalacho mine site (Figure 10). The study areas are defined as follows.

Nechalacho mine site (PR#182, p. 28, PR#76, p. 267):

- **local study area** (LSA)- consists of the immediate proposed mine site and areas associated with the development including the Project site, access roads, and barge landings totalling an area of roughly 5km^2 or about 2,184 hectares.
- **regional study area** (RSA)– measures about 15km in radius centered on Thor Lake (truncated along the north shore of Great Slave Lake) and has been used for assessing potential Project effects within the LSA. The size of the RSA reflects the estimated area necessary to evaluate potential Project effects for species with larger home ranges (e.g., caribou, moose), totalling approximately 44,000 hectares.

Hydrometallurgical plant site (PR#76 p. 267):

- **local study area** – consists of the Hydrometallurgical plant and associated infrastructure, including the transportation route along Hwy 5/6 to Hay River

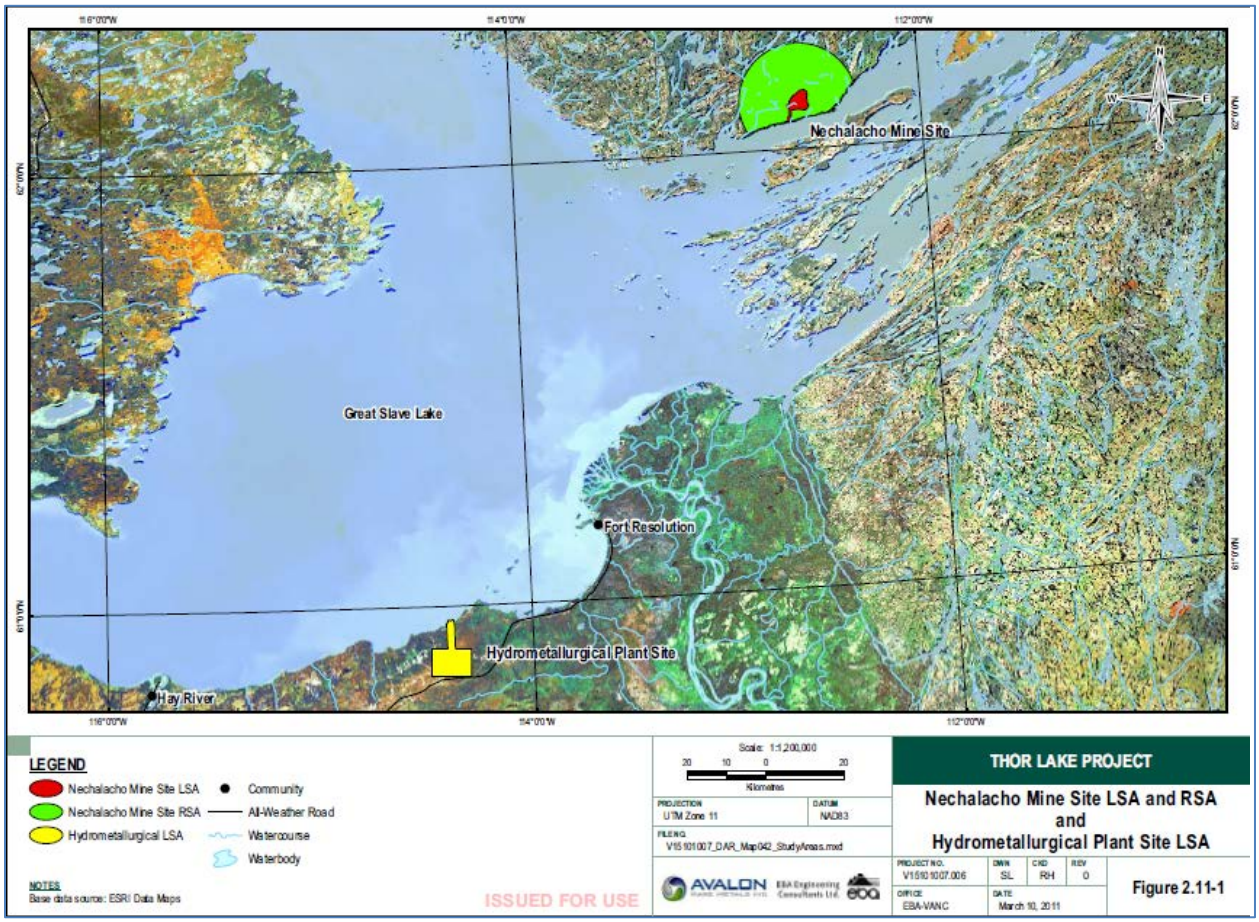

Figure 10: Nechalacho mine site LSA and RSA and Hydrometallurgical plant site LSA (PR#76, p. 268).

Through the processes of project scoping, baseline information collection, project-effects assessment, mitigation identification, residual effects evaluation, significance

determination, and follow-up needs identification, the Developer has provided its assessment of the Project and its impacts on wildlife in the DAR. (PR#76) Valued components of the assessment were identified through public consultation, scoping, and existing knowledge and principles of the biophysical and social environment.

Potential wildlife valued components included: fish and fish habitat, barren ground caribou, woodland caribou, moose, wood bison, black bear, other furbearers, peregrine falcon, short-eared owl, common nighthawk, olive-sided flycatcher, rusty blackbird, yellow rail, horned grebe, and the whooping crane (PR#76, p. 630).

In response to concerns regarding the naturally occurring radioactive material, particularly levels of uranium and thorium, the Developer conducted a screening-level radioactivity pathways assessment of the Project. This assessment was completed to determine any potential pathways for radiological exposures to vegetation, wildlife or fish and fish habitat and to evaluate doses to members of the working public, people who hunt, fish or live in the surrounding area, and to non-human biota (aquatic and terrestrial receptors) present in the area. (PR#76, p. 544) No potential pathways were identified by the Developer from the Hydrometallurgical plant site. A conceptual site model was developed for the Nechalacho mine site, identifying potential pathways of exposure. The Developer determined that,

> *…contaminants of potential concern may be introduced to the water and sediment through the use of the Nechalacho water system as a Tailings Management Area (TMA). Ore extraction, transfer, and processing may introduce radiological COPC to the air as suspended particulate, which may be respired by receptors, or fall as dust to enter the soil profiles and be taken up by vegetation.* (PR#76, p. 547)

The results of the pathways assessment showed that the doses to both aquatic and terrestrial biota were below the accepted benchmark dose and that no adverse effects would be expected from the release of low levels of radionuclides to the air or water (PR#76, p. 549).

The Developer also concluded, in the DAR, that:

> *…air emissions associated with all phases of the Nechalacho Project will be localized, short-term, periodic, low magnitude and rapidly reversible, for all criteria air contaminants (CACs) and are predicted to be lower than the corresponding NWT AQ Standards. As a result, the limited air emissions are not anticipated to have a measurable effect on wildlife.* (PR#76, p. 761)

At the technical sessions, prior to discussing the Project-related impacts on wildlife, the Developer provided a summary of the vegetation classification that informs part of the assessment on wildlife habitat. The Developer indicated that it has designed the Project so as to limit the size of the Project footprint to the extent possible and to avoid development impacts on any rare ecosystem types or plants. The Developer also repeated its commitments to use dust suppressants, mostly water, throughout all Project phases and to conform to existing air quality guidelines, where applicable (PR#182, p. 30).

In the DAR, the Developer reported that mammals such as barren ground caribou, moose, and various furbearers (including black bear, beaver, fox, lynx, marten, mink, muskrat, otter, rabbits, squirrels, wolf, and wolverine) are harvested from the Nechalacho mine site regional area, whereas, wood bison, woodland caribou, moose and various furbearers (including black bear, cougar, beaver, coyote, fisher, fox, hare, lynx, marten, mink, muskrat, otter, squirrels, weasel, wolf, and wolverine) are harvested from the greater Pine Point area. Approximately 29 and 38 species of mammals may frequent the Nechalacho mine site area and Hydrometallurgical plant site area, respectively (PR#76, p. 273).

During the technical sessions, the Developer presented some summary information regarding caribou, Species at Risk, waterfowl and other wildlife within the Project area. Satellite collar data showed that the winter range of the Bathurst caribou includes areas very close to, and likely including, the Nechalacho mine site while the Hydrometallurgical plant site is found within the woodland caribou annual range. Wood bison also occur around the Hydrometallurgical plant site and the Developer has committed to do its best to not disturb them while present. The Developer also indicated that peregrine falcon habitat was available but that no birds were observed during wildlife surveys and that several whooping cranes were observed within 20 km of the Hydrometallurgical plant site (PR#182, p. 31-35).

7.2.1 Waterfowl, resident and migratory birds

The Developer`s DAR indicates that numerous bird species occupy a variety of habitat types across the Project study area year round. Migratory birds are expected to arrive around mid-April and remain into October (PR#76, p. 301).

Many species of upland breeding birds were recorded during surveys of the Project study area (PR#76, p. 301) and 17 raptor species were also recorded. The Developer notes in the DAR that raptors can be expected to breed within the study area and are particularly sensitive to disturbance during their nesting season (PR#76, p. 305).

A total of 47 and 57 waterfowl and waterbird species are expected to occur within the Nechalacho mine site and Hydrometallurgical plant site study areas, respectively (PR#76, p. 308). Traditional knowledge collected for the preparation of the DAR suggests that there has been a decline in duck abundance and a change in geese and duck migration routes away from the Pine Point regional area, but that the shoreline of Great Slave Lake from the mouth of Buffalo River to Sandy Creek, near Hay River, and around the North Arm are important staging and harvesting areas. Designated important waterfowl and waterbird areas have been identified near the study areas, including: 1) the North Arm Great Slave Lake, 2) South Shore Great Slave Lake (also referred to as the Slave River Delta) and 3) Sass and Nyarling Rivers (PR#76, p. 313).

Waterfowl are sensitive to disturbance during nesting, fledging, and moulting seasons. (PR#76, p. 310) In its DAR, the Developer identifies two ways in which its proposed Project might affect waterfowl:

- Changes in daily movements and avoidance caused by Project-related disturbances. Waterfowl nesting, moulting and staging habitat exists at the Hydrometallurgical plant study area, including a small beaver pond and the former T-37N pit, but available ponds and open waters along the south shoreline of Great Slave Lake is considered limited due to the prevailing wind patterns and the presence of ice. More suitable breeding habitats are common throughout the region and for these reasons, the Developer concludes that direct loss of waterfowl habitat as a result of the Project is considered negligible.
- Direct and indirect mortality as a result of vehicle collisions and hunting. The Developer considers the threat of mortality as a result of the Project as moderate in magnitude and likelihood without mitigation. To minimize any potential for direct and indirect development-related waterfowl effects, the Developer will implement mitigation measures similar to those listed for caribou (below) including avoidance of known or suspected nests (PR#76, p. 802).

Barging will occur during the open water season from approximately the end of June to the end of October. The timing of barging operation coincides with waterfowl brood rearing, moulting, and fall migration. The Developer states that "[t]he proposed dock facility and the shoreline in the local area have limited emergent vegetation cover and are not considered high quality waterfowl nesting and rearing habitat, although some nesting and rearing are expected." The Developer concludes

that activities associated with barging will result in the temporary displacement causing low, reversible, and periodic disturbance on a few nesting waterfowl.

7.2.2 Species at risk

Common nighthawks are expected to arrive in the study areas in mid-May or early June to breed and leave the NWT by mid-August to September. Suitable nesting and foraging habitat exists throughout both the Nechalacho mine site and Hydrometallurgical plant site areas (including along Highway 5/6 and on the islands in Great Slave Lake). In the NWT, potential threats to the population include mortality due to vehicle collisions and predation (PR#76, p. 339).

Olive-sided flycatcher habitat exists throughout the Nechalacho mine site and Hydrometallurgical plant site areas, and its presence has been recorded in both areas during previous surveys and by the Developer`s personnel. In the NWT, potential threats to the population includes: fire suppression practices and extreme weather during breeding (PR#76, p. 340).

Rusty blackbird habitat occurs throughout the study areas. Potential threats to rusty blackbirds in the NWT include habitat loss and degradation and climate change (PR#76, p. 341).

Peregrine falcon populations can be found nesting in the east arm of Great Slave Lake (along the steep cliffs) and in Wood Buffalo National Park. The Hydrometallurgical plant site area lies outside the known peregrine falcon breeding range and based on the GNWT-ENR Raptor Nest Database, no peregrine falcon nests are known to occur in the study areas, including the cliffs on Great Slave Lake. There has been an increasing trend in peregrine falcon numbers since 1980 (PR#76, p. 323, 325).

During the Review Board scoping sessions held for the Project in Fort Resolution in August 2010, Mr. Tom Unka informed the Developer that he had observed peregrines nesting on the steep sides of one or more of the historical mined-out pits in the area of the former Pine Point mine site. In September, 2005, two peregrine falcons were also observed in the Pine Point region during field surveys. In the DAR, the Developer states that it does not believe that the Hydrometallurgical plant site will directly affect peregrine falcon nesting or feeding habitat.

The **short-eared owl** arrives in the NWT to breed by late April or May and departs by late October. Within the Nechalacho mine site and Hydrometallurgical plant site areas, short-eared owl feeding habitat exists along lake shorelines, beaver ponds and in open wetlands; however, no short-eared owl were observed within either study area during previous surveys. Existing threats include human disturbances during nesting and habitat loss (PR#76, p. 341).

Horned grebe nesting and feeding habitat occurs within the Nechalacho mine site and Hydrometallurgical plant site areas (including along Highway 5/6 and the proposed shipping route) and are expected to arrive within the study area at the end of April or early May to breed and depart by mid-August to early September. In the NWT, potential threats to the population include habitat loss and degradation, predation, and climate change (PR#76, p. 342).

The nearest known **whooping crane** nest is located approximately 20 km east and south of the proposed Hydrometallurgical plant site. They are not expected to occur in the Nechalacho mine site area. During a 2005 wildlife study conducted in the Pine Point area a single non- breeding whooping crane was identified (PR#76 p. 804) at a recently flooded beaver pond located approximately 17 km west of the Hydrometallurgical plant site. In the NWT, potential threats to the whooping crane population includes: habitat loss and degradation, disturbance from aircraft and human presence, predation, accidental hunting, and collisions with power lines (PR#76, p. 338).

Based on their known distribution in the NWT and their preferred habitat requirements, **yellow rail** does not occur in the area of the proposed Nechalacho mine site; however, this species has been documented in the Pine Point region. Potential threats in the NWT include habitat loss and degradation, collisions with towers and other structures during migration and human activities resulting in increased numbers of predators (PR#76, p. 340).

Impacts to bird species at risk

In the DAR, the Developer has identified ways that the Project may impact avian species at risk including the common nighthawk, olive-sided flycatcher, rusty blackbird, peregrine falcon, short-eared owl, horned grebe, whooping crane, yellow rail. The following is a summary of potential impacts (PR#76, p. 780, 811-816):

- direct nesting and feeding habitat loss as a result of construction activities and mine infrastructure building including the Hydrometallurgical plant, dock facility, marshalling area and access road. For species present at the Nechalacho mine site clearing of the tailings management facility results in the primary direct habitat loss;
- displacement during nesting and fledging seasons as a result of development-related noise, dust and visual disturbances; and
- direct and indirect mortality as a result of clearing operations, vehicle collisions, and predator attraction.

Mitigation for bird species at risk

The Developer does not anticipate significant adverse impacts from the Project on avian species at risk. The Developer proposes the following mitigation to reduce impacts to these avian species at risk (PR#76, p. 782-784, 804, 813-816):

- commitment to limit the Project's footprint noting that the Hydrometallurgical facility is located at a previously disturbed brownfield site;
- commitment to avoid all known or suspected nest sites and to avoid clearing activities from mid-May to late August;
- commitment to a no hunting policy;
- maintain existing drainage patterns to avoid potential alterations to existing waterfowl habitat;
- implement appropriate waste management strategies to avoid attracting predators; and
- maintain sufficient buffer distances between development activities and water bodies, avoiding all known or suspected nest sites, and providing education to all Project employees on wildlife related policies and mitigation.

Boreal woodland caribou are known to occur southwest of Great Slave Lake, including the area of the proposed Hydrometallurgical plant (Figure 11), along Highway 5/6 to Hay River and the railway to Alberta, however, the Developer predicts that they do not occur in the Nechalacho mine site area. In the DAR, the Developer acknowledges the special status attributed to boreal woodland caribou by GNWT as "sensitive" under the general status program (GNWT ENR 2010a) and listed by SARA as "threatened" (PR#76, p. 289). Current threats to the woodland caribou population in the NWT include direct and indirect habitat loss and alteration, vehicle collisions, parasites and disease, harvesting, and predation (PR#76, p. 336).

The Hydrometallurgical plant site and associated infrastructure will be entirely located within the previously disturbed Pine Point mine site. With the exception of some access road upgrades, the Developer does not anticipate directly contributing to the loss of woodland caribou habitat. The Developer concludes that fragmentation of woodland caribou habitat will remain at baseline conditions and that direct habitat loss and fragmentation of woodland caribou habitat as a result of the Hydrometallurgical plant and associated infrastructure is considered negligible (PR#76, p. 787).

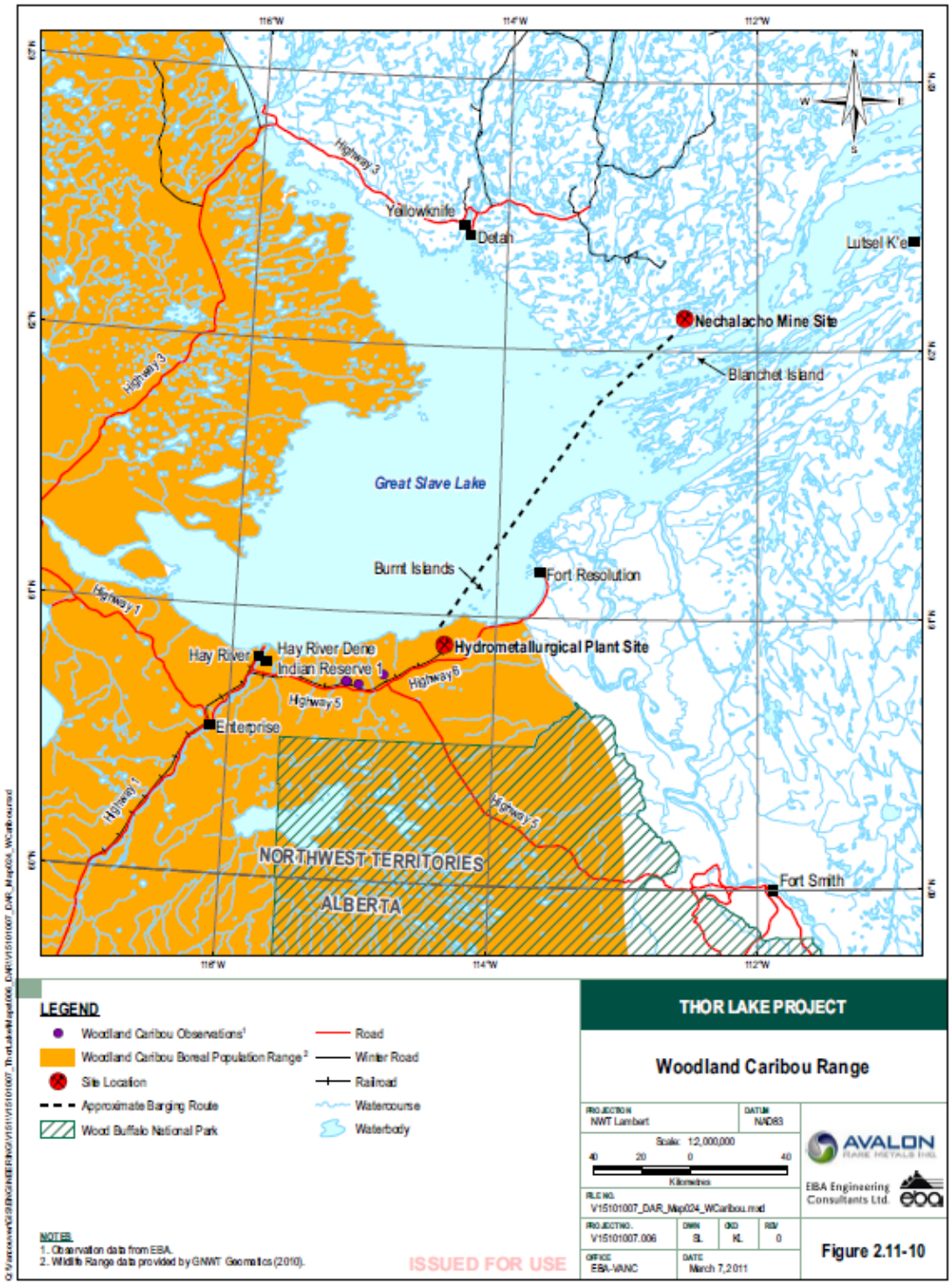

Figure 11: Woodland Caribou Range (PR#76, p. 290).

In its DAR, the Developer notes that a *Woodland Caribou Action Plan and Implementation Plan in the NWT,* has been developed by the GNWT. The Action Plan outlines recommendations to address existing and anticipated threats to woodland caribou populations in the NWT. A key recommendation calls for the development of best practice guidelines for industrial activities to manage or mitigate disturbance to woodland caribou.

7.2.3 Bathurst caribou

In the DAR, the Developer acknowledges the importance of the Bathurst caribou to the people and culture of the Northwest Territories. The Nechalacho Mine site area and the islands in the east arm of Great Slave Lake lie at the border of the known Bathurst herd's winter range (November to May). The Developer also acknowledges the hunting pressures on the Bathurst caribou and the decline that has been recorded since 1986, from 472,000 ± 72,900 down to 31,900 ± 11,000 in 2009 (PR#76, p. 275).

Potential impacts to barren ground caribou from the Nechalacho mine site include:

- loss of habitat availability due to mine construction and Project footprint,
- avoidance of Project area due to sensory disturbance, and
- direct or indirect mortality due to vehicle collisions or hunting.

The Developer has designed the Project to minimize impacts to the Bathurst caribou herd. For example, placing crushing activities underground will reduce disturbance to caribou from noise and mining underground rather than from an open pit will lessen dusting, noise and visual impacts to caribou. The Developer also commits to limiting the Project's footprint. Other commitments to reduce impacts to barrenground caribou include:

- a no hunting policy and wildlife education program;
- aircraft procedures to accommodate caribou;
- speed limits on roads and giving caribou the right of way;
- dust suppression strategies; and
- practising proper waste management.

According to the Developer, observations indicate that known barren ground caribou migration corridors are well outside the zone of influence identified for the Project. The Developer predicts that disturbance impacts on the Bathurst caribou will be low in magnitude since the Nechalacho mine site is on the edge of the herd's range.

The Developer concludes that due to the Bathurst's large winter range and infrequent use of the Nechalacho mine site area, the loss of quality forage, resting/security, and traveling habitat will be of a low magnitude, local in extent, reversible over the long term, and therefore insignificant at both the local and regional scale. As a result, the

Developer expects that increases in caribou mortality will be low with no residual impacts on herd population expected (PR#76, p. 762).

7.2.4 Cumulative effects

In its cumulative effects assessment, the Developer provided the following predictions and states:

> **Wildlife** - *None of the intermittent, short-term, highly localized and rapidly reversible Project-related effects are anticipated to cause impacts that may contribute to cumulative effects on any of the wildlife species that use or may be present in the area of the Nechalacho Mine and flotation plant site, the hydrometallurgical plant site, or any of the transportation-related activities.* (PR#76, p. 908)
>
> **Barren ground caribou** - *...habitat and disturbance-related effects on the few barren-ground caribou that may occasionally overwinter in the Nechalacho Mine area would be of a negligible and insignificant nature, with no residual effects expected to occur. As a result the Nechalacho Project is not anticipated to contribute to a possible cumulative effect on barren-ground caribou or on the continued use of caribou by people that value the animals as part of their culture and livelihood*. (PR#76, p. 909)
>
> *The cumulative direct disturbance to the landscape from the Nechalacho Project and other previous, existing, and future developments was predicted to be less than or equal to 1.7 percent (%) of the Bathurst caribou herd's seasonal ranges relative to reference conditions (low magnitude). The Nechalacho Project and other developments were predicted to result in habitat-specific cumulative changes to the number of patches and the distance between similar habitat patches, with the magnitude ranging from 0% to 5% (low magnitude). These changes were expected to have a negligible influence on the carrying capacity of the seasonal ranges and the movement and distribution of caribou.* (PR#76, p. 910)
>
> *The assessment also considered the cumulative effects from indirect changes to habitat quality (sensory disturbance zones of influence) associated with the Nechalacho Project and other developments on the availability of preferred habitats. Overall, the magnitude of cumulative declines in preferred habitat across seasonal ranges of the Bathurst caribou herd was predicted to be low (ranged from 1.1% to 7.3%).* (PR#76, p. 911)
>
> ***Woodland caribou*** *- As a result of Avalon's decision to locate the physical footprints of the Hydrometallurgical plant and all associated infrastructure*

> *on existing brownfields or disturbed terrain, the direct physical effects, including direct habitat loss and fragmentation, on preferred woodland caribou habitat in the area of the Hydrometallurgical plant are expected to be negligible.*
>
> *Fragmentation of woodland caribou habitat will therefore remain essentially unchanged from current baseline conditions. Direct habitat loss and fragmentation of woodland caribou habitat as a result of the Hydrometallurgical plant and associated infrastructure is considered negligible.* (PR#76, p. 918)

7.2.5 Monitoring and management

In the DAR, the Developer committed to preparing a conceptual wildlife monitoring and management plan designed to specifically address and adaptively manage any potential Project-related effects on furbearers, migratory birds, waterfowl, large ruminants, and large carnivores in the Nechalacho mine site project study area (PR#76, p. 836). In a report submitted after a meeting between the Developer and GNWT on January 24, 2013, the Developer agreed to rename this plan the Wildlife and Wildlife Habitat Protection Plan (WWHPP) (PR#281). With respect to the Wildlife Effects Monitoring Program (WEMP), the Developer made the following commitment:

> *Avalon acknowledges GNWT request for a Wildlife Effects Monitoring Program (WEMP) and commits to continued discussions with the GNWT about wildlife monitoring. Avalon has a general principle of collaborating with affected parties in the development of the Project, which would include collaborating with the GNWT, affected aboriginal organizations, co-management authorities, and any other affected parties in the development and on-going review of a possible WEMP.* (PR#281)

In addition, the Developer committed to attend the GNWT cumulative effects workshop, held February 4-7, 2013 (PR#281).

Mitigation measures planned by the Developer to prevent the attraction of wildlife to either of the Project sites include appropriate waste management handling, storage, and disposal, and intentional infrastructure design to discourage burrowing or nesting. The Developer has also committed to allowing wildlife the right of way on all roads, and implementing a no hunting policy for all employees on the work sites.

7.3 Parties' submissions

7.3.1 Waterfowl, resident and migratory birds

In its technical report, Environment Canada reminds the Developer that "Section 5.1 of the Migratory Birds Convention Act prohibits persons from depositing substances harmful to migratory birds in waters or areas frequented by migratory birds or in a place from which the substance may enter such waters or such an area." Because the Developer predicts aluminum concentrations will exceed CCME guidelines in the Nechalacho tailings management facility effluent, Environment Canada recommends that the Developer monitor the tailings management facility daily during spring migration, breeding season and fall migration and deter migratory bird from using the Nechalacho tailings management facility until monitoring shows that contaminant concentrations are not of concern. Environment Canada further recommends that the Developer collect data on waterfowl/waterbird use of the tailings management facilities at both the Nechalacho mine site and Hydrometallurgical plant sites as part of their Wildlife Effects Management and Monitoring Program and provide results of monitoring through annual reporting. Any incidents involving Project-related injury or mortality of migratory birds should be reported directly to Environment Canada (PR#219, p. 16-18).

Environment Canada recommends that the Developer practice due diligence in its efforts and commitments to avoid the incidental take of migratory birds and their nests and eggs. Migratory birds have been documented in the boreal region of the NWT as early as May 7 and as late as August 10. Environment Canada recommends that the Developer adjust the start date within which clearing should not take place to at least May 7 and extend the period to avoid mowing the airstrip buffer zone to mid-August. Environment Canada is also of the view that the best mitigation to avoid any incidental take should be scheduled clearing outside the migratory bird seasons. Environment Canada recommends that the Developer consult Environment Canada's "Planning Ahead to reduce Risks to Migratory Bird Nests" fact sheet. Environment Canada further recommends that the Developer include the setback distance in their Wildlife Effects Management and Monitoring Program, develop nest-specific guidelines in cases where setbacks are not feasible, and monitor and report annually on the success of mitigation measures implemented (PR#219, p. 18-21).

In response to Environment Canada's technical report recommendations, the Developer describes mitigation measures to reduce impacts to waterfowl and other

birds in its Updated Commitments Table (PR#297 p. 17-18). This Commitments Table is included in Appendix C of this Report and key commitments are described below:

- infrastructure will be designed to minimize the attraction of predators to the extend reasonable (specific examples detailed in commitments table);
- monitoring for whooping crane near the Project site including visually checking the wetland, avoiding disturbance and contacting Environment Canada if cranes are observed;
- develop and implement an education program for wildlife related policies and mitigation to be delivered to all project employees and contractors;
- employee education on the SARA listed species, including identification and reporting;
- habitat clearing activities will be avoided to the greatest extent possible from May 15 – August 15 annually to prevent accidental mortality of adults, eggs and pre-fledged young of SARA listed species (e.g. common nighthawk, olive-sided flycatcher, rusty blackbird) as well as other upland breeding birds;
- mowing or other activities within the airstrip buffer zone will be avoided from late April to July to prevent accidental mortality of nesting and fledging Short-eared owls; and
- if a deterrent is required to prevent birds and species at risk from coming into contact with tailings or water within the TMF, the Developer is committed to consulting with Environment Canada and GNWT ENR to determine the most appropriate method(s) to employ.

Environment Canada points out concerns about the effects of possible predation on birds' eggs and chicks if predators or scavengers are attracted to the Project sites. Environment Canada supports the implementation of the mitigation measures and management practices outlined in the Developer`s commitments, WEMP and conceptual waste management plan. Environment Canada recommends that the Developer ensure that all food, domestic waste and petroleum-based chemicals be made inaccessible to wildlife at all times, and that the Developer perform regular monitoring of Project infrastructure, waste storage and handling facilities, including mitigation if necessary (PR#219, p. 27).

Based on the proposed barge routes provided by the Developer in their response to Technical Sessions Undertaking #5, Environment Canada pointed out that it appears that barge trains will pass by nesting colonies of California gulls on Egg Island, Outer Whaleback Rocks, and Francois Bay Island. In order to mitigate potential impacts to these nesting colonies, Environment Canada recommends that the Developer advise barge operators of the location of known California gull nesting colonies along the proposed barge routes in order to avoid disturbance to nesting birds and to prioritize these areas for protection in the event of a fuel spill (PR#219, p. 29).

7.3.2 Species at risk

In its hearing presentation, Environment Canada provided the Review Board with an updated list of potentially impacted species at risk. Barn swallow, little brown myotis and northern myotis have been assessed by COSEWIC since the writing of the DAR. The updated listing of species at risk is found in Table 6 below.

Table 6: Species at Risk at Nechalacho and Pine Point sites

Terrestrial Species at Risk	Nechalacho	Pine Point
Whooping crane		x
Common nighthawk	x	x
Olive-sided flycatcher	x	x
Yellow rail		x
Horned grebe (western population	x	
Peregrine falcon	o	x
Short-eared owl	o	o
Rusty blackbird	x	x
Woodland caribou (boreal population)		x
Wood bison		x
Wolverine	o	o
Barn swallow	o	o
Little Brown myotis		o
Northern myotis		o

x = detected during baseline surveys
o = potentially occurring
(PR#263 p. 16)

Overall, Environment Canada indicated that it is satisfied with the Developer`s general and species-specific mitigation measures for species at risk identified in the Developer`s list of commitments and draft Wildlife Effects Management and Monitoring Program. Environment Canada requested that the Developer update the Wildlife Effects Management and Monitoring Program to be consistent with its final list of commitments, including commitments to monitor whooping crane in the shrubby fen around the Hydrometallurgical plant (PR#219, p. 21-24).

Environment Canada noted that the Developer`s assessment of the Project impacts on yellow rail were based on surveys completed for the Tamerlane Pine Point Project and a one-day survey of the haul road. Environment Canada has recommended that

the Developer complete further studies in order to better characterize the potential presence of yellow rail at the site prior to carrying out planned upgrades to the haul road (PR#219, p. 25). In its Updated Commitments Table, the Developer commits to the following to mitigate impacts to species at risk:

> *The primary mitigation measure for any species at risk will be avoidance. If species at risk are encountered the proponent will avoid contact with or disturbance to the species, its habitat or its residence. Monitoring will be done to determine the effectiveness of mitigation or to determine if further mitigation is required. At minimum, the proponent will record and provide to the relevant authorities all observations of any species at risk, including information on location sighted, number and reaction of the wildlife to project activities, and in some cases further monitoring may be required for particular species. Mitigation and monitoring will be consistent with recovery strategies and action or management plans for the particular species.* (PR#297 p. 17)

A specific commitment from the Developer to mitigate project impacts on whooping cranes is described as,

> *The proponent will undertake monitoring for whooping crane near the project site. Wetlands near the project site including the area identified as shrubby fen in the local study area will be visually checked every two (2) weeks from May to September to see if any cranes are present. If a whooping crane is observed, the wetland area will be visually checked on a weekly basis for cranes and measures undertaken to avoid disturbance to the bird. As well, Environment Canada will be contacted to determine whether any further mitigation measures might be required. Additionally, any other observations of whooping cranes will also be reported to Environment Canada.* (PR#297 p. 18)

Commitments by the Developer described above in the water fowl/bird section that mitigate impacts to birds are also applicable to avian species at risk (PR#297 p. 18).

7.3.3 Boreal caribou

The national Recovery Strategy for the Boreal Woodland Caribou in Canada was posted to the Federal Species at Risk Registry in October, 2012. The Hydrometallurgical plant site is wholly within the boreal caribou range boundary and although is being constructed on previously disturbed land, the GNWT reminds the Developer and other co-management authorities that the development must still be

assessed under the principles defined in the Recovery Strategy and the soon to be developed range management and action plans. The GNWT is satisfied with commitments made by the Developer during the environmental assessment but acknowledges the potential for the Project to contribute to cumulative impacts on wildlife and refer the Developer to its recommendations under cumulative effects, below, which include participation in the development and implementation of regional-scale caribou monitoring programs (PR#225, p. 11-12).

Environment Canada supports the recommendations of the GNWT and the mitigation measures proposed by the Developer to reduce sensory disturbances and risk of wildlife collisions from vehicle traffic at the Hydrometallurgical plant site. Environment Canada reminds the Developer that its monitoring and mitigation strategies for species at risk must be consistent with existing (and future) applicable status reports, recovery strategies, action plans and management plans and that the Developer should consult with the GNWT and Environment Canada on adaptive management strategies should they be required. Again, Environment Canada recommends that the Developer ensure its draft Wildlife Effects Management and Monitoring Program cross-reference the latest list of commitments (PR#219, p. 25).

7.3.4 Bathurst caribou and cumulative effects

In their submissions and during the public hearings, parties described impacts from the Nechalacho mine site on the Bathurst caribou herd in the regional scale context of cumulative adverse impacts from developments on the Bathurst caribou herd throughout its range. This section therefore, combines parties' views on the impacts of the Project at the Nechalacho mine site on caribou with cumulative impact considerations.

In its closing comments, LKDFN state that they rely on caribou as a major food source and that over the past two decades harvesters have observed a significant decline in caribou numbers and caribou health. LKDFN point out that traditional knowledge and scientific information indicates that development in the Bathurst caribou herd range is causing adverse impacts to caribou from habitat fragmentation, disturbance and diversion from historical travel routes. These impacts range far beyond the actual footprint of development. In order to mitigate these impacts LKDFN recommend that the Developer be required to monitor beyond the Nechalacho mine site footprint for wildlife and especially caribou in order to contribute to the body of knowledge of caribou in relation to mining and to monitor the potential long range impacts of the mine on wildlife (PR#299 p. 4). In addition, LKDFN recommends that

the Developer participate in any regional cumulative effects framework that comes into effect through the life of the mine (PR#284 p. 7).

LKDFN express concern in their closing comments that commitments made by past developers have not been adhered to. In other cases the commitments are unenforceable without an associated measure. LKDFN therefore encourages the Review Board to ensure that company commitments are upheld through a measure worded as, "that Avalon be required to achieve the commitments made throughout the regulatory process, with failure to meet commitments being treated as a failure to comply with conditions of approval of the project." (PR#299 p. 5)

In its technical report, the GNWT suggest that cumulative effects on many wildlife species may best be measured through regional-scale monitoring programs. Given the fragile state of the barren ground caribou, and the current levels of disturbance measured in the boreal caribou range, a federally-listed species at risk, the GNWT recommends that the Developer participate in species-specific cumulative effects workshops with governments, developers, co-managements authorities and other interested parties in an effort to develop regional-scale monitoring programs (PR#225, p. 9).

In its technical report, Akaitcho IMA Office (Akaitcho) expressed concern about the existing and cumulative effects of existing mines on the declining Bathurst caribou herd. The Akaitcho are concerned about having been forced to limit harvesting rights while exploration and development programs continue to proceed without constraint. In addition to the existing harvesting restrictions, the Akaitcho fear that this Project will result in the removal of part of the traditional range from caribou use. In response to these concerns, the Akaitcho recommend that the Review Board require, through imposition of measures, that the GNWT and Government of Canada work together with developers to develop and implement a meaningful strategy for the monitoring and management of cumulative effects, particularly related to caribou and that the Developer contribute to the development and implementation of any such regional cumulative effects framework that may be established during the life of the Project (PR#224).

In closing comments, LKDFN and YKDFN state that they believe the Developer should be required to work with government, aboriginal groups and industry to better understand cumulative effects and how it relates to management decisions so that industrial development and caribou conservation can be better balanced (PR#299 p. 5 and PR#306 p. 5).

The NSMA is concerned that the cumulative impacts from this Project and other mineral exploration and development may limit their opportunities to continue

harvest barren ground caribou. Specific impacts to caribou include incremental loss of habitat, increased stress and change in migration patterns. During the public hearing in Yellowknife on February 19, 2013 (PR#273), NSMA presented maps showing hunting patterns overlapping the Nechalacho mine site. NSMA state in closing comments, with reference to their *Thor Lake Traditional Land Use, Occupancy and Knowledge Report* (PR#231 p. 15-16) that they have harvested barren ground caribou around the Nechalacho mine site for over 200 years and that they need assurance that harvesting of caribou will continue for future generations. To address this concern NSMA recommend that the Developer form a caribou working group to prepare a response framework for managing and mitigating cumulative impacts from the Nechalacho Project and other projects on the Bathurst caribou herds range. In addition, NSMA request the Developer to prepare a WEMP and incorporate Metis traditional knowledge in both the WEMP and the response framework (PR#303 p. 3).

7.3.5 Monitoring and management

During the technical session, Environment Canada expressed some concern about monitoring the tailings management facility during early operations. The Developer does not intend to dewater the small lakes that are currently within the TMF footprint. Instead, it proposed to displace the water as tailings are being deposited. Environment Canada expressed concern about the possibility of wildlife using the lakes as the tailings are being deposited. In response, the Developer expressed its intensions to have the TMF inspected daily to ensure the stability of the infrastructure and to report on any wildlife sightings (PR#182, p. 41).

The GNWT followed up on Environment Canada's question to identify if the Developer had any intentions to prevent wildlife access to standing water in the TMF and polishing ponds. In response, the Developer indicated that it believed daily monitoring will in itself help mitigate wildlife intrusion and that previous surveys have shown that wildlife rarely use the area (PR#182, p. 43).

The Akaitcho IMA Office also expressed its concerns about wildlife, especially birds and ducks, entering the tailings management facility. The Akaitcho were not satisfied that daily monitoring would be enough to mitigate access to standing water and tailings stored within the facility. In response, the Developer committed to investigating methods of deterring wildlife, especially birds, if it is deemed necessary to do so (PR#182. p. 61).

The Akaitcho IMA Office asked the Developer about how it collected and incorporated traditional knowledge into its monitoring programs. The Developer responded by

identifying the Traditional Knowledge Studies it had completed with the Lutsel K'e Dene, the Deninu Kue, and the Yellowknives Dene. The Developer explained that information from the traditional knowledge studies was used in the preparation of the DAR and factored into some of the considerations built into the waste management plan (PR#182, p. 60). The idea behind the Traditional Knowledge Studies was to gather all knowledge from around the local region of the two Project sites. The information was used in developing Project and monitoring design details. On August 23, 2012, the Developer submitted a conformity table to the Review Board to highlight areas where traditional knowledge was used in the development of the DAR (PR#197).

The Lutsel K'e Dene First Nation (LKDFN) reiterated the importance of wildlife protection to First Nations and concerns about the nature and risks of the Project as argument to support its request for the establishment of an independent monitoring agency (PR#182, p. 76-82).

The YKDFN state in closing comments that they have witnessed a dramatic decline in caribou herd populations. YKDFN believe that the Developer should be required to prepare and implement a WEMP because it is industry best practice for industrial sites in the NWT (PR#306 p. 6).

In general, the parties also recognize the value of the commitments made by the Developer during the course of the EA and recommend that the Review Board include all of the commitments made by the Developer, including the development and implementation of management plans as a measure in the report of environmental assessment (PR#219, p. 32).

In its technical report, Transport Canada reiterated requirements under the Canadian Aviation Regulations for the Developer to develop Wildlife Management and Emergency Response Plans in order to obtain proper certification to operate the Project airstrip (PR#221, p. 11).

In its technical reports, the GNWT acknowledged commitments made by the Developer to mitigate impacts on wildlife through the development of waste management plans, human safety plans, and a Wildlife Effects Monitoring and Management Plan for the Project sites. The Developer has committed to working with the GNWT and other relevant parties in the development of the Project WWHPPP, with the goal of producing a mutually agreed upon final plan 90 days prior to the Project construction phase (PR#188 p. 18).

The GNWT suggests that the Developer rename the existing conceptual Wildlife Effects Monitoring and Management Plan to the Wildlife and Wildlife Habitat

Protection Plan so as to contribute to the establishment of a "common language in the development of industry-wide best practices and guidelines as it clearly separates Project-site-specific mitigations, employee and contractor policy and procedures, and monitoring/reporting from a wildlife follow-up program that tests predictions." The GNWT argue that the contents of a Wildlife and Wildlife Habitat Protection Plan would be within the authority of the Mackenzie Valley Land and Water Review Board under section 26(1)(*h*) of the *Mackenzie Valley Land Use Regulations* and that the Developer should apply the general WWHPP definition found in section 5.1.1 of its technical report through continued collaboration with the GNWT, affected Aboriginal organizations, co-management authorities and any other affected parties in the development and ongoing review of this plan throughout the life of the Project. Likewise, the GNWT provided a general definition for the WEMP in section 5.1.2 of its technical report and recommended that the Developer reference these in the collaborative development of an updated Wildlife Effects Monitoring Program.

Prior to the public hearings on February 4, 2013, the GNWT submitted a summary of a meeting between the Developer and GNWT that provides new or revised commitments regarding the Wildlife and Wildlife Habitat Protection Plan (WWHPP) and Wildlife Effects Monitoring Program (WEMP). Specifically the commitments state that (PR#281):

- *Avalon commits to GNWT Technical Report Recommendation #4 in renaming its Wildlife Effects Monitoring and Management Plan to a Wildlife and Wildlife Habitat Protection Plan.*
- *Avalon acknowledges GNWT request for a Wildlife Effects Monitoring Program (WEMP) and commits to continued discussions with the GNWT about continued discussion with the GNWT about wildlife monitoring. Avalon…would include collaborating with the GNWT, affected aboriginal organizations, co-management authorities and any other affected parties in the development and on-going review of a possible WEMP*.

In its final written submission, GNWT provides guidelines intended to assist the Developer in the preparation of the WWHPP and a WEMP. The guidelines briefly describe the purpose of the plan and program and distinguish between the two as follows:

WWHPP

- outlines the steps necessary to protect personnel, wildlife and wildlife habitat around the Project footprint;
- documents day-to-day standard operating procedures including mitigations, reporting and best practices for the Project site;

- includes measures for compliance monitoring and reporting, environmental monitoring and reporting; and
- ensures human safety by reducing potential for interaction between people and wildlife and reduces or prevents any direct impacts to wildlife from the Project footprint.

WEMP

- monitors wildlife at the local and regional scale for the life of the Project;
- tests the effectiveness of the Developer's impact predictions on wildlife including mitigation techniques for the life of the Project;
- does not include mitigation measures;
- results support adaptive management approaches , if needed and contribute to cumulative effects assessment, if appropriate; and
- developed such that monitoring and mitigation techniques can be revisited and revised pending new information (ie. using an adaptive management framework). (PR#302 p. 14-15)

GNWT describes a project-specific response framework for the monitoring, management and mitigation of impacts from the Project on wildlife and wildlife habitat. The linkage of the Developer's WWHPP and WEMP are presented and show how adaptive management allows for monitoring in both the WWHPP and WEMP that can result in changes to mitigation measures in the WWHPP that reduce adverse impacts from the Project on wildlife.

In its final submission GNWT notes that the conceptual WWHPP prepared by the Developer does not satisfy GNWT requirements, particularly as they relate to caribou, moose and species at risk and that continued development of the WWHPP is required to resolve wildlife and habitat issues. The GNWT notes that the Developers' commitments table dated August 23 2012 states that:

> *Avalon commits to working with ENR and other relevant parties in the development of the Wildlife Effects Monitoring and Management Plan (WEMMP) with the goal of an endorsed, final Plan in place 90 days prior to construction proceeding at the Nechalacho Mine and Hydrometallurgical Plant site area.* (PR#302 p. 2 and PR#188 p. 18)

Notably, this same commitment is repeated in the Developer`s updated commitments table of March 12, 2013 with the exception that "final Plan" is changed to "initial Plan" (PR#297 p. 18 and PR#188 p. 18). The Developer provides no rationale for this change in wording from a "final Plan to an "initial Plan". The GNWT references the version of the commitment that requires a

"final Plan" in the August 23, 2012 commitments table. Based on the August 23, 2012 version of this commitment, GNWT expects that the Developer can produce a WWHPP consistent with GNWT guidelines so that outstanding concerns can be addressed (PR#302 p. 2).

With respect to the WEMP, GNWT advises that while the Developer is willing to continue discussions with GNWT regarding wildlife monitoring, they did not commit to developing a WEMP for the Project. In the GNWT's view, wildlife monitoring is a standard practice for all projects of this scale and is required for the Project. The WEMP is required as a proactive measure so that the effectiveness of mitigation of impacts from the Project on wildlife can be tested and if unacceptable impacts exist they can be addressed through adaptive management. The lack of a commitment from the Developer on the preparation of a WEMP is an outstanding concern for the GNWT. To address this concern, the GNWT recommends that "Avalon develop a WEMP as a follow-up program for the Project." (PR#302 p. 3)

With respect to cumulative effects on wildlife, the GNWT advises the Review Board in its final submission that a project level WEMP can contribute to cumulative effects assessment, monitoring and management. Since a WEMP tests the predictions of adverse impacts from the Project on wildlife and tests the mitigation predictions, it can contribute to cumulative effects assessment if standard monitoring protocols are followed. In the case of barren ground caribou, information from multiple programs such as traditional knowledge research, long-term studies on caribou distribution patterns and project WEMPs feed into large scale monitoring, assessment and management programs for caribou. The GNWT state that cumulative effects management needs to be addressed collaboratively and requires agreement on the competing values of the landscape, its ecological components and the limits of acceptable change. The GNWT acknowledges that cumulative effects monitoring of barren-ground caribou, for example, remains a work in progress, but that multi-party contributions including information from WEMPs provide important information to track population scale trends (PR#302 p. 4-5).

The final submission from the GNWT outlines a current conception of a Cumulative Effects Response Framework for cumulative effects monitoring, assessment and management. In order to address cumulative effects at the project scale, the framework indicates that cumulative effects management can result in changes to project-level monitoring (e.g. through the WEMP) and mitigation (e.g. through the WWHPP) by emphasizing the use of best practices. In this way an individual developer, such as Avalon, can reduce its own project's contribution to cumulative

effects on wildlife and wildlife habitat (PR#302 p. 5-7). The GNWT's conception of a Cumulative Effects Response Framework for the monitoring, assessment and management of cumulative effects is described in detail its final submission (PR#302).

GNWT notes in its final submission, that the management of cumulative effects requires agreement between multiple parties on landscape values, the various ecological components and a collaborative view on the limits of acceptable change. In the GNWT's view, cumulative effects assessment must be conducted in a collaborative way at a scale appropriate to the species or region of interest. Management of cumulative effects is a shared responsibility with many contributors. The GNWT states that they have agreed to take a lead role in facilitating this work, but that monitoring, cumulative effects assessment and cumulative effects management is a multiparty process.

7.4 Board analysis and recommendations

The Review Board has considered all information available on the public registry in its analysis of the evidence and its deliberations on the potential impacts to wildlife and wildlife habitat as a result of the Project.

The Review Board acknowledges that Boreal caribou are a species at risk listed as threatened under the SARA. The Review Board observes, however, that there will be no likely impacts to boreal caribou from the Nechalacho mine site on the north side of the lake because boreal caribou do not occur there. In addition, the majority of disturbance for the Hydrometallurgical plan site will occur at the former Pine Point mine site, which is previously disturbed (a brownfield site) and is devoid of vegetation. There will be no new disturbance to wildlife habitat from construction of the Hydrometallurgical facility and negligible additional habitat disturbance to boreal caribou habitat from widening of the existing access road to Great Slave Lake. The Review Board notes that in the Developer's updated commitments table that its mitigation and monitoring for species at risk will be consistent with recovery strategies and action or management plans for that particular species. The Review Board is aware that one such recovery strategy relevant to this project at Pine Point is the National Recovery Strategy for Woodland Caribou, Boreal Population. The Review Board finds that the Developer's commitments to mitigate impacts to boreal caribou will result in no significant adverse impacts to boreal caribou.

The Review Board acknowledges commitments made by the Developer to reduce impacts to species at risk including birds and other wildlife listed in Table 6. The Review Board finds that the Developer's commitments to mitigate adverse impacts to

the species at risk listed in Table 6 will result in no significant impacts to these wildlife species.

The Review Board considered the impacts of the Project on species at risk and in accordance with s. 79 of the *Species and Risk Act* concludes that there will be no significant impacts on species at risk.

The Review Board notes that the Nechalacho mine site is on the southern edge of the winter range of the Bathurst caribou herd. Road access to the Nechalacho mine site is limited to a 10 km road from the Great Slave Lake barge landing site to the Nechalacho mine site. There is no winter or all season access from an existing NWT highway network to the Nechalacho mine site and none planned. The scope of development for this Project does not include the construction of any type of access from the Nechalacho mine site to the existing NWT highway network. The Review Board understands from NWT experience that new access often results in increased hunting pressure in new areas which results in direct mortality of wildlife. The Review Board finds that this lack of road access to Nechalacho mine site will reduce adverse impacts from the Project to the Bathurst caribou and other wildlife from hunting.

Evidence on the public record indicates that the Developer has not committed to the development of a WEMP. The Review Board is concerned that without both the WWHPP and WEMP in place for the Project, monitoring to determine whether wildlife impact predictions are accurate or not will not be undertaken. For monitoring to be effective in a regional context for wildlife such as caribou, the project monitoring needs to be conducted consistently by developers so that information collected at one site can be combined with information collected at other sites. This assists in understanding the accuracy of impact predictions and the effectiveness of mitigation by comparing experiences at comparable developments (ie. mining projects) A WWHPP and WEMP developed in accordance with GNWT guidelines would help with consistency and assist in making monitoring meaningful geographically and temporally.

In addition, management actions by the Developer that could reduce adverse impacts may be missed or ignored without adequate monitoring. The submissions from the GNWT clearly describe the requirements for both a WWHPP and a WEMP in order to reduce adverse impacts from the Project on wildlife and wildlife habitat. This is done by linking information collected through monitoring in the WEMP with mitigation including best practices outlined in the WWHPP. Given the current low numbers of the Bathurst caribou herd in particular, the Review Board agrees with GNWT that

both of these plans are necessary to reduce impacts and track the Developer predictions on impacts to caribou and other wildlife through monitoring.

The Review Board understands that the WWHPP and WEMP are linked with the former protecting wildlife through mitigation and best practices at the project site and the latter encompassing monitoring at both the local and regional scales. The WWHPP contains specific mitigation to reduce impacts to caribou and other wildlife at the project site while the WEMP tests the predictions made by the Developer on impacts to caribou and other wildlife from the Project at the regional scale through monitoring. This monitoring is intended to contribute to adaptive management approaches as described by the GNWT in its technical report and final submission. These plans are also important because they will compile commitments made by the Developer to mitigate adverse impacts from both project sites on species at risk.

The Review Board anticipates that the GNWT will work with the Developer to further refine the linkage between the WWHPP and WEMP and its contribution to the management of cumulative effects, particularly on barren-ground caribou. The Review Board appreciates the work GNWT has done to define the WWHPP and WEMP and to describe how monitoring by the Developer can assist with regional scale monitoring and link with the use of best practices in mitigating impacts to wildlife at both project sites.

The Review Board finds that both the WWHPP and WEMP are required for this Project due to the importance of wildlife to aboriginal communities and the current low population of the Bathurst caribou. The Review Board observes that this Project will add to the human activities that are occurring and are proposed within the range of the Bathurst Caribou herd. Considering the current population and apparent vulnerability of the herd, the addition of a mine, even at the periphery of the range, in combination with impacts from other activities, is likely to cause significant adverse cumulative impacts. Since the Bathurst herd has a large annual range, preparation and implementation of monitoring within a WWHPP and WEMP by the Developer needs to be consistent with monitoring at other project sites in the NWT. This can only be done with oversight on the development of the plans by GNWT which is responsible for wildlife management.

The Review Board finds that significant adverse cumulative impacts from the Project to wildlife and wildlife habitat, in particular caribou are likely. The Developer has not committed to recommendations made by the GNWT, the regulatory authority for wildlife in the NWT, intended to reduce cumulative impacts to caribou. In order to reduce impacts from the Project on wildlife so that they are no longer significant, the Review Board requires the following measures:

Measure #3

To reduce or prevent significant adverse impacts to wildlife and wildlife habitat from Project activities, and to inform adaptive management through active monitoring, the Review Board requires the timely and collaborative development of a Wildlife and Wildlife Habitat Protection Plan prior to construction by the Developer.

At a minimum this plan is to include:

- both traditional and scientific knowledge;
- an adaptive management approach designed to assess how well mitigation measures perform and support the adoption of new mitigation, if necessary;
- best practices for mitigation and monitoring;
- the development of clear protocols and standard operating procedures for Project employees and contractors to ensure the implementation of site-specific mitigation; and
- instructions and training to mine staff to reduce the potential for interactions between people and wildlife.

Measure #4

To reduce or prevent significant adverse impacts on wildlife and wildlife habitat, in particular barren ground caribou, from project activities and to inform adaptive management of mitigation that will further prevent significant impacts, the Review Board requires the timely and collaborative development of a Wildlife Effects Monitoring Program by the Developer.
Before starting mine construction, the Developer will collaborate with the GNWT to complete and implement a Wildlife Effects Monitoring Program.

At a minimum, this program is to include:

- Both traditional and scientific knowledge;
- An adaptive management approach designed to use monitoring to test impact predictions, assess how well mitigation measures perform, and support the adoption of new mitigation measures, if necessary;
- Best practices for monitoring and mitigation;
- Monitoring to test effect predictions and effectiveness of mitigation related to sensory disturbances, energy costs, the estimated zone of influence through all mine phases;
- Monitoring that involves Aboriginal people in the Project study area;
- Monitoring that can be readily integrated into regional cumulative effects programs; and
- A communications component to ensure Wildlife Effects Monitoring Program results are being reported back to Aboriginal community members on at least an annual basis.

8 Impacts on atmosphere

Air quality and emissions of waste to the atmosphere were identified early in the assessment process as key lines of inquiry based on information gathered from parties during scoping. This was reinforced during the assessment process when the subject was brought up by Aboriginal parties and government departments.

The Terms of Reference required the Developer to:

- describe and quantify dust dispersion and deposition potential and its potential impact on the surrounding environment using an approved air quality model during all phases of the Nechalacho Project;
- potential impacts from project emissions during construction, operation and closure phases:
    a) estimate criteria air contaminant emissions from all project sources including fugitive dust;
    b) provide test results and include the levels of uranium and thorium in fugitive tailings dust, or any other radioactive element from any mineral; and
    c) predict annual carbon emissions over the life of the mine and describe any offsets proposed to mitigate carbon emissions;

- describe proposed mitigations and any plans for air quality monitoring, evaluation and adaptive management.

This section of the report of environmental assessment examines the evidence on the impacts to ambient air quality and also impacts from discharging waste to the atmosphere that are deposited back to the land and water both onsite and offsite.

8.1 Developer's submission

The Project consists of two sites; the Nechalacho mine and flotation plant site and the Hydrometallurgical plant site at Pine Point. The Developer conducted an air quality assessment that included the primary emission sources at both these sites.

These emissions may contain many compounds; the ones that make up the largest portion are called criteria air quality contaminants (CACs) which include:

- nitrogen oxides ($N0_X$);
- sulphur oxides (SO_X);
- carbon monoxide (CO);
- total suspended particulate (TSP);
- particulate matter (PM 2.5); and
- dust fall.

These atmospheric emissions can affect air quality and cause adverse impacts to water quality, soil and sediment quality, wildlife, fish, vegetation, visibility, odour perception and human health. These impacts are described in the DAR (PR#76, p. 903, 836, 754, 637).

Nechalacho mine site

At the Nechalacho mine site the sources of emissions are primarily from the burning of fossil fuels, dust, and the incineration of waste. The majority of these sources are point sources which mean the emissions come from the end of a stack.

The major emission sources are (PR#76, p. 644):

- The mine ventilation raises provide ventilation to the underground mine by allowing contaminated mine air to escape. It is predicted that this exhaust will contain NO_2, SO_2, CO and TSP.
- The mine air heater is required to provide warm air to the underground mine. The heater operates when air temperatures fall below zero degree C. The heater will emit NO_2, SO_2, CO, TSP, and PM 2.5.
- Six 1.5 megawatt diesel generators are proposed for the mine site to meet an 8.4 MW continuous demand. The primary emissions are NO_2, SO_2, CO, TSP, and PM 2.5.
- Two transfer and handling points for dry and wet ore. The main emission is dust measured as TSP and PM 2.5.
- The use of ammonium nitrate fuel-oil explosives are expected to produce C0.
- Vehicles will produce greenhouse gases and CACs.
- Roads may produce fugitive dust emissions.
- Incineration of waste produces CACs and potentially other emissions such as dioxins and furans.

Hydrometallurgical plan site

At the Hydrometallurgical plant site the primary emitters are related to the processing of the rare earth element concentrate and include:

- Sulphur acid bake plant which is expected to be large source of $S0_2$. The sulphur acid plant produces sulphuric acid which is required in the further processing of the concentrate. This process is predicted to release $S0_2$ which can potentially lead to acid rain. To mitigate the release the Developer proposes to use a double contact double absorption process that will convert 99.8% of the SO_2 to SO_3 (PR#147, p. 71).

- Product dryers produce CACs and dust.
- Backup diesel generator produces CACs and GHG. This generator is used as a backup.
- Limestone stockpile will produce fugitive dust emissions.
- Roads may produce fugitive dust emissions.
- Incineration of waste produces CACs and potentially other emissions such as dioxins and furans.

8.1.1 Developers prediction

The Developer initially modelled the impacts to ambient air quality from major project related sources in a 20 km by 20 km area centred on both sites. These models predict that there will not be any long term exceedances of the ambient air quality guidelines outside of the site boundaries (PR#76, p. 761).

The Developer states in its DAR that: "Construction of the mine, flotation plant and Hydrometallurgical Plant is expected to result in localized, short-term, periodic, low magnitude and rapidly reversible increases in ambient concentrations of CACs" (PR#76, p. 667).

The Developer further states that:

> *During the longer term operations phase of the Thor Lake Project the maximum CAC concentrations due to emissions from the major sources at the Nechalacho Mine, the Flotation Plant and the Hydrometallurgical Plant are predicted to be lower than the corresponding NWT AQ Standards. In addition, the maximum predicted dustfall levels are less than criteria of other Canadian jurisdictions*. (PR#76, p. 668)

The GNWT expressed concern that the models did not contain receptors within the "fence line" of the mine site and the Hydrometallurgical site, in other words the Developer did not model air quality within the site boundaries. The Developer stated that at the mine site and plant site that a different set of standards apply, the occupational health and safety standards. Regardless, the GNWT requested that the Developer add receptors inside the facility boundaries (PR#131). The Developer did as requested and the updated the models indicate that there may be short term exceedances of the ambient air quality guidelines (PR#147, p. 50).

The GNWT and Environment Canada expressed further concerns that the models did not include many other sources of emissions. The Developer updated the models to include all sources of emissions and found that local exceedances of SO_2 at the mine

site may occur. The Developer committed to additional mitigations that are discussed next.

8.2 Parties' submission

During the assessment the GNWT and Environment Canada, through information requests and questioning at the technical hearings and public hearings, reached an agreement with the Developer on many issues that were addressed through developer commitments. These commitments include:

- The Developer minimizing dust emissions at both sites,
  Avalon is committed to minimizing dust emissions through the diligent application of appropriate dust suppression strategies (in particular water spray) both above and below ground, as per the GWNT dust suppression guidelines. (PR#147, p. 62)

- Monitoring SO_2 and TSP,
  Avalon commits to continuous monitoring of sulphur dioxide for one year within the fence line at the Thor Lake mine site and Hydrometallurgical Plant site. (PR#216 p. 2)

- Preparing an air quality monitoring and management plan (AQMMP),
  Avalon commits to developing an Air Quality Monitoring and Management Plan in consultation with ENR and Environment Canada, including but not limited to stack testing and SO_2 and TSP monitoring. (PR#216 p. 2)

    - Related to the above commitment is the Developer's commitment to stack test the larger sources of emissions including diesel generators and the sulphur acid plant. This is done in order to ensure that the device is working properly and the amount, type, and concentration of waste emitted are as predicted (PR#279).

- An Incineration Management Plan (IMP),
  Avalon commits to consulting with Environment Canada and GNWT/ENR to develop and implement an Incineration Management Plan that incorporates the information in the Environment Canada technical document on Batch Waste Incineration Management. (PR#216 p. 2)

  And,

…to developing an incineration management plan that will outline operating procedures to minimize emissions. This includes:

- *selecting an appropriate incinerator for the load size;*
- *following the manufacturer's installation and operation guidelines;*
- *source separation of waste and mixing waste for optimal incineration; and*
- *monitoring operations (record-keeping, training, and maintenance log).* (PR#227 p. 2)

And,

Avalon is pleased to commit to the preparation and implementation of an incineration management plan that incorporates the guidance provided in the Environment Canada Technical Document for Batch Waste Incineration.

Avalon will specify the requirement for an incineration management plan in the bid documents that will be provided to potential incinerator suppliers for the Nechalacho Mine and Flotation Plant site. Avalon will follow the manufacturer's specifications for the installation, commissioning, operation and maintenance of the incinerator. Avalon's incinerator operators will be trained by the equipment manufacturer. All manufacturer specifications will be followed including installation, batch size, temperature, maintenance, and record keeping. (PR#152, p. 14)

8.3 Board analysis and recommendations

The Review Board finds that Project related emissions from both sites do not pose a risk of significant adverse impacts to air quality provided the developer's commitments are implemented. The Review Board recognizes the Developer's commitments for an air quality management plan, additional monitoring, minimizing dust emissions, stack testing, and an incineration management plan and a commitment to work with EC and GNWT on these plans.

9 Impacts on Blachford Lodge

The Project is located approximately 7 km by air south/southeast of the Blachford Lake Lodge (the Lodge) wilderness tourism destination (see Figure 12). The Terms of Reference for the Project requested that the Developer describe existing noise, light and viewshed conditions at the Project site with particular reference to ongoing operation of the existing Lodge.

This section describes the Developer's impact assessment and mitigation proposed to address potentially adverse impacts from the Project on the Lodge, presents the views of Mr. Freeland (the Lodge owner) on impacts from the Project on his tourism business and concludes with the Review Board's analysis and recommendations.

9.1 Developers' submission

In its DAR, the Developer describes baseline viewshed, noise and light conditions, predicts impacts from the construction and operations of the Project on the Lodge and presents mitigation to minimize adverse impacts from viewshed, noise and light impacts (PR#76 p. 820-823).

Viewshed

With respect to viewshed, the facilities at Nechalacho mine site are between 6.5 km to 8 km from the Lodge and undulating shield terrain and forest cover exist between the two locations (Figure 12). The existing 50 m lighted wind tower is currently the tallest structure at Nechalacho mine site. It cannot be seen from the Lodge. During the construction phase of the mine, the tallest construction equipment would be considerably shorter than 50 m and any new infrastructure during operations will be less than 20 m high. As a result, the Developer states that none of the proposed Nechalacho mine site infrastructure during mine construction or operations will be visible from the Lodge (PR#76 p. 820-821).

Noise

The proposed Nechalacho mine site is located in a remote area and background noise is low. Current human made sounds from periodic mineral exploration activities at Nechalacho mine site are intermittent and sourced from exploration drilling activities, vehicle movements, the camp generator and fixed-wing flights at the airstrip (PR#76 p. 822). In response to questioning during the public hearing on February 18, 2013, Mike Freeland on behalf of the Lodge stated that noise from the exploration activities at the Nechalacho mine site can be heard at the Lodge from 5-7 to possibly 10 days per month depending on wind direction and the extent of exploration activity (PR#286 p. 277-278).

During the mine construction phase, noise levels are expected to be considerably greater and last for longer periods of time. The mine construction phase occurs over 2 years and during that time noise sources include site preparation and infrastructure construction, blasting, excavation, earth moving and building construction (P#76 p. 822).

During mine operations, noise levels from Nechalacho are expected to be lower than the construction phase because mining will take place underground and the process plant, camp and power plant will be in insulated buildings. Noise from vehicle activity including hauling concentrate containers to the dock site, barging activities and air traffic in and out of the airstrip will contribute to noise impacts from the Project. The Developer states that noise impacts from the Nechalacho mine site and associated infrastructure are predicted to be typically less than 40 decibels at a distance of 1.5 km from the site (PR#76 p. 822).

The Developer reports in its DAR that sound level predictions and modelling for the Snap Lake mine were considered relevant and applicable in anticipating noise impacts from the Project. For comparison, the Developer states that the Snap Lake Project, which is also an underground mine, predicted less than 40 decibels of sound at 1.5 km from the mine. This is the sound level equivalent of the level of continuous background noise that would occur in a small town residential area. Due to the natural attenuation of sound with distance, continuous noise from the Snap Lake site was predicted to be close to or less than ambient sound levels at a distance of about 6 km from the site. The noise producing activities at the Nechalacho mine site are expected to be similar to those at the Snap Lake mine and are used for comparative purposes (PR#76 p. 664-665).

At the Nechalacho mine site, noise is expected to be variable during the two-year construction phase and 20-year mine operations phase. At mine closure, noise will return to ambient conditions. In the DAR, the Developer states that the overall consequences of noise from the Project and associated activities are predicted to be low and residual impacts to the local study area and regional study area are expected to be negligible (PR#76 p. 665).

The Developer states in its DAR that it is,

> *…committed to ensuring that all reasonable measures will be taken to minimize noise levels associated with its operations and will work closely with Blachford Lake Lodge to ensure the wilderness experience enjoyed by their guests will be maintained*. (PR#76 p. 822)

During the February 18, 2013 public hearing, the Developer noted that in an effort to reduce and mitigate noise impacts from the Project, the crushing of mine rock would take place underground. The Developer states,

> *We have removed our noisiest operations, that being the crushing, and put that underground in an effort to be -- to reduce the noise. And all of our other equipment will be placed within solid and insulated structures that will dramatically reduce the sources of noise from the site.* (PR#286, p. 81)

Light conditions

In the DAR, the Developer briefly describes light conditions from the Project during the construction and operations phases of the Project. The Developer states that the existing exploration camp emits considerable light from surface exploration drilling rigs and the tent camp. During the two- year mine construction phase, light levels will be somewhat higher than current levels but will return to current exploration camp levels during mine operations because all mining activities will be underground and the process plant and camp will be inside solid structures (PR#76 p. 823).

The Developer acknowledges the fact that tourists come to the Lodge to have a remote, wilderness experience and that the Lodge would like to have this preserved. In particular, the Developer understands that the Lodge and its guests want to continue to experience northern lights viewing during the winter months. The Developer states in its DAR that it is,

> *…committed to managing light emissions from its future operations to ensure that the opportunity to enjoy the wilderness experience and night-time viewing of the Aurora Borealis is maintained.* (PR#76 p. 823)

During the February 18, 2013 public hearings, the Developer described mitigation it would implement in order to reduce impacts from light pollution. The Developer would design outside lights to be of as low intensity as possible, while still remaining safe. In addition, lighting would be directed at the ground in an effort to limit the amount of light escaping from the mine site (PR#76 p. 81-82).

During the public hearing on February 18, 2013, the Developer advised the Review Board that,

> *…a lot of our activities are going to be underground, and -- and the rest of them will be inside process plant buildings, such that we will minimize the amount of light that escapes to the natural environment. We will design our lights that, where they are needed outside, to be of as low an intensity as*

possible, while still remaining safe, and direct that light to the ground in an effort to minimize any light escaping from the site. (PR#286, p. 81)

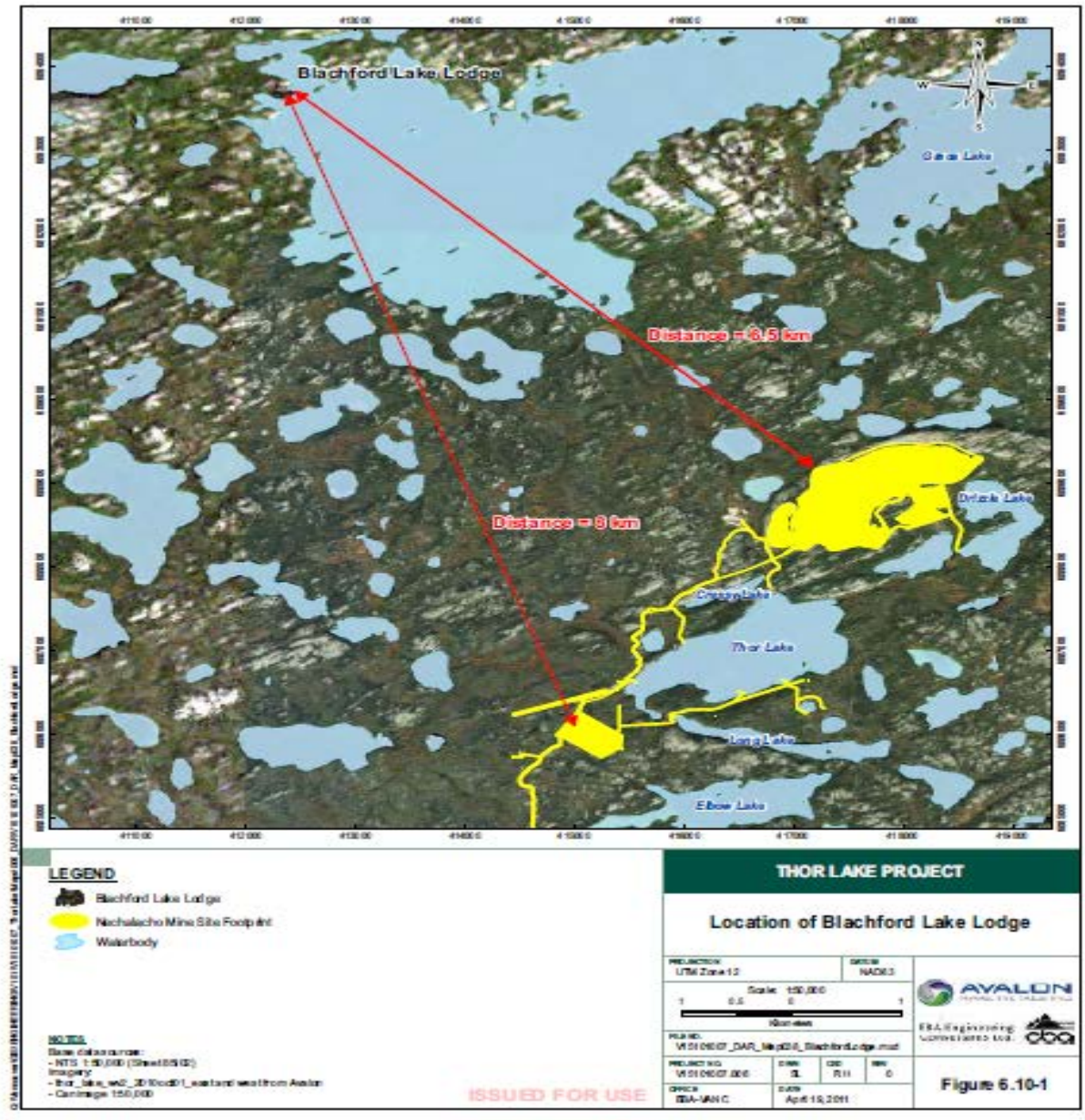

Figure 12: Location of Blachford Lodge and Nechalacho Project (PR#76 p. 821)

9.2 Parties' submissions

During the public hearings on February 18, 2013, Mr. Freeland of Blachford Lake Lodge presented the history of the Lodge to the Review Board and described potential impacts from the Project on this wilderness tourism business. The Lodge is a multi-seasonal fly-in only resort that has been in business for over 30 years. It is an internationally recognized destination for viewing the aurora borealis, or northern lights, and targets primarily "high end" clients from Europe and Asia specifically for aurora viewing (PR#277 p. 1-20). In response to questioning during the public hearing Mr. Freeland stated that aurora borealis viewing accounts for approximately 60 % of its total business (PR#286 p. 288). The Lodge hosts the Dechinta University program and also caters to the local snowmobiling market and hosts conferences and meetings (PR#286 p. 260, 289-90).

The Lodge has a federal land lease for the site of its cabin and buildings at Blachford Lake as well as a Tourism Licence that specifically lists Blachford Lake, Grace Lake, Long Lake, and Magrim Lake as lakes that the business can operate on. The Lodge itself is 7 km by air from the Nechalacho mine site and the shores of Blachford Lake and Grace Lake are 3 km from the proposed mine site (PR#287 p. 51, PR#277 p. 20).

The Lodge offers clean water from the lake that people can drink and clean air as well as peace and quiet in a wilderness setting. According to Mr. Freeland, the Lodge is a sustainable operation that can operate over the long-term (PR#286 p. 259).

In the view of Mr. Freeland, a wilderness resort is not compatible with a mining development. Key impacts it says will result from the proposed construction and operation of the Project on the Blachford Lake wilderness lodge and its clients include:

- impacts to aurora viewing and wilderness experience from light pollution;
- impacts to wilderness experience from noise pollution; and
- impacts to air quality and water quality from release of atmospheric emissions.

On March 3, 2012, the Developer met with Mr. Freeland to discuss potential impacts of the Project on the Lodge and potential synergies between the two operations. As a result of the meeting, the Developer committed to continue dialogue with Mr. Freeland and to review his synergistic proposals (PR#158).

According to Mr. Freeland, the Lodge has already experienced some of these adverse impacts from the exploration phase of the Project. For example, a glow in the sky at night from the exploration camp can be seen at the Lodge which detracts from both the wilderness experience and adversely impacts northern lights viewing (PR#286 p. 262). During questioning at the public hearing, Mr. Freeland confirmed that the glow

from the existing Nechalacho exploration camp can be seen from the Lodge on cloudy days because the light is reflected off the clouds (PR#286 p. 276).

Mr. Freeland stated during the public hearing that he has been in discussions with the Developer regarding the noise and light pollution impacts from the Project on the Lodge, but that solutions for mitigating these impacts have not yet been realized. A meeting report between the Developer representatives and Mr. Freeland was submitted in April 2012 (PR#158). Mr. Freeland acknowledges that unlike the exploration project, the Nechalacho mine will be underground but is still concerned with the potential for substantial noise and light impacts from the mine (PR#286).

Mr. Freeland expressed grave concern about the future of his wilderness tourism business in such close proximity to the propose operating mine. He specifically requests that the Developer address in detail methods to mitigate noise and light impacts (PR#286 p. 263-267). In response to questioning from Review Board counsel during the February 18 public hearings, Mr. Freeland stated that he has been in preliminary discussions with the Developer to try and discuss how the mine and wilderness lodge might co-exist but that challenges exists with this approach because the two types of businesses are "at the opposite ends of the spectrum". Mr. Freeland said he had received negative feedback from guests regarding the glow in the sky from the Nechalacho exploration camp (PR#286 p. 293, 300-301).

During questioning at the public hearings in Yellowknife on February 19, Mr. Freeland asked AANDC how dust pollution from the Project would be monitored at Blachford, Grace, Long and Horseshoe Lakes. AANDC responded by stating that dust suppression techniques or "source control" operational measures would be put in place to reduce dust emissions from the mine site. Since dust emitted into the atmosphere is a pathway to adverse impacts of dusting to water bodies, the Aquatic Effects Monitoring Plan could assist in water monitoring at those lakes to ensure acceptable standards for water are met. While monitoring is the responsibility of the Developer, AANDC stated they would assist in the development of the Aquatic Effects Monitoring Program as a requirement of the Water Licence (PR#287 p. 48-50).

Mr. Freeland stated that they would support and fully cooperate with the Developer, AANDC and YKDFN in any monitoring of air, noise, light and water in lakes connected with their tourism business (Blachford, Grace, Long and Horseshoe) that may be impacted by the Project (PR#287 p. 50, 170).

In its technical report, the GNWT recommend that the Developer continue to work with and develop relationships with all tourist operators in the vicinity of the Project to address the potential impacts from Project-related infrastructure and activity (PR#225, p. 23).

9.3 Board analysis and recommendations

The Review Board acknowledges that both mineral exploration in the vicinity of the Nechalacho mine site and tourism activities at Blachford Lake Lodge have been ongoing in various forms over the last few decades within 7 km of each other.

The record shows that the Developer has responded to the concerns raised by Mr. Freeland and that the Developer has made a number of commitments to mitigate the potential impacts identified by him. These actions include installing directional lighting to minimize the glow from the proposed mine and placing crushing activities underground to limit noise impacts. In the Review Board's view there are further opportunities for the Developer and Mr. Freeland to collaborate in order to address the impacts of the mine's development, operation and closure and the Review Board encourages such collaboration.

Mr. Freeland's evidence did not include any specific indication of potential economic impacts from the mine. The Review Board was simply told that "a wilderness lodge business was not compatible with mining". That may be correct but the Review Board has little additional evidence to support that assertion. At the same time the evidence indicates that sound and light pollution affecting the Lodge is likely only to be intermittent and of low magnitude. The Developer's commitments may further mitigate these effects.

The Review Board finds that the potential adverse impacts of noise and light from the Project on the Blachford Lake Lodge are not likely to be significant provided the Developer implements its commitments.

10 Social, economic and cultural impacts

This section examines the evidence on the potential impacts and changes to social, economic and cultural conditions and values resulting from development activities associated with the Project. The Project may result in changes to the social, economic and cultural environments of affected communities including:

- Health and well-being;
- Employment, business and training;
- Heritage, culture and traditional use; and
- Monitoring and follow-up.

Regional and local study area

The Developer identified a Local and Regional Study Area for its assessment of impacts on the human environment. The Regional Study Area includes the communities of Yellowknife, N'Dilo, Dettah, Lutsel K'e, Fort Resolution, Hay River, Hay River Reserve, and Fort Smith. These communities have been identified as those most likely to be affected by the Project due to their relative proximity as well as likely contributions to the Project workforce (PR#76, p. 353).

The Local Study Area for its assessment of economic impacts includes the Nechalacho mine site, affecting the communities of Yellowknife, N'Dilo, Dettah and Lutsel K'e and the Hydrometallurgical plant site, affecting the communities of Fort Resolution, Fort Smith, Hay River, and Hay River Reserve (PR#76, p. 841).

10.1 Developer's submissions

Health and Well-being

In its DAR, the Developer identifies and describes potential adverse social and economic impacts from the Project. Key potential adverse social and economic impacts include (PR#76 p. 853-866):

- Population in-migration and pressure on infrastructure and services;
- Increased income and potential mismanagement of income ;
- Increased crime rates and substance abuse; and
- Risk of reduced community wellness.

The Developer predicts that at least 60 individuals or families will move into the North to work on the Project. Because of the availability of housing and other services, it is most likely that these in-migrants will settle into "the more market-based and larger communities" of Yellowknife and Hay River. In an effort to reduce or

prevent out-migration, the Developer plans to provide flights to the Nechalacho mine site from several communities, including Edmonton, Yellowknife, Lutsel K'e, and Hay River. Transportation by bus to the Hydrometallurgical plant site will be provided from Hay River and Fort Resolution (PR#76, p. 855).

In an effort to mitigate the potential adverse impacts associated with increased incomes, the Developer has committed to provide support to employees and their immediate families dealing with personal health or well-being issues, including those related to substance abuse (PR#76 p. 855, 858).

In the interest of mitigating disruption to families and preserving community wellness and participation in traditional activities, the Developer plans to operate on a one-week on/one-week off rotation for the Project. This option will allow employees to spend shorter stretches of time at work while providing sufficient time at home to participate in family, community and traditional activities (PR#76, p. 851, 860).

Employment, business and training

In its DAR, the Developer identifies positive economic impacts from the Project as follows (PR#76 p. 840-853):

- government revenues,
- employment opportunities,
- business opportunities, and
- training.

In its Developer's Assessment Report, the Developer concludes that "[t]he Thor Lake Project will provide broad benefits to the economy in terms of employment and government tax revenues" (PR#76, p. 840). The Developer commissioned G S Gislason and Associates Ltd. to analyze potential economic impacts of the Project. Overall, the Developer anticipates substantial contribution to the NWT GDP, it estimates that total Project expenditures during construction and operation of the mine equal about $4.2 billion with $800 million spent on wages and benefits. The Developer anticipates that the NWT will see approximately $382 million in wages and benefits, $774 million in the GNWT revenues, and $1,229 million in supply purchases (PR#76, p. 843). During construction, the Developer expects that 25% of each purchase dollar will be spent in the North. During operations, it expects that 39% will be spent in the North. The Developer also anticipates significant indirect

benefits through supplier purchasing and induced spending in the NWT (PR#76, p. 844, 852).

The Developer expects to need 216 employees during operations at the Nechalacho mine site, and 69 employees during operations at the Hydrometallurgical plant site (PR#76, p. 845). In total, The Developer expects to create about 470 positions annually in the NWT through direct and indirect employment and induced spending (PR#76, p. 846).

The Developer predicts that about 20% of the direct employees during construction and 30% of the direct employees during operations will be northerners from communities within the Regional Study Area (PR#76, p. 846). During traditional knowledge studies completed by the Developer in 2011 participants were concerned that only low level jobs would be available to community members. As a result, community members emphasized the need for job and skill-specific training.

An analysis of local employment opportunities, employment participation rates, and unemployment rates showed that Aboriginal communities within the Regional Study Area (N'Dilo, Dettah, Lutsel K'e, Fort Resolution and Hay River Reserve) would best benefit from active training and recruitment strategies by the Developer (PR#76, p. 847). Many jobs created by the Project will require specific skill-sets. To address this need locally, the Developer has partnered with the Mine Training Society with funding through the Aboriginal Skills and Employment Partnership and is working with Aurora College to develop training programs tailored to job-specific functions required at the Project. Apprenticeship programs and other on-the-job training opportunities will also be provided to help build and maintain transferrable skillsets over time (PR#76, p. 850).

The work rotation schedule may act as a barrier to some potential employees, especially those responsible for caregiving or those heavily involved in traditional pursuits. The Developer`s preferred rotation schedule is discussed above (PR#76, p. 848). Barriers specific to Aboriginal participation may include the cost of travel from small communities, workforce education and skills, and a broad range of cultural, social, political and economic issues (PR#76, p. 848). Barriers specific to female participation may include childcare responsibilities, lack of family support, workforce education and skills, the perception that trades and industrial occupations are better suited to men, and significant social issues such as physical and sexual abuse, substance abuse and addictions (PR#76, p. 848). Issues related to discrimination and harassment are addressed in the Developer`s Code of Conduct and Ethics Policy (PR#76, p. 850). The need for southern-based or in-migrant workers will remain. The Developer presents this as an opportunity for cross-training and mentorship

between skilled workers and northerners looking to gain further experience in their field (PR#76, p. 858).

The Developer`s preferential northern hiring policy will extend to the support of northern businesses as suppliers as much as practical, but the nature of the Project requires very specialized good and services that may likely have to be supplied by southern or international companies (PR#76, p. 851). In order to maximize business and contracting opportunities in the North, the Developer has committed to (PR#76, p. 852):

- *preparing annual business opportunities forecast to identify foreseeable procurement requirements for mining equipment, operations and maintenance support services;*
- *providing technical support and assistance in accessing sources of commercial capital;*
- *working closely with local Aboriginal organizations and communities;*
- *identifying Project components at all stages of development and operations that should be targeted for the northern business development strategy;*
- *facilitating subcontracting opportunities for northern businesses; and*
- *identifying possible opportunities for joint ventures with Aboriginal and northern businesses*).

The Developer anticipates that significant indirect benefits through supplier purchasing and induced spending in the NWT will also support local businesses, including the support of traditional art and experiences (PR#76, p. 852, 867).

The Developer has committed to treating all key stakeholder groups as fairly as possible in the distribution of benefits such as employment, training, business opportunities, etc. and will continue to implement this approach in consultation with the communities for the life of the Project (PR#76, p. 859).

Culture, heritage and traditional land use

In its DAR, the Developer states that it is currently in negotiation with both the Yellowknives Dene First Nation and the Deninu Kue First Nation to establish Impact-Benefit/Accommodation Agreements. These agreements will be structured to mitigate any adverse effects of the Project, define the benefits to the parties, including

employment, and provide greater certainty with respect to the development of the Project (PR#76, p. 849). The Developer has also identified some best practices for addressing socio-economic issues through analysis of existing agreements and participation in mining forums. Lessons learned that the Developer has incorporated into its Project, plans and policies include:

- early and ongoing dialogue with Aboriginal stakeholders is imperative;
- developing relationships with Aboriginal stakeholders is key;
- recognize traditional knowledge in planning process;
- recognize and respect Aboriginal treaty claims/rights;
- adopt environmentally sound practices;
- provide employees with a healthy and safe work environment;
- provide employees with a high standard of living while away from home;
- involve the public stakeholders when public interest if affected;
- provide opportunities to northern residents first; and
- develop the northern workforce as much as reasonably possible.

In anticipation of eventual mine closure, the Developer has also committed to supporting existing communities and infrastructure in an effort to reduce the impacts of cyclical economic fluctuations and ongoing employee training opportunities should ensure the ongoing opportunity for future employment, if required (PR#76, p. 865).

In its Developer's Assessment Report and Deficiency Response, the Developer provides information on the Project's potential impacts on culture and heritage, including traditional land use activities. Traditional knowledge studies were supported by the Developer for the Yellowknives Dene First Nation, the Deninu Kue First Nation, Fort Resolution Métis Council and Lutsel K'e Dene First Nation. Each resulted in the identification of concerns about the Project's impacts on traditional land use activities and the potential effects of noise, light and changing aesthetics.

YKDFN participants expressed concerns about the loss of use and avoidance of the land in the vicinity of the mine site and worried about the potential impacts of contamination to the water, land, air, fish, and wildlife. Participants expressed their concerns about the cumulative impacts on culture as access to the land for traditional pursuits becomes more constrained while access for non-Aboriginals become increasingly enabled. DKFN and FRMC participants echoed many of the YKDFN concerns. In addition to those brought up by the YKDFN, a participant from the DKFN and FRMC study expressed concern about the restriction of access and use of the area along the Pine Point access road (PR#76, p. 868). LKDFN added the concern about wildlife avoidance around the mine site and the resulting impacts on their ability to hunt and trap around Narrow Island and Francois Bay. To minimize the impacts on

traditional harvesting activities in the vicinity of the Nechalacho mine site the Developer will not restrict the use of any lands beyond the Nechalacho mine site. As stated earlier, the Developer hopes to support employees' continued participation in traditional harvesting activities through its shorter rotation schedules (PR#76, p. 869).

Increased access as a result of the development and use of all-season roads including the Nechalacho mine site roads, Great Slave Lake access road, and Pine Point access road has been identified as a concern for impacts on wildlife and traditional harvesting. In order to ensure safely during operations, the Developer expressed its intentions to have security personnel monitor the Nechalacho mine site and Hydrometallurgical plant site to the docking facilities to ensure that only authorized traffic is using the road in a safe manner as a routine duty within their daily tasks. The Developer has also proposed to establish a security building at the confluence of the road and laydown area at the mine site to control access (PR#92, p. 60, 64).

The impacts of visible and audible changes in the landscape, and its impacts on traditional activities as a result of the Project were also assessed. The Developer predicted minimal visual and audible impacts from the mine site and no effects from the Hydrometallurgical plant site (PR#76, p. 869). In its Deficiency Response, the Developer provided a number of illustrations to show how the shorelines of Great Slave Lake would appear from the near the docks at the mine site and Hydrometallurgical plant sites (Figures 12 and 14). To minimize visual and auditory impacts from Great Slave Lake, the Developer has committed to maintaining the existing tree cover as a buffer area around the dock and laydown areas to the extent possible (PR#92, p. 60-63). The Developer has also committed to compartmentalize drilling activities and limit flights to and from the mine site to ensure noise is kept to a minimum and underground mining activities will limit the mine's contribution of light pollution (PR#76, p. 870).

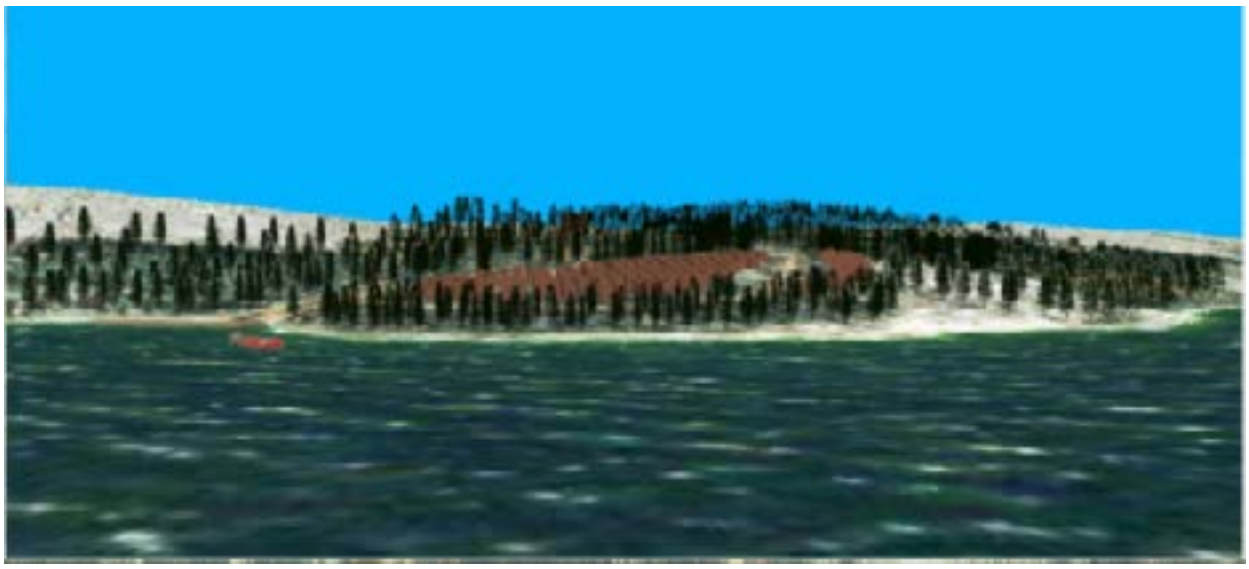

Figure 13: A rendering of the Nechalacho mine site docking facility and concentrate container laydown area as seen looking north from Great Slave Lake might look like. (PR#92, p. 62)

Figure 14: A rendering of the Hydrometallurgical plant site from Great Slave Lake. (PR#92, p. 63)

During the technical meetings in August of 2012, Aboriginal parties requested that the Developer provide information on how traditional knowledge was incorporated

into the design of the Project. The Developer responded to this request as an undertaking (PR#197), stating that it sought traditional knowledge from Aboriginal groups during its preparation of the DAR and that this engagement will continue through the life of the Project, in particular for areas such as wildlife monitoring and closure planning. The undertaking lists specific project design modifications resulting from incorporation of traditional knowledge including (PR#197):

- locating the Nechalacho Tailings Management Facility in an area known to have less wildlife use and over non-fish bearing lakes (Ring and Buck);
- underground mining to reduce surface footprint and locating crusher and other infrastructure underground;
- re-locate Tailings Management outflow from Elbow Lake to Drizzle Lake which results in long route (18 km) prior to eventual discharge to Great Slave Lake;
- Possible access development by winter road from Yellowknife abandoned; and
- careful selection of barge routes and number of barging days based on weather presented by traditional knowledge holders.

An archaeological study of the proposed mine site area was completed in 1988 as part of the Thor Lake Environmental Baseline Survey. Three sites were recorded at that time representing a mix of prehistoric, historic and recent use. The Developer has since carried out additional archaeological impact assessment at the Nechalacho mine site and the Hydrometallurgical plant site. Results of the archaeological investigations were submitted under confidential cover on November 27, 2012 (PR#215). An Archaeological Site Protection Plan will be prepared based on the results to facilitate the continued protection of archaeological resources during mine construction and operations. The vicinity of more significant access routes such as the Francois and Beaulieu River may explain the lack of use identified at the site at that time. The historic presence of the Pine Point Mine at the Hydrometallurgical plant site limits the potential for existing archaeological sites. Participants of the traditional knowledge studies identified culturally significant sites in the vicinity of the Project but not within the Project boundaries itself (PR#76, p. 872-873).

Monitoring and follow-up

The Developer will provide monitoring information on the socio-economic effects of its Project so that the data can be included in the monitoring and analysis done by the GNWT. Monitoring will include the success of training programs, rates of employment and contractors, employee retention, and amount spent on wages and

goods and services. The Developer will confidentially track other human resources information, including the use of compensation/benefits and employee relations. This will provide information regarding the health and wellness of workers and their families (PR#76, p. 874).

Other types of social, economic, and cultural monitoring, including mitigation and adaptive management strategies will also be conducted through ongoing communication and consultation with the potentially impacted communities (PR#76, p. 875).

In its Developer's Assessment Report, the Developer concludes that "[t]he Project offers the opportunity for Aboriginal peoples to have meaningful participation in the wage economy, while also having the work schedule flexibility to accommodate traditional pursuits and activities." (PR#76, p. 840)

10.2 Parties' submissions

Health and Well-being

In the first round of information requests, the North Slave Métis Alliance requested that the Developer provide information about how the existing environment and indicators of well-being of the North Slave Métis community were identified in the Developer's Assessment Report (PR#137, p. 1). In its response, the Developer stated that the indicators of well-being and quality of life that the Developer identified were collected through the NWT Bureau of Statistics and are similar to those used by other project developers (PR#144, p. 1).

In its technical report, the GNWT recommends that the Developer provide clarity on the services that will be offered under the proposed Employee Assistance Plan. The GNWT also recommends that the Developer report on the usage and monitor the effectiveness of its Employee Assistance Program. In support of the Developer`s intentions to encourage a healthy lifestyle, the GNWT requested clarity on how the Developer plans to enforce its alcohol-free/dry-camp policy and recommend that the Developer collaborate with the GNWT to carry out on-site alcohol and drug prevention and awareness services, programs to address alcohol and substance abuse, and provide on-site information regarding the existence of support services available. The GNWT further recommended that the Developer collaborate with the GNWT to define and promote healthy food options and develop a mutually acceptable way to measure the success of providing such options. (PR#225, p. 17-18) In its Updated Commitments Table, the Developer provides specific commitments related to health and wellness issues described by GNWT (PR#297 p. 11).

In an effort to address employment barriers identified by the GNWT as a result of child care needs, the Developer`s primary strategy to address this is to offer shorter rotations at both work sites, including the option for daily commuting to Hay River and Fort Resolution from the Hydrometallurgical plant site. The rotation schedule will allow workers to be home with their children at least every other week, which should reduce reliance on childcare during that period. The GNWT expressed some concern about the ability of Aboriginal or other northern employees to re-locate to Hay River or Fort Resolution to obtain work at the Hydrometallurgical site (PR#131, p. 7). In response, the Developer indicated that it may consider providing transportation and accommodations within the towns during shift rotations, if necessary (PR#147, p. 13). During an August 1, 2012 meeting with the GNWT, the Developer provided some clarity on differing shift schedules between the construction and operation phases of the Project. The Developer indicated that rotations during construction at both sites will be longer than the one-week and daily schedules planned for operations (PR#178, p. 1).

In its first round of information requests, the Lutsel K'e Dene First Nation expressed concerns about the effects of the proposed fly-in-fly-out operation on the economic health of local communities and employment rates of local populations. They requested that The Developer provide details on incentives for the Developer`s employees or contractors' employees to live in the NWT. They also requested that the Developer commit to employing at least 50% NWT resident over the life of the mine (PR#130, p. 2). Though the Developer could not commit to ensuring that 50% of its employees will reside in the NWT over the life of the mine, the Developer did highlight its commitment to the development of a northern workforce, its preference to have employees live within or re-locate to the NWT, and its intentions to encourage southern hires to move north, where most transportation to the Project sites will be available. Specific incentives for relocation and retention were not identified in the Developer`s response, but it did commit to research lessons learned from historic and existing mining operations (PR#143, p. 2).

Business, training and employment

During the first round of information requests, the Government of the Northwest Territories asked the Developer to identify the point at which mitigative actions will be implemented and describe the steps for adaptive management if northern procurement and employment rates prove to be below the expected 39% mark (PR#131, p. 2). The Developer responded that it would meet with the GNWT and Aboriginal partners and committed to help prepare local businesses for contracting opportunities (PR#147, p. 2). The Developer expects that most Project jobs will be

located in the NWT, at the Nechalacho mine site, Hydrometallurgical plant site, and administration offices in Yellowknife and Hay River (PR#147, p. 21).

In further information requests, the GNWT expressed concern about the Developer`s intentions to only spend between 25%-38% of total Project purchases in the NWT. GNWT observed that by comparison, the existing diamond mines spend a cumulative total of 73% of their procurement purchases in the NWT (PR#131, p. 3). In response, the Developer indicated that NWT spending estimates were conservative since it did not include new business start-ups, growth over time, or fuel costs; it did not provide any details on southern purchase requirements other than to indicate that many reagents and specialty processing equipment required for the Project are specialized and not readily available in the North. The Developer has committed to proactively seek out companies with the capacity to deliver goods or services, give first priority to Aboriginal businesses within the impacted area, and use the GNWT business registry as secondary source of business listings through the life of the Project. The Developer has also committed to provide technical support and assistance to NWT businesses through active encouragement and letters of support for obtaining financing and to assist businesses in the establishment of joint ventures, where possible (PR#178, p. 2).

The Developer pointed to its commitments to work with Aboriginal partners to identify supply and service contracts, prequalify northern suppliers, provide web-based information about potential future business opportunities, and support small businesses in the development of required systems and protocols. The Developer implies that some services will not be available in the North and refers to advertising procurement opportunities where “known capacity exists” and “where feasible” (PR#147, p. 4-6).

In its technical report, the GNWT expressed its interest in working with the Developer and the NWT business community to review the goods and services required for the Project, and to help in the building of NWT business capacity in both specialized and non-specialized rare earth industry. In support of these efforts, the GNWT recommends that the Developer provide a list of goods and services required to operate the Project, identify what services (specialized and non-specialized) are required for rare earth production, and provide an NWT-specific Business Development Strategy for the Project. This Strategy should include adaptive management measures, confirm contractor and subcontractor adherence to procurement and hiring priorities, and business development commitments, and detail how this adherence requirement will be implemented (PR#225, p. 21).

In order for the GNWT to determine whether training and employment opportunities and hiring practices for Aboriginal and Northerners in the NWT are being maximized throughout each phase of the Project, the GNWT asked the Developer through a formal information request to provide more specific training and employment information (PR#131, p. 8). In response, the Developer expressed its goals to have its Human Resources Plan for the construction phase completed in 2012 and for operations in 2013. To clarify some points questioned by the GNWT, the Developer emphasized that completion of Grade 12 will be a typical minimum requirement for employment with the Developer. It also provided some insight on training and education programs including possible partnerships with the Mine Training Society, Aboriginal Human Resources Development Council of Canada, Service Canada, and the GNWT. On-the-job training opportunities in health, safety, environment and community were also discussed, including opportunities for local and regional training facilities to assist in its provision.

The Developer has also committed to support employee participation in external training programs for some higher skilled job categories. The Developer plans to continue to communicate with its Aboriginal partners to address barriers to employment and enhance workplace readiness through its strategic recruitment plan which will include advertising and physical recruitment drives, focussed training programs, and local business support. Transportation to the Project sites from a number of communities is also expected to maximize northern access to the mine and participation in employment (PR#147, p. 15-17).

In response to questions from the YKDFN during the technical sessions, the Developer provided more information about opportunities through the Aboriginal skills and employment partnership funding. Prior to mine construction, funding will be used to support pre-construction training activities. During construction, there will be more opportunities to obtain on-the-job training. During operations, the Developer will have apprenticeship programs available for both skilled and non-skilled employees (PR#183, p. 57). The YKDFN expressed their concerns about the lack of First Nation representation in skilled employment positions at the existing mines and their interest in working with the Developer to improve the skills of Aboriginal people through training and employment programs (PR#183, p. 58).

The GNWT also recommended that the Developer provide further details and/or clarify recruitment, hiring and training processes and initiatives used to fill apprenticeship and technical occupations. The GNWT recommend that the Developer complete the anticipated Human Resources Management Plan, detailed job

descriptions and Strategic Recruitment Plan so that methods of hiring; training funding, partnerships and delivery; maximization of northern employment; and support, promotion, advancement and career development of northerners are clearly defined (PR#225, p. 14).

The GNWT also requested that the Developer provide (PR#225, p. 14):

a) quantitative predictions for Aboriginal resident hiring for each phase of the project, as well as northern resident hiring for the closure phase;
b) further details on the job positions detailed job descriptions in each phase of the Project for which the Developer expects to hire southern workers;
c) additional information on the development of apprentice and trade positions including orientation, development and recruitment plans that expand upon references in the DAR to pre-employment and on-the-job training in accordance with the requirements of the NWT *Apprenticeship, Trade and Occupations Certification Act*;
d) which job positions will be apprenticeship positions and the associated supports that will be given to northern apprentices , and other policies and practices that will maximize opportunities for northerners to fill potential positions;
e) detail and clarification on travel allowances, employment incentives and benefits provided to NWT-based employees as compared to employees living outside the NWT;
f) finalized detailed job descriptions, including required skills and education;
g) a monitoring and annual reporting process for contractor employment data, and for the programs and practices put in place to support training and development of a skilled northern workforce, including apprentices;
h) clear processes and mechanisms that will be in place to oversee and enforce contractor compliance with the Developer's northern hiring processes and support for training and apprenticeships for northern employees; and
i) further details regarding outreach and promotional activities in support of communities, community members, students and apprentices.

The GNWT request that the Developer continue to inform and work with the GNWT and other organizations to plan, design and co-ordinate the delivery of education, pre-employment and on-the-job training, skill development, professional development and other related programs and services that support and inform employment and northern labour market development (PR#225, p. 16).

In addition to the provision of training, business capacity support, and agreements with Aboriginal communities, the Developer plans to address barriers to women for working at the Project through ensuring the visibility of women in promotional materials and through partnerships with organizations such as Skills Canada, the NWT Native Women's Association, and the NWT Status of Women Council. The Developer's Code of Conduct, Ethics Policy, and Human Resources strategies should further address issues of discrimination and harassment and will be included as part of employee orientation. The Developer believes that its one week shift rotation at the mine site and daily commute from the Hydrometallurgical site will facilitate female and other primary caretaker employment (PR#147, p. 27).

The Developer did not respond to GNWT questions regarding programs and initiatives to reduce barriers to hiring and retaining those with low education levels; plans to recognize and support cultural differences and activities; explanations or descriptions of job classifications; or specific training opportunities, apprenticeship positions and certification opportunities (PR#147, p. 15-17).

The GNWT also stressed the importance of collecting, evaluating and annual reporting of all socio-economic data so that the accuracy of the EA and identification of effects can be understood (PR#131, p. 4). The Developer`s response indicated its intentions to report on hiring statistics, including breakdowns between contractors and employees, between Aboriginal, northern, and other employees, and eventually on participation by job category, by gender, and other target-specific areas. The Developer also proposes to track its ability to retain employees in an effort to develop retention strategies, and participation in training to identify advancement and promotion targets (PR#147, p. 8). During a meeting with the GNWT, the Developer committed to report annually on the following socio-economic indicators (PR#178, p. 2-4):

- total person year employment by skill category;
- total person year employment by hiring priority and skill category;
- northern employment in person years by Northwest Territories (NWT) community of residence;
- northern hiring by community of residence;
- number of NWT resident employees who resigned or who were laid off, fired or otherwise terminated in the previous year;
- participation in and results of training activities;

- advancement and promotion of northerners, including Aboriginal northerners;
- total northern and Aboriginal purchases; and
- business forecast and assessment.

The Developer did not address its intentions to report on the value of goods and services purchased within and outside the NWT (PR#147, p. 8). At the technical sessions, the GNWT stressed the importance of this information so that it could quantify the benefits for northern procurement and businesses. The Developer would not commit directly to providing this information but indicated that such details could be discussed with the GNWT during discussions on the development of a Socio-Economic Agreement (PR#184, p. 54).

In its technical report, the GNWT reiterated the importance of consistent reporting among all developers in the NWT to ensure effective monitoring of the socio-economic well-being of NWT residents and asked again, that the Developer report publically and annually on the gross value of goods and services purchased by major category or in relation to each phase of the project, (including both goods and services produced in the NWT and goods and services produced outside the NWT that are purchased through NWT businesses); and business opportunities for the upcoming year (PR#225, p. 24).

During the public hearing in Fort Resolution, the Review Board heard representatives of the NWT Metis Nation, the Chief of the DKFN and community residents state that this Project could provide needed employment opportunities for youth in local communities who will soon be entering the workforce. In addition, the Review Board heard support for the Project from the Mayor of the Town of Hay River due to positive prospects for growth, business, employment and opportunities for youth (PR#292 p. 129, 175-181).

Culture, heritage and incorporation of traditional knowledge

The Developer supported the development of three traditional knowledge studies to inform its assessment of the Project's impacts on the biophysical and human environment. In 2011, traditional knowledge summary reports from the Community of Fort Resolution: Deninu Ku'e First Nation & Fort Resolution Metis Council (January 2011), the Lutsel K'e Dene First Nation (February 2011), and the Yellowknives Dene First Nation (January 2011) were completed. The results from the studies were incorporated into the DAR (PR#92, p. 64).

During technical sessions, the GNWT also asked the Developer for clarification regarding restrictions on haul road access. The question was to confirm that

traditional and business users will be able to use the road during the life of the mine. The Developer confirmed that the road would remain available for traditional and business use except when there may be safety concerns as a result of active transport and haulage (PR#183, p. 52). In its technical report, the GNWT commended the Developer for its working relationship with local trappers and its commitments to work with trappers and fishers to ensure unrestricted access to trap lines and the shorelines. The GNWT recommends that the Developer maintain this working relationship and address and, if necessary, accommodate the needs of the local trappers and fishers throughout the life of the Project (PR#225, p. 22).

In its first round of information requests, the GNWT acknowledged the Developer's ongoing work to complete an archaeological impact assessment at the Nechalacho mine site. Despite the previous levels of disturbance at the Hydrometallurgical plant site because of the Pine Point Mine, the GNWT requested that the Developer provide a more detailed assessment of the potential for new ground disturbance in order to predict the risk of impacts to archaeological sites by Project activities (PR#131, p. 17). The Developer indicated in its response that the only new ground disturbance proposed is the marshalling yard near the dock and that the archaeological impact assessment would cover this area, including reconnaissance to confirm all other Hydrometallurgical plant site features are located on previously disturbed ground (PR#147, p. 33).

During technical sessions, the Developer reviewed the 2011/2012 archaeological program results which added eight sites around the Nechalacho mine site in addition to the four recorded in 1988. Six of these sites were identified as potentially threatened by the Project and in 2012 systematic data recovery was undertaken to mitigate the potential impacts. The final reports have been submitted to the Review Board under confidential cover. No artifacts were recovered and the Developer considered the threats mitigated. The contracted archaeologists recommended that the Developer hire a qualified archaeologist and train employees to identify potential features and artifacts in case there are any changes in the mine's design plans. In response, the Developer has committed to the recommendation and plans to develop a site protection plan through collaboration with the Prince of Wales Northern Heritage Centre and Aboriginal partners to facilitate the continued protection and management of archaeological resources (PR#183, p. 67-71).

In its technical report, the GNWT recommended that the Developer provide a finalized list of archaeological sites that will be avoided by the Project and details of

the systematic data recovery efforts for the sites that cannot be avoided. For the development of an archaeological site protection plan, the GNWT recommended that the Developer (PR#225, p. 4-5):

a) *Demonstrate how avoided archaeological sites will be protected over the life of the project (including closure).*
b) *Demonstrate how footprint changes will be assessed for archaeological impacts.*
c) *Provide procedures to follow in the event archaeological materials are discovered during Project development or related activities.*
d) *Commitment is added to the Avalon commitment table list for the Project.*

In its final submission, GNWT confirms that the Developer has submitted its final archaeological report titled, "Archaeological Investigation in 2012 at the Thor Lake Project: Northwest Territories Final Permit Report". In addition, the Developer has committed to develop an Archaeological Sites Protection Plan and included this in its Updated Commitments Table (PR#297).

In its presentation at the public hearings in February19, 2013, YKDFN advised the Review Board that in its view, the Developer did not properly conduct its traditional knowledge study or accurately describe Yellowknives Dene traditional or current use of the Nechalacho mine site on the north side of Great Slave Lake. YKDFN described deficiencies in the Developer's traditional knowledge gathering efforts including a lack of spatial and temporal context, lack of historical and cultural research, and a lack of follow-up on answers given by YKDFN members on the Developer's questionnaire. For example, a proper traditional knowledge study that took into account a longer span of time (temporal scale) would have found that the Project area has in the past been frequented by large numbers of caribou. This traditional knowledge information would enhance the Developer's baseline information on caribou which only considered radio-collar data for caribou over the past 15 years (PR#287 p. 134-137, PR#285 p.9-10). In addition, YKDFN stated that in the future they would like to see the traditional knowledge work by the Developer include a greater consideration of the impacts of the Project on traditional and current use of trails and travel corridors through the Nechalacho mine site (PR#287 p. 140). In order to address concerns that YKDFN have with the Developer's inadequate collection and use of traditional knowledge in project design, YKDFN requests,

> *…that the Board require Avalon Rare Metals conduct a detailed, properly designed Traditional Knowledge study of the region. The information gathered must guide Avalon in the design, operation, and closure of the mine*

> *and must also become part of the long-term evaluation of impacts the mine will have on the surrounding land and water.* (PR#285 p. 15)

In its closing comments, the Developer provides clarity on how it conducted traditional knowledge studies for the Project and how it will build on these existing studies should the Project proceed. The Developer advises the Review Board that in support of its DAR, the Developer obtained approval for traditional knowledge study designs with Deninu Kue First Nation, Fort Resolution Metis Council, Lutsel K'e Dene First Nation and the Yellowknives Dene First Nation. NSMA conducted its own traditional knowledge and land use study with Developer funding. The Developer commits to building on these traditional knowledge studies by valuing traditional knowledge in the following processes (PR#307 p. 2):

- the design and update of management plans (Closure Aquatic Effects, Archaeological Sites Protection, Wildlife);
- the use of Aboriginal workers of their traditional knowledge at site and when monitoring;
- input from the broader community as a result of engagement activities; and
- promotion of traditional knowledge in negotiated Agreements.

Temporary or permanent closure

The Developer committed to address socio-economic conditions as a result of closure in its final closure plan which should be completed three years prior to closure. In an effort to mitigate the potential adverse impacts of closure, the Developer has committed to maintain communication with suppliers, contractors, employees, and communities; to support transferrable education and training initiatives that should increase local capacity; to continue its support of local businesses where practical; and to provide reclaimed mine infrastructure to local businesses, where feasible. Ultimately, the Developer sees the management of economic development and maintenance of social programs in the NWT as the responsibility of the different levels of government which should be supported through taxes and benefits paid by the Developer throughout the Project life (PR#147, p. 11). In its technical report, the GNWT request that the Developer work with the GNWT to ease employee transition to new jobs upon Project closure (PR#225 p. 17).

In its technical report, the GNWT requested that the Developer provide notification in the event of any temporary layoff of the Developer employees and employees of its

contractors and subcontractors so that the GNWT can prepare itself to respond to increased demand for additional support and services (PR#225, p. 16). In response the Developer commits to provide notification to GNWT in advance of any temporary closures for both sites, excluding the annual 2 week summer shutdown at the Hydrometallurgical facility (PR#297 p. 12).

Monitoring and follow-up

The GNWT emphasize the need for monitoring and follow-up in the form of adaptive management so that the Developer has a means to continually mitigate any Project-related negative socio-economic impacts. The GNWT see the signing of a Socio-Economic Agreement as a means for follow-up to this environmental assessment. The Developer has committed to discuss a Socio-Economic Agreement with the GNWT and is in the process of negotiating Impact-Benefits Agreements with some affected communities. The GNWT recommends that the Developer complete Impact and Benefit Agreements prior to engaging in SEA discussions so that the agreements can be consistent and complimentary. It is the GNWT's opinion that,

> *[s]uch an agreement with Avalon would confirm and formally recognize its socio-economic commitments related to the Project and provide for ongoing monitoring and adaptive management with respect to Project-related socio-economic issues… The GNWT views SEAs as an essential tool to: monitor and test socio-economic predictions; evaluate successes; identify gaps when predictions are not met, and; identify adaptive management measures to address unintended results. Ideally, the socio-economic commitments made by Avalon during the Project EA, including items for reporting, will be formalized in a SEA. In order to link the SEA to the EA, the GNWT recommends a socioeconomic follow-up program, in the form of a SEA between the GNWT and Avalon, be a condition of project approval.*
> (PR#225, p. 24)

GNWT states in its final submission that there is a risk of significant adverse socio-economic impacts from the Project to residents of the NWT if mitigation commitments are not implemented by the Developer, and that significant beneficial socio-economic impacts to residents of the NWT will not be realized without mitigation being followed. The GNWT acknowledges the commitments that the Developer has made to mitigate these potential impacts but believes that without a follow-up program to formalize the commitments there is a significant risk that they will not be implemented by the Developer. In the view of GNWT, a socio-economic agreement is therefore required as a follow-up program in order to ensure that the commitments made by the Developer are

fulfilled. This socio-economic agreement is recommended by GNWT as a condition of Project approval.

In its final submission, the GNWT outlines specific remaining concerns regarding both mitigating adverse socio-economic impacts and ensuring that beneficial impacts to residents of the NWT from the Project will be realized. The GNWT states that while negotiations on a socio-economic agreement have been initiated with the Developer, there is no legal mechanism in the NWT that can ensure that the socio-economic agreement is completed and implemented for the life of the Project. The GNWT believes that the socio-economic agreement is required to protect the wellbeing of residents of the NWT. Therefore the GNWT recommends that the Review Board include a requirement for a socio-economic follow-up program as a condition of project approval in accordance with Section 128(b)ii of the MVRMA as follows:

> *Avalon and the GNWT shall negotiate and sign a follow-up program in the form of a Socio-Economic Agreement.* (PR#302 p. 12)

In its final submission, the YKDFN recognize the merits of a Socio-economic Agreement between the Developer and the GNWT in providing benefits to northerners, but stress the need for the Developer to adhere to its commitments in the agreement. In addition, YKDFN state that other agreements, such as Impact Benefits Agreements with aboriginal groups need to be negotiated fairly. To this end, YKDFN request a measure that requires the signing of an "Accommodation Agreement" between YKDFN and the Developer prior to mine licensing (PR#306 p. 3-4).

10.3 Board analysis and recommendations

The Review Board agrees with the GNWT on the value and importance of socio-economic agreements between the Developer and the territorial government. The Review Board recognizes that there is no legal mechanism (license or permit) that can ensure that commitments regarding socio-economic impacts made by the Developer will be implemented. A socio-economic agreement is fundamentally important to mitigating the adverse impacts of the development on NWT residents and ensuring that people in the NWT benefit from the Project.

The importance of Socio-economic agreements to the people of the NWT has been demonstrated with the three existing diamond mines. The GNWT advises the Review Board in its closing comments that there is a risk of significant adverse socio-economic impacts from the Project as well as significant risk that potential benefits

will not be realized by NWT residents unless mitigation measures are put in place. The GNWT states that unless there is a follow-up program in the form of a socio-economic agreement put in place for this Project, there is a significant risk that the commitments made by the Developer will not be adhered to. The Review Board is persuaded by these submissions made by the GNWT.

The Review Board views a socio-economic agreement as a key tool to test socio-economic predictions made by the Developer, to identify what mitigation has worked and to focus on any gaps where impact predictions were not accurate and benefits are not achieved. The parties were clear and forceful during the public hearings in predicting adverse social impacts from the Project on communities and the need for benefits to communities from the Project. In response, the Developer has made commitments to enhance employment, business and training opportunities for aboriginal groups and people of the NWT. The Developer has also made commitments to mitigate adverse social impacts from the Project on communities. These commitments made by the Developer need to be implemented, monitored and reported during the construction, operations and closure phases of the Project. The Review Board believes this is best done through a Socio-economic Agreement.

The GNWT manages its socio-economic agreements in a transparent way. The Socio-economic agreement can be referred to throughout the construction, operations and closure phases of the mine to compare original commitments with execution and implementation of those commitments. Reporting requirements in the agreement allow NWT residents to check on whether the Developer is implementing its commitments and mitigation.

Socio-economic agreements have become an industry best practice in the Mackenzie Valley and elsewhere. In the opinion of the Review Board significant adverse social and economic impacts to the people in the region affected by the Project are likely unless the Developer's mitigation measures and commitments are formalized in a Socio-economic agreement with the GNWT. The Review Board therefore requires the following measure:

Measure #5

In order to mitigate potentially significant adverse social and economic impacts from the Project, the Developer will formalize and sign a socio-economic agreement with the Government of the Northwest Territories as a follow-up program prior to construction of the Project. This agreement will include monitoring and public reporting of results each year, with the results distributed to all Aboriginal organizations and communities in the regional study area.

11 Impacts on the environment from mine closure

The Terms of Reference for the environmental assessment asked the Developer to prepare a framework for a Closure and Reclamation Plan for the Nechalacho mine site and the Hydrometallurgical plant site (PR#72 p. 37). In this section, the Review Board describes the Developer's approach to closure and reclamation, presents the view of parties on closure and reclamation and provides the Review Board's recommendations.

11.1 Developer's submission

In its DAR, the Developer states that it has based its conceptual closure and reclamation plan on the "design for closure" approach. A preliminary closure and reclamation plan will be a requirement of a MVLWB land use permit and/or water licence. In its Updated Commitments Table, the Developer states that reclamation and closure of the Nechalacho mine site and the Hydrometallurgical plant site will be conducted in accordance with the *Mine Site Reclamation Policy for the Northwest Territories and the Minesite Reclamation Guidelines for the Northwest Territories and Nunavut (INAC, 2007)* (PR#76 p. 931, PR#297 p. 7).

The Developer describes the objectives of the closure and reclamation plan are as follows:

- to protect public health and safety;
- to minimize the effects of mining on the environment;
- to establish conditions that lead to acceptable long-term physical and chemical stability in reclaimed areas;
- to establish conditions that are appropriate for the surrounding environment and identified end land uses; and
- to provide the public and government with a clear understanding of reclamation expectations.

In Section 11 of the DAR, the Developer briefly summarizes reclamation strategies at the Nechalacho mine site for the underground workings, the tailings management facility, surface buildings and infrastructure, temporary waste and ore stockpiles, solid and hazardous waste, roads, the airstrip and docking facilities. At the Hydrometallurgical plant site, brief reclamation strategies are described for the plant, the tailings facility, concentrate storage and loading facility, limestone storage, roads and docking facilities (PR#76 p. 932-945).

The Developer describes specific mitigation for closure and reclamation in its Updated Commitments Table. In particular, the Developer makes a commitment that

"the conceptual closure plan will be regularly updated with the input of regulators, land users, stakeholders and aboriginal governments and organizations." (PR#297 p. 7-8)

During the public hearing on February 18, 2013, the Developer presented an overview to the Review Board on how it is planning for mine closure after the 20 year mine operations phase is complete. The Developer believes that it can reclaim the site to the point where no long term treatment of tailings or water at closure will be required. The Developer specifically made the following key commitments regarding mine closure as part of its presentation during the hearing (PR#286 p. 76-80 and PR#279 p. 37-41):

- no landfills on site so there will be no issues with closing landfills;
- progressive reclamation during operations where practical;
- maximize placement of tailings underground as paste backfill at Nechalacho which means less tailings on surface;
- salvage surface soils and use them during closure;
- docks on Great Slave Lake are seasonal and will be hauled away at closure;
- exposed tailings will be capped and re-vegetated (Nechalacho);
- process tailings will be placed in an abandoned open pit for progressive reclamation and tailings will be covered with overburden at closure (Hydrometallurgical facility); and
- the plant site and tailings will be re-vegetated, rehabilitating a previously disturbed site (Hydrometallurgical facility).

In its presentation during the public hearing on February 18, 2013, the Developer reiterated in its commitment to work with all parties to refine the closure plan throughout the project life (PR#279 p. 41). As stated by the Developer during the hearings:

> *We have already submitted our conceptual closure plan, but we recognize that we need to get the input of our Aboriginal partners and communities and regulators to further refine that design as we move forward. We will be regularly reviewing that plan during the life of the operation to make sure that it is up to date and meets the potentially changing expectations, potentially changing regulations, all those sorts of things, and to make sure that the financial assurance is adequate and in place for the closure.*
> (PR#286, p. 80)

11.2 Parties' submissions

During its presentation at the public hearings on February 19, 2013, the YKDFN stated that the Developer's closure plans lacked sufficient detail to warrant accurate assessment of risks and the potential for long-term adverse impacts on the surrounding environment and humans. Examples of closure components that the YKDFN would like addressed include restoration of the waterfront, removal of infrastructure and restoration of traditional trails. The YKDFN argue that this unique mine warrants extra consideration regarding financial ability to fulfill closure expectations and necessitates better communication of closure plans with interested groups (PR#287).

In its presentation during the public hearings the YKDFN stated its closure goal for the Project is,

> *to return the area to an environment as close to pristine as possible so that wildlife, and environmental quality will once again thrive and be conducive to traditional practices*. (PR#285 p. 8)

During the public hearings on February 18, 2013, the LKDFN stressed the importance of closure planning for the Nechalacho mine site tailings management facility because it will remain a permanent feature on the landscape. The LKDFN requested that a robust tailings closure management plan be in place prior to mine permitting.

AANDC described its position on closure and reclamation in its Technical Report and in its presentation to the Review Board during the public hearings on February 19, 2013 (PR#222, PR#287). AANDC's expectations for mine closure and reclamation are based on its *Mine Site Reclamation Policy for the Northwest Territories, 2002* and its *Minesite Reclamation Guidelines for the Northwest Territories and Nunavut, 2007*. The Policy was put in place in response to a number of instances where the Crown assumed environmental liability for mine sites where the operator went bankrupt and abandoned the mine property (PR#222 p. 13).

During its presentation at the public hearing, AANDC stated that the intent of the policy and guideline is to minimize long-term care and maintenance activities at closed mine sites and to eliminate the need for any perpetual care requirements (PR#287 p. 27). AANDC advises that several of the key principles in the reclamation policy of particular importance to the Project include the following:

- *Following mine closure, mining companies or their future owners should continue to be responsible for the site, including the remediation of any additional environmental complications which develop.*
- *The total financial security for final reclamation required at any time during the life of the mine should be equal to the total outstanding reclamation liability for land and water combined.*
- *The required standard of reclamation should be based on the 1994 Whitehorse Mining Initiative definition: "returning mine sites and affected areas to viable, and wherever practicable, self sustaining ecosystems that are compatible with a healthy environment and with human activities.* (PR#222 p. 14)

AANDC advised the Review Board at the February 19, 2013 public hearings that the Developer has committed to conducting closure and reclamation of both the Nechalacho mine site and the Hydrometallurgical plant site in accordance with this reclamation policy and associated guidelines and clarified commitments regarding post-closure monitoring (PR#287 p. 27).

With respect to mine closure, AANDC advises that its primary concern is post-closure water quality and covers for the tailings facilities at both the Nechalacho mine site and the Hydrometallurgical plant site. In AANDC's view, uncertainties remain in how the Developer will achieve its goal of closure conditions that result in long-term physical and chemical stability of all reclaimed areas. In particular, AANDC believes that considerable work needs to be done by the Developer to better understand the interactions between surface water pools, marshes and wetlands, as well as tailings characteristics at both Project sites and the respective proposed tailings covers.

AANDC states that in order to provide assurance that closure strategies are appropriate, operational monitoring and reclamation research is required during the early years of mine operations. For example, tailings consistency (ie. water/solid content) will be different at the two Project sites, and must be stable enough in both cases to be trafficable (e.g. able to operate equipment) so that a cover can be placed on the tailings facilities as part of reclamation. This concern is identified by AANDC because the saturation level of tailings has resulted in challenges with trafficability on the tailings after mine operations cease at other mine sites in the NWT (PR#222 p. 14, PR#287 p. 28-30).

In order to mitigate potential concerns with tailings covers at both Project sites in the proposed closure scenario AANDC recommends,

> *…that the company be required to place tailings covers during the winter and design them sufficiently to maintain long-term stability, including during summer thaw periods, for both the Nechalacho and L-37 tailings facilities.* (PR#222 p. 16)

and,

> *…that the company be required to monitor tailings during operations within the L-37 tailings facility to confirm saturation levels and ensure trafficability for closure and placement of a cover.* (PR#222 p. 16)

In its Updated Commitments Table dated March 12, 2013, the Developer commits to both of the two AANDC recommendations listed above (PR#297 p. 6, 8).

AANDC states in its Technical Report that post-closure monitoring of the tailings facilities will be necessary to assess the impacts of seepage from the tailings over time. The length of time required for post-closure monitoring will be determined by Performance Assessments as outline in the *Mine Site Reclamation Guidelines* and must continue until the Developer can demonstrate that closure goals, objectives and criteria have been achieved and will be maintained over the long-term. AANDC observes that with respect to post-closure monitoring the Developer has stated during Technical Sessions that post-closure monitoring would be limited to monitoring for 5 years. AANDC states that in order to be consistent with its closure guidelines it recommends,

> *…that the developer be required to conduct post closure monitoring and maintenance until such time as closure goals, objectives and criteria are achieved and maintained.* (PR#222 p. 16)

At the Hydrometallurgical plant site, groundwater monitoring may be necessary because the proposed discharge location of tailings water is into the Presqu'ile Aquifer. The Developer's modelling suggests that the tailings water entering the aquifer will dissipate and become non-detectable over time and will take approximately 40-80 years to reach Great Slave Lake (PR#222 p. 15, PR#287 p. 30). In order to ensure that these modeling predictions are accurate, AANDC recommends that the Developer be required to,

> *…implement monitoring during operations to verify the modeling predictions of the effluent plume down gradient of the L-37 tailings facility,*

> *assess the modeling parameters and initiate mitigation, if required.*
> (PR#222 p. 16)

In its Updated Commitments Table dated March 12, 2013, the Developer commits to this recommendation (PR#297 p. 6).

At the close of its presentation to the Review Board during the February 19, 2013 public hearing AANDC reiterated that in its view, the overall goal regarding closure and reclamation of the mine is to "return the mine and affected areas to viable, and wherever practical, self-sustaining ecosystems that are compatible with a healthy environment and with human activities." (PR#287p. 31)

During questioning of AANDC at the public hearing, the representative from Akaitcho IMA Office asked AANDC how it would ensure a security amount, sufficient to reclaim the Project at any time in its mine life, would be accessible to the Government of Canada in the event that a developer abandoned the site. AANDC replied that while it is the responsibility of the Mackenzie Valley Land and Water Board to set the amount of security in a water licence and/or land use permit, AANDC reviews and holds the type security with the goal that at any point in time in the life of a project that sufficient security must be held to cover the cost of reclamation (PR#287 p. 43-45).

In its closing statement, Akaitcho IMA Office recommends that the closure and reclamation plan must be developed collaboratively with Aboriginal parties and that the plan should be developed immediately (PR#305 p. 2). The Developer commits to seeking input from Aboriginal governments and organizations during the regular updating of the closure plan (PR#297 p. 8).

11.3 Board analysis and recommendations

The Review Board has considered the evidence regarding closure and reclamation of the Project submitted by the Developer, regulators, Aboriginal groups and other parties in both written submissions and in person during the public hearings. The Review Board agrees with parties on the importance of designing the Project for eventual mine closure. In the opinion of the Review Board, planning for closure is particularly relevant given NWT examples of mine owners abandoning their properties with insufficient security held to cover extensive environmental liabilities.

Long-term impacts to the environment from mining after mine closure can include degraded water quality and contamination of soils and vegetation in the vicinity of the closed mine. There are examples of these impacts at many closed mine sites in the NWT. These impacts lead to concerns from people about how safe fish, wildlife and plants that may have been exposed to contaminants from closed mines are to consume. These concerns are both real in terms of potential contaminant uptake

through the food chain from fish, wildlife and plants to people as well as the perception of risks that may result in the loss of use by people of the area surrounding a closed mine.

The Review Board acknowledges that the Developer has committed to prepare and implement a closure and reclamation plan in compliance with AANDC policy and guidance documents. In addition, the Review Board recognizes that the Developer has made specific commitments in response to recommendations from AANDC regarding closure of the tailings management facilities at both Project sites.

In the opinion of the Review Board, there are uncertainties with closure of the sites, in part because of the lack of understanding of how the waste stream from a rare earth elements mine will interact with the aquatic and terrestrial environment in the site specific context of the two Project sites. The Review Board heard from the Developer that the unique and variable combination of elements in each REE mine and variety of deposit host rocks make it challenging to compare the potential impacts of this REE mine with legacies of other REE mines around the globe. The Review Board is aware that there appear to be no currently operating REE mines in North America. Aboriginal groups expressed concern to the Review Board regarding the uncertain impacts from the mining of REEs.

The Review Board also heard conflicting predictions of the potential duration, or temporal scope of the Project. Based on information provided by the Developer in its DAR, the operations phase of the scope of development for the Project is 20 years. However, during the hearing in Fort Resolution, the Developer advised the Review Board that,

> *…what we have found is that there is a tremendous amount of resource available that if we are able to attain a -- a world market share for sales of the products, then we have the opportunity to – to actually have a sustainable project that goes on long -- long after just twenty (20) years*. (PR#292 p.145)

In order to clarify the matter, the Review Board conducted an EA based on a 20 year operations phase for the Project.

The Review Board is aware that the Developer has committed to consulting with Aboriginal groups and regulators in the development of a closure and reclamation plan as the Project moves forward. The Review Board is of the opinion that uncertainties remain in the Developer's approach to closure planning and that the

conceptual closure plan lacks detail in terms of how the goals and objectives will be achieved.

However, the Review Board is confident that detailed closure and reclamation planning based on goals and objectives arrived at in consultation with Aboriginal groups and regulators will occur during the water licensing phase of the Project. Further, the Review Board finds that closure planning for the site is required to meet the requirement of the *Mine Site Reclamation Policy for the Northwest Territories* and *the Minesite Reclamation Guidelines for the Northwest Territories and Nunavut (INAC, 2007)* and that the requirements of these guidelines will be rigorously applied during the Water Licencing phase. The Review Board understands that these two guidance documents set out standards that protect the environment and that a developer is not permitted to abandon a site unless the site is proven safe through monitoring.

Therefore, the Review Board finds that adverse impacts from the Project to the environment at mine closure are not likely to be significant provided that the developer fulfills its commitments and regulators rigorously apply the guidelines described above.

12 Conclusion

The Review Board has carefully considered all evidence and information on the public record for the Project. The sections above describe the basis and reasons for the Review Board's findings. The Review Board finds that the Project has the potential to cause significant adverse impacts to the environment. In order to mitigate significant adverse impacts so that they are no longer significant, the Review Board has prescribed measures described in the sections above.

Specifically, the Review Board has prescribed measures to mitigate the potential for significant adverse impacts to water quality, wildlife and social and economic impacts so that they are no longer significant.

The Review Board's decision depends on the implementation of the commitments made by the Developer during the proceedings in addition to the measures set out in this Report.

The Review Board therefore concludes that the Project should proceed to the regulatory phase for approvals subject to the implementation of the measures described by the Review Board and the Developer's commitments set out in this Report.

Appendix A: Summary of measures and suggestions

Summary of measures

Impacts to water quality

Measure #1

The Mackenzie Valley Land and Water Board will set effluent quality criteria as required during the water licensing phase for the Nechalacho mine site for all of the parameters listed in Appendix B and for ammonia, nitrate, nitrite, phosphorus and sulphate. These criteria will satisfy the following narrative statements in order to protect the aquatic environment downstream of Drizzle Lake during construction, operations, closure and post-closure phases of the Project:

- Water quality changes due to mining activities will not significantly alter benthic macro-invertebrate and plankton abundance, taxonomic richness or diversity;
- Water quality changes due to mining activities will not significantly alter fish abundance or diversity or impact the ability of traditional users to harvest or consume fish;
- Water quality changes due to mining activities will not significantly alter areas utilized as traditional drinking water sources;
- Water quality changes due to mining activities will not significantly alter the use by mammals or wildfowl of the area for drinking water, food source or habitat, or the current ability for people to harvest these animals for consumption.

Measure #2

The Developer will install groundwater monitoring wells prior to mine construction in the vicinity of the Pine Point site to monitor the baseline and affected groundwater concentrations until such time as closure goals, objectives and criteria are achieved and maintained. The monitoring wells should be placed in sufficient number and appropriate locations to monitor background concentrations, delineate the plume, and provide comparisons to the Developer's modeled plume. The monitoring well samples should be analyzed for the full suite of parameters of concern.

Impacts to wildlife

Measure #3

To reduce or prevent significant adverse impacts to wildlife and wildlife habitat from Project activities, and to inform adaptive management through active monitoring, the Review Board requires the timely and collaborative development of a Wildlife and Wildlife Habitat Protection Plan prior to construction by the Developer.

At a minimum this plan is to include:

- both traditional and scientific knowledge;
- an adaptive management approach designed to assess how well mitigation measures perform and support the adoption of new mitigation, if necessary;
- best practices for mitigation and monitoring;
- the development of clear protocols and standard operating procedures for Project employees and contractors to ensure the implementation of site-specific mitigation; and
- instructions and training to mine staff to reduce the potential for interactions between people and wildlife.

Measure #4

To reduce or prevent significant adverse impacts on wildlife and wildlife habitat, in particular barren ground caribou, from project activities and to inform adaptive management of mitigation that will further prevent significant impacts, the Review Board requires the timely and collaborative development of a Wildlife Effects Monitoring Program by the Developer.

Before starting mine construction, the Developer will collaborate with the GNWT to complete and implement a Wildlife Effects Monitoring Program.

At a minimum, this program is to include:

- Both traditional and scientific knowledge;
- An adaptive management approach designed to use monitoring to test impact predictions, assess how well mitigation measures perform, and support the adoption of new mitigation measures, if necessary;
- Best practices for monitoring and mitigation;
- Monitoring to test effect predictions and effectiveness of mitigation related to

sensory disturbances, energy costs, the estimated zone of influence through all mine phases;
- Monitoring that involves Aboriginal people in the Project study area;
- Monitoring that can be readily integrated into regional cumulative effects programs; and
- A communications component to ensure Wildlife Effects Monitoring Program results are being reported back to Aboriginal community members on at least an annual basis.

Social and economic impacts

Measure #5

In order to mitigate potentially significant adverse social and economic impacts from the Project, the Developer will formalize and sign a socio-economic agreement with the Government of the Northwest Territories as a follow-up program prior to construction of the Project. This agreement will include monitoring and public reporting of results each year, with the results distributed to all Aboriginal organizations and communities in the regional study area.

Summary of suggestions

Impacts to Water Quality

Suggestion #1

The Developer should update the modelling of discharges at the Nechalacho mine site during the water licensing phase for the floatation plant processes and effluent treatment system, effluent discharge concentrations, effluent discharge rates, and TMF geometry for the simulated duration of mine operation. The model will be calibrated and updated periodically with operational data to track performance and to improve the model's accuracy and manage the project accordingly.

Suggestion #2

The Developer should run the predictive model for the duration of the Nechalacho mine site operation and for a sufficiently long period following closure to allow for an estimate of how long it will take Drizzle Lake to return to background conditions and provide this data to the Mackenzie Valley Land and Water Board during the water licensing phase.

Suggestion #3

The Review Board suggests that the Developer provide data to the Mackenzie Valley Land and Water Board during the water licensing phase on:

- the amount of the untreated tailings fluid remaining within the tailings after dewatering;
- the chemical composition of the untreated tailings fluid remaining within the tailings after dewatering; and
- the predicted chemical composition of the water to be transferred from the plant site runoff collection pond to the TMF.

The Review Board further suggests that the Developer calculate the consolidated flow rate and chemical composition of all of the flows from the Nechalacho floatation plant to the TMF. i.e. the treated mine water, the treated water from tailings slurry dewatering, the untreated slurry water remaining with the tailings solids, and the untreated plant site runoff collection pond water.

Impacts from barging

Suggestion #4

The Review Board suggests that the Developer should prepare a comprehensive spill contingency plan prior to commencement of mine construction for all materials to be transported by barge, including concentrate. This plan could incorporate any applicable spill contingency plans of contractors. The Developer should share this plan with Aboriginal groups and organizations in the Project study area and to the communities on Great Slave Lake including: Lutsel K'e, Hay River, Fort Resolution, Yellowknife, Dettah and N'dilo.

Suggestion #5

The Developer should provide annually, before each barging season, notice of all barging activities associated with the Nechalacho mine operations to Aboriginal groups and organizations in the Project study area and to the communities on Great Slave Lake including: Lutselk'e, Hay River, Fort Resolution, Yellowknife, Dettah, and N'dilo.

Suggestion #6

The Developer should provide a report of seasonal barging activities upon the conclusion of each barging season including:

- the date of each trip;
- the total number of trips;
- the list of materials shipped;
- any reportable spills; and
- any other accidents (ie. “incidents”, as defined by the Transportation Safety Board).

This Report should be sent to Aboriginal groups and organizations in the Project study area and to the communities on Great Slave Lake including: Lutselk’e, Hay River, Fort Resolution, Yellowknife, Dettah, and N’dilo.

Appendix B: Site specific water quality objectives

SSWQO – Metals Concentrations Nechalacho Mine Site						
Parameter	Untreated tailing water (ug/L)	Treated effluent and Mine Water (ug/L)	Drizzle Lake Background Mean (ug/L)	Thor Lake Background Mean (ug/L)	Proposed SSWQO for Drizzle Lake (ug/L)	CCME Guidelines (ug/L)
Aluminum (Al)	1000	120	8.30	3.3	100	100
Arsenic (As)	<2	0.9	0.92	0.77	5	5.0
Cadmium (Cd)	0.04	0.003	0.01	0.02	Background	0.052
Chromium (Cr)	<5	<0.5	<0.5	<0.5	8.9	8.9
Copper (Cu)	<5	1.9	0.25	0.36	3	2-4
Iron (Fe)	2080	44	1091	69.5	Background (seasonal)	300
Lead (Pb)	1.3	0.92	0.028	0.05	4	1-7
Mercury (Hg)	<0.1	<0.1	<0.1	<0.1	0.026	0.026
Molybdenum (Mo)	13	6.2	1.27	2.1	73	73
Nickel (Ni)	5	2	<0.5	<0.5	110	25-150
Selenium (Se)	10	<1	<1.0	<0.1	1	1
Silver (Ag)	>0.1	<0.01	<0.01	<0.01	0.1	0.1
Thallium (Tl)	<2	0.017	<0.1	<0.1	0.8	0.8
Uranium (U)	2.8	0.01	0.08	0.36	15	15
Vanadium (V)	0.4	0.19	<1.0	<1.0	6	6
Zinc (Zn	8	28	0.90	1.43	Background	30

SSWQO – REE Concentrations Nechalacho Mine Site					
Parameter	Untreated tailing water (ug/L)	Treated effluent and Mine Water (ug/L)	Drizzle Lake Background Mean (ug/L)	Thor Lake Background Mean (ug/L)	Proposed SSWQO for Drizzle Lake (ug/L)
Cerium (Ce)	221	0.92	<0.05	<0.05	3.2
Dysprosium	16.2	0.63	<0.05	<0.05	16.2
Erbium (Er)	6.8	0.022	<0.05	<0.05	19.1
Europium (EU)	3.2	0.014	<0.05	<0.05	11.2
Gadolinium (Gd)	26.5	0.11	<0.05	<0.05	15
Hafnium (Hf)	0.8	0.005	<0.1	<0.1	4.4
Holmium (Ho)	2.9	0,010	<0.05	<0.05	0.7
Lanthanum (La)	94.2	0.41	<0.05	<0.05	1.8
Lutetium (Lu)	0.5	0.002	<0.05	<0.05	2.9
Niobium (Nb)	2.2	0.045	<0.1	<0.1	2.6
Neodymium (Nd)	114	0.49	<0.05	<0.05	14.3
Praseodymium (Pr)	29.7	0.11	<0.05	<0.05	3.5
Samarium (Sm)	26.1	0.11	<0.05	<0.05	7.4
Scandium (Sc)	1.2	0.82	0.9	0.5	2.9
Tantalum (Ta)	0.6	0.009	<0.1	<0.1	0.2
Terbium (Tb)	3.5	0.014	<0.05	<0.05	8.4
Thulium (TM)	0.73	0.003	<0.05	<0.05	6.9
Ytterbium (Yb)	4.2	0.012	<0.05	<0.05	6.9
Zirconium (Zr)	9.7	0.07	<0.01	<0.01	11.2

Site Specific Water Quality Objectives from public hearing presentation by Avalon (PR# 279 p 7-8)

Appendix C – Final Commitments Table, March 2013

Source of Commitment	DAR Item #	Plant Site	Commitment
			REGULATORY / OTHER
GNWT IR#17.2 February 2012		Both	Avalon will commit to providing an updated "final" List of Commitments two weeks prior to the Public Hearings
Public Hearing March 18, 2013		Both	Avalon will provide an updated commitment table following the public hearings, including any commitments made before the final submission
Technical Session #6 August 16, 2012		Both	Avalon to provide the Review Board with a copy of presentations from the August 16 technical sessions
TC IR#2 January 2012		Both	More detailed design information for the two proposed barge docking structures, including plan and cross section drawings, will be provided to Transport Canada in the future NWPA applications that will be prepared and submitted to the Department for review and approval
NSMA IR#4.1 January 2012		Both	Avalon will incorporate the results from the Traditional Knowledge study into their action plans once NSMA's study is complete.
Technical Session #1 August 14, 2012		Both	Should the reagents change within the EA, Avalon notify the Board as soon as possible of that Avalon notify the Board as soon as possible
Public Hearing March 18, 2013		Both	Avalon has committed to two independent standards. ISO 14001 (Environment) and OHSAS 18001 (Health & Safety) which periodic external audit. Results will be summarized in Avalon's annual sustainability reports which are publically available.
	AIR QUALITY		
DAR May 2011	1	Nechalacho	For all underground activities, A designated responsible employee will be assigned to monitor the air quality at each working location, during each shift, on a daily basis and maintain records of the air quality monitoring information as per the NWT Mine Health and Safety Regulations.
DAR May 2011	2	Both	Minimize potential effects on local and regional air quality and to control greenhouse gas emissions.
DAR May 2011	3	Both	Avalon will comply with Land Use Permit and Water License conditions to be issued by the MVLWB.

DAR May 2011	4	Nechalacho	Avalon commits to utilize low sulphur diesel fuel in conjunction with regular equipment and engine maintenance to ensure air quality standards are met during operations.
DAR May 2011	5	Nechalacho	Avalon commits to use low NOx and SOx diesel power generators at the Nechalacho Mine site.
DAR May 2011	6	Hydromet Plant	Avalon commits to the use of line power as the main source of power for the Hydrometallurgical Plant.
DAR May 2011	7	Both	Avalon will conform with the Guidelines for Ambient Air Quality Standards in the NWT
DAR May 2011	8	Nechalacho	Avalon will conform with GNWT and WSCC standards for mine and process plant(s) air quality
DAR May 2011	9	Both	Avalon will employ Passive Integrated Samplers to capture monthly averages for parameters such as NO2, SO2 and VOC's. An Air metrics "MiniVol" sampler or equivalent will be employed to sample PM10.
Technical Session #10 August 17, 2012		Nechalacho	Avalon commits to developing an air quality monitoring and management plan in consultation with ENR and Environment Canada, including, but not limited to, stack testing and SO2 and TSP monitoring
Technical Session #11 August 17, 2012		Nechalacho	Avalon commits to continuous monitoring of sulphur dioxide for one (1) year within the fence line at the Thor Lake mine site and Hydrometallurgical plant site
EC IR #7 March 2012		Nechalacho	Avalon is pleased to commit to the preparation and implementation of an incineration management plan that incorporates the guidance provided in the Environment Canada Technical Document for Batch Waste Incineration. The dual chamber (two-stage process) selected will minimize emissions of persistent organic pollutants, including dioxins and furans. The incinerator manufacturer's specifications will be followed.
Technical Session #9 August 17, 2012		Both	Avalon commits to consulting with Environment and the GNWT to develop and implement an incineration management plan that incorporates information in the Environment Canada Technical Document on Batch Waste Incineration Management
Public Hearing March 18, 2013		Both	Avalon will ensure the incinerators will be installed properly. This may include input from the manufacturer and monitoring operating parameters.
Public Hearing March 18, 2013		Nechalacho	Avalon will not burn sewage.
	CONTRACTORS		
DAR May 2011	10	Both	All contractors or subcontractors will be required to sign and

			adhere to Avalon's policies and procedures when working at both sites.
DAR May 2011	11	Both	Avalon intends to maximize Northern and Aboriginal employment into its final contractual agreements with key specialized contractors.
DAR May 2011	12	Both	Avalon will give precedence to Northern contractors/vendors/suppliers that have a strong aboriginal involvement.
	DUST CONTROL		
DAR May 2011	13	All	Secure containment of concentrate product during transportation from the Nechalacho Mine site to the Hydrometallurgical Plant site and from there to the Hay River railhead
DAR May 2011	14	Hydromet Plant	Avalon will utilize a combination of flat bed and bulk truck haulage from the Hydrometallurgical plant to the Hay River railhead. For bulk haulage, the concentrates will be maintained in a "moist" condition and the truck boxes and product will be covered.
DAR May 2011	15	Hydromet Plant	Use of existing highways for all Hydrometallurgical Plant-related vehicle traffic.
DAR May 2011 (+ EC IR March 2012)	16	Both	Conformance with GNWT Guideline for Dust suppression through the application of dust suppressants - e.g., water or approved dust suppressant products.
	HAZMAT		
DAR May 2011	17	Nechalacho	Underground fuel will be transported in a Schedule 40 pipe from the tank farm on the surface directly to the mine decline. The piping will be attached to the rib of the decline to an underground holding facility with double walled storage tanks sized to supply 1-2 days of fuel. Avalon's Hazardous Spills Contingency Plan applies underground as it does above.
DAR May 2011	18	Nechalacho	There will not be any Beryllium produced from the operations.
LKDFN IR#4 January 2012		Nechalacho	Based on the uranium levels in the ore, personnel monitoring for radon is not anticipated to be an on-going requirement. However, to confirm the expected levels, the exposures of a representative group of underground workers to radon will be measured using monitors called PADs (personal alpha dosimeters) The results from any monitoring of the workers will be given to the workers. The frequency and necessity for any ongoing radon monitoring will be determined as part of the overall environmental monitoring programfor the proposed mine.
LKDFN IR#8.3 January 2012		Hydromet Plant	A Radiation Protection Program (RPP), which will include any necessary monitoring requirements and worker training, will be developed for the Hydrometallurgical plant.

DAR May 2011	19	Nechalacho	The temporary construction explosives storage facility will be designed, located and operated in accordance with the NWT Mine Health and Safety Act and Regulations. Avalon will obtain an Explosives Magazine Permit for its proposed temporary construction explosives storage facility.
DAR May 2011	20	Nechalacho	At the Nechalacho site, two fuel containment areas are necessary to maintain year round operations located near the seasonal barge area and at the Nechalacho Mine. The seasonal barge area will contain two tanks capable of holding 1.5 million litres of diesel fuel while the Nechalacho mine will contain 4 tanks capable of storing 4.5 million litres each. All fuel and lubrication tanks (welded in place) will be placed in an engineered and lined enclosure capable of holding 110% of the capacity of the largest tank. Appropriate spill response equipment will be stored at the tank farm facility. Any fuel leaks and/or equipment spills will be reported to the EHS Coordinator. The EHS Coordinator will record and report the spills and direct cleanup activities in accordance with the procedures described in Avalon's Hazardous Materials Spill Contingency Plan. A spill kit will be located at both surface fuel storage facilities.
DAR May 2011	21	Hydromet Plant	At the Hydrometallurgical Plant site, diesel fuel will be utilized in small quantities and a small fuel containment area will be constructed for a total volume of 20,000 litres and meeting all requirements as outlined in commitment #16.
DAR May 2011	22	Both	The EHS Coordinator will conduct training for all surface personnel working on the Thor Lake Project. Surface personnel will be trained in the techniques and materials required to manage hazardous spill responses. Training will include the following instruction: the initial spill response procedure to use in the event of a spill; location and use of emergency equipment to respond to spills; safe operation of equipment and tools to minimize the potential for spills; operational procedures to limit the potential and impact of spills; monthly safety discussions to address work hazards.
DAR May 2011	23	Both	The transportation of all hazardous materials transported to and from the site will be conducted in accordance with existing territorial and federal regulations, including the Transportation of Dangerous Goods guidelines.
DAR May 2011	24	Both	Response preparedness will be maintained for incidents involving medical, fire, fuel or concentrate spills or other environmental related incidents (e.g., wildlife collisions).

DAR May 2011	25	Both	Fuel and other hydrocarbons will be stored in accordance with the existing CCME environmental code of practice for storage of these products (CCME 2003).
DAR May 2011	26	Both	"Any spills will be immediately reported to the 24-hour Spill Report Line… and spill containment and cleanup activities will be implemented in accordance with Avalon's Hazardous Materials Spill Contingency Plan".
DAR May 2011	27	Nechalacho	"Explosives ingredients (e.g., Ammonium Nitrate, diesel) will be transported to the site from local distributors in accordance with federal *Transportation of Dangerous Goods, Workplace Hazardous Materials Information System, and Explosives Act* requirements".
DAR May 2011	28	Nechalacho	"Both [underground explosives] storage drifts will be gated and locked with access keys given only to designated responsible employees. The two drifts will be separated by at least 4.5 metres (15 feet) of consolidated rock. One drift will be used for the safe storage of ammonium nitrate fuel-oil and Emulsion and the second drift will be utilized for all Detonators. Only properly trained and certified employees or contractors will be permitted to handle explosives".
DAR May 2011	29	Nechalacho	Explosives and detonators will be stored separately at the temporary surface explosives magazines. A primary lock will secure the magazines while a secondary lock will be used for a chain link fence to be installed at the magazine access.
DAR May 2011	30	Both	Hazardous materials not incinerated on site, will be shipped to the hazardous waste facility in both Yellowknife and Hay River for both sites.
DAR May 2011	31	Both	Used oils will be burned in an approved used oil heater by the Canadian Standards Association of the Underwriters' Laboratories of Canada for incineration of used oil and waste fuel. The Developer will adhere to ENR's *Used Oil and Waste Fuel Management Regulations.*
DAR May 2011	32	Both	All solid non-combustible and non-hazardous waste will be collected and consolidated weekly and disposed of in either the Hay River or Yellowknife landfills.
DAR May 2011	33	Both	Disposal of all hazardous wastes in an approved manner.
DAR May 2011	34	Both	All solid wastes will be managed in accordance with NWT regulations.
	HEALTH & SAFETY		
DAR May 2011	35	Both	Avalon will conduct annual health and safety checkup for its employees.
DAR May 2011	36	Both	Avalon has committed to using health and safety training as well as zero tolerance drug policy to promote a healthy employee population.

DAR May 2011	37	Both	Upon completion of Avalon's Emergency Response Plan, the following will be included but not limited to: an emergency response coordinator, a site hazard assessment, an ERP committee, site personnel accountability method, posted and designated escape routes and assembly points, reporting procedures, alarm system notification, procedures for key employees who are required to remain to operate critical equipment, identity of medically trained employees, posting of emergency numbers and contacts throughout facility, emergency drills, annual employee reviews.
DAR May 2011	38	Hydromet Plant	A manned gate will be installed near the Main access to provide security for plant equipment and materials. It will also serve as a safety precaution and prevent the public from coming into contact with plant equipment and operations.
DAR May 2011	39	Both	All machinery will be equipped with standard noise suppression equipment. The company will construct earth berms as needed. Employee Personal Protective Equipment guidelines will also be outlined in all contractor and company operation procedures.
DAR May 2011	40	Both	The Thor Lake Project will employ a full-time EHS coordinator to implement and deliver specific training sessions. Safety related training will be given high priority and be a requirement for all employees and subcontractors. Required training will include: site orientation, mine site general safety rules, personal protective equipment use, hazardous materials spill contingency training, basic first aid training, and other (job specific) training.
DAR May 2011 & GNWT IR#12 February 2012	41	Both	Avalon will comply with all Emergency Medical Response criteria associated with the Mine Health and Safety Act. An Emergency Response Plan will be distributed to all employees and posted for easy access in the event of an emergency. Selected employees will be trained in First Aid, and mine rescue crews will be on-site. A dedicated first aid facility will be located on-site. There will be a dedicated ground vehicle for evacuation to Hay River and may include medi-evacuation options.
DAR May 2011	42	Nechalacho	There will be an underground medical vehicle equipped to treat and transport personnel from any location at the Nechalacho site to the airstrip for medi-evacuation.
DAR May 2011	43	Hydromet Plant	There will be a dedicated ground vehicle for evacuation to Hay River with the option of medi-evacuation in the event of a serious injury occurring at the Hydrometallurgical Plant.

DAR May 2011	44	Nechalacho	All underground escape routes will be inspected on a regular interval and maintained in a safe, travelable condition. Both the primary and secondary escape-ways will be marked with conspicuous and easily read direction signs that clearly indicate the ways of escape. Prior to entering the mine, all personnel will be trained and oriented to the proper method of escape from the mine.
DAR May 2011	45	Both	Avalon will put up signage indicating a no shooting zone within 3 square kilometers of the sites. Avalon will consult on a consistent basis with the local Aboriginal groups to ensure that traditional land users are award of the project and its boundaries.
DAR May 2011	46	Both	If unexpected archeological materials are encountered during any phase of this development, all activity in the area must cease and the PWNHC and any affected First Nations must be contacted.
GNWT IR#13.2 February 2012		Hydromet Plant	An archaeological impact assessment (AIA) of the marshalling yard at Pine Point will occur in the Summer of 2012, upon approval of the archaeological permit. The archaeologist will also conduct reconnaissance at the other proposed Pine Point infrastructure locations to confirm that they are located on previously disturbed ground and no further archaeological assessment will be required.
DAR May 2011	47	Both	During early stages of construction orientation sessions will be held w/personnel to address the issues including: site safety, heritage/archaeological protection, environmental protection. The Heritage resource component includes info on legal, reporting and mitigation requirements related to the protection of Archaeological/Heritage Resources in the event any are found
Technical Report response December 2012		Both	Avalon will provide an Archeological Sites Protection Plan to the Prince of Wales Northern Heritage Centre prior to construction.
GNWT IR# 8.4 February 2012		Both	All contract employees will be required to take some form of workplace orientation and safety training program before being allowed to work on-site. This orientation will be provided by Avalon.
GNWT IR#9.3 February 2012		Both	The Code of Business Conduct and Ethics will be reviewed with each new employee during workplace orientation including the section related to harassment
LKDFN IR#6.2 January 2012		Both	Avalon is committed to increasing the public understanding of rare earth elements, their nature, uses, etc.

	INFRASTRUCTURE		
DAR May 2011	48	Both	Avalon has and will locate, to the greatest extent possible, buildings and site infrastructure on previously disturbed terrain.
DAR May 2011	49	Both	Avalon is committed to employing an adaptive management approach including a number of mitigation measures to minimize potential effects on the existing noise environment
DAR May 2011	50	Both	Avalon commits to regular maintenance of mobile and stationary equipment used during construction and operations.
DAR May 2011	51	Both	Avalon commits to the use of high performance engine exhaust silencers at the power plant.
DAR May 2011	52	Nechalacho	At the Nechalacho site, runoff mine ore will be temporarily stockpiled on surface during development activities. This ore will be the first material ran through the flotation plant. After start-up of operations, no additional ore will be stockpiled on surface.
DAR May 2011	53	Nechalacho	Concentrate from the Nechalacho flotation plant will be loaded into enclosed intermodal containers prior to shipment.
DAR May 2011	54	Both	Concentrate shipped across GSL will be handled with great care to ensure no loss of material. In the event any loss of containers where to occur in the lake, Avalon would recover the inert material.
DAR May 2011	55	Nechalacho	Diesel generation will be utilized for all power needs at the Nechalacho mine. Generator and stack heat will be utilized throughout the site.
DAR May 2011	56	Hydromet Plant	Avalon will employ hydroelectric line power for the bulk of its Hydrometallurgical plant needs. A small diesel generation plant will be used for primary safety and environmental back-up in the event of power failures or scheduled maintenance on the Taltson Dam.
Technical Session #5 August 16, 2012		Hydromet Plant	Avalon commits to monitoring tailings during operations within the L-37 tailings facility to confirm saturation levels and ensure traffic ability for closure and placement of a cover
Technical Session #7 August 16, 2012		Nechalacho	Avalon commits to a contingency of placing a tailings cover during the winter and designing it sufficiently to maintain long-term stability, including summer thaw periods, for the Nechalacho tailings facility
Technical Session #8 August 16, 2012		Hydromet Plant	Avalon commits during operations to implement monitoring, to verify the modelling predictions of the effluent plume down gradient of the L-37 tailings facility, assess the modelling parameters, and if there are deviations, initiate mitigation, if

			required
Public Hearing March 18, 2013		Both	Avalon will conduct test plots for revegetation at both sites.
	RECLAMATION		
DAR May 2011	57	Both	Reclamation of both sites will consist of removing all surface and underground conveyor components and belting. The surface structures will be dismantled and removed from site.
DAR May 2011	58	Both	Organic and mineral top soils collected from the Nechalacho site (Hydrometallurgical site has no organics) will be salvaged and stored for future reapplication during reclamation of the site
DAR May 2011	59	Both	Re-contouring, scarification, and reseeding of disturbed areas with appropriate and approved native seed mixes will occur.
DAR May 2011	60	Both	Water discharge lines will be reclaimed and shipped off site. The fuel and lube tanks and associated piping will be drained, washed, cleaned and then dismantled. All infrastructure will be removed from site. The catchment containment berms will be breached or re-contoured to encourage natural drainage.
DAR May 2011	61	Both	Waste oils will be shipped off site or consumed in the on site incinerators or used oil heaters. Unused explosives will be shipped off site or burned or destroyed on site and unused chemicals as well as any other hazardous waste material will be either treated on site or shipped off-site for disposal. All non-combustible, non-hazardous waste will be disposed of in the permanent non-hazardous solid waste disposal facilities located in either Yellowknife or Hay River. Peripheral equipment like lighting and signposting will be removed.
DAR May 2011	62	Nechalacho	Reclamation of the underground decline will consist of removing all piping and support sets. Once the decline is cleared, rock material will be used to fill the underground entrance back to natural topographic levels.
DAR May 2011	63	Both	All temporary and permanent surface structures will be removed at the completion of mining and processing. All buildings will be stripped down and prepared for off-site transport. Any remaining foundations will be buried and where appropriate, the application of stockpiled organics, and re-vegetation to the extent possible.
DAR May 2011	64	Both	Reclamation and closure of all the Nechalacho Mine, Flotation Plant and Hydrometallurgical Plant facilities will be conducted in accordance with the terms and conditions of the future MVLWB Land Use Permit and Water License, the "Mine Site Reclamation Policy for the Northwest Territories" and the "Mine Site Reclamation Guidelines for the Northwest

			Territories and Nunavut" (INAC, 2007).
DAR May 2011	65	Nechalacho	Specifically for the Nechalacho 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.
DAR May 2011	66	Hydromet Plant	Specifically for the Hydrometallurgical Plant tailings management facility, the main objective of the closure and reclamation initiatives will be to transform the historic L-37 open pit to a pre-mining usage and capability to the greatest degree possible. Reclamation strategies will focus on utilizing nearby waste and overburden material to cover the exposed tailings and re-establish surface flow patterns and seeding with jack pine.
DAR May 2011	67	Both	Fuel and lube tanks, if not sold or reused, will be washed and the wash water captured and the tanks hauled off site to an appropriate disposal facility either in Hay River or Edmonton.
DAR May 2011 & ED IR #16 March 2012	68	Both	Post-closure monitoring will be limited to evaluating the success of the re-vegetation effort. Post-closure monitoring for re-vegetation success is envisioned to be conducted 1 & 5 year post closure.
DAR May 2011	69	Both	Following removal of the Thor Lake Project surface facilities, the remaining fill embankments, borrow pits, access roads and development footprint will be re-contoured and scarified

			as required to ensure surface stability and to facilitate the re-establishment of native vegetations.
DAR May 2011	70	Both	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.
EC IR #17.1 March 2012		Both	The conceptual closure plan will be regularly updated with the input of regulators, land users, stakeholders, and Aboriginal governments and organizations.
Technical Session #3 August 16, 2012		Nechalacho	Avalon commits to a contingency of placing a tailings cover during the winter and designing it sufficiently to maintain long-term stability, including summer thaw periods
Technical Session #4 August 16, 2012		Hydromet Plant	Avalon commits to a contingency of placing a tailings cover during winter and designing it sufficiently to maintain long-term stability, including summer thaw periods, for the L-37 tailings facility
	SOCIO-ECONOMICS		
DAR May 2011	71	Both	Avalon will conduct pre-employment screening, including criminal background checks on all finalists. In considering whether to hire a finalist who has been convicted of a criminal offense, Avalon will consider several factors including but not limited to: the relevance of the criminal conviction to job duties, the date of the most recent offense and employment history since the commission of the crime, the nature of the offense, the accuracy of the information the finalist provided on the employment application, and whether the offense was committed as a minor.
DAR May 2011	72	Both	Avalon will have zero tolerance for the possession and/or use of drugs or alcohol at any Avalon work location. The Company will conduct drug screening for "reasonable cause" and "post-accidents".
DAR May 2011	73	Both	Avalon will consider prior work experience as equivalent to education on a case-by-case basis.
DAR May 2011 & GNWT IR #1.2 February 2012	74	Both	Avalon will be working with the Mine Training Society to begin mine and process training programs that will target local communities including but not limited to Yellowknife, Ndilo, Dettah, Lutsel K'e, Fort Resolution, Hay River, Hay River Reserve and Fort Smith. Avalon's HR Management will liaise with the community points of contact and the Mine Training Society to advertise, screen and select candidates.
DAR May 2011	75	Both	Avalon will provide content expertise to the Mine Training Society in the development of curriculum for college

			certificate level training in mining and processing at Aurora College in Yellowknife, NT.
DAR May 2011	76	Both	Avalon's training program will initially be designed to fill apprenticeship and technological occupations. In addition, all Thor Lake Project contractors will also be required to adhere to Avalon's goal of maximizing Northern and Aboriginal employment.
DAR May 2011	77	Hydromet Plant	No camp facilities are expected during operations of the Hydrometallurgical Plant located at the former Pine Point mine site.
DAR May 2011	78	Both	Avalon is committed to employing as many persons as it can from the limited, locally available labour pool. The criteria for employee selection will recognize the value of years of experience in the work world.
GNWT IR #1.1 February 2012		Both	Avalon will continue to monitor the feedback from its employees to determine if changes to its Human Resources strategy and policies are necessary in order to attract and retain northern employees
DAR May 2011	79	Both	Avalon's commitment to training will include site-based on the job training and the support of a number of apprenticeships. Avalon will consult and collaborate with local Aboriginal interests and communities to encourage effective development and delivery of the training programs.
GNWT IR #3.1& 3.2 February 2012		Both	Socio-economic information will be shared through continued engagement with communities and governments and an annual Corporate Social Responsibility Report.Avalon will be reporting its hiring statistics in its sustainability reports, broken-down by Aboriginal, northern (NWT) and other employees. As our systems mature and the company grows, we anticipate that we will further break down our reporting into job categories such as skilled and unskilled labour and by gender in an effort to eventually give performance objectives in these areas. Avalon proposes to track its ability to retain employees
GNWT IR#3.2 February 2012		Both	If requested, Avalon would allow access to the mine site for the GNWT Bureau of statistics to conduct mine-employee surveys, similar to arrangements made for the 2009 NWT Survey of Mining Employees.

DAR May 2011 & GNWT IR#2.4 February 2012	80	Both	In considering contract bids, Avalon will prioritize Aboriginal and northern businesses, and will take a number of measures to maximize project-related business opportunities. These measures will include: preparing annual business opportunities forecast to identify foreseeable procurement requirements for mining equipment, operations and maintenance support services; providing technical support and assistance in accessing sources of commercial capital; working closely with local First Nations interests and communities; identifying project components at all stages of development and operations that should be targets for a northern business development strategy; facilitating subcontracting opportunities for northern businesses; and identifying possible opportunities for joint ventures with Aboriginal and northern businesses.
DAR May 2011	81	Both	Avalon will seek out bid packages from all local communities and aboriginal groups for the non-specialized services required for the project. Avalon will work first with the aboriginal groups to determine and demonstrate capacity, competiveness, regulatory requirement compliance and Avalon's operational requirement. If this cannot be done the developer will encourage joint venturing w/local business to meet these requirements.
GNWT IR#2.5 February 2012		Both	Avalon is committed to preferentially purchase materials and services in the NWT as long as they meet the product/service requirements and are competitive in price, including those identified as specialized where it is feasible to do so.
GNWT IR#2.4 February 2012		Both	a local NWT office and website will be opened to allow local suppliers to enquire about potential future business opportunities
Dec 7, 2011 - GNWT IR Mtg		Hydromet Plant	Avalon may need to accommodate fishermen so that they can safely store their equipment near the dock. Avalon is aware that they need to communicate with local fisherman on this and are initiating that discussion.
Dec 7, 2011 - GNWT IR Mtg		Hydromet Plant	Avalon has a working relationship with local trappers, is aware of trap lines in the regional study area and will ensure trappers have unrestricted access to their lines.
Dec 7, 2011 - GNWT IR Mtg		Hydromet Plant	Avalon's primary preference is to have employees live within or re-locate to Hay River or Fort Resolution to work at the Hydrometallurgical Facility in Pine Point. Should employees not be able to move, Avalon will: 1) Investigate various ways to accommodate employees working at the Pine Point site 2) · Pay transportation costs (where economically feasible) for northern employees working at the Pine Point site and

			rotating on a weekly basis.
Dec 7, 2011 - GNWT IR Mtg		Both	Avalon will have human resource generalists and procurement staff at both the Pine Point site and at the Nechalacho site. The staff at both of these sites will have the authority to hire employees and to purchase goods and services.
GNWT IR#7.3 February 2012		both	Most Project jobs will be located in the NWT, at the Nechalacho mine site, the Hydrometallurgical facility, and at the administration offices located in Yellowknife and Hay River.
Dec 7, 2011 - GNWT IR Mtg & GNWT IR#4.1 February 2012		Both	Avalon will include socio-economic matters in its plans dealing with closure.
GNWT IR#6.1 February 2012		Both	Avalon will endeavor to complete its HR Plan for construction by the end of this year while the operations plan will be developed in 2013.
GNWT IR#9.4 February 2012		Both	Avalon will ensure that gender is taken into account when developing and incorporating our human resource policies
GNWT IR# 10.1 February 2012		Both	Avalon intends to have an Employee Assistance Program (EAP) for its employees.
GNWT IR#11 February 2012		Both	Avalon will require employees from outside of the NWT to have adequate medical insurance.
GNWT Meeting November 5th, 2012		Both	Avalon Minerals will ensure that all Avalon Minerals and Contractor employees who are non-Northwest Territories (non-NWT) residents as defined in the Medical Care Act (NWT) and the Hospital Insurance and Health and Social Services Administration Act (NWT), carry health care insurance from their home province or territory and that their insurance will provide them with Canada health care coverage while working in the NWT. For any non-Canadian worker who is hired to work on the Project and who is not eligible for a Canadian provincial or territorial health care plan, Avalon Minerals and/or its Contractors will ensure that health care coverage is in place during the individual's employment period.

GNWT Meeting November 5th, 2012		Both	Avalon Minerals will ensure that all Avalon Minerals and Contractor employees are aware that any elective (non-acute) procedures for non-NWT residents may require prior approval from the non-residenfs home provincia/territorial health care plan.
GNWT Meeting November 5th, 2012		Both	Avalon Minerals acknowledges that the Department of Health and Social Services recommends the following vaccinations as part of the Adult Immunization Standards, which include, at a minimum: Varicella; Measles, Mumps and Rubella; Influenza; Diphtheria; Tetanus; and Hepatitis A&B as well as a baseline tuberculosis skin test and/or chest x-ray. Avalon Minerals will make its employees and Contractors aware of the vaccinations recommended by the Department of Health and Social Services, the associated risks if an employee chooses to not be vaccinated in accordance with the recommendations of the Department of Health and Social Services and of the authority which public health officials have under the Public Health Act. Updated vaccination records for all employees will be maintained by Avalon Minerals. Avalon Minerals acknowledges the authority of the Chief Public Health Officer under the Public Health Act to acquire personal health information of employees. Avalon Minerals will, through its tendering and contracting process, notify its Contractors of this obligation.
GNWT Meeting November 5th, 2012		Both	Prior to the commencement of construction, Avalon Minerals and the GNWT Department of Health and Social Services (Department) will enter into a protocol for arrangements regarding access to the Nwrs Emergency Room (ER) services.
GNWT Meeting January 28, 2013		Both	Avalon will comply with the provisions of the Public Health Act and Regulations applicable to it and its activities
GNWT Meeting January 28, 2013		Both	Avalon agreed to provide notification to the GNWT in advance of temporary closures of its Nechalacho Mine and flotation plant sites and/or the hydrometallurgy site. This notification of temporary closures excludes the annual two-week shutdown of the hydrometallurgy plant every summer.
GNWT IR#8.5 February 2012		Both	Once in operation, Avalon will consider educational tours to the Project site for community, Aboriginal and territorial stakeholders when applicable.
GNWT IR #9.1 February 2012		Both	Avalon will work with community partners to try to address barriers for women in mining. Avalon will also collaborate with organizations that have expertise in promoting omen in the trades and in mining occupations like Skills Canada, the NWT Native Women's Association, the NWT Status of Women Council.

			Avalon will actively pursue the visibility of women in the company through its promotional materials and during recruitment drives and community outreach.
	TRANSPORTATION		
DAR May 2011	82	Railhead	At the railhead transfer facilities, concentrate and product will be handled in a fully enclosed shelter, the facility size will be large enough to ensure rail loaders and haul truck traffic in and out, the facility will be supported by CN's environmental policy and standards. All material will be contained inside the building. Railcar loading activities will also take place inside the building to eliminate outside exposure. Any spillage of concentrate will be picked up in accordance with Avalon's hazardous spills contingency plans.
DAR May 2011	83	Railhead	Avalon's proposed rail loadout facility will be constructed ~1.0 m above the Designated Flood Level.
DAR May 2011	84	Both	Construction, materials, repair and maintenance of all secondary access roads pertaining to the Thor Lake Project, will be undertaken by Avalon to ensure year round, safe access for the Thor Lake Project and local land users.
DAR May 2011	85	Hydromet Plant	Avalon will provide daily transportation via bus/van to and from the Hydrometallurgical site to workers from Hay River and Fort Resolution, from designated parking areas.
DAR May 2011	86	Hydromet Plant	Hydromet Plant related traffic will be complying with all DOT traffic regulations. Avalon will reinforce this expectation with all employees and contractors involved in travelling along the highway or any other roads from the Hydromet Plant.
DAR May 2011	87	Hydromet Plant	Concentrate produced will be transported from the Hydrometallurgical Plant to the railhead facility in designated trucks equipped with covers.
DAR May 2011	88	Hydromet Plant	Avalon will haul during both day and night shift. The haul trucks to follow all operating regulations in the NWT and operate within the posted speed limits. Avalon will require its contractors or subcontractors to comply with government and company policies
DAR May 2011	89	Hydromet Plant	If a truck accident occurs hauling Avalon concentrate or product, Avalon will assist local authorities by ensuring the scene is safe to enter before starting clean-up of its products as per the Companies materials spills response plan. Cleaned up material will either be hauled to the railhead or back to the Hydrometallurgical Plant for reprocessing.

DAR May 2011	90	Hydromet Plant	Avalon will post proper signage to make sure people are aware of main intersections used by Avalon traffic.
Public Hearing March 18, 2013			In the unlikely event of a barging accident, Avalon will recover any barges or freight (including containers and concentrate) that sink in Great Slave Lake. This will be done with input from regulators and Aboriginal parties.
DAR May 2011	91	Both	Seasonal barging of the Nechalacho concentrate will be conducted under contract. Avalon will ensure that any contractor/subcontractor follow applicable marine guidelines when transporting across the GSL.
	WATER MANAGEMENT and FISH		
DAR May 2011	92	Both	The BIODISK treatment system will be used for treating sewage, and the treated sewage [and greywater] will be co-mingled with process and mine water and directed to the tailings management facility.
DAR May 2011	93	Both	The sewage treatment plant will meet the Camp Sanitation Regulations, RR.NWT. 1990 c P12 and Public Health Act, RS.NWT. 1998, c P12
DAR May 2011	94	Nechalacho	Flotation system operators will be trained to prevent excess quantities of all reagents entering the process. Clearly written instructions will be provided to all trained flotation system operators. A written contingency plan for the handling of reagent spills will be prepared before the commissioning of the flotation plant.
DAR May 2011	95	Nechalacho	The Nechalacho Flotation Plant water intake will be designed to conform with the DFO Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO 1995).
DAR May 2011	96	Both	Riparian vegetation clearance and erosion control will be conducted according to the DFO Land Development Guidelines (DFO 1993), which provides comprehensive guidance to protect watercourses from construction activities, including incursions into the riparian zone.
DAR May 2011	97	Both	All blasting activities near waterbodies will comply with DFO Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (DFO 1998).
DAR May 2011	98	Both	The design basis and criteria for the TMF are based on Canadian standards for the design of dams. In particular, all aspects of the design of the TMF have been completed in compliance with the following documents: • CDA Dam Safety Guidelines (CDA, 2007) • The Mining Association of Canada (MAC) Guide to the Management of Tailings Facilities (MAC, 1998)

DAR May 2011	99	Nechalacho	The principal objective of the Tailings Management Facility (TMF) design is to ensure protection of the environment during operations and in the long term (after closure) and achieve effective reclamation at mine closure. The design of the TMF has taken 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, for recycling as process water to the maximum practical extent; • The inclusion of monitoring features for all aspects of the facility to ensure performance goals are achieved and design criteria and assumptions are met.
DAR May 2011	100	Nechalacho	The construction will be scheduled to ensure that there is always sufficient storage capacity available in the facility to avoid overtopping. The embankment raising schedule provides sufficient freeboard to safely accommodate the supernatant pond and Environmental Design Storm event, combined with wave run-up.
DAR May 2011	101	Nechalacho	The tailings and water management strategy for the Thor Lake design consists of a closed loop system to minimize impact on the natural hydrologic flows within the Thor Lake watershed area. All tailings solids and fluids as well as impacted water from the process plant will report to the Tailings Basin.
DAR May 2011	102	Nechalacho	All excess water released from the TMF will be returned to Thor Lake via the Drizzle Lake/Murky Lake drainage system
DAR May 2011	103	Nechalacho	All decant water released from the TMF into Drizzle Lake will comply with the requirements of the MVLWB Water License and the federal MMER regulations.
DAR May 2011	104	Nechalacho	Natural flows and conditions will be monitored and mimicked as closely as possible throughout operations to minimize possible effects on the local hydrological regime.
DAR May 2011	105	Nechalacho	Water will be recycled from the TMF to the greatest extent possible to minimize the fresh water requirement (currently 50% recycle and 50% fresh water has been modelled).
DAR May 2011	106	Nechalacho	Tailings will be pumped from the Process Plant to the Tailings Basin 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.

DAR May 2011	107	Nechalacho	The Tailings Basin and Polishing Pond embankments will be constructed from rock fill (mine development and/or waste rock) and till (local borrow). Construction of the two phases will be completed to meet scheduling requirements related to solids containment and water management.
DAR May 2011	108	Nechalacho	Before and during construction, an Operation, Maintenance and Surveillance (OMS) Manual will be developed for the TMF.
DAR May 2011	109	Nechalacho	Regular inspections of the TMF and associated structures will be completed. Regular inspections will help identify any areas of concern that may require maintenance or more detailed evaluation. The inspection program would include detailed visual inspection of all embankments and berms, pipelines, pumps, culverts, spillways, etc. The regular inspections will be completed as follows: • Detailed monthly inspections by the EHS Coordinator to look for any less obvious signs of potential problems. • Detailed inspections by the EHS Coordinator, during and following any extreme events, including snowmelt and precipitation, to assess if any damages due to erosion, settlement, etc., require attention. • Annual inspection of the TMF by a qualified Geotechnical Engineer to verify that the embankments are performing as designed and that the facility is being operated following design intent.
DAR May 2011 + EC IR#20.1 March 2012	110	Nechalacho	Water quality and biological monitoring will be carried out according to requirements of the Water License and the MMER. Monitoring results will be used to confirm that water quality downstream of the TMF discharge remains within allowable limits.
EC IR#20.5 March 2012			Water monitoring will include winter water quality sampling to measure nutrient and oxygen levels.
DAR May 2011	111	Nechalacho	The floor of the process plant will be concrete lined and sloped to a central drainage sump.
DAR May 2011	112	Nechalacho	Extraction of fresh water from Thor Lake will be managed to conform to the 2010 Department of Fisheries and Oceans (DFO) Protocol for Winter Water Withdrawal (DFO 2010), which specifies the use of no more than 10% of the available under-ice water volume.
DAR May 2011	113	Nechalacho	Mine water and Plant site runoff will be collected and directed into the process as appropriate
DAR May 2011	114	Nechalacho	Avalon will be putting in place a pumping system with a maximum capacity of 500 gallons per minute In the event there are surges of water inflows outside the current geomechanical and hydrogeological designs.

DAR May 2011	115	Hydromet Plant	The tailings solids from the proposed process will be predominantly gypsum (approx. 84%) which are expected to be similar to gypsum tailings in terms of void ratio, dry density and consolidation properties. From a geochemical point of view the tailings will be a fully neutralized material (by the addition of limestone) and it is expected that there will not be any regulatory exceedances of significant amounts of leachable metals based on testing of the concentrate completed to date.
DAR May 2011	116	Hydromet Plant	Based on a review of several local historic open pits in close proximity to the Process Plant Site, the L-37 Pit was selected as the best option. The L-37 pit is located approximately 2.5 km south of the proposed Hydrometallurgical Process Plant site at Pine Point.
DAR May 2011	117	Hydromet Plant	Preparation of the L-37 pit for tailings disposal will involve the following items: • Existing waste rock within the bottom of the pit will be used to re-grade the bottom of the pit so that all areas are above the aquifer water table. This will ensure that the deposited tailings are not in direct contact with aquifer water and that tailings are deposited within a dry basin to promote drainage and consolidation of the solids. • A perimeter road will be constructed around the edge of the pit to allow tailings to be strategically discharged to form an initial layer as quickly as possible over the bottom of the pit. Once the initial layer is formed, the discharge can be managed to maintain a central pond for water management.
DAR May 2011	118	Hydromet Plant	During ongoing operations, excess water accumulation within the L-37 pit be pumped to an adjacent pit (N-42) for discharge and infiltration within the Presqu'ile aquifer.
DAR May 2011	119	Both	Avalon commits to water quality sampling until such time that demonstration of compliance with the license criteria has been proven.
DAR May 2011	120	Hydromet Plant	There will be no direct discharge of any Hydrometallurgical waste water discharges to any surface water such as area streams or lakes.
DAR May 2011	121	Both	Implementation of erosion control measures if and as warranted.

DAR May 2011	122	Hydromet Plant	Monitoring of water quality will be conducted in the following manner: • Samples of slurry will be taken at the plant discharge and both the solids and pore water will be tested for parameters of interest • Groundwater monitoring wells will be established around the pit and used for determination of baseline water quality as well as ongoing monitoring • Once a water pond starts to form within the pit, additional water samples can be taken to be tested for parameters of interest
EC IR#22 March 2012		Both	The AEMP sampling program will include periodic biological sampling (fish, benthic invertebrates) will be carried out in adherence to the schedule required by the MMER. monthly Surveillance Network Program (SNP) sampling will commence prior to mine operational start-up, thereby providing further baseline data.
Public Hearing March 18, 2013		Nechalacho	Avalon will develop its aquatic effects monitoring program in accordance with Aboriginal Affairs and Northern Development Canada's AEMP guidelines
DFO IR #10 March 2012		Both	Avalon is committed to working with DFO and implementing appropriate mitigation measures for any works in Great Slave Lake in order to protect all fish and fish habitat, including shortjaw cisco.
DAR May 2011	123	Hydromet Plant	Process water for the Hydrometallurgical plant will be retrieved from the T-37 (J-44: listed in Aug 2012 commitment table) historic open pit located 4 kilometres North of the proposed plant.
AANDC IR #22.5 & 22.6 March 2012		Hydromet Plant	Additional sampling (groundwater andsurface water) is planned to be carried out in 2012. The results of this future sampling will be provided to the MVEIRB when they become available.
DFO IR #6 March 2012		Nechalacho	The decant pipe will discharge into an excavated ditch near the toe of the Polishing Pond embankment. The ditch will be inspected and maintained to ensure its integrity during operations and to verify that significant sediment is not reaching Drizzle Lake due to operations.
Technical Session #2 August 15, 2012		Hydromet Plant	Avalon to provide information at the Pine Point site on modelling of the contaminant plume stemming from the aquifer, including a plume diagram
Public Hearing March 18, 2013		Nechalacho	Avalon suggests that SSWQOs be tied to natural seasonal variations. This seasonal variation would be discussed during the water licensing phase.

Public Hearing March 18, 2013		Nechalacho	Avalon will employ adaptive management or treatment in order to meet SSWQO for nutrients.
Public Hearing March 18, 2013		Nechalacho	Avalon will periodically monitor fish tissue for a full range of parameters, including selenium, to monitor for changes.
Public Hearing March 18, 2013		Both	Avalon will continue to do test work on the toxicity on rare earth metals as it relates to the Thor Lake Project.
	TERRAIN/VEGETATION		
DAR May 2011	124	Both	Minimize footprint size
DAR May 2011	125	Both	Incorporate previously disturbed areas into development plans
DAR May 2011	126	Both	To the extent possible, construct infrastructure on bedrock, avoiding permafrost areas
DAR May 2011	127	Both	Use of appropriate engineering design for permafrost conditions where construction in permafrost cannot be avoided
DAR May 2011	128	Both	To the extent possible, avoid ecosystem types that are sensitive or provide high rare plant habitat potential
DAR May 2011	129	Both	Restrict site activities (e.g., ATV use) to footprint area
DAR May 2011	130	Both	Conduct periodic monitoring of disturbance areas, particularly roadsides, for invasive species presence
DAR May 2011	131	Both	Conduct reclamation trials throughout the life of the Project to identify effective treatment options
DAR May 2011	132	Both	Reclamation of the TLP will be conducted in accordance with the terms and conditons of the MVLWB Land Use Permit and INAC's Mine Site Reclamation Guidelines for the NWT (2007)
	WILDLIFE		
DAR May 2011 / Revised GNWT IR #17.1 February 2012	133	Both	GNWT's ENR *Food and Waste Management Guidelines* will be implemented to ensure carnivores do not become habituated and eventually require relocation and destruction. Adaptive management will be applied to Avalon's waste management strategies such that if problem wildlife (e.g. black bears, bald eagles, red fox, etc.) is attracted to the site, additional management practices will be implemented.
GNWT IR #17.1 February 2012	[134]	Both	Develop and implement an education program for all Project employees and contractors detailing wildlife related policies and mitigation.
DAR May 2011	134 [135]	Both	As required by the NWT Mine Health and Safety Regulations (s.15.05), all field personnel will undertake bear-safety training. In the event that a bear is disturbed and/or encountered during project operations, information on the sighting will be forwarded to the local Renewable Resource Officer at the earliest opportunity. If a bear is encountered,

			response should be in accordance with ENR's Bear Response Guidelines (by extension, all employees must be familiar with these guidelines; it will be included in employee training). Any defense of life and property (DLP) kills must be reported ASAP.
DAR May 2011	135 [136]	Hydromet Plant	Power poles from the existing substation will be located alongside existing access roads. Marking material will be added to enhance visibility of the power lines between the poles.
DAR May 2011	136 [137]	Both	Avalon will implement a no hunting policy for all project employees and contractors within the Projects zone of influence defined by the shooting restrictions of 3 kilometres from the Project sites. In addition, the company will require all project-related transportation activities to give the right-of-way to any wildlife that such activities may encounter.
DAR May 2011 / Revised GNWT IR #17.1 February 2012	137 [138]	Both	Implement a transportation and traffic management plan to minimize vehicular interactions with wildlife, including: · Implementation of speed limits on all site roads · All Project-related transportation activities will give the right-of-way to any wildlife that such activity may encounter · Implementation of an alert system to warn personnel of wildlife (barrenground caribou, moose, bear, wolverine, etc.) in the Project area by relaying sighting information to vehicles and equipment operators and on-site personnel to avoid the area, if possible · Implementation of bus transportation for employees and contractors from Hay River and Fort Resolution to the Hydrometallurgical Plant site to minimize the risk of vehicle-wildlife collisions and disturbances from the road · Dust suppression strategies (e.g. water or approved dust suppressant products) in accordance with GNWT dust suppression guidelines
GNWT IR #17.1 February 2012	[139]	Nechalacho	Develop standard aircraft procedures for flying into and departing from the Nechalacho Mine airstrip to accommodate caribou if present
DAR May 2011	138 [140]	Both	Maintain a minimum flight altitude of 600 m during all times, except during take off and landings
DAR May 2011	139 [141]	Both	If a mineral lick is present in the project area, the proponent will maintain a 300 m buffer zone between any development activities and the lick.
DAR May 2011 / Revised GNWT IR #17.1 February 2012	140 [142]	Both	Maintain a buffer zone of 500 m between identified large mammal dens (wolf,black bear, wolverine) and Project personnel during construction; dens discovered within 500 m of the Project area after construction will be reported immediately to GNWT ENR to determine appropriate course

			of action.
DAR May 2011	141 [143]	Both	If caribou are encountered during the development they will be left alone, and as necessary, local wildlife officials will be consulted.
DAR May 2011	142	Both	Maintain sufficient buffer distances between development activities (e.g., re-fueling and material storage) and waterbodies
DAR May 2011	143 [144]	Both	No wildlife will be purposefully encouraged to habituate to human presence (eg wildlife will not be fed)
DAR May 2011	144 [147]	Both	Avalon will conduct limited wildlife monitoring in the immediate vicinity of the Nechalacho and Hydrometallurgical development area. Avalon will record all significant wildlife observations made by site personnel while in the project area, and report any wood bison sightings to GNWT's ENR.
DAR May 2011	145 [148]	Both	All waste foods and human garbage will be stored in wildlife proof containers prior to offsite disposal in an approved manner. No land filling of such wastes will be conducted on site.
DAR May 2011	146 [149]	Both	To the extent reasonable, Infrastructure design will consider minimizing attraction of predators: wedges of greater than 45 degrees to deter ravens from nesting; all areas (large and small) with horizontal surface that can be enclosed will be enclosed; horizontal supports will be of the minimum possible width; anti-nest spikes or angled surfaces will be used near heat sources at greater than 45 degrees; surface complexity of all infrastructure will be reduced to avoid small nooks and crannies; all buildings and stairs will be skirted down to the ground; waste management will be consolidated in one secure, well-monitored location; domestic waste will not be exposed to the environment; all infrastructure will be continuously monitored for points of compromise; monitoring of wildlife use of decommissioned sites will continue once project is complete.

DAR May 2011	147 [150]	Both	The primary mitigation measure for any species at risk will be avoidance. If species at risk are encountered the proponent will avoid contact with or disturbance to the species, its habitat, or its residence. Monitoring will be done to determine the effectiveness of mitigation or to determine if further mitigation is required. At minimum, the proponent will record and provide to the relevant authorities all observations of any species at risk, including information on location sighted, number and reaction of the wildlife to project activities, and in some cases further monitoring may be required for particular species. Mitigation and monitoring will be consistent with recovery strategies and action or management plans for the particular species.
DAR May 2011	148 [151]	Both	The proponent will undertake monitoring for whooping crane near the project site. Wetlands near the project site including the area identified as shrubby fen in the local study area will be visually checked every two (2) weeks from May to September to see if any cranes are present. If a whooping crane is observed, the wetland area will be visually checked on a weekly basis for cranes and measures undertaken to avoid disturbance to the bird. As well, Environment Canada will be contacted to determine whether any further mitigation measures might be required. Additionally, any other observations of whooping cranes will also be reported to Environment Canada.
DAR May 2011	149 [152]	Both	Develop and implement an education program of wildlife related policies and mitigation to all project employees and contractors
DAR May 2011	150 [153]	Both	The developer will provide employee education on the SARA listed species, so that people do understand what they are looking at and know what to identify when they do see it, as well as make it a policy that they report that immediately to Avalon's EHS Coordinator.
GNWT IR#14.2 February 2012		Both	Avalon commits to working with ENR and other relevant parties in the development of the Wildlife Effects Monitoring and Management Plan with the goal of an endorsed, initial Plan (Aug 2012 commitment table states "final Plan") in place 90 days prior to construction proceeding at the Nechalacho Mine and Hydrometallurgical Plant site areas.
GNWT IR #17.1 February 2012	[145]	Both	Habitat clearing activities will be avoided to the greatest extent possible from May 15 – August 15 annually to prevent accidental mortality of adults, eggs, and pre-fledged young of SARA listed species (e.g. Common nighthawk, Olive-sided flycatcher, Rusty blackbird, etc.) as well as other upland breeding birds

GNWT IR #17.1 February 2012	[146]	Both	Mowing or other activities within the airstrip buffer zone will be avoided from late April to late July to prevent accidental mortality of nesting and fledging Short-eared owls.
EC IR #12.1 March 2012		Nechalacho	Avalon is committed to avoiding to the extent possible: · all known or suspected nest sites. · clearing during nesting season from May 15 to August 15. · clearing habitat from May 15 to August 15 to prevent accidental mortality of Olive-sided Flycatcher adults, eggs, and pre-fledged young (as well as other upland breeding birds). · clearing activities from mid-May to late August.
EC IR #13.5 March 2012		Both	If a deterrent is required to prevent birds and Species at Risk from coming into contact with tailings or water within the TMF, Avalon is committed to consulting with Environment Canada and GNWT ENR to determine the most appropriate method(s) to employ
GNWT meeting January 24th, 2013		Both	Rename the Conceptual Wildlife Effects Monitoring and Management Plan to a Wildlife and Wildlife Habitat Protection Plan (WWHPP)
GNWT meeting January 24th, 2013		Both	Avalon acknowledges GNWT request for a Wildlife Effects Monitoring Program (WEMP) and commits to continued discussions with the GNWT about wildlife monitoring. Avalon has a general principle of collaborating with affected parties in the development of the Project, which would include collaborating with the GNWT, affected aboriginal organizations, co-management authorities, and any other affected parties in the development and on-going review of a possible WEMP
GNWT meeting January 24th, 2013		Both	Avalon commits to GNWT Technical Report Recommendation #6. Specifically, Avalon commits to attend tne GNWT cumulative effects workshop (February 4-7, 2013).
Public Hearing March 18, 2013		Both	Avalon will participate in cumulative effects programs developed by the GNWT and Aboriginal parties that are applicable to Avalon's operation and provide meaningful information for both communities and Avalon.

Commitments from August 2012 Commitments Table that were not included in the final March 2013 Commitments table

Source	DAR Item #	Plant Site	Avalon Commitment
	Dust Control		

EC IR#4 March 2012		Both	It is recommended that one passive SO2 monitor be located at the location of predicted exceedance inside the plant fenceline at the mine site and that one be installed at the Hydrometallurgical plant at the location of predicted exceedance. It is also recommended that TSP be monitored inside the fenceline of the mine site in the area of predicted exceedance for a minimum of one year, at which time the need for continued monitoring would be determined in consultation with Environment Canada and GNWT.
	Water Management	**and Fish**	
AANDC IR#3 March 2012 and letter to MVEIRB April 2012		Nechalacho	Avalon will conduct acute and chronic toxicity testing on representative Nechalacho Flotation plant effluent as soon as practical. Upon completion of both acute and chronic toxicity testwork, Avalon will be pleased to provide the Review Board with those results.

Appendix D: List of public registry documents

This appendix contains a list of documents and corresponding Public Registry documents. Physical copies of these documents are available at the Review Board office. With few exceptions, these documents may be viewed online at the Review Board website (www.reviewboard.ca).

The following acronyms are used in this appendix:

Avalon	Avalon Rare Metals Inc.
AANDC	Aboriginal Affairs and Northern Development Canada
Akaitcho	Akaitcho Treaty # 8 Tribal Corporation
Blachford	Blachford Lake Lodge
DKFN	Deninu Kue First Nation
DFO	Fisheries and Oceans Canada
EC	Environment Canada
FRMC	Fort Resolution Metis Council
GNWT	Government of Northwest Territories
KFN	K'atlo'deeche First Nation
LKDFN	Lutsel K'e Dene First Nation
MVLWB	Mackenzie Valley Land and Water Board
NRCan	Natural Resources Canada
NSMA	North Slave Metis Alliance
NWTMN	Northwest Territory Metis Nation
Review Board	Mackenzie Valley Environmental Impact Review Board
TG	Tlicho Government
TC	Transport Canada
YKDFN	Yellowknives Dene First Nation

Avalon Metals Inc. - Nechalacho - EA-1011-01

Reg Item No	Doc Name	Originator	Date Received
1	Referral to environmental assessment by MVLWB June 11, 2010.	MVLWB	24-Jun-10
2	Notice of referral to Avalon Rare Metals Inc.	Review Board	25-Jun-10
3	Letter from the Review Board to the Distribution List Regarding the Referral of the Nechalacho Rare Earth Element Project to Environmental Assessment	Review Board	28-Jun-10
4	Land Use Permit Application	Avalon	29-Jun-10
5	Water Licence Application	Avalon	29-Jun-10
6	Correction - no road access to the Thor Lake site	Review Board	30-Jun-10
7	Final Project Description Report	Avalon	30-Jun-10
7	Appendix A - Community Engagement Log	Avalon	30-Jun-10
7	Appendix B - Climate and Hydrology	Avalon	30-Jun-10
7	Appendix C - Hydrogeology	Avalon	30-Jun-10
7	Appendix D - Aquatics and Fisheries	Avalon	30-Jun-10
7	Appendix E - Terrain and Soils	Avalon	30-Jun-10
7	Appendix F - Vegetation	Avalon	30-Jun-10
7	Appendix G - Wildlife	Avalon	30-Jun-10
7	Appendix H - Environmental Considerations at Pine Point Mine Site	Avalon	30-Jun-10
7	Appendix D - Aquatics and Fisheries	Avalon	30-Jun-10
8	Letter from the Review Board to the Distribution List Regarding Scoping for Avalon Rare Metals Inc.'s Nechalacho Rare Earth Element Project	Review Board	9-Jul-10
9	Distribution List for the Environmental Assessment of Avalon Rare Metals Inc.'s Nechalacho Rare Earth Element Project	Review Board	14-Jul-10
10	Scoping Scheduling Letter for the Environmental Assessment of Avalon Rare Metals Inc.’s Nechalacho Rare Earth Element Project	Review Board	6-Aug-10
11	Dettah Scoping Session Agenda for the proposed Nechalacho Rare Earth Element Project	Review Board	10-Aug-10
12	Fort Resolution Scoping Session Agenda for the	Review	18-Aug-10

	proposed Nechalacho Rare Earth Element Project	Board	
13	Lutsel K'e Scoping Session Agenda for the proposed Nechalacho Rare Earth Element Project	Review Board	27-Aug-10
14	Technical Scoping Session Agenda for the proposed Nechalacho Rare Earth Element Project	Review Board	1-Sep-10
15	Sign-in sheet from the Review Board's Dettah Scoping Session for Avalon's Nechalacho Project	Review Board	17-Aug-10
16	Sign-in sheets from the Review Board's Fort Resolution Scoping Session for Avalon's Nechalacho Project	Review Board	25-Aug-10
17	Map from Ronald McKay outlining a Protected Area near Fort Resolution - Scoping Session Submission	R. McKay	25-Aug-10
18	Fort Resolution Metis Council Scoping Session Submission	FRMC	25-Aug-10
19	Rare Earth Elements Profile - British Geological Survey	Review Board	2-Sep-10
20	Scoping Submission from Natural Resources Canada for Avalon's Nechalacho Rare Earth Element Project	NRCan	20-Aug-10
21	Avalon's Nechalacho Project Presentation - Dettah Scoping Session	Avalon	17-Aug-10
22	Avalon's Nechalacho Project Presentation – Fort Resolution Scoping Session	Avalon	25-Aug-10
23	Report from the Review Board's Scoping Session in Dettah for Avalon's Nechalacho Project	Review Board	17-Aug-10
24	Review Board's Technical Scoping Session Report for the environmental assessment of Avalon's Nechalacho Rare Earth Element Project	Review Board	24-Sep-10
25	Scoping submission from Environment Canada	EC	27-Sep-10
26	Scoping submission from INAC	AANDC	27-Sep-10
27	Scoping submission from North Slave Metis Alliance	NSMA	27-Sep-10
28	Scoping Submission from Transport Canada	TC	27-Sep-10
29	Fisheries and Oceans Canada's Scoping Submission to the Review Board for Avalon Rare Metals Inc.'s Nechalacho Rare Earth Element Project	DFO	27-Oct-10
30	Government of the Northwest Territories' Scoping Submission to the Review Board for Avalon Rare Metals Inc.'s Nechalacho Rare Earth Element Project	GNWT	27-Oct-10
31	Yellowknives Dene First Nation's Scoping Submission to the Review Board for Avalon Rare Metals Inc.'s Nechalacho Rare Earth Element Project	YKDFN	29-Sep-10
32	Blachford Lake Lodge/Mike Freeland's Scoping Submission to the Review Board for Avalon Rare Metals Inc.'s Nechalacho Rare Earth Element Project	Blachford	27-Sep-10

33	September 2010 Water Balance for Avalon Rare Metals Inc.'s Nechalacho Rare Earth Element Project	Avalon	20-Sep-10
34	Hay River Reserve Scoping Session Agenda for the proposed Nechalacho Rare Earth Element Project	Review Board	15-Oct-10
35	Lutsel K'e Scoping Session Meeting Report for Avalon Rare Metals Inc.'s Nechalacho Rare Earth Element Project	Review Board	28-Oct-10
36	Fort Resolution Scoping Session Meeting Report for Avalon Rare Metals Inc.'s Nechalacho Rare Earth Element Project	Review Board	28-Oct-10
37	Cover letter for the draft Terms of Reference for the environmental assessment of Avalon's Nechalacho Rare Earth Element Project	Review Board	26-Nov-10
38	Draft Terms of Reference for the environmental assessment of Avalon Rare Metals Inc.'s Nechalacho Rare Earth Element Project	Review Board	26-Nov-10
39	Review Board Letter to Environment Canada Regarding Species at Risk and Avalon's Nechalacho Rare Earth Element Project	Review Board	6-Dec-10
40	Mackenzie Valley Review Board's Hay River Reserve Scoping Session Report for Avalon's Nechalacho Rare Earth Element Project	Review Board	6-Dec-10
41	Katlodeeche First Nation Scoping Submission for the Environmental Assessment of Avalon's Nechalacho Rare Earth Element Project	KFN	28-Oct-10
42	Sign-in sheets for Review Board's Hay River Reserve Scoping Session for Avalon's Nechalacho Rare Earth Element Project - October 25th-26th	Review Board	26-Oct-10
43	Review Board Letter to Fisheries and Oceans Canada Regarding Species at Risk and Avalon's Nechalacho Rare Earth Element Project	Review Board	7-Dec-10
44	Environment Canada's SARA Notification Letter Response to the Review Board	EC	7-Dec-10
45	Correspondence from Avalon Rare Metals Inc.'s Vice President of Operations David Swisher Regarding Radioactivity Exposure Levels for the Nechalacho Rare Earth Element Project	Avalon	26-Oct-10
46	Avalon's Proposed Site for one of the Pine Point Tailings Management Facilities for the Nechalacho Rare Earth Element Project	Avalon	27-Oct-10
47	Avalon's Proposed Site for the Pine Point	Avalon	27-Oct-10

	Hydrometallurgical Processing Facility for the Nechalacho Rare Earth Element Project		
48	Comments from Avalon Rare Metals Inc. on the draft Terms of Reference for the environmental assessment of Avalon's Nechalacho Rare Earth Element Project	Avalon	9-Dec-10
49	Comments from Environment Canada on the draft Terms of Reference for the environmental assessment of Avalon's Nechalacho Rare Earth Element Project	EC	10-Dec-10
50	Comments from Natural Resources Canada on the draft Terms of Reference for the environmental assessment of Avalon's Nechalacho Rare Earth Element Project	NRCan	10-Dec-10
51	Comments from Fisheries and Oceans Canada on the draft Terms of Reference for the environmental assessment of Avalon's Nechalacho Rare Earth Element Project	DFO	10-Dec-10
52	Comments from Indian and Northern Affairs Canada on the draft Terms of Reference for the environmental assessment of Avalon's Nechalacho Rare Earth Element Project	AANDC	10-Dec-10
53	Comments from the Government of the Northwest Territories on the draft Terms of Reference for the environmental assessment of Avalon's Nechalacho Rare Earth Element Project	GNWT	10-Dec-10
54	Letter from Review Board to Distribution List Regarding Extension of Comment Period on the draft Terms of Reference for Avalon's Nechalacho Project	Review Board	17-Dec-10
55	Letter from the Review Board to Avalon Rare Metals Inc. regarding the Development Description for the Nechalacho Project	Review Board	17-Dec-10
56	Requests for extension to the comment period for the draft Terms of Reference for the environmental assessment of Avalon's Nechalacho Project	YKDFN/KFN/ EC	10-Dec-10
57	Updated development description for proposed Hydrometallurgical Plant Tailings Management Facility	Avalon	20-Dec-10
58	Review Board's Community Scoping Session Presentation	Review Board	16-Aug-10
59	Avalon's Nechalacho Project Presentation - Hay River Reserve Scoping Session	Avalon	21-Dec-10
60	Audio File - Review Board's Dettah Scoping Session for Avalon's Nechalacho Project	Review Board	16-Aug-10
61	Audio File - Review Board's Fort Resolution Scoping Session for Avalon's Nechalacho Project	Review Board	24-Aug-10

62	Audio File - Review Board's Lutsel K'e Scoping Session for Avalon's Nechalacho Project	Review Board	7-Sep-10
63	Audio File - Review Board's Hay River Reserve Scoping Session for Avalon's Nechalacho Project	Review Board	25-Oct-10
64	Sign-in sheets for the Review Board's Technical Scoping Session in Yellowknife for Avalon's Nechalacho Project	Review Board	10-Sep-10
65	Sign-in sheets for the Review Board's Scoping Session in Lutsel K'e for Avalon's Nechalacho Project	Review Board	7-Sep-10
66	Correction to the updated development description for Avalon's proposed Tailings Management Facility	Avalon	7-Jan-11
67	Comments from the Deninu Kue First Nation on the draft Terms of Reference	DKFN	7-Jan-11
68	Comments from the Katlodeeche First Nation on the draft Terms of Reference	KFN	7-Jan-11
69	Comments from the Lutsel K'e Dene First Nation on the draft Terms of Reference	LKDFN	7-Jan-11
70	Comments from the Yellowknives Dene First Nation on the draft Terms of Reference	YKDFN	7-Jan-11
71	Cover Letter for the Final Terms of Reference for Avalon's Thor Lake Rare Earth Element Project	Review Board	14-Feb-11
72	Final Terms of Reference for the environmental assessment of Avalon Rare Metals Inc.'s Thor Lake Rare Earth Element Project	Review Board	14-Feb-11
73	Note to File on the Naming of Avalon's Rare Earth Element Project	Review Board	14-Feb-11
74	Letter from Avalon Rare Metals Inc. re: the initial estimated completion date of the dAR	Avalon	3-Mar-11
75	Avalon estimated DAR submission date	Avalon	4-Apr-11
76	12 Thor Lake Project DAR References [951-982]	Avalon	20-May-11
76	13 Thor Lake DAR List of Appendices	Avalon	20-May-11
76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.01	Avalon	20-May-11
76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.01 Maps-1	Avalon	20-May-11
76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.01 Maps-2	Avalon	20-May-11
76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.01 Maps-3	Avalon	20-May-11
76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.01 Maps-4	Avalon	20-May-11

76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.01 Maps-5	Avalon	20-May-11
76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.02	Avalon	20-May-11
76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.03	Avalon	20-May-11
76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.04	Avalon	20-May-11
76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.05	Avalon	20-May-11
76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.06	Avalon	20-May-11
76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.07	Avalon	20-May-11
76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.08	Avalon	20-May-11
76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.09	Avalon	20-May-11
76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.10	Avalon	20-May-11
76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.11	Avalon	20-May-11
76	Thor Lake Project DAR Appendix C Knight Piesold Geotechnical, Hydrology, Hydrogeology Reports C.01	Avalon	20-May-11
76	Thor Lake Project DAR Appendix C Knight Piesold Geotechnical, Hydrology, Hydrogeology Reports C.02	Avalon	20-May-11
76	Thor Lake Project DAR Appendix C Knight Piesold Geotechnical, Hydrology, Hydrogeology Reports C.03	Avalon	20-May-11
76	Thor Lake Project DAR Appendix C Knight Piesold Geotechnical, Hydrology, Hydrogeology Reports C.04	Avalon	20-May-11
76	Thor Lake Project DAR Appendix C Knight Piesold Geotechnical, Hydrology, Hydrogeology Reports C.05	Avalon	20-May-11
76	Thor Lake Project DAR Appendix C Knight Piesold Geotechnical, Hydrology, Hydrogeology Reports C.06	Avalon	20-May-11
76	Thor Lake Project DAR Appendix C Knight Piesold Geotechnical, Hydrology, Hydrogeology Reports C.07	Avalon	20-May-11
76	Thor Lake Project DAR Appendix C Knight Piesold Geotechnical, Hydrology, Hydrogeology Reports C.08	Avalon	20-May-11
76	Thor Lake Project DAR Appendix C Knight Piesold Geotechnical, Hydrology, Hydrogeology Reports C.09	Avalon	20-May-11
76	Thor Lake Project DAR Appendix C Knight Piesold Geotechnical, Hydrology, Hydrogeology Reports C.10	Avalon	20-May-11
76	Thor Lake Project DAR Appendix C Knight Piesold	Avalon	20-May-11

	Geotechnical, Hydrology, Hydrogeology Reports C.11		
76	Thor Lake Project DAR Appendix C Knight Piesold Geotechnical, Hydrology, Hydrogeology Reports C.12	Avalon	20-May-11
76	Thor Lake Project DAR Appendix C Knight Piesold Geotechnical, Hydrology, Hydrogeology Reports C.13	Avalon	20-May-11
76	Thor Lake Project DAR Appendix C Knight Piesold Geotechnical, Hydrology, Hydrogeology Reports C.14	Avalon	20-May-11
76	Thor Lake Project DAR Appendix D NWT Community Statistics D.01	Avalon	20-May-11
76	Thor Lake Project DAR Appendix E Archaeology Study E.01	Avalon	20-May-11
76	Thor Lake Project DAR Appendix E Archaeology Study E.02	Avalon	20-May-11
76	Thor Lake Project DAR Appendix F SGS Geochemistry-Mineralogy Report F.01	Avalon	20-May-11
76	Thor Lake Project DAR Appendix F SGS Geochemistry-Mineralogy Report F.02	Avalon	20-May-11
76	Thor Lake Project DAR Appendix F SGS Geochemistry-Mineralogy Report F.03	Avalon	20-May-11
76	Thor Lake Project DAR Appendix F SGS Geochemistry-Mineralogy Report F.04	Avalon	20-May-11
76	Thor Lake Project DAR Appendix F SGS Geochemistry-Mineralogy Report F.05	Avalon	20-May-11
76	Thor Lake Project DAR Appendix G SENES Radiological Reports G.01	Avalon	20-May-11
76	Thor Lake Project DAR Appendix H Avalon's Traditional Knowledge Study Communication-Consultation Logs H.01	Avalon	20-May-11
76	Thor Lake Project DAR Appendix I MVEIRB Terms of Reference I.01	Avalon	20-May-11
76	Thor Lake Project DAR Appendix J RWDI Air Quality Report J.01	Avalon	20-May-11
76	Thor Lake Project DAR Appendix K GSGislason Economic Impact Report K.01	Avalon	20-May-11
76	Thor Lake Project DAR Appendix L Avalon Hazardous Materials Spill Contingency Plan L.01	Avalon	20-May-11
76	Thor Lake Project DAR Appendix L Avalon Hazardous Materials Spill Contingency Plan L.02	Avalon	20-May-11
76	Thor Lake Project DAR Appendix L Avalon Hazardous Materials Spill Contingency Plan L.03	Avalon	20-May-11
76	Thor Lake Project DAR Appendix L Avalon Hazardous	Avalon	20-May-11

	Materials Spill Contingency Plan L.04		
76	00 Avalon's Thor Lake Rare Earth Element Project DAR Executive Summary, Concordance Table, Table of Contents, List of Commitments	Avalon	20-May-11
76	01 Thor Lake Project DAR Main Document - Project and Corporate Overview [001-017]	Avalon	20-May-11
76	02 Thor Lake Project DAR Description of Existing Biophysical Environment [018-055]	Avalon	20-May-11
76	02 Thor Lake Project DAR Description of Existing Biophysical Environment [056-155]	Avalon	20-May-11
76	02 Thor Lake Project DAR Description of Existing Biophysical Environment [156-180]	Avalon	20-May-11
76	02 Thor Lake Project DAR Description of Existing Biophysical Environment [181-205]	Avalon	20-May-11
76	02 Thor Lake Project DAR Description of Existing Biophysical Environment [206-230]	Avalon	20-May-11
76	02 Thor Lake Project DAR Description of Existing Biophysical Environment [231-280]	Avalon	20-May-11
76	02 Thor Lake Project DAR Description of Existing Biophysical Environment [281-305]	Avalon	20-May-11
76	02 Thor Lake Project DAR Description of Existing Biophysical Environment [306-343]	Avalon	20-May-11
76	03 Thor Lake Project DAR Description of Local Communities and Socio-Economic Conditions [344-440]	Avalon	20-May-11
76	04 Thor Lake Project DAR Development Description [441-455]	Avalon	20-May-11
76	04 Thor Lake Project DAR Development Description [456-480]	Avalon	20-May-11
76	04 Thor Lake Project DAR Development Description [481-505]	Avalon	20-May-11
76	04 Thor Lake Project DAR Development Description [506-549]	Avalon	20-May-11
76	05 Thor Lake Project DAR Public Consultation [550-622]	Avalon	20-May-11
76	06 Thor Lake Project DAR Environmental Assessment [623-655]	Avalon	20-May-11
76	06 Thor Lake Project DAR Environmental Assessment [656-680]	Avalon	20-May-11
76	06 Thor Lake Project DAR Environmental Assessment [681-755]	Avalon	20-May-11
76	06 Thor Lake Project DAR Environmental Assessment [756-837]	Avalon	20-May-11

76	07 Thor Lake Project DAR Human Environment Assessment [838-875]	Avalon	20-May-11
76	08 Thor Lake Project DAR Effects of the Environment on the Development [876-877]	Avalon	20-May-11
76	09 Thor Lake Project DAR Accidents and Malfunctions [878-891]	Avalon	20-May-11
76	10 Thor Lake Project DAR Cumulative Effects [892-930]	Avalon	20-May-11
76	11 Thor Lake Project DAR Closure and Reclamation [931-950]	Avalon	20-May-11
76	Thor Lake Project DAR Appendix B EBA Baseline and Other Reports B.01	Avalon	20-May-11
76	Thor Lake Project DAR Appendix B EBA Baseline and Other Reports B.02	Avalon	20-May-11
76	Thor Lake Project DAR Appendix B EBA Baseline and Other Reports B.03	Avalon	20-May-11
76	Thor Lake Project DAR Appendix A Stantec Environmental Baseline Reports A.12	Avalon	20-May-11
77	Note to File for the Developer's Assessment Report for the Thor Lake Rare Earth Element Project	Review Board	28-May-11
77	Instructions for downloading Developer's Assessment Report	Review Board	21-May-11
78	Letter from Avalon Rare Metals Inc. to Review Board regarding change in location for Thor Lake Rare Earth Element Project Hydrometallurgical Plant	Avalon	11-Aug-11
79	Cover Letter from the Review Board to Avalon Rare Metals Inc. regarding the Conformity Review for Avalon's Thor Lake Rare Earth Element Project Developer's Assessment Report	Review Board	25-Aug-11
80	Deficiency Statement for Avalon Rare Metals Inc.'s Thor Lake Rare Earth Element Project Developer's Assessment Report	Review Board	25-Aug-11
81	Workplan for the Environmental Assessment of Avalon Rare Metals Inc.'s Thor Lake Rare Earth Element Project	Review Board	25-Aug-11
82	Avalon's Deficiency Statement Response Part 1A	Avalon	9-Sep-11
83	Avalon's Deficiency Statement Response Part 1B	Avalon	9-Sep-11
84	Avalon's Deficiency Statement Response Part 1C	Avalon	9-Sep-11
85	Avalon's Deficiency Statement Response Part 1D	Avalon	9-Sep-11
86	Avalon's Deficiency Statement Response Part 1E	Avalon	9-Sep-11
87	Avalon's Deficiency Statement Response Part 1F	Avalon	9-Sep-11

88	Avalon's Developer's Assessment Report Executive Summary – Chipewyan Translation	Avalon	23-May-11
88	Placeholder for Chipewyan Audio Translation of Avalon's DAR Executive Summary	Avalon	23-May-11
89	Avalon's Developer's Assessment Report Executive Summary – Dogrib Translation	Avalon	23-May-11
89	Placeholder for Dogrib Audio Translation of Avalon's DAR Executive Summary	Avalon	23-May-11
90	Avalon's Developer's Assessment Report Executive Summary – South Slavey Translation	Avalon	23-May-11
90	Placeholder for South Slavey Audio Translation of Avalon's DAR Executive Summary	Avalon	23-May-11
91	Avalon's Deficiency Statement Response Part 2A.01	Avalon	27-Sep-11
92	Avalon's Deficiency Statement Response Part 2B.01	Avalon	27-Sep-11
93	Avalon's Deficiency Statement Response Part 2C.01	Avalon	27-Sep-11
94	Avalon's Deficiency Statement Response Part 2B.02	Avalon	27-Sep-11
95	Avalon's Deficiency Statement Response Part 2B.03	Avalon	27-Sep-11
96	Avalon's Deficiency Statement Response Part 2B.04	Avalon	27-Sep-11
97	Avalon's Deficiency Statement Response Part 2B.05	Avalon	27-Sep-11
98	Thor Lake Project – Pine Point Site Groundwater and Surface Water Quality Test Results	Avalon	7-Oct-11
99	Note-to-File regarding the Retention of a Technical Advisor for the Thor Lake Project EA	Review Board	14-Oct-11
100	Application for Party Status in the Thor Lake Rare Earth Element Project Environmental Assessment	Review Board	28-Oct-11
101	14-Oct-11 E-mail from the Review Board to Avalon Regarding Deficiency Response – Thor Lake Rare Earth Element Project Environmental Assessment	Review Board	14-Oct-11
102	Avalon's Deficiency Statement Response - Attachment 1 and 2A	Avalon	18-Oct-11
103	Avalon's Deficiency Statement Response - Attachment 2B	Avalon	18-Oct-11
104	Avalon's Deficiency Statement Response - Attachment 3A	Avalon	18-Oct-11
105	Avalon's Deficiency Statement Response - Attachment 3B	Avalon	18-Oct-11
106	Avalon's Deficiency Statement Response - Attachment 3C	Avalon	18-Oct-11
107	Avalon's Deficiency Statement Response - Attachment 3D	Avalon	18-Oct-11
108	Avalon's Deficiency Statement Response - Attachment 3E	Avalon	18-Oct-11

109	Avalon's Deficiency Statement Response - Attachment 3F	Avalon	18-Oct-11
110	Deficiency Response Cover Letter from Avalon to Review Board 18-Oct-11	Avalon	18-Oct-11
111	Curricula Vitae for Technical Advisors to the Review Board - Thor Lake Rare Earth Element Project Environmental Assessment	Review Board	1-Nov-11
112	Note to File regarding Thor Lake DAR Conformity	Review Board	3-Nov-11
113	Updated Workplan for the Environmental Assessment of Avalon's Thor Lake Rare Earth Element Project	Review Board	24-Nov-11
114	Review Board Information Request Cover Letter - Thor Lake Rare Earth Element Project	Review Board	24-Nov-11
115	Review Board Information Requests for Avalon's Thor Lake Rare Earth Element Project	Review Board	24-Nov-11
116	Thor Lake Project - Thor Lake Site Groundwater Quality Test Results	Avalon	22-Nov-11
117	Note-to-File for Avalon's Thor Lake Project EA - Party Status and Information Request Deadline Revision	Review Board	16-Dec-11
118	Cover Letter and Meeting Summary – GNWT and Avalon Rare Metals Inc.	GNWT/Avalon	15-Dec-11
119	Information Requests 1-3 from Yellowknives Dene First Nation to Avalon Rare Metals Inc.	YKDFN	16-Dec-11
120	Information Requests from Fisheries and Oceans Canada to Avalon Rare Metals Inc.	DFO	19-Dec-11
121	NB11-00454 Thor Lake Groundwater Quality Results September 2011	Avalon	20-Dec-11
122	Requests for Revision to Information Request Submission Date – Thor Lake Rare Earth Element Project Environmental Assessment	YKDFN/LKDFN/Akaitcho	15-Dec-11
123	Avalon Rare Metals Inc.'s Responses to November 2011 Review Board Information Requests – Part 1	Avalon	21-Dec-11
124	Avalon Rare Metals Inc.'s Responses to November 2011 Review Board Information Requests – Part 2 – Attachments	Avalon	21-Dec-11
125	1989 Thor Lake Area Environmental Baseline Survey – Saskatchewan Research Council	Avalon	21-Dec-11
126	Avalon Rare Metals Inc.'s Response to Information Request-YKDFN-Dec. 16_2011	Avalon	4-Jan-12
127	Information Request Deadline Reminder for the Environmental Assessment of Avalon's Thor Lake Rare	Review Board	6-Jan-12

	Earth Element Project		
128	Avalon's Part 1 Responses to Information Request - DFO - Dec 19 2011	Avalon	10-Jan-12
129	Avalon's Part 2 Responses to Information Request - DFO - Dec 19 2011	Avalon	10-Jan-12
130	Information Requests from Lutsel K'e Dene First Nation to Avalon Rare Metals Inc.	LKDFN	12-Jan-12
131	Information Requests from the Government of the Northwest Territories to Avalon Rare Metals Inc.	GNWT	12-Jan-12
132	Note-to-File for Avalon's Thor Lake Rare Earth Element Project Environmental Assessment – Party Status Update	Review Board	16-Jan-12
133	Information Requests #4-6 from Yellowknives Dene First Nation to Avalon Rare Metals Inc.	YKDFN	13-Jan-12
134	Information Requests from Environment Canada to Avalon Rare Metals Inc	EC	13-Jan-12
135	Information Requests from Deninu Kue First Nation Regarding the Thor Lake Rare Earth Element Project	DKFN	13-Jan-12
136	Information Requests from Transport Canada to Avalon Rare Metals Inc.	TC	13-Jan-12
137	Information Requests from North Slave Metis Alliance to Avalon Rare Metals Inc.	NSMA	13-Jan-12
138	Information Requests from Aboriginal Affairs and Northern Development Canada to Avalon Rare Metals Inc.	AANDC	13-Jan-12
139	DFO Response to Lutsel K'e Dene First Nation Information Request Regarding Avalon's Thor Lake Project	DFO	17-Jan-12
140	Avalon's Response to Information Request - Transport Canada - Jan 12 2012	Avalon	23-Jan-12
141	Avalon's Response to Information Request – Deninu Kue First Nation - Jan 13 2012	Avalon	23-Jan-12
142	Investigating Rare Earth Element Mine Development in EPA Region 8 and Potential Environmental Impacts	Review Board	26-Jan-12
143	Avalon's Response to Information Requests - Lutsel K'e Dene First Nation - Jan 12 2012	Avalon	25-Jan-12
144	Avalon's Response to Information Requests - North Slave Metis Alliance - Jan 13 2012	Avalon	25-Jan-12
145	Avalon's Response to Information Requests #4-#6 - Yellowknives Dene First Nation - Jan 13 2012	Avalon	25-Jan-12
146	GNWT Response to Lutsel K'e Dene First Nation Information Request #4 Feb 1 2012	GNWT	1-Feb-12
147	Avalon's Response to GNWT January 12 2012	Avalon	17-Feb-12

	Information Requests		
148	Avalon's Responses to AANDC's January Information Requests – Part 1	Avalon	21-Feb-12
149	Avalon's Responses to AANDC's January Information Requests – Part 2	Avalon	21-Feb-12
150	Avalon's Responses to AANDC's January Information Requests – Part 3	Avalon	21-Feb-12
151	Avalon's Responses to AANDC's January Information Requests – Part 4	Avalon	21-Feb-12
152	Avalon's Responses to Environment Canada's January Information Requests – Part 1	Avalon	2-Mar-12
153	Avalon's Responses to Environment Canada's January Information Requests – Part 2	Avalon	2-Mar-12
154	Note-to-File for Avalon's Thor Lake Rare Earth Element Project Environmental Assessment - Party Status Update	Review Board	2-Mar-12
155	Review Board Letter to Avalon Rare Metals Inc. Regarding Clarification of Information Request Responses	Review Board	22-Mar-12
156	Avalon Response to Review Board Information Request Clarification Letter	Avalon	2-Apr-12
157	16-April-12 Letter from the Review Board to Avalon Rare Metals Inc.	Review Board	16-Apr-12
158	Meeting Between Avalon and Blachford Lake Lodge	Avalon	19-Apr-12
159	Review Board April 30th 2012 Note to File for Avalon's Thor Lake Rare Earth Element Project	Review Board	30-Apr-12
160	Avalon's Thor Lake Project April 2012 Groundwater Quality Results	Avalon	4-May-12
161	Avalon Rare Metals Inc.'s Response to the Review Board's April 16th 2012 Letter	Avalon	10-May-12
162	Letter from Avalon Rare Metals Inc. Regarding the Review Board's April 16th Letter	Avalon	18-May-12
163	Avalon Rare Metals Inc.'s Information Request Clarification Letter to Fisheries and Oceans Canada	Avalon	18-May-12
164	Letter from Review Board to Avalon Regarding Technical Session Scheduling	Review Board	15-Jun-12
165	Letter from Avalon regarding July 2012 Thor Lake Project Update	Avalon	3-Jul-12
166	July 2012 Note-to-File Regarding Technical Session Scheduling - Thor Lake Project EA	Review Board	6-Jul-12
167	Draft Thor Lake EA Technical Session Agenda August	Review	13-Jul-12

	14th-17th	Board	
168	Note to File Regarding Technical Session Draft Agenda for Thor Lake Project EA	Review Board	13-Jul-12
169	Final Thor Lake Project EA Technical Session Agenda August 14th-17th	Review Board	23-Jul-12
170	Avalon Corporate Sustainability Report 2011	Avalon	3-Aug-12
171	Avalon Presentation from Review Board Technical Session	Avalon	14-Aug-12
172	Review Board 15-Aug-12 Technical Session Avalon Homework Items 1-8	Avalon	15-Aug-12
173	Review Board Technical Session 15-Aug-12 Thor Lake Project Water Quality Corrected Tables	Avalon	15-Aug-12
174	Avalon Paste-Backfill Feasibility Study Excerpt - Thor Lake Project	Avalon	15-Aug-12
175	Tailings Management Facility Diagrams – Nechalacho Site – Technical Session 15-Aug-12	Avalon	15-Aug-12
176	NWTMN-MCI Presentation for Review Board Technical Session on Thor Lake Project	NWTMN	15-Aug-12
177	Avalon's Technical Session Presentation from 16-Aug-12 – Thor Lake Rare Earth Element Project	Avalon	16-Aug-12
178	Meeting Minutes - GNWT-Avalon 1-Aug-12	GNWT/Avalon	16-Aug-12
179	Review Board 16-Aug-12 Technical Session Avalon Homework Items 9-11	Avalon	16-Aug-12
180	Day 1 Technical Session Transcripts – Avalon's Thor Lake Project	Review Board	14-Aug-12
181	Day 2 Technical Session Transcripts – Avalon's Thor Lake Project	Review Board	15-Aug-12
182	Day 3 Technical Session Transcripts – Avalon's Thor Lake Project	Review Board	16-Aug-12
183	Day 4 Technical Session Transcripts – Avalon's Thor Lake Project	Review Board	17-Aug-12
184	Avalon's Technical Session Presentation from 17-Aug-12 – Thor Lake Project	Avalon	17-Aug-12
185	Corrected Slide on HMP Tailings Pit L-37 – Thor Lake Project	Avalon	17-Aug-12
186	Thor Lake Project Zone of Influence – Technical Session Undertaking #5	Avalon	17-Aug-12
187	Note to File - Avalon Thor Lake Project - September 2012	Review Board	7-Sep-12
188	Avalon's List of Commitments to 23-August-12 – Undertaking #2	Avalon	23-Aug-12
189	Thor Lake Project Reagent MSDS Sheets –	Avalon	23-Aug-12

	Undertaking #3		
190	Sodium hydroxide MSDS	Avalon	23-Aug-12
191	Hydroflosilicic acid MSDS	Avalon	23-Aug-12
192	Limestone (Lafarge 2008) MSDS	Avalon	23-Aug-12
193	Soda ash (Brenntag 2006) MSDS	Avalon	23-Aug-12
194	EBA Downstream Water Model Assumptions for Thor Lake Project – Undertaking #4	Avalon	23-Aug-12
195	Thor Lake Project Tailings Facility Operating Level and Capacity – Undertaking #1, #7 and #8	Avalon	23-Aug-12
196	Avalon Workplan September 2012	Review Board	10-Sep-12
197	Thor Lake Project and Traditional Knowledge Modifications – Undertaking #6	Avalon	23-Aug-12
198	Second round IRs from the Review Board	Review Board	21-Sep-12
199	Letter from Review Board to Avalon Regarding Round 2 Information Requests	Review Board	26-Sep-12
200	Letter from Review Board to DKFN Regarding Round 2 Information Requests	Review Board	26-Sep-12
201	Joint Hay River MLA Letter to Review Board Regarding Round 2 Information Requests - Avalon	Hay River MLA	27-Sep-12
202	Letter from Review Board to Hay River North-South MLAs Regarding Round 2 Information Requests	Review Board	27-Sep-12
203	Avalon's Response to Round 2 Information Requests	Avalon	5-Oct-12
204	Transport Canada's Response to Round 2 Information Request – Thor Lake EA	TC	11-Oct-12
205	Review Board Letter to Avalon on Round 2 Information Request Responses	Review Board	26-Oct-12
206	Letter MVRB to NWT CofC re Avalon EA Oct 29 2012	Review Board	29-Oct-12
207	Letter MVRB to MLA Hawkins re Avalon EA Oct 29 2012	Review Board	29-Oct-12
208	Letter MVRB to Town of HR re Avalon EA Oct 29 2012	Review Board	29-Oct-12
209	Pine Point Groundwater Quality Monitoring Presentation	Avalon	1-Nov-12
210	Avalon's Response to Round 2 IR	Avalon	31-Oct-12
211	Letter from Avalon to Board	Avalon	2-Nov-12
212	GNWT Letter Regarding Avalon Meeting and Health Commitments 15-Nov-12	GNWT	15-Nov-12
213	Transport Canada Letter Regarding the NWPA and	TC	19-Nov-12

	Thor Lake Project 19-Nov-12		
214	Technical Report Deadline Reminder - Avalon EA Note to File	Review Board	20-Nov-12
215	Note to File - Archaeological Report and Summary Placeholder – Thor Lake Project	Avalon	17-Aug-12
216	Thor Lake EA Technical Session Undertakings-Commitments	Review Board	17-Aug-12
217	Note to File - Board Staff - Avalon Technical Clarification Minutes	Review Board	29-Nov-12
218	21-Nov-12 Review Board Staff- Avalon Meeting Follow-Up Data	Avalon	22-Nov-12
219	Environment Canada Technical Report – Thor Lake REE Project	EC	29-Nov-12
220	Fisheries and Oceans Canada Technical Report – Thor Lake REE Project	DFO	29-Nov-12
221	Transport Canada Technical Report – Thor Lake REE Project	TC	29-Nov-12
222	AANDC Technical Report – Thor Lake REE Project	AANDC	29-Nov-12
223	29-Nov-12 LKDFN Letter to Review Board – Thor Lake Project EA	LKDFN	29-Nov-12
224	29-Nov-12 NWT-T8TC Letter to Review Board – Thor Lake Project EA	Akaitcho	29-Nov-12
225	GNWT Technical Report – Thor Lake REE Project		29-Nov-12
226	Hearing Directive for Review Board's EA of Avalon's Thor Lake Project	Review Board	10-Dec-12
227	Avalon Response to Technical Reports' Recommendations	Avalon	18-Dec-12
228	Pre-Hearing Conference Letter to Parties - Thor Lake Project EA	Review Board	16-Jan-13
229	Preliminary Agenda for Thor Lake Project EA Public Hearings in February	Review Board	24-Jan-13
230	NSMA, Technical Submission	NSMA	22-Jan-13
231	NSMA Traditional Land Use, Occupancy and Knowledge of the Thor Lake Project Area	NSMA	22-Jan-13
232	NSMA, supporting documents for Technical Submission, citations	NSMA	22-Jan-13
233	NSMA Technical Sumbission, Supporting document, AAEDIRP. aboriginal indicators social economic	NSMA	22-Jan-13
234	NSMA Technical Submission, supporting document, NSMA Community Engagement Policy	NSMA	22-Jan-13
235	NSMA Technical Submission, Supporting Document, The social licence to operate.	NSMA	22-Jan-13

236	NSMA Technical Submission, supporting document, "Limits of Acceptable Change: A new Framework for Managing the Bob Marshall Wilderness Complex	NSMA	22-Jan-13
237	NSMA Technical Submission, supporting document, "Historical Development of Limitis of Acceptable Change: Conceptual Clarificaitons and Possible Extensions"	NSMA	22-Jan-13
238	NSMA Technical Submission, supporting document, "Historical Profile of the Great Slave Lake Area's Mixed European-Indian Ancestory Community"	NSMA	22-Jan-13
239	NSMA Technical Submission, supporting document, "UN Declaration on the Rights of Indigenous Peoples"	NSMA	22-Jan-13
240	NSMA Technical Submission, supporting document, "Performance Standard 7, Indigenous Peoples"	NSMA	22-Jan-13
241	NSMA Technical Submission, supporting document, Government of Canada "Research Involving the First Nations, Inuit and Metis Peoples of Canada"	NSMA	22-Jan-13
242	NSMA Technical Submission, supporting document, "DFO Great Slave Lake Fisheries Management"	NSMA	22-Jan-13
243	NSMA Technical Submission, supporting document, "Standing Senate Committee on Fisheries and Oceans, The Management of Fisheries and Oceans in Canada's Western Arctic"	NSMA	22-Jan-13
244	NSMA Technical Submission, supporting document, "NSMA Applicaton #914 - 2008 to 2010 Baseline Studies of Avalon Ventures Ltd. Proposed Thor Lake Rare Earth Metals Project (Aquatics and Hydrology component)"	NSMA	22-Jan-13
245	NSMA Technical Submission, supporting document, "NSMA 2008-2009 Baseline Studies for Avalon Ventures Ltd. Proposed Thor Lake Rare Earth Metals Project"	NSMA	22-Jan-13
246	Rare Earth Elements: The Global Supply Chain	Review Board	22-Jan-13
247	Rare Earth Elements: The Global Supply Chain	Review Board	28-Jan-13
248	Report of Environmental Assessment Tamerlane Ventures, Pine Point Pilot Project, EA0607-002	Review Board	28-Jan-13
249	The Canadian Guideline for the Management of Naturally Occuring Radioactive Elements	Review Board	21-Jan-13
250	Email from GNWT regarding Air Quality	GNWT	8-Jan-13

251	Review of the Rare Earth Elements and Lithium Mining Sectors	Review Board	28-Jan-13
252	LKDFN Letter regarding Hearing Locations	LKDFN	17-Jan-13
253	Rare Earth Elements: A Review of Production, Processign, Recyling, and Associated Environmental Issues	Review Board	22-Jan-13
254	Note to File Regarding Review Board IR #2.07 – Barging Data	Review Board	7-Dec-12
255	Hearing Directive – Thor Lake Project EA	Review Board	1-Feb-13
256	Final Hearing Agenda – Thor Lake Project EA	Review Board	1-Feb-13
257	Prehearing Conference Minutes – Thor Lake Project EA	Review Board	1-Feb-13
258	Perceptions of the North Slave Metis Regarding the Socio-Economic Effects of Diamond Mining 2005, DCAB Toolkit Survey	NSMA	3-Feb-13
259	NSMA's Top Ten Recommendations Resulting From the 2005 DCAB Toolkit Survey	NSMA	3-Feb-13
260	North Slave Metis Alliance Socio-Economic Baseline Report for Environmental Assessment #EA0809-004, Fortune Minerals' NICO Gold Project	NSMA	3-Feb-13
261	Transport Canada Presentation for the Public Hearing	TC	4-Feb-13
262	Environment Canada, cover letter to their presentation	EC	4-Feb-13
263	Environment Canada's presentation for the Public Hearing	EC	4-Feb-13
264	AANDC Presentation for the Public Hearing	AANDC	4-Feb-13
265	US EPA - Rare Earth Elements - Associated Environmental Issues	Review Board	1-Dec-12
266	DKFN Public Hearing Presentation	DKFN	4-Feb-13
267	DKFN Ethno-history Report De Beers [Part 1 pgs 1-240]	DKFN	4-Feb-13
268	DKFN Ethno-history Report [Part 2 pgs 241-435]	DKFN	4-Feb-13
269	NWT Treaty 8 Tribal Corporation Public Hearing Presentation	Akaitcho	4-Feb-13
270	GNWT and Avalon meeting summary	GNWT/Avalon	4-Feb-13
271	02-05-13 - Letter GNWT to MVEIRB - New Commitments	GNWT	5-Feb-13
272	Letter from GNWT to MVRB re New Commitments	GNWT	5-Feb-13
273	NSMA Presentation	NSMA	4-Feb-13

274	Change in Review Board contact for Thor Lake Project	Review Board	8-Feb-13
275	GNWT Cover Letter and Presentation	GNWT	4-Feb-13
276	YKDFN's public hearing presentation	YKDFN	4-Feb-13
277	Blachford Lake Lodge Public Hearing Presentation	Blachford	12-Feb-13
278	Avalon, cover letter to their presentation and project animation	Avalon	11-Feb-13
279	Avalon Public Hearing Presentation	Avalon	11-Feb-13
280	Updated Hearing Agenda	Review Board	12-Feb-13
281	Letter, GNWT to MVEIRB - Meeting Summary and Commitments	GNWT	8-Feb-13
282	Letter, Review Board to LKDFN re: request for community hearing,	Review Board	15-Feb-13
283	LKDFN Presentation	LKDFN	4-Feb-13
284	Updated LKDFN Presentation	LKDFN	19-Feb-13
285	Updated YKDFN Presentation	YKDFN	19-Feb-13
286	Hearing Transcript February 18, 2013 - Yellowknife	Review Board	21-Feb-13
287	Hearing Transcript February 19, 2013 - Yellowknife	Review Board	21-Feb-13
288	Hearing Transcript February 20, 2013 - Yellowknife	Review Board	21-Feb-13
289	Hearing Exhibit 1 - Robert Boucher speaking notes	Robert Boucher	18-Feb-13
290	Hearing Exhibit 2 - Hydromet Tailings pilot test work	Avalon	20-Feb-13
291	DKFN Updated Hearing Presentation	DKFN	22-Feb-13
292	Hearing transcripts - February 22, 2013 Fort Resolution	Review Board	22-Feb-13
293	Post-hearing submission deadlines	Review Board	4-Mar-13
294	Letter from Angus Charlo	Angus Charlo	4-Mar-13
295	Transport Canada response to Undertaking #1	TC	7-Mar-13
296	AANDC response to undertaking #2	AANDC	12-Mar-13
297	Avalon Rare Metals - Commitment table	Avalon	12-Mar-13
298	Updated - AANDC Response to Undertaking #2	AANDC	13-Mar-13
299	LKDFN Closing Comments	LKDFN	17-Mar-13
300	Environment Canada Closing Comments	EC	19-Mar-13
301	Transport Canada Closing Comments	TC	19-Mar-13
302	GNWT Closing Comments	GNWT	19-Mar-13

303	NSMA Closing Comments	NSMA	19-Mar-13
304	AANDC Closing Comments	AANDC	19-Mar-13
305	AIMA Implementation Office Closing Comments	Akaitcho	19-Mar-13
306	YKDFN Closing Comments	YKDFN	19-Mar-13
307	Avalon Rare Metals Inc. Closing Comments	Avalon	21-Mar-13
308	Letter from Avalon requesting a name change for the project	Avalon	15-Mar-13
309	Letter from Review Board to Avalon regarding name change	Review Board	26-Mar-13
310	note to file - closure of public registry	Review Board	3-Apr-13