

# Mackenzie Valley Review Board



**Draft Terms of Reference  
for the  
Environmental Assessment  
of  
Avalon Rare Metals Incorporated's  
Nechalacho Rare Earth Element Project  
EA1011-001**

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**Mackenzie Valley Review Board**  
200 Scotia Centre  
P.O. Box 938  
Yellowknife, NT  
X1A 2N7  
Tel: (867) 766-7050  
Fax: (867) 766-7074

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# 1. Introduction

## 1.1 Overview

This document outlines the information required for the environmental assessment of the Avalon Rare Metals Incorporated's ("Avalon" or "the developer") Nechalacho Rare Earth Element Project (Nechalacho Project), a mine proposed in the Akaitcho area of the Northwest Territories. This Terms of Reference has the following sections:

- Section 1 – Introduction - including the reasons for environmental assessment referral, the legal context, and the *Terms of Reference* development process;
- Section 2 – Description of the scope of the development and the scope of the assessment, including minimum geographic and temporal boundaries for consideration of impacts from the proposed development on valued components of the biophysical and human environments;
- Section 3 – The *Terms of Reference* that directs the production of a *Developer's Assessment Report*; and
- Appendices.

The *Terms of Reference* will direct the developer to organize existing material, and conduct additional study and analysis as appropriate, in order to submit a "stand-alone" *Developer's Assessment Report*. That report will then be used to inform all interested parties about the proposed development during the analytical phase of the environmental assessment.

## 1.2 Referral to environmental assessment

Avalon has applied to develop a primarily underground mine and milling complex approximately 8km north of the Hearne Channel of Great Slave Lake, 100km southeast of Yellowknife and approximately 100 km west of Lutsel K'e. Avalon proposes to ship concentrate from the proposed mine by barge to a hydrometallurgical facility at Pine Point, Northwest Territories.

In April of 2010 the Mackenzie Valley Land and Water Board received applications for a Type A Land Use Permit (MV2010D0017) and Type A Water License (MV2010L2-005) for the Nechalacho Project. A description of the proposed development was submitted by the developer as part of its application. The Mackenzie Valley Land and Water Board initiated a preliminary screening of the Nechalacho Project according to Section 124 of the *Mackenzie Valley Resource Management Act (MVRMA)*.

On June 11<sup>th</sup>, 2010, the Mackenzie Valley Land and Water Board referred the Nechalacho Project application to environmental assessment under paragraph 125(1)(b) of the *MVRMA*. The Mackenzie Valley Land and Water Board referred the project to environmental assessment "because the development proposal might have a significant adverse impact on the environment and be of public concern". Key areas identified where these impacts may occur included tailings water quality issues, metal leaching/acid rock drainage, barging, and reclamation/closure.

The Review Board notified Avalon on June 25<sup>th</sup>, 2010, that the development had been

referred to environmental assessment.

### **1.3 Legal context and the Terms of Reference development process**

This environmental assessment is subject to the requirements of Part 5 of the *Mackenzie Valley Resource Management Act (MVRMA)*. Section Three of the Review Board's *Environmental Impact Assessment Guidelines* describes the environmental assessment process in detail. That document, as well as the Review Board's *Rules of Procedure*, other guidelines, reference bulletins and relevant policies applicable to this assessment are available online ([www.reviewboard.ca](http://www.reviewboard.ca)) or by contacting Review Board staff.

In accordance with section 115 of the *MVRMA*, the Review Board must conduct an environmental assessment of the proposed development with regard for the protection of the environment from significant adverse impacts, and the protection of the social, cultural and economic well-being of Mackenzie Valley<sup>1</sup> residents and communities. Subsection 114(c) of the *MVRMA* further requires the Review Board to ensure that concerns of aboriginal people and the general public are taken into account. Accordingly, the Review Board has developed these *Terms of Reference* based on an examination of information from the following sources:

- The public record of the preliminary screening;
- All information on the public registry in relation to the Nechalacho Project;
- Issues and information from participants at scoping sessions held
  - in Akaitcho communities in August and September;
  - on the Hay River Katlodeeche First Nation Reserve in October;
  - in Yellowknife at a September technical scoping session; as well as
- Review Board experience in the conduct of environmental assessment.

## **2. Scope considerations**

### **2.1 Scope of development**

Under subsection 117(1) of the *MVRMA*, the Review Board determines the scope of development for every environmental assessment it conducts. The scope of development consists of all the physical works and activities required for the project to proceed.

Within this document the term “Nechalacho Project” means 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. Where this document refers to the “Thor Lake mine site”, that means the area covered by Avalon’s mineral claims and mining leases at, adjacent to, or near Thor Lake. “Pine Point” means the area that Avalon will either use or discharge into at, adjacent to, or near the proposed hydrometallurgical facility in the former Pine Point mine-site area.

In the *Developer’s Assessment Report* (see section 3.2.5) the developer is required to fully describe all required facilities and activities for the development, including any not listed in Appendix B. The Review Board may amend the scope of development at any time during the environmental assessment if the proposed development changes.

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<sup>1</sup> Throughout this document, the term “Mackenzie Valley” refers to the area as defined in section 2 of the *Mackenzie Valley Resource Management Act*.

## 2.2 Scope of assessment

### 2.2.1 Overview

The scope of assessment defines which issues will be examined in the environmental assessment. The scope of assessment includes all potential impacts on valued components of the biophysical and the human environment (for example, wildlife species or heritage resources) from the development, by itself and in combination with other past, present and reasonably foreseeable future developments (see section 2.2.3 for details).

To determine the scope of assessment, the Review Board considered Avalon's Project Description Report and the public registries of the preliminary screening and written scoping submissions. The Review Board also hosted scoping sessions in Dettah, Hay River, Fort Resolution, Lutsel K'e and Yellowknife.

### 2.2.2 Geographic scope

The geographic scope will include all areas that may be affected by activities within the Nechalacho Project scope of development. The geographic scope for each valued component must be appropriate for the characteristics of that component, or the impact and nature of the impact source. For example, consideration of impacts on air should reflect the airshed, wind patterns and mobility of airborne contaminants, while the habitat ranges of wildlife using the area may be relevant from a project specific and cumulative effects perspective. All of these areas together will be considered in the environmental assessment study area, which will be further defined by the developer in its *Developer's Assessment Report* (see section 3.2.3). The developer will provide rationale for the spatial boundaries it selects for the assessment of potential mine-related impacts on each valued component.

The minimum geographic scope will include the following areas:

- 1) Avalon's mineral and surface leases and mining claims in the area of the Nechalacho Project Thor Lake mine site, sub-surface workings, and a reasonable impact footprint radius centered on the mine site. The Review Board excludes from this environmental assessment Avalon's subsurface mineral leases and mining claims for the portion of the Avalon claim block that includes beryllium deposits. However, the Review Board includes surface activities and leases on that same portion of the claim block for the purposes of the Nechalacho Project that do not involve the mining and/or processing of beryllium ore in the geographic scope of assessment;
- 2) The Thor Lake mine site access road connecting the Nechalacho Project mine site to the north shore of Great Slave Lake's Hearne channel and a reasonable impact footprint corridor, including any portions of watercourses that may be affected;
- 3) The watersheds from Ring and Buck Lakes to Thor Lake and downstream of the Nechalacho Project to the confluence of the Hearne Channel of Great Slave Lake to the point where reasonably foreseeable project-related impacts cease to occur;
- 4) Avalon's surface leases and and/or other claims in the area of the Nechalacho Project Pine Point processing site, sub-surface workings, and a reasonable impact footprint radius centered on the processing site;
- 5) The Pine Point processing site haul road connecting the hydrometallurgical facility to the southern shore of Great Slave Lake;
- 6) The road between Hay River and the Pine Point processing site, as well as the road

- between Fort Resolution, Fort Smith and the Pine Point Processing site;
- 7) The Hay River railhead transfer facility;
  - 8) The rail line between the Hay River railhead through Woodland Caribou habitat to the extent of the NWT-Alberta border;
  - 9) Any watershed into which Avalon proposes to discharge water from the hydrometallurgical facility to the point where reasonably foreseeable project-related impacts cease to occur;
  - 10) Any underground aquifers leading to Great Slave Lake from either the Thor Lake mine site or Pine Point processing site; and
  - 11) Great Slave Lake related to any potential impacts on water quality, fisheries and the human environment from any project-related activity, for example barging or effluent discharge.

The geographic scope for assessing impacts to the human environment includes the physical communities Fort Resolution, Lutsel K'e, Hay River area and Yellowknife area and their residents, as well as the Akaitcho and Métis cultural communities resident in or making traditional use of any part of the environmental assessment study area. Together, these groups are described in this document as “potentially-affected communities”.

In its response to section 3.2.3 (below) the developer is required to define and provide rationale for the specific spatial boundaries it used to examine the potential impacts on each of the valued components in its impact assessment. Figure 1 below gives a visual indication of the minimum geographic scope for this environmental assessment.

Figure 1



### 2.2.3 Temporal scope

The developer will use temporal boundaries for this environmental assessment according to potential long-term impacts on valued components, rather than on a single generic timeline. In all cases, the temporal boundary may not end with the duration of the operating phase of the Nechalacho Project.

For project specific (that is, non-cumulative) impacts, the temporal scope will include all phases of the Nechalacho Project lifespan including construction, operation, closure and reclamation, and extends until no potentially significant adverse impacts are predicted. 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 Nechalacho Project.

The developer will place special focus on the consideration of times during the development when activities are particularly intense (such as during initial construction) or when valued components are particularly sensitive to potential impacts (such as during wildlife migration periods, or spawning and incubation periods for fish, key harvesting periods and annual cultural gatherings). The developer will also give special attention to appropriate temporal boundaries for considering any impacts that may require long-term monitoring and management after closure, such as mine water release into the environment (see section 3.3.3 for details on this subject).

The Review Board notes that Avalon has indicated that the Nechalacho Project may be a long-term mine, and requires the developer to accurately portray a realistic mine life in the Developer's Assessment Report.

In its response to section 3.2.3 (below) the developer is required to define and provide rationales for the specific temporal boundaries it used to examine the potential impacts on each of the valued components considered in its impact assessment.

#### **2.2.4 Other scope of assessment considerations**

The scope of assessment set out in these *Terms of Reference* may be re-examined at any time by the Review Board if new information emerges.

The scope of assessment will also include the various alternative methods for carrying out the proposed development as well as any and all related potential impacts stemming from their construction, operation and closure. This is particularly important in light of several project components still being undefined.

Also, the scope of assessment will include an examination of cumulative effects. This will involve considering impacts from other past, present and reasonably foreseeable future developments or human activities that combine with the impacts of the Nechalacho Project to affect the same valued components. Such cumulative effects will be assessed at a spatial and temporal scale appropriate to the particular effect or valued component under consideration.

For example, contaminated sites in the area that are not part of the Nechalacho Project are excluded from the scope of development. However, where the impacts and continuing effects of past activities may combine with the potential impacts of the Nechalacho Project, they must be considered in the cumulative effects assessment (see Appendix L for more details).

Section 3.1 indicates the level of effort required in considering specific issues.



## 3. Terms of Reference

### 3.1 Considerations

The developer will consider the following when developing the specific material the Review Board requests in Section 3.2 – 3.4 and related Appendices. The developer is encouraged to seek clarification from the Review Board in writing if specific requirements in the *Terms of Reference* are unclear. If the developer finds that a question cannot be answered, the developer must provide a reasonable rationale explaining why the question could not be answered.

#### 3.1.1 Issues prioritization

The purpose of scoping is not only to identify issues, but also to prioritize them and if possible, focus required additional work on the most important ones. Avalon will consider all the items described in Section 3.3 because every issue identified in this *Terms of Reference* requires a sufficient analysis to demonstrate whether the development is likely to be the cause of – or a contributor to - significant adverse impacts. However, one particular issue was identified during scoping as requiring increased attention, because of high impact potential and concerns raised in scoping sessions. Avalon is required to give special consideration to the following **key line of inquiry** in the *Developer's Assessment Report*:

- **Impacts of the Nechalacho Project on water quality**, 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 Thor Lake mine site;
  - the Pine Point processing site; as well as
  - the prospect of significant adverse impacts to water quality from barging accidents on Great Slave Lake.

Key lines of inquiry are the topics of greatest concern that require the most attention during the environmental assessment and the most rigorous analyses in the *Developer's Assessment Report*. These are designated as key lines of inquiry to ensure a comprehensive analysis of the issues most likely to cause significant environmental impacts or significant public concern. Data collection and analyses for the key line of inquiry in the *Developer's Assessment Report* should be at a level of detail appropriate for other interested parties to understand the technical material prior to any technical sessions on these topics.

The key line of inquiry will be presented in comprehensive stand-alone sections in the *Developer's Assessment Report*. This will facilitate close examination of the developer's response to these key lines of inquiry, and will require only minimal cross-referencing with other parts of the report and appendices.

#### 3.1.2 Incorporation of traditional knowledge

The Review Board considers both traditional knowledge and scientific knowledge in its deliberations. In addition, subsection 115(c) of the *MVRMA* provides as a guiding principle for the Review Board the importance of conservation to the well-being and way of life of the aboriginal peoples of Canada to whom Section 35 of the *Constitution Act 1982*, applies and who use an area of the Mackenzie Valley. Avalon will make all reasonable efforts to assist in the collection and consideration of traditional knowledge relevant to the Nechalacho Project for the Review Board's consideration. Where it is applicable, Avalon will make all

reasonable efforts to incorporate traditional knowledge from aboriginal culture holders as a tool to collect information on and evaluate the specific impacts required in this *Terms of Reference*. The developer should refer to the Review Board's *Guidelines for Incorporating Traditional Knowledge into the Environmental Impact Assessment Process*<sup>2</sup> and community/culture group-specific traditional knowledge protocols.

### **3.1.3 Assessing the impacts of the environment on the development**

Potential impacts of the physical environment on the development, such as changes in the permafrost regime, other climate change impacts, seasonal flooding and melt patterns, seismic events, geological instability, and extreme precipitation must be considered in each of the applicable items of this *Terms of Reference*. Any changes to the design or management of the Nechalacho Project as a result of considering potential impacts of the environment should be noted in the relevant sections.

### **3.1.4 Use of appropriate media**

The Review Board encourages the developer to present information in user-friendly ways. The use of maps, aerial photos, development component/valued component interaction matrices, full explanation of figures and tables, and an overall commitment to plain language is encouraged. When it is necessary to present complex or lengthy documentation to satisfy the requirements of the *Terms of Reference*, the developer should make every effort to simplify its response in the main body of the text and place supporting materials in appendices. Avalon will also produce all electronic documents in Adobe portable document format.

The developer is encouraged to visually represent both sites of the Nechalacho Project and its surroundings using a diorama-type 3 dimensional landscape model to indicate scale, setting and direct footprint.<sup>3</sup> This model should include the viewscape of the mine site and barge-docking facility from the surface Great Slave Lake.

The *Developer's Assessment Report* will be submitted as a stand-alone document. Relevant information and analyses from previous project descriptions should be incorporated into the *Developer's Assessment Report* and combined with the supplementary material and analyses required by this *Terms of Reference*. Information referenced will be made accessible.

## **3.2 General information requirements**

This *Terms of Reference* document describes the general information required on a subject-by-subject basis. For the sake of readability, detailed requirements are to be included in corresponding appendices for many of the following sections. The developer is encouraged to consider the information gaps identified and questions raised by interested parties on the public record in scoping submissions and comments on the *draft Terms of Reference* when determining the level of detail required in its *Developer's Assessment Report* for specific issues covered in this *Terms of Reference*.

### **3.2.1 Summary materials**

The following summary materials are required:

1. English, Chipewyan, Yellowknives/Weledeh-Dogrib, and South Slavey plain language,

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2 Available at [http://www.reviewboard.ca/upload/ref\\_library/MVEIRB\\_TK\\_Guide.pdf](http://www.reviewboard.ca/upload/ref_library/MVEIRB_TK_Guide.pdf).

3 For an example, see EA 0708-07- Taltson Hydroelectric Expansion Project.

- non-technical summaries of the *Developer's Assessment Report*;
2. A concordance table that cross references the items in the *Terms of Reference* with relevant sections of the *Developer's Assessment Report*; and
  3. A commitments table listing all mitigation measures the developer will undertake, including but not limited to those described in the project application. These should be organized by subject (e.g. water quality, wildlife) for easy reference.

### **3.2.2 Developer**

The following information is required regarding Avalon as well as its subsidiary companies, related corporations and joint venture partners:

1. A summary of the corporate history and operational experience in Canada and the Northwest Territories;
2. How the developer will ensure that its contractors and subcontractors honour commitments made by Avalon;
3. Environmental performance records for Avalon and its partners during prior exploration and development work in support of the Nechalacho Project and any other projects in the NWT. This will include discussion of regulatory compliance (for example, regarding land use permits and water licenses). List any situations where compliance was breached, the issue and cause, and how and when it was mitigated to the regulator's satisfaction; and
4. A description of any corporate policies, codes of practice, programs or plans concerning Avalon's environmental, sustainable development, community engagement and workplace health and safety commitments or policies.

### **3.2.3 Developer's assessment boundaries**

The developer will provide a description, map and rationale for all of the chosen geographic and temporal boundaries used during its impact assessment. Certain minimum requirements and other instructions to assist in the determination of appropriate boundaries are discussed in Section 2.2 of the *Terms of Reference*. Separate boundaries may be required for cumulative effects assessment (see Section 3.6).

The developer will describe and provide rationales for:

1. An overall environmental assessment study area and the rationale for its boundaries;
2. Avalon's chosen spatial boundaries for the assessment of potential impacts for each of the valued components considered; and
3. The temporal boundaries chosen for the assessment of impacts on each valued component.

### **3.2.4 Description of the existing environment**

A detailed description of the existing environment is required, including current status and trends for all valued components. Wherever possible, the developer is responsible for providing a clear picture of what typical environmental conditions existed in the environmental assessment study area prior to any industrial activity occurring. This must consider the current state of the baseline conditions and the natural range of background conditions.

In addition, the developer must provide a description of the methods used to acquire the information used to describe baseline conditions. This description will distinguish between techniques used to measure parameters in the field from information derived from the utilization of models. The developer will also differentiate between natural background water quality and any effects from past development such as exploration.

Describe the biophysical environment at both the Thor Lake mine site and Pine Point processing site, including:

- the geographic location
- air quality
- climate
- hydrology
- surface water quality and quantity - both local and downstream until Great Slave Lake including a reasonable local outflow area of Great Slave Lake
- aquatic organisms
- vegetation
- wildlife, within the scope of development above
- landscape
- terrain and geology
- soil characteristics
- groundwater quality and quantity - both local and downstream until Great Slave Lake, including a reasonable local outflow area of Great Slave Lake

Describe the human environment, including:

- population demographics in surrounding communities
- existing infrastructure
- regional labour pool, skill levels and regional business capacity
- socio-economic conditions in potentially affected communities
- historic and present land use, including harvesting
- heritage resources
- other economic activities

Appendix A provides more guidance on the specific information that the developer should present in the Developer's Assessment Report for the Review Board's consideration on the description of the existing environment.

### **3.2.5 Development description**

Avalon will ensure that a description of all its planned facilities and activities is included in the *Developer's Assessment Report*, including any proposed or existing facilities and activities not listed in Section 2.1 of this *Terms of Reference*. In this section, Avalon is only asked to provide details on the Nechalacho Project itself, not to comment on potential impacts from the development. During scoping the issue of a well-defined project design was raised by various parties - for example, Avalon's lack of a definite plan for tailings management and water treatment at the hydrometallurgical facility. For the purpose of an efficient and effective environmental assessment, the Review Board requires the developer to present the project description in its final configuration in the *Developer's Assessment Report*, or to apply this terms of reference to all alternatives under consideration.

In the *Developer's Assessment Report*, Avalon must also describe alternative development components, management systems, or alternative locations for physical works and activities considered for the Nechalacho Project. Where applicable, the developer will provide reference to research that identifies the successful use of the specific technologies being proposed, and their relevance for this environmental setting.

Avalon must describe the proposed Nechalacho Project, providing details of all works and

activities throughout construction, operation, closure and reclamation, and long-term monitoring phases, with a description of major activities by phase.

This description will include:

- mine components and facilities
- any on-site processing
- chemicals and explosives
- tailings
- mine rock management area
- stockpiling of material
- water usage, management and treatment measures, including Avalon's proposed points of control
- waste management
- power generation
- transportation
- site infrastructure
- employment
- any other activities

Appendix B provides more guidance on the specific information that the developer should present in the Developer's Assessment Report for the Review Board's consideration on the development description.

### **3.2.6 Public engagement**

Engagement with Akaitcho communities, other Aboriginal groups, other governments, or other organizations with interests related to areas that might be affected by the Nechalacho Project should be considered in this section. Aboriginal groups, government agencies and other interested parties may have information useful to the conduct of this impact assessment and all reasonable efforts should be made to engage with them. The Review Board encourages the developer to meet with interested groups outside the environmental assessment process, and to place any information from those discussions they consider may be relevant to the Review Board's decision on the public record.

The following items are required for consideration of public engagement:

- An engagement log, describing dates, individuals and organizations engaged with, the mode of communication, discussion topics and positions taken by participants, including:
  - All commitments and agreements made in response to issues raised by the public during these discussions, and how these commitments altered the planning of the proposed Nechalacho Project
  - All issues that remain unresolved, documenting any further efforts envisioned by the parties to resolve them
- Description of all methods used to identify, inform and solicit input from potentially-interested parties, and any plans Avalon has to keep engagement moving forward;
- Discussion of the implications for environmental monitoring and management of any relevant agreement between the developer and other interested parties; and
- How Avalon has engaged, or intends to engage, traditional knowledge holders in order to collect relevant information for establishing baseline conditions and the effects assessment of potential impacts, as well as a summary table indicating where and how in which of the subsequent sections (3.3-3.6) traditional knowledge was incorporated (see Review Board's *Guidelines for Incorporating Traditional Knowledge in Environmental Impact Assessment*).

## 3.3 Impacts on the biophysical environment

### 3.3.1 Impact assessment steps and significance determination factors

In order to facilitate the consideration of the specific questions posed in this section, the developer is required to address the following impact assessment steps. In assessing impacts on the biophysical environment, the *Developer's Assessment Report* will for each subsection:

- Identify any valued components used and how they were determined;
- For each valued component, identify and provide a rationale for the criteria and indicators used;
- Identify the sources, timelines and methods used for data collection;
- Identify natural range of background conditions (where historic data are available), and current baseline conditions, and analyze for discernible trends over time in each valued component, where appropriate, in light of the natural variability for each;
- Identify any potential direct and indirect impacts on the valued components that may occur as a result of the proposed development, identifying all analytical assumptions;
  - Predict the likelihood of each impact occurring prior to mitigation measures being implemented, providing a rationale for the confidence held in the prediction;
  - Describe any plans, strategies or commitments to avoid, reduce or otherwise manage the identified potential adverse impacts, with consideration of best management practices in relation to the valued component or development component in question;
  - Describe techniques, such as models utilized in impact prediction including techniques used where any uncertainty in impact prediction was identified;
- Assess and provide an opinion on the significance of any residual adverse impacts predicted to remain after mitigation measures; and
- Identify any monitoring, evaluation and adaptive management plans required to ensure that predictions are accurate and if not, to proactively manage against adverse impacts when they are encountered.

The developer will describe how the predicted impacts are expected to arise from the proposed development. This will include describing the mechanisms for cause and effect and providing supporting references (including where Traditional Knowledge was used). Where professional judgment has been used in determining impacts, this must be made clear. Avalon will also provide a discussion on the uncertainty involved with each prediction. For each predicted impact, the developer will also describe:

- the nature or type of the impact;
- the geographical range of the impact;
- the timing of the impact (including duration, frequency and extent);
- the magnitude of the impact (what degree of change is expected);
- the reversibility of the impact; and,
- the likelihood and certainty of the impact.

These criteria will be used by the developer as a basis for its opinions on the significance of impacts on the biophysical environment. The Review Board will make ultimate determinations of significance after considering all the evidence on the public record later in the environmental assessment. For more information on the above criteria, please refer to section 3.11 of the Review Board's *Environmental Impact Assessment Guidelines* available on the Review Board's public registry.

### **3.3.2 Key line of inquiry: water quality**

During the issues scoping process, potential impacts of the Nechalacho Project on water quality at both project sites was identified as a top priority by most interested parties. The developer will consider all potential impacts on water quality in the watershed to the point where no mine-related changes can be measured and present this in a stand-alone section of the Developer's Assessment Report. The developer will:

#### **Thor Lake**

- Describe the impacts of the proposed project on water quality around the Nechalacho mine site and downstream. Include discussion of predicted physical or chemical changes resulting from effluent discharge, tailings facility leakage, acid rock drainage etc. This will include predictions of any changes in levels of contaminants, pollutants or other harmful or deleterious substances caused entirely or partly by the Nechalacho Project.
- Describe any predicted changes to water quality from the Nechalacho Project on surface water bodies both near the mine site and downstream of the project's last point of discharge control until Great Slave Lake
- Describe and predict potential impacts to ground water quality and to groundwater flows from the project area.
- Describe and predict the potential impacts to water quality stemming from both the use of water for project-related activities as well as the removal of Ring and Buck lakes from the watershed.
- Predict what metals or any other substances would leach from a given amount of concentrate if left under water under varying acidic conditions. Provide test results and include the levels of uranium, thorium and beryllium in water, or any other radioactive element. Avalon must give particular attention to uranium, thorium and beryllium levels in supernatant water – in addition to any other radioactive minerals/materials regardless of level of radioactivity.
- Discuss what could leach from Avalon's frozen-concentrate transport container if left to thaw over a summer season or during a temporary shutdown of operations. Also discuss the likelihood of that happening over the course of a transport season and suggested mitigations to prevent any impacts.
- Describe mitigation measures to minimize impacts to water quality, including water treatment measures as well as Avalon's proposed last point of control for potential non-compliant treated-water.

Appendix C provides more guidance on the specific information that the developer should present in the Developer's Assessment Report for the Review Board's consideration on water quality.

#### **Pine Point**

- Describe the impacts of the proposed project on water quality around the Pine Point processing site and downstream, both on surface and ground water quality. Include discussion of predicted physical or chemical changes resulting from effluent discharge, tailings facility leakage, acid rock drainage etc. This will include predictions of any changes in levels of contaminants, pollutants or other harmful or deleterious substances caused entirely or partly by the Nechalacho Project.

- Describe any predicted changes to water quality from the Nechalacho Project on:
  - The one or several water bodies, surface or underground, that Avalon may use as a water source for hydrometallurgical processing or as a point of discharge for effluent;
  - Any connecting waterways (including any streams and/or ephemeral springs that form during freshet) stemming from that use;
  - Groundwater quality stemming from that use and or disposal of effluent into those water bodies; and
  - Surface water bodies downstream of Avalon’s discharge and compliance point at the processing site.
- Predict potential impacts to groundwater flows and water quality in the Presquile Aquifer stemming from its potential use as a source of water and/or as a point of effluent discharge.
- Describe and predict the impacts to both surface water and groundwater quality stemming from Avalon’s proposed alternative of a geothermal electric power plant, given that Avalon would have to drill through the Presquile Aquifer to reach economic heats and discharge any effluent from this operation. Also indicate how the quantity of water used in this case would affect surface water and groundwater quality.
- Describe mitigation measures to minimize impacts to both surface water and groundwater quality, including water treatment measures as well as Avalon’s proposed point of control for potential non-compliant treated water.

#### **Both sites**

- Predict and describe tailings management facility supernatant water quality and quantity as well as percent water content. On this matter, Avalon must give particular attention to uranium, thorium and beryllium levels in supernatant water – in addition to any other radioactive minerals/materials regardless of level of radioactivity - as well as any dust that may come from tailings deposition. Include a discussion of:
  - a. at Thor Lake, interaction of water with paste backfill and resulting effects to water quality. Include a discussion of effects to water quality from uranium, thorium and beryllium levels in supernatant water – in addition to any other radioactive minerals/materials regardless of level of radioactivity;
  - b. at Pine Point, effects of runoff from the coal storage area. Avalon will provide an analysis on the range of water quality that can come from the use of varying ‘grades’ of coal, from poor to high. Also predict and describe runoff from the sulphur storage area.
- Predict and describe the long term effects of water recycling on water quality for different water recycling scenarios, as well as from winter water withdrawal from any lake for any project-related purpose;
- Describe discharge criteria for treated water and how Avalon’s water treatment facilities will achieve those objectives.

#### **Great Slave Lake**

- Predict the effects to water quality from a potential complete overturning of all barges during a Great Slave Lake transit of a typical concentrate-loaded barge-train at various points along the barge corridor between Thor Lake and the delivery point on the south shore of Great Slave Lake. Include a discussion of the associated radioactivity with such an event. [Avalon will discuss the likelihood of such an event in response to



section 3.5.]

- Describe and predict the potential impacts to the local water quality of Great Slave Lake from concentrate spillage at both barge loading/unloading sites over the life of the mine.
- At and after the confluence of the downstream environment of both project sites with Great Slave Lake, describe and predict the potential impacts to the local water quality of Great Slave Lake from the plumes of discharged effluent from both sites. Include a discussion of how project-related changes to any and all discharge into aquifers at both sites may affect the local water quality of Great Slave Lake

Appendix C provides more guidance on the specific information that the developer should present in the Developer's Assessment Report for the Review Board's consideration on water quality.

### **3.3.3 Cumulative effects at the Pine Point site area**

Pursuant to paragraph 117(2)(a) of the *Mackenzie Valley Resource Management Act*, the Review Board considers cumulative effects in its determinations. Cumulative effects are the combined effects of the development in combination with other past, present or reasonably foreseeable future developments and human activities. The Nechalacho Project processing facility at the Pine Point site will sit in an area that has been adversely affected by past development. In addressing cumulative effects, the developer is encouraged to refer to Appendix H of the Review Board's *Environmental Impact Assessment Guidelines*. The developer will:

- Describe and provide rationale for which past, present or reasonably foreseeable future developments and human activities are being considered in the cumulative effects assessment.
- Identify which of the valued components may be affected by other past, present or reasonably foreseeable future developments and human activities.
- Assess the likelihood, duration and magnitude of the combined effect of these human activities on the identified valued components.
- Discuss the various liabilities associated with using land adjacent to the former Pine Point mine site, and how Avalon's liabilities may interact with that of Tamerlane's and Teck Cominco's with regard to reclamation issues.
- Describe any mitigation measures proposed to reduce or avoid the predicted effects, specifying if and how adaptive management will be used, and provide an assessment of any residual cumulative impacts.

Appendix D provides more guidance on the specific information that the developer should present in the Developer's Assessment Report for the Review Board's consideration on cumulative effects assessment.

### **3.3.4 Water quantity**

While water quantity is not a key line of inquiry, the proposed removal of Ring and Buck Lake from the Thor Lake watershed may impact the downstream aquatic environment. As such, the developer is required to answer the following questions. The developer will:

## **Thor Lake**

- Provide a comprehensive water balance for the mine site (with various proposed water recycling scenarios).
- Describe the potential impacts of the Nechalacho Project on upstream and downstream water quantity, with a particular emphasis on changes in:
  - Drizzle, Murky and Thor Lakes;
  - Downstream water bodies of Thor Lake until Great Slave Lake; and
  - Groundwater flows.
- Discuss potential effects of dewatering Ring and Buck Lakes on surface levels downstream in Drizzle, Murky, and Thor Lakes as well as downstream water bodies, including how this may affect Avalon's water balance for the mine site.
- Discuss potential effects of dewatering Ring and Buck Lakes on groundwater levels and water table drawdown, both locally at the mine site and downstream of Thor Lake.
- Discuss potential changes to groundwater-surface water interactions resulting from project activities.
- Discuss how potential changes to permafrost resulting from Project activities may affect groundwater quantity.
- Describe potential impacts of water withdrawals and the loss of littoral habitat both locally at the mine site and especially downstream of Thor Lake.
- Describe mitigation measures to minimize impacts related to water quantity.

## **Pine Point**

- Describe the potential impacts of the Nechalacho Project on upstream and downstream water quantity relating to the use of water for the hydrometallurgical processing of concentrate at the Pine Point site, with a particular emphasis on changes to:
  - the one or several water bodies, surface or underground, that Avalon may use as a water source for hydrometallurgical processing or as a point of discharge for effluent;
  - any connecting waterways (including any streams and/or ephemeral springs that form during freshet) stemming from that use; and
  - groundwater flows stemming from that use and or disposal of effluent into those water bodies.
- Provide a water balance for the Pine Point processing site.
- Discuss potential effect of any possible pit dewatering on groundwater levels and water table drawdown.
- Discuss potential changes to groundwater-surface water interactions resulting from project activities.
- Discuss how potential changes to permafrost resulting from Project activities may affect surface water or groundwater quantity.
- Describe potential impacts of water withdrawals and the loss of littoral habitat downstream of the processing site.
- Describe and predict the impacts to both surface water and groundwater quantity stemming from Avalon's proposed alternative of a geothermal electric power plant, given that Avalon would have to drill through the Presquile Aquifer to reach economic heats.
- Describe mitigation measures to minimize impacts related to water quantity.

### **3.3.5 Fish and aquatic habitat**

The developer will:

#### **Thor Lake**

- Provide all data Avalon has acquired that supports any declaration of Ring and Buck Lakes as non-fish-bearing water bodies, and include the methodologies used to collect such data
- Discuss the potential effects that removal of Ring and Buck Lakes would have on downstream fish and aquatic habitat until the confluence of the watershed with Great Slave Lake
- Predict the effects to aquatic habitat from winter withdrawal from Thor Lake and Drizzle Lake on both lakes and the downstream environment to the extent of Great Slave Lake.

#### **Both sites**

- Identify the fish bearing lakes and rivers that the project may affect near both the Thor Lake Mine site and the Pine Point processing site, as well as a reasonable radius of the neighbouring area of Great Slave Lake
- Describe the potential impacts on aquatic life and riparian areas from changes to water quality, any other changes to water quantity from project use, and any introduction of contaminants to aquatic food chains from effluent discharge.
- Describe in detail the mitigations to which Avalon will commit to avoid or reduce impacts to fish and aquatic habitat, and predict the effects from the Nechalacho Project after those mitigations.
- Predict the effects to water quality from winter withdrawal from any surface water body or bodies for use at the Pine Point hydrometallurgical processing facility.

#### **Great Slave Lake**

- Predict the impacts to fish habitat from mooring barges at the proposed sites on either side of Great Slave Lake.
- Predict the effects to fish and fish habitat from a potential complete overturning of all barges during a Great Slave Lake transit of a typical concentrate-loaded barge-train at various points along the barge corridor between Thor Lake and the delivery point on the south shore of Great Slave Lake. Include a discussion of the associated radioactivity with such an event and effects to fish and aquatic habitat. [Avalon will discuss the likelihood of such an event in response to section 3.5.]
- At and after the confluence of the downstream environment of both project sites with Great Slave Lake, describe and predict the potential impacts to the local fish and fish habitat of Great Slave Lake from the plumes of discharged effluent from both sites. Include a discussion of how project-related changes to any and all discharge into aquifers at both sites may affect the local fish and aquatic habitat of Great Slave Lake.

Appendix E provides more guidance on the specific information that the developer should present in the Developer's Assessment Report for the Review Board's consideration on fish and aquatic habitat.

### 3.3.6 Wildlife

Section 79 of the federal *Species at Risk Act* (SARA) requires that the Review Board identify the adverse effects of the project on all *SARA*-listed wildlife and its critical habitat, and if the project is carried out, must ensure that measures are taken to avoid or lessen those effects and to monitor them. The measures must be taken in a way that is consistent with any applicable recovery strategy and action plans. Cumulative effects on wildlife are examined in section 3.3.3. The developer will:

#### Both sites

- Describe potential effects from the Nechalacho Project on wildlife and its habitat. This will include impacts on hoofed mammals, large carnivores, furbearers (terrestrial and aquatic), and migratory birds. This description will consider:
  - direct and indirect habitat loss;
  - behavioural disturbance from Nechalacho Project activities including but not limited to effects from noise;
  - barriers to movements;
  - effects of tailings ponds on waterfowl
  - impacts related to increased access;
  - project-related transport mortality, with particular emphasis on the increased vehicle traffic between Pine Point and Hay River, as well as the increased rail traffic through Woodland caribou habitat;
  - any other sources of direct or indirect mortality.
- Potential impacts on barren-ground caribou, species that are harvested (moose, etc.) and wildlife at risk require special consideration.
- Describe any mitigation proposed to avoid or reduce impacts to wildlife, and predict any residual impacts.

Appendix F provides more guidance on the specific information that the developer should present in the Developer's Assessment Report for the Review Board's consideration on wildlife.

### 3.3.7 Terrain

The developer will:

- Describe the stability of the proposed mine rock management and tailings management areas and evaluate both the probability and potential impacts of their failure from any number of causes, including shifting in permafrost due to project – related activities or due to climate change;
- Describe how Avalon will ensure the stability of all engineered structures against a range of climate change, seismic, and extreme precipitation scenarios.
- Describe plans to mitigate impacts on terrain, including plans for monitoring, evaluation and adaptive management of the mine rock management area, tailings management area the system of dykes and dams.

Appendix G provides more guidance on the specific information that the developer should present in the Developer's Assessment Report for the Review Board's consideration on terrain.

### 3.3.8 Air quality, including noise, light and viewshed

The *Developer's Assessment Report* will evaluate the Nechalacho Project's potential impacts on air quality due to project emissions. The developer is encouraged to enter dialogue with Environment Canada and the Government of the Northwest Territories about appropriate methods for modeling air quality to ensure compatibility between the developer's and government's analysis. The same is true for strategies for minimizing air quality impacts. The developer should further consider the *Guideline for Ambient Air Quality Standards in the Northwest Territories* and Government of the Northwest Territories *Guideline for Dust Suppression*. The developer will:

#### Both sites

- Describe and quantify existing conditions with respect to air quality and meteorological conditions.
- Predict all sources of greenhouse gas and other types of emissions and their potential impacts on valued components of the surrounding environment using an established air quality model, during all phases of the Nechalacho Project. The model shall predict both dispersion and deposition potential.
- Regarding Avalon's use of coal at the Pine Point processing site, Avalon will provide an analysis on the range of emissions that can come from the use of varying 'grades' of coal, from poor to high.
- 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.
  - c. predict annual carbon emissions over the life of the mine and describe any offsets proposed to mitigate carbon emissions;
- Describe baseline ambient noise levels, differentiating between that associated with Avalon's exploration activities and background noise, and describe how this may affect the surrounding environment with particular attention to effects on wildlife such as caribou
- Describe proposed mitigations and any plans for air quality monitoring, evaluation and adaptive management.

Appendix H provides more guidance on the specific information that the developer should present in the Developer's Assessment Report for the Review Board's consideration on air quality.

### 3.3.9 Vegetation

The developer will:

#### Both sites

- Describe the total amount of land cleared.

- Describe potential impacts on rare plants.
- Describe how Avalon will prevent the introduction of invasive plants.
- Describe mitigation measures related to impacts to vegetation.

Appendix I provides more guidance on the specific information that the developer should present in the Developer's Assessment Report for the Review Board's consideration on vegetation.

### **3.3.10 Biophysical environmental monitoring and management plans**

Monitoring in the environmental assessment is to focus only on monitoring activities required for recognizing potentially significant impacts and ensuring that they are mitigated by adaptive management of the development. For clarity, this excludes monitoring details related to routine regulatory compliance monitoring and state of the environment monitoring, *unless these relate to potentially significant impacts.*

Describe the framework for monitoring plans that will guide Avalon's evaluation of and adaptive management for biophysical impacts. Specify which phase of the development each plan is for, how Avalon's proposed mitigations fit into these adaptive management plans and the thresholds for action within these plans. The Review Board encourages the developer to consult INAC's 2009 *Guidelines for Designing and Implementing Aquatic Effects Monitoring Program for Development Projects in the Northwest Territories.*

Avalon must also show that the monitoring plans have representative baseline information, consider the natural range of variability, and will detect any relevant impacts before they become significant. Describe how project management will be adapted if necessary to prevent significant adverse impacts.

Appendix J provides more guidance on the specific information that the developer should present in the Developer's Assessment Report for the Review Board's consideration on environmental monitoring and management plans.

### **3.4 Impacts on the human environment**

The *Mackenzie Valley Resource Management Act* lists social impacts, cultural impacts, impacts on heritage resources and impacts on wildlife harvesting in the definition of impacts on the environment. In addition, the Guiding Principles of Part 5 of the MVRMA require the consideration of the social, economic and cultural well being of residents and communities of the Mackenzie Valley during every environmental assessment. The Review Board's *Socio-economic Assessment Guidelines* provide a context for assessing impacts on the human environment.

The developer is encouraged to work with communities and responsible government authorities to identify valued components of the human environment, appropriate indicators and sources of information to measure change, pathways by which change may likely occur, and mitigation and monitoring strategies that may be required to maximize benefits and minimize adverse impacts. Mitigation may not be entirely the responsibility of the developer, as governments and communities have social, economic and cultural protection mandates. However, it is primarily the responsibility of the proponent of the project to initially

document these issues in its Developer's Assessment Report. The developer will:

**Both sites**

- Describe employment, training and business opportunities from the Nechalacho Project, and any plans to maximize opportunities for Akaitcho residents, Aboriginal peoples and other Northerners.
- Estimate the total economic activity to be generated by the development (e.g. employment and income generation including multiplier effects and taxes) and associated socio-economic impacts, with a focus on the distribution of beneficial and adverse impacts. Include a description of any plans or strategies to mitigate adverse socio-economic impacts.
- Describe the social impacts of the Nechalacho Project, focusing on community wellness and population health issues at regional, community, family and individual levels.
- Predict potential impacts on public safety, especially in regards to the use of the Great Slave Lake as a barging corridor in light of the use of the East Arm in the summer;
- Describe potential impacts from the Nechalacho Project – including from barging activities – on traditional lifestyles, pursuits and activities on or near Great Slave Lake;
- Predict potential impacts on public safety from barging accidents, including from the public consumption of fish from Great Slave Lake and any mitigation to minimize the potential for vehicle accidents. Also include a discussion on impacts to Great Slave Lake fisheries and tourism operators;
- Predict potential impacts to public safety due to project-related open- or thin-ice areas downstream of both project sites;
- Predict potential impacts to public safety from the increase in traffic on the Pine Point-Hay River road;
- Describe any lessons learned about short and long-term social and economic impacts of previous mine developments in the Mackenzie Valley and the Canadian North, and how the developer has incorporated such lessons into its impact assessment and mitigation commitments for the Nechalacho Project.
- Discussion of any plans, strategies or other commitments the developer has to help potentially-affected communities avoid over-exposure to cyclical economic fluctuations, with a focus on:
  - i. potential social and economic effects of mine closure (including unforeseen early closure or project hiatus) on potentially-affected communities and the Akaitcho region as well as northern businesses; and
  - ii. any plans to assist post-closure transition for mine employees.
- Describe potential cultural impacts, including potential impacts on physical heritage resources, traditional land use (including hunting, fishing, gathering, and use within a reasonable radius surrounding both project sites).
- Describe the specific hazards to employees as well as to public safety and health from project-related radiation or other hazards that may arise from Nechalacho Project operations
- Describe research methodology (see <http://www.pre.ethics.gc.ca/english/policystatement/introduction.cfm>).

- Describe commitments and plans to monitor, evaluate and manage impacts on the human environment.

Appendix K provides more guidance on the specific information that the developer should present in the Developer's Assessment Report for the Review Board's consideration on the human environment.

### **3.5 Accidents and malfunctions**

The developer will:

#### **Both sites**

- Conduct a risk assessment using best practices for the Nechalacho Project, including components, systems, hazards, and failure modes. Avalon will particularly explore and report on the risk of barging accidents on Great Slave Lake due to any cause from a number of different scenarios. Include the transport of a barge-train fully loaded with Thor Lake concentrate.
- Assess likelihood and severity of each risk identified.
- Provide rationale for criteria used for decisions on the various risks related to malfunctions/accidents during all project phases from construction through post-closure.
- Describe contingency plans for accidents, malfunctions or unforeseen impacts of the environment on all aspects of the development – for example earthquakes, climate change-related or project-induced permafrost shifts, extreme precipitation events, etc.
- Describe on-site containment features, such as concrete pads and dykes and detection systems used for early warning of spills.
- Describe the likelihood of spillage into Great Slave Lake at each barge unloading facility
- Describe all accident and emergency response plans that will be in place during the construction phase and operations phase, including emergency communication plans.

### **3.6 Alternatives means to carry out the project**

The Review Board's assessment of impacts may be hindered until Avalon can provide a more definitive project description. The Review Board therefore requires the developer to list the various alternatives to carrying out the objectives of the Nechalacho Project that deviate from that presented in the April 2010 Project Description Report. The developer must also present the various ways that such alternatives may impact any valued component of the surrounding environment and suggested mitigations to prevent significant adverse impacts to those components. For example:

- Avalon has suggested using geothermal electric power plants in place of coal. This has the potential to cause impacts to water quality, and Avalon must present how to mitigate those potential impacts;
- Avalon has also suggested utilizing wind generators to supplement power needs. Avalon must predict impacts to migrating birds from wind generation sites or other impacts;
- Avalon must describe any options or alternatives for tailings disposal at Pine Point.



### **3.7 Closure and Reclamation**

Avalon will present its framework Closure and Reclamation Plan for the Nechalacho Project in the *Developer's Assessment Report*. The developer should consider existing guidance, such as Indian and Northern Affairs Canada's mine closure and reclamation policy and guidelines for the NWT when developing its reclamation plan for the Nechalacho Project (see <http://www.ainc-inac.gc.ca/ai/scr/nt/ntr/pubs/MSR-eng.asp>). The developer is also advised to work with communities and other parties to determine clear closure objectives and link them to measureable closure criteria and indicators. The formation of a Closure and Reclamation working group composed of regulators and other groups will assist in the development of closure objectives and reclamation standards for the Closure and Reclamation Plan.

The temporal scope of the Closure and Reclamation Plan should focus on impacts to water, fish, wildlife and people during the closure and post-closure phases of the project. This discussion is not intended to duplicate the requirements of Section 3.3.6. Long-term project effects on caribou should specifically focus impact predictions in the context of the current serious decline in caribou populations, particularly the Bathurst herd. As well, Avalon must describe plans for reclaiming the barging area laydown and littoral habitat underneath the temporarily moored barges at both project sites.

Appendix L provides more guidance on the specific information that the developer should present in the Developer's Assessment Report for the Review Board's consideration on closure and reclamation.

## **4. Conclusion**

The Review Board anticipates that the requirements described in this document will help Avalon produce a *Developer's Assessment Report* that clearly describes Avalon's predictions of impacts from the Nechalacho Project while providing sufficient basis for the Review Board and parties to analyze and evaluate those predictions.

## Appendices

The Review Board provides these appendices as guidance to the developer on what information to consider when developing the developer's assessment report. The developer's assessment report must address the items from the main body of this terms of reference in a comprehensive manner but does not necessarily need to address each specific item from the appendices.

### Appendix A: Existing environment

#### *Biophysical environment*

Describe the biophysical environment within the relevant environmental assessment study areas. The following description should be at a level of detail sufficient to allow for a thorough assessment of project effects. Describe the following:

#### **Both sites**

- 1) The physical location of both sites and identification of associated ecozones and ecoregions, including the main barging transport corridor between the Thor Lake mine site and the Pine Point processing site.
- 2) Ambient air quality.
- 3) Background noise levels with a description of all human-caused noise sources.
- 4) Climatic conditions, including temperature, precipitation and wind patterns.
- 5) Hydrology and hydrogeology, including surface water and groundwater amounts, direction of flow, likely surfacing points/discharge area (for groundwater and shallow subsurface water), and maps and descriptions of associated watersheds. Discussion should focus in particular on:
  - a. both project sites with sufficient data to capture spatial and temporal variations in water quality;
  - b. seasonal and annual variation in groundwater and surface water quantity around both project sites; including trends over time related to climatic change and extreme events (e.g. high flows);
  - c. the relative contribution of water from the Nechalacho Project mine site to the volume of Thor Lake and the downstream environment;
  - d. the relative contribution of water from any water body, surface or underground, from which Avalon proposes to draw water from for processing at the Pine Point processing site;
  - e. surface water and groundwater flow regimes associated with the area on which both sites are located, including groundwater flow at both project sites;
  - f. relationship between the groundwater regime and permafrost and active layer conditions, including a characterization of those conditions, and how permafrost and active layer changes influence hydrogeology at both project sites;
  - g. description of the methodology used to derive the components of the water balance and characterization of flow regimes including a discussion of any uncertainty. Avalon will also produce refresh rates for Drizzle, Murky and Thor Lakes;
  - h. provide a map indicating the location with rationale of all existing and planned wells, and seeps within the study area and other monitoring locations;

- i. provide location of seepage meters, if any, and evaporation pans installed in the study area; and
  - j. provide a water table elevation map and a map detailing drainage patterns for surface and groundwater for the both project sites, and mine workings.
- 6) Current and historic data on surface water and groundwater quality for the Thor Lake mine site area, and downstream until Great Slave Lake, including a reasonable neighbouring area of Great Slave Lake. Avalon will include the overall range of natural variability of background conditions. Avalon will also include reference lakes in this analysis and a rationale for their selection.
- 7) Current and historic data on surface water and groundwater quality for the Pine Point processing site area, and downstream until Great Slave Lake, including a reasonable neighbouring area of Great Slave Lake. Avalon will include the overall range of natural variability of background conditions. Avalon will also include reference lakes in this analysis and a rationale for their selection.
- 8) Aquatic organisms and aquatic habitat in the environmental assessment study area for both project sites. Include water bodies on the mine site, water sources and downstream areas. Describe the following for key aquatic species:
- a. seasonal and life cycle movements;
  - b. local and regional abundance and distribution;
  - c. known or suspected sensitive habitat areas for different development stages and times of year;
  - d. the food chain that supports the species; and
  - e. any known issues currently affecting fish and other aquatic life forms in the area.
- 9) Wildlife (including resident and migratory bird species), wildlife habitat and migration corridors. Special emphasis will be placed on key harvested species including moose, caribou and furbearers. Where available, the following information is required for each species:
- a. population trends, including abundance, distribution and demographic structures;
  - b. habitat requirements, including identification of local areas of important habitat, attributes of the seasonal habitats that relate to how the species use them (e.g. travel routes, forage) and sensitive time periods;
  - c. migration routes, patterns and timings including typical patterns and the range of known variation;
  - d. factors known or suspected to be currently affecting the species in the environmental assessment study area (e.g. harvesting, disease);
  - e. known or suspected sensitivities to human activities; and
  - f. gaps in current knowledge of the species such as the impacts of disturbance on behaviour or abundance.
- 10) Wildlife at risk occurring in the environmental assessment study area. The developer will:
- a. identify any species present or potentially present in the environmental assessment study area that are listed under schedule 1 of the federal SARA, including but not limited to Woodland caribou;

- b. identify any species present or potentially present in the project area assessed by the COSEWIC; and
  - c. describe each species in terms of the requirements of Item #8 above.
- 11) Vegetation and plant communities, including identification of any areas where rare plants are known or suspected to be present.
- 12) Terrain, surficial geology, structural geology, mineralogy, bedrock geology (type, depth, composition, and permeability), seismic activity records and risk factors, permafrost locations and types within the environmental assessment study area. In particular:
- a. describe the structure, permeability, stability, and other relevant characteristics of the area on which both project sites are located;
  - b. describe permafrost conditions at the site including thermal conditions and ground ice/moisture contents of underlying material, particularly if maintenance of frozen conditions is required;
  - c. identify the chemical composition of host rock and ore bodies at the mine site including:
    - i. potential for acid rock drainage; and
    - ii. uranium, thorium and beryllium content in ore.
  - d. describe and map the ground composition underlying the proposed mine site;
  - e. identify the location, amounts and type of granular material deposits including any information on ground ice;
  - f. describe the ground conditions under and around both project-Great Slave Lake access roads proposed by Avalon, with emphasis on identifying areas susceptible to erosion, and permafrost instability;
  - g. provide complete references for historical data and indicate when historical data is used to provide geological descriptions;
  - h. provide sources of information for geological descriptions and provide relevant information on sampling timing, frequency and duration; and
  - i. include maps, cross-sections and figures to illustrate geological features, where appropriate.
- 13) Physical and chemical makeup of soils and water body sediments.

***Human environment***

Describe the following:

- 14) Any other physical infrastructure present in the environmental assessment study area, including habitations, roads, buildings, quarries, power lines and industrial works.
- 15) Available information pertaining to the project area from land use planning in the Akaitcho region.
- 16) The availability and average training or skill levels of people in the local Akaitcho region and the other Aboriginal and Northern resident regional labour pool.
- 17) The local and regional business capacity available to support the Project.
- 18) Current socio-economic conditions and relevant trends in the potentially-affected communities and the Akaitcho region as a whole, using appropriate indicators of well-being

and quality of life.

- 19) A summary of historic and present land use in the study area, including identification of traditional land use groups, areas used and traditional travel routes and timings.
- 20) Traditional harvesting activities, relevant species (wildlife, fish and plants), observed trends and any traditional values expressed about harvested species.
- 21) Known physical heritage resources locations, areas of high potential for unfound physical heritage resources and cultural values associated with the environmental assessment study area.
- 22) Other current economic activities in the environmental assessment study area.

## **Appendix B: Development description**

Provide a development description including descriptions of:

### **General items**

1. The estimated lifespan, illustrated by a Gantt chart, of the Nechalacho Project broken down into construction, operation, closure and reclamation, and long-term monitoring phases, with a description of major activities by phase.
2. The direct physical footprint of both project sites (outlining efforts made to reduce the footprint), with locations and descriptions of all structures and all aboveground and underground infrastructure.
3. A list of all regulatory permits, licenses and other authorizations required to carry out the development.
4. Land tenure and any existing or anticipated agreements related to access to facilitate the proposed development.
5. A list of any other required developments that need to be constructed or improved in order for the Nechalacho Project to proceed.

### **Thor Lake**

6. All underground and open pit facilities, including ramps, portals, declines, location of infrastructure, machinery requirements, and water management facilities and methods.
7. The mining, crushing, and ore transportation methods used in the open pit and underground works.
8. A description of the milling process from initial separation to concentrate, including primary and secondary crushing and flotation and filtration processes.
9. Tailings management facility including a description of dams and dykes with techniques utilized to ensure their stability and containment, estimated tailings volumes over the life of mine, expected capacities and how they may change over the life of mine – including how Avalon proposes to potentially expand such facilities in the future, a description of how closure considerations affected the weighing of alternative locations, and if frozen conditions are to be relied upon, describe techniques utilized to ensure maintenance of these conditions.
10. A description of the expected volume of the mine, how much of that volume Avalon anticipates to fill with paste-backfill, and the number and volume of bulkheads throughout the mine,
11. Construction and operation of the airstrip, frequency of use, type of aircraft and estimated number of passengers and volume of materials.
12. The expected number of single, one-way trips per day to and from the Nechalacho mine site by barge, type and weight of load, any related storage, transfer and handling, and estimated duration of the annual barging season, including the thresholds that guide Avalon's go-no go decisions on barging safety.
13. The proposed upgrade to the Thor Lake mine-Great Slave Lake access road and any roads within the mine site, including construction (width of right-of-way, vegetation removal, road bed type) and maintenance, and the expected number of trips on that road, as well as the type and weight of load, any related storage, transfer and handling, etc.

## **Pine Point**

14. The expected number of trips per day to and from the Pine Point processing site from Hay River by truck, type and weight of load, any related storage, transfer and handling, and estimated duration of the annual haul season.
15. A description of the entire hydrometallurgical cycle, from beginning to effluent discharge.
16. Mine rock management area including location, underlying ground conditions and volume of waste rock over the life of mine.
17. Describe any proposed use of the existing Teck Cominco tailings management facility.
18. Describe the tailings management facility or facilities proposed in existing open pits at Pine Point including storage capacity, operational life of each facility, pit floor conditions and permeability, presence of standing water, distance to groundwater table, rock types, presence of faults, pit wall stability and any containment dams or dykes.

## **Both sites**

19. All proposed Nechalacho access roads – at both sites – water crossings, including construction/upgrade schedule, amount of water and other materials required and a description of techniques to be utilized to minimize erosion and bank instability.
20. The volume and management of sludge produced at the water treatment facilities.
21. The types and estimated amounts of explosives to be used, their storage, handling and application, both aboveground and underground.
22. The location, contents and estimated amounts of mined materials, soil and overburden at all surface storage facilities, along with estimates of storage requirements, storage capacity limits, separation of materials, and maintenance of materials to facilitate reclamation.
23. Location(s) and proposed activities of aggregate production and storage, with an estimate of the amount of aggregate that will be produced per year over the life of the mine, by location.
24. The siting and design of any waste disposal facilities and management of all wastes generated including storage and disposal plans with contingencies, treatment and testing programs.
25. The type, volume, storage (location and method), handling, transport and disposal of all potentially hazardous materials used on site, as well as fuel and reagents.
26. List the storage location of mill reagents including maximum volumes and concentrations of reagents to be stored on site.
27. The water collection, management and treatment system and all of its component parts, including drainage and other control structures, water and sewage treatment facilities, water storage facilities, and water transport components.
28. The total amount of water in cubic meters estimated to be collected, for both project sites presented separately, and other project site components and eventually be released into local watercourses, with consideration of changes during the life of the Nechalacho Project and the range of seasonal fluctuations.
29. Water intake locations, withdrawal methods and estimated amounts of water required for all on-site activities.
30. Energy requirements and generation sources.

31. Fuel storage facilities including a justification for the fuel storage container type selected, on-site fuel transport and handling procedures.
32. All other infrastructure and activities at the Nechalacho project sites including intensity and type of on-site vehicle traffic required.
33. The number of full-time job equivalents and person years of work associated with the Nechalacho Project, broken down by life cycle phase.
34. Worker transportation and proposed work scheduling.

At a minimum the description should cover the following aspects of the Nechalacho Project, including but not limited to:

### **Construction**

#### **Thor Lake**

- Construction of the waste rock management area
- Construction of any tailings pond and tailings management area, including any water management systems;
- Construction of the underground mine and associated support structures;
- Construction of a waste disposal facility;
- Construction of facilities for milling, initial separation and concentration of ore;
- Construction of power generation and heat recovery facilities;
- Construction of any water treatment facility that will treat water from the tailings pond and other sources;
- Construction of any sewage treatment facilities;
- Construction of drainage control structures, process pipelines and waste water pipelines from mine to surface, on surface at the Nechalacho Project mine site, run-off collection trenches and sedimentation pond;
- 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 camp and a sewage treatment plant;
- Construction of fuel storage facilities on-site;
- Construction of the permanent camp south of Thor Lake;
- Upgrades to the Thor Lake mine site-Great Slave Lake access road as well as construction of any new roads at the mine site;
- Expansion or any other modification to the existing airstrip;
- Development of borrow sources for aggregate production at the mine site or along the Thor Lake mine site-Great Slave Lake access road;
- Seasonal construction and demobilization of the barge-docking facility on the north shore of Great Slave Lake's Hearne Channel;
- Construction of the concentrate and supply storage/laydown area adjacent to barge docking facility.

#### **Pine Point**

- Construction of the hydrometallurgical plant;
- Construction of project-related buildings including garages, maintenance and administration;
- Construction of a waste disposal facility;
- Construction of power generation and heat recovery facilities;



- Construction of storage facilities for fuel, coal, sulphur, limestone and other reagents;
- Construction of any water treatment facility that will treat water from the tailings pond and other sources;
- Construction of any sewage treatment facilities;
- Construction and/or upgrade of the haul road from the hydrometallurgical facility to Great Slave Lake shore and any other new roads;
- Development of borrow sources for aggregate production at the mine site or along the facility-Great Slave Lake access road;
- Seasonal construction and demobilization of the barge-docking facility on the south shore of Great Slave Lake near the Pine Point site;
- Construction of the concentrate and supply storage/laydown area adjacent to barge docking facility near the Pine Point site;
- Construction of any water treatment facility that will treat water from the hydrometallurgical facility or tailings pond and other sources;
- Construction of drainage control structures, process pipelines and waste water pipelines from mine to surface, on surface at the Nechalacho Project mine site, run-off collection trenches and sedimentation pond;
- 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 camp and a sewage treatment plant; and
- Construction of any tailings management facilities, including any water management systems.

## **Operations - Mining and materials storage**

### **Thor Lake**

- Development of underground workings, including crosscut and drift development;
- Extraction and crushing of ore-bearing rock;
- Transport, storage and use of explosives;
- Mine dewatering and deposit of mine water on surface;
- Transportation of materials, management of ore and tailings, the mine rock management area
- Operation of tailings management facility, including waste management systems and paste backfill plant;
- Management of a waste disposal facility;
- Management of initial separation and concentration reject materials, ore and tailings stockpiles on surface, including construction of any associated foundations, buildings, and water treatment and management systems; and
- Operation of mining equipment, including vehicles and materials conveyance systems.

### **Pine Point**

- Hydrometallurgical facility equipment operation, including vehicles and material conveyance systems;
- Transport, storage and use of all reagents, including sulphur, limestone and site-manufactured reagents such as sulphuric acid;
- Transport, storage and use of all Thor Lake-bound fuel, reagents and other materials;
- Transport, storage and use of coal;
- Transportation of materials, management of ore and tailings, tailings pond and tailings management facility, including waste management systems;
- Transport and storage of concentrate;
- Management of a waste disposal facility within the tailings management area.

## **Operations - Milling**

### **Thor Lake**

- 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.

### **Pine Point**

- Use of facilities for processing concentrate via any of the proposed refining techniques, as well as the regeneration of reagents;
- Storage, handling, use and disposal of milling process additives and chemicals;
- Use of facilities to create useable reagents such as sulphuric acid;
- Use of coal-burning or other heat-producing facility; and
- Extraction, transportation, consumption, recycling, treatment and discharge to the environment of mine water and process water.

## **Other on-site facilities and activities**

### **Both sites**

- Power generation and heat recovery facilities;
- Paste backfill facility
- Use of any water treatment facility that may treat water from the tailings pond and other sources;
- Use of drainage control structures, process pipelines and waste water pipelines from mine to surface, on surface at the Nechalacho Project mine site, run-off collection trenches and sedimentation pond;
- Use of roads at both sites;
- Use of any water treatment plant;
- Use during mine operations of the pump house and water intake, water discharge system (including seasonal water storage areas, all drainage ditches and discharge points) and potable water supplies for camps;
- Use of fuel storage facilities on-site;
- Use of the exploration camp at Thor Lake and permanent camp south of Thor Lake;
- Sewage treatment plants;
- Service complex and mine equipment management building;
- Use of vehicles and all other emissions sources both the Thor Lake and Pine Point sites; and
- Use of waste incinerators.

## **Support/ancillary facilities and activities**

### **Both sites**

- Transportation activities by air that support the Nechalacho Project's operation, including transportation of goods, fuel, contractors, and employees into and out of the mine;
- Use of the airstrip at the mine site;
- Transportation activities by road (including the Nechalacho-Great Slave Lake access road)

that support the Nechalacho Project's operation, including transportation of goods, fuel, contractors, and employees into and out of the mine as well as the road transport of goods, fuel, contractors, employees and product between Pine Point and Hay River, as well as between Pine Point and Fort Resolution and Fort Smith;

- Transportation activities by water including the barging corridor between the Thor Lake Project and Pine Point barge loading sites for concentrate, goods, and fuel;
- Loading/unloading activities at the barge docking and transfer facilities as well as the transfer of concentrate, goods and fuel on and off the barges;
- Transportation activities by rail between the Hay River railhead through Woodland Caribou habitat to the NWT-Alberta border;
- Removal and disposal of wastes or other materials;
- Any sites for the alternative energy sources (wind, solar, geothermal, etc.) for either project site;
- Use of borrow sources for aggregate production at the Thor Lake mine site or along the access road; and
- Use of borrow sources for aggregate production at or near the Pine Point mine site.

### **Closure and reclamation**

#### **Both sites**

- Removal or stabilization of all structures and equipment;
- Reclamation of tailings management facilities, and all other site water management facilities at both the Thor Lake and Pine Point sites;
- Reclamation of the waste rock management area;
- Reclamation of the access and haul roads at the Thor Lake mine site and Pine Point processing site;
- Reclamation of infrastructure foundations, piping, and all built structures at the mine site and Pine Point site;
- Reclamation of any stockpiles and materials storage locations;
- Re-vegetation of areas affected by mining, access road or support activities;
- Bulkhead installation and other capping of the underground works at the Thor Lake site; and
- Long-term mine water outflow monitoring and water management around the mine site.

## Appendix C: Water quality Thor Lake

In predicting the impacts on water quality from the Thor Lake mine site, the developer will:

1. Identify, describe, and estimate amounts of contaminants from all potential sources at the Nechalacho mine site. Predict the likelihood and consequences for each of the following, alone or in combination, to leach metals, create acid rock drainage, or otherwise affect water quality. Avalon will include all results of testing to support such conclusions. The predictions will include analysis of:
  - a. mine water quality and quantity from the underground workings;
  - b. the tailings management facility supernatant water quality and quantity as well as percent water content. On this matter, Avalon must give particular attention to uranium, thorium and beryllium levels in supernatant water – in addition to any other radioactive minerals/materials regardless of level of radioactivity - as well as any dust that may come from tailings deposition.
  - c. interaction of water with paste backfill and resulting effects to water quality. Include a discussion of effects to water quality from uranium, thorium and beryllium levels in supernatant water – in addition to any other radioactive minerals/materials regardless of level of radioactivity;
  - d. the mine rock management area runoff water quality and quantity, including effects from waste rock blasting residue;
  - e. the water quality resulting from processing ore to concentrate, including the end-products of concentrate, all reagent chemicals, hydrocarbons, sludge, incinerator residue, explosives, and any other potentially hazardous products used at the mine site that enter the water treatment stream;
  - f. any other materials stored on surface at the Thor Lake mine site, including aggregates;
  - g. other site runoff including but not limited to impacts to water quality from dust suppression activities; and,
  - h. a comparison of the contaminant levels to natural background variability.

This discussion will include estimates of how much of the waste rock will likely be placed in the mine rock management area, delineation of all potential contaminant pathways and receptors, and post-closure locations, predicted amounts, and management systems for all surface materials storage systems.
2. Predict the water quality and quantity of final effluent discharged to the environment during all phases of the Nechalacho Project life cycle, incorporating:
  - a. identification of the constituents of, and quantity likely to come out of, each on-site water source;
  - b. present discharge criteria for treated water;
  - c. predicted changes over time in the amount or quality of mine water outflows;
  - d. all relevant water quality parameters including pH, temperature, concentrations of metals, nutrients, total suspended solids, major ions, process chemicals and bacteria;
  - e. identification of all committed-to mitigation measures to minimize initial water

contamination (e.g. mitigative measures to limit blasting residues) and to remove contaminants via the treatment process; and

- f. identification of the uncertainties and confidence levels in the predictions, the assumptions used, and the likely range of variation for the parameters identified.
3. Describe the range of natural variation, flows and ecological pathways in surface water and groundwater, including refresh rates for Drizzle, Murky and Thor Lakes, and how the Nechalacho Project will affect this range of conditions. Describe how metals solubility under site conditions (both acidic and neutral) has been considered in long term mine planning and engineering designs.
4. Assess potential impacts of effluent discharge in Drizzle, Murky, Thor Lake and downstream water bodies (up to and including a reasonable local area after the confluence with Great Slave Lake) including the predicted likelihood and severity of:
  - a. changes to pH in downstream watercourses;
  - b. increasing sediment levels and water turbidity;
  - c. increasing contaminant concentrations in the sediments, fish and other aquatic organisms, including consideration of bio-accumulation effects;
  - d. discharge of ammonia and other nutrients, including possible changes in nutrients available in the food chain in downstream water bodies; and
  - e. any other impacts which may alter water quality or aquatic ecosystem integrity downstream of the mine.
5. For Drizzle, Murky and Thor Lake, describe:
  - a. method and location of effluent discharge; and
  - b. plume behaviour of effluent for these lakes and downstream of these lakes including an estimate of mixing behaviour and an estimate of where the plume will be sufficiently mixed so that there is no chronic toxicity.
6. For Drizzle, Murky, Thor Lake and downstream water bodies (up to and including a reasonable local area after the confluence with Great Slave Lake), describe:
  - a. contaminant mobility in water under likely environmental conditions;
  - b. effects on dissolved oxygen and nutrient levels, especially during winter; and
  - c. potential increase in sedimentation and erosion (including lake bed and banks).
7. Identify any potential sources of contaminated groundwater not captured in the mine water management system. This discussion should identify:
  - a. where losses to the groundwater system could occur;
  - b. estimated quantities of contaminated groundwater loss; and
  - c. potential impacts of contaminated groundwater on the environment and their likely geographic distribution.
8. Describe potential effects on project effluent from *incoming* groundwater quality, and resulting impacts on the environment. Include a discussion on how project-related changes to permafrost and active layer may contribute to effects on effluent water quality and management.
9. Describe:

- a. site-specific characteristics of the receiving environment;
  - b. proposed site-specific water quality objectives for all stressors of potential concern, treated water quality levels, limits and proposed thresholds for water quality that the developer is committed to meeting in order to protect the downstream environment;
  - c. Avalon's proposed draft framework for aquatic effects monitoring and environmental effects monitoring programs, considering historical metals levels.
10. Describe Avalon's evaluation of water treatment alternatives. For the proposed water management and treatment facilities, provide an analysis - including an analysis of how seasonal variability affects the efficacy of water quality management - on the adequacy of:
- a. the water treatment facility specifically to meet site specific water quality objectives for:
    - i. *Metal Mining Effluent Regulation* metals; and
    - ii. other applicable parameters such as selenium, iron, cobalt, bismuth, total suspended solids, ammonia, cyanide and radium-226.
  - b. all water collection systems, including that surrounding the mine rock and tailings management areas;
  - c. the sewage treatment system; and
  - d. any water storage facilities.

This discussion should emphasize the ability of these facilities and the system as a whole to handle expected increased mine water inflows and retention capacity timelines and contingency plans for greater than expected outflows, the ability to handle greater than predicted concentrations of contaminants in pre-discharge waters or other treatment upsets, and impacts of any identified failure mode. Include discussion of seasonal effects on the effectiveness of the water treatment facility.

11. Describe the likelihood and consequences of accidents, malfunctions, or impacts of the environment on the development influencing water quantity and quality and the ability of the water management system to function. Describe the impact as though it has happened, then probabilities for occurrence and accompanying mitigations. 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 address them. The following scenarios, at a minimum should be considered:
- a. extreme short-term precipitation events, snowpack buildup or other factors leading to flooding events;
  - b. geologic instability or seismic activity causing slope failures at or near the Nechalacho mine, impacts on the mine workings, or compromising of the mine rock management area;
  - c. the complete overturning of a barge train - fully loaded with Thor Lake concentrate - on Great Slave Lake;
  - d. failure of existing dams/containment structures;
  - e. freezing effects on water transportation systems;
  - f. interaction of water with improperly mixed or cured paste backfill
  - g. how mine water will be managed if the water treatment system malfunctions, with a focus on retention capacity timelines for water storage facilities and contingency water treatment plans;

- h. potential impacts to water from accidents in transport of processing chemicals and other dangerous goods; and
  - i. potential impacts to water from tailings spills or leaks.
12. Describe the long-term effect of water recycling on water quality for different water recycling scenarios.
  13. Predict the effects to water quality from winter withdrawal from Thor Lake and Drizzle Lake on both lakes and the downstream environment to the extent of Great Slave Lake.
  14. Predict impacts to water quality for any other lake that the project may affect at the Thor Lake mine site.
  15. Describe water quality monitoring and management during operations including:
    - a. contingency plans in case metals leaching or acid rock drainage occurs;
    - b. contingency plans for unacceptable treated-water quality;
    - c. spill contingency plans on site and along transportation routes;
    - d. the framework for surface water plans and ground water monitoring; and
    - e. whether and how Avalon will incorporate Akaitcho region residents in environmental monitoring, and how it will report monitoring results to potentially-affected communities.

## **Pine Point**

In predicting the impacts on water quality from the Pine Point Hydrometallurgical processing site, the developer will:

1. Identify, describe, and estimate amounts of contaminants from all potential sources at the processing site. Predict the likelihood and consequences for each of the following, alone or in combination, to leach metals, create acid rock drainage, or otherwise affect water quality. Avalon will include all results of testing to support such conclusions. The predictions will include analysis of:
  - c. the tailings management facility (or facilities) supernatant water quality and quantity as well as percent water content. On this matter, Avalon must give particular attention to uranium, thorium and beryllium levels in supernatant water – in addition to any other radioactive minerals/materials regardless of level of radioactivity - as well as any dust that may come from tailings deposition.
  - d. impacts on local aquifer(s) if exfiltration through an existing pit is selected as one of the preferred options for the Pine Point site, the hydrogeological information must include a review of, travel time to Great Slave Lake, volume of ex-filtrate, migration pathway (location and depth), monitoring points, distinct points of control and contingencies for non-compliant discharges.
  - e. runoff from the coal storage area. Avalon will provide an analysis on the range of water quality that can come from the use of varying ‘grades’ of coal, from poor to high;
  - f. runoff from the sulphur storage area;
  - g. the water quality resulting from processing at both sites, including the end-

products of concentrate, reagent chemicals, hydrocarbons, sludge, incinerator residue, explosives, and any other potentially hazardous products used at the mine site that enter the water treatment stream;

- h. any other materials stored on surface at the processing site, including limestone, aggregates reagents and hazardous materials;
- i. other site runoff such as impacts to water quality from dust suppression activities; and,
- j. a comparison of the contaminant levels to natural background variability.

This discussion will include delineation of all potential contaminant pathways and receptors, and post-closure locations, predicted amounts, and management systems for all surface materials storage systems.

2. Predict the water quality and quantity of final effluent discharged to the environment during all phases of the Nechalacho Project life cycle, incorporating:
  - a. identification of the constituents of, and quantity likely to come out of, each on-site water source;
  - b. present discharge criteria for treated water;
  - c. predicted changes over time in the amount or quality of effluent outflows;
  - d. all relevant water quality parameters including pH, temperature, concentrations of metals, nutrients, total suspended solids, major ions, process chemicals and bacteria;
  - e. identification of all committed-to mitigation measures to minimize initial water contamination and to remove contaminants via the treatment process; and
  - f. identification of the uncertainties and confidence levels in the predictions, the assumptions used, and the likely range of variation for the parameters identified.
3. Describe the range of natural variation, flows and ecological pathways in surface water and groundwater, including refresh rates for any water body or bodies that Avalon proposes to use as a source for water or as a point of discharge [including downstream water bodies until the confluence with Great Slave Lake and a reasonable local area of Great Slave Lake], and how the processing site will affect this range of conditions. Describe how metals solubility under site conditions (both acidic and neutral) has been considered in long term processing site planning and engineering designs.
4. For any water body or bodies that Avalon proposes to use as a point of discharge [including downstream water bodies until the confluence with Great Slave Lake and a reasonable local area of Great Slave Lake], describe:
  - a. method and location of effluent discharge; and
  - b. plume behaviour of effluent for these lakes and downstream of these lakes including an estimate of mixing behaviour and an estimate of where the plume will be sufficiently mixed so that there is no chronic toxicity.
  - c. contaminant mobility in water under likely environmental conditions;
  - d. effects on dissolved oxygen and nutrient levels, especially during winter; and
  - e. potential increase in sedimentation and erosion (including lake bed and banks).
5. Assess potential impacts of effluent discharge in any water body or bodies that Avalon



proposes to use a source for water or as a point of discharge [including downstream water bodies until the confluence with Great Slave Lake and a reasonable local area of Great Slave Lake]and downstream water bodies (to a reasonable local area after the confluence with Great Slave Lake) including the predicted likelihood and severity of:

- a. changes to pH in downstream watercourses;
  - b. increasing sediment levels and water turbidity;
  - c. increasing contaminant concentrations in the sediments, fish and other aquatic organisms, including consideration of bio-accumulation effects;
  - d. discharge of ammonia and other nutrients, including possible changes in nutrients available in the food chain in downstream water bodies; and
  - e. any other impacts which may alter water quality or aquatic ecosystem integrity downstream of the mine.
7. For any pits that Avalon may use to deposit tailings into at the processing site, describe potential effects on project effluent from *incoming* groundwater quality, and resulting impacts on the environment. Include a discussion on how project-related changes to permafrost and active layer may contribute to effects on effluent water quality and management.
8. Identify any potential sources of contaminated groundwater not captured in the water management systems at the processing site. This discussion should identify:
- a. where losses to the groundwater system could occur;
  - b. estimated quantities of contaminated groundwater loss; and
  - c. potential impacts of contaminated groundwater on the environment and their likely geographic distribution.
9. Describe, for the processing site:
- a. site-specific characteristics of the receiving environment;
  - b. proposed site-specific water quality objectives for all stressors of potential concern, treated-water quality levels, limits and proposed thresholds for water quality that the developer is committed to meeting in order to protect the downstream environment;
  - c. Avalon's proposed draft framework for aquatic effects monitoring and environmental effects monitoring programs, considering historical metals levels.
10. Describe Avalon's evaluation of water treatment alternatives. For the proposed water management and treatment facilities, provide an analysis - including an analysis of how seasonal variability affects the efficacy of water quality management - on the adequacy of:
- a. the water treatment facility specifically to meet site specific water quality objectives for:
    - i. *Metal Mining Effluent Regulation* metals; and
    - ii. other applicable parameters such as selenium, iron, cobalt, bismuth, total suspended solids, ammonia, cyanide and radium-226.
  - b. all water collection systems, including that surrounding the tailings management facility or facilities;
  - c. the sewage treatment system; and
  - d. any water storage facilities.

This discussion should emphasize the ability of these facilities and the system as a whole to handle expected increased water inflows to any pit (should Avalon decide to use pits for tailings) and retention capacity timelines and contingency plans for greater than expected outflows, the ability to handle greater than predicted concentrations of contaminants in pre-discharge waters or other treatment upsets, and impacts of any identified failure mode. Include discussion of seasonal effects on the effectiveness of the water treatment facility.

11. Describe the likelihood and consequences of accidents, malfunctions, or impacts of the environment on the development influencing water quantity and quality and the ability of the water management system to function. Describe the impact as though it has happened, then probabilities for occurrence and accompanying mitigations. 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 address them. The following scenarios, at a minimum should be considered:
  - a. extreme short-term precipitation events, snowpack buildup or other factors leading to flooding events;
  - b. geologic instability or seismic activity causing slope failures at or near the hydrometallurgical processing site, impacts on the site workings, or compromising of the tailings management facility or facilities;
  - c. failure of existing dams/containment structures;
  - d. how water will be managed if the water treatment system malfunctions, with a focus on retention capacity timelines for water storage facilities and contingency water treatment plans;
  - e. potential impacts to water from accidents in transport of processing chemicals and other dangerous goods; and
  - f. potential impacts to water from tailings spills or leaks.
12. Predict the effects to water quality from winter withdrawal for any water body or bodies that Avalon proposes to use a source for water or as a point of discharge [including downstream water bodies until the confluence with Great Slave Lake and a reasonable local area of Great Slave Lake].
13. Predict the impacts to water quality if Avalon decides to use Teck Cominco's tailings pond for discharge of water or tailings or any effluent for any reason.
14. Describe water quality monitoring and management during operations including:
  - a. contingency plans for unacceptable treated-water quality;
  - b. spill contingency plans on site and along transportation routes;
  - c. the framework for surface water plans and ground water monitoring; and
  - d. whether and how Avalon will incorporate Akaitcho region residents in environmental monitoring, and how it will report monitoring results to potentially-affected communities.

## Appendix D: Cumulative effects

The following items are required for consideration of cumulative effects:

1. Predict potential impacts of the Nechalacho Project on fish and wildlife in combination with impacts from past or present pollution from contaminated sites in the area, with particular emphasis on the former Pine Point mine site and the reasonably foreseeable progression of Tamerlane's Pine Point Pilot Project.
2. In terms of cumulative effects, predict:
  - a. potential impacts of the Nechalacho Project on the Bathurst caribou herd in combination with impacts of other developments in the range of the Bathurst caribou herd;
  - b. potential socio-economic changes, cultural changes and changes to community well-being from the Nechalacho Project using publicly available data;
  - c. potential socio-economic changes, cultural changes and changes to community well-being from the Nechalacho Project in combination with other with other industrial developments using publicly available data including:
    - i. existing and proposed diamond mines;
    - ii. the proposed Yellowknife Gold Project; and
    - iii. the proposed Mackenzie Gas Project.
2. Determine how any other past, present and reasonably foreseeable human activities or developments that may affect the same valued components as the Nechalacho Project.
3. Predict the combined impact of the Nechalacho Project in combination with the impacts of the other developments identified above.
4. Identify means for Avalon, either on its own or cooperatively with others, to reduce or avoid the predicted cumulative effects.
5. Describe the residual cumulative effects following mitigation.
6. Provide the rationale for including the developments that are chosen for examination on specific valued components, as well as a description of and rationale behind the chosen geographic cumulative effects study area and temporal boundary.
7. Describe any plans for the monitoring and evaluation of cumulative effects and the adaptive management of the Nechalacho Project's contribution to cumulative effects.
8. A description of how project-specific monitoring can contribute to and be compatible with regional monitoring programs such as the NWT Cumulative Impact Monitoring Program (see <http://www.nwtcimp.ca> for details).

## **Appendix E: Fish and aquatic habitat**

When assessing impacts on fish and aquatic habitat:

### **Thor Lake**

1. Describe fish and aquatic habitat in Ring, Buck, Murky, Drizzle, Cressy and Thor Lake and any other water bodies within the mine site on the Avalon claim block, as well as water bodies and watercourses downstream of Thor Lake until Great Slave Lake, including watercourses that the Thor Lake mine site-Great Slave Lake access road crosses or that the development otherwise affects.
2. Describe the potential for the Nechalacho Project to affect fish in Thor Lake, Drizzle Lake, Murky Lake and Cressy Lake, or to affect fish downstream of the project which may migrate to or from Thor Lake.

### **Pine Point**

3. Describe fish and aquatic habitat in any water bodies that Avalon may use as a water source or effluent discharge point at or near the Pine Point processing site, as well as water bodies and watercourses downstream of the processing site until Great Slave Lake, including watercourses that the Pine Point processing site-Great Slave Lake access road crosses or that the development otherwise affects.
4. Describe the potential for the Nechalacho Pine Point processing site to affect fish in any of the water bodies from point 3, or to affect fish downstream of the project which may migrate to or from such water bodies.

### **Both sites**

5. Describe the impacts of the Nechalacho Project on aquatic organisms and habitat, including potential impacts from:
  - a. changes to flow or habitat, including alterations to banks, shores and riparian areas of water bodies near road water crossings, and associated changes in habitat availability;
  - b. reduced oxygen concentration;
  - c. increased concentrations of metals, nutrients and other contaminations in water, sediment and the aquatic food chain;
  - d. increased sedimentation in Thor Lake and watercourses downstream until Great Slave Lake, especially from the mine rock management area, the mine site, airstrip and road activities; and
  - e. alteration of pH.
6. Describe the developer's commitments to:
  - a. mitigate any habitat losses (such as habitat creation); and
  - b. specific management activities and plans, such as the adoption of relevant *Operational Statements* of the Department of Fisheries and Oceans.
7. Identify best management practices to minimize impacts on fish in this type of environment (including specific consideration of activity timing windows to avoid spawning and incubation periods and proper sedimentation and erosion control measures in close proximity to water bodies), a listing of all commitments to mitigate impacts on fish, fish habitat and other aspects of the aquatic ecosystem, and, where the two differ, a rationale for why certain management

practices have not been adopted.

8. Describe all water crossings along the access road and roads on the mine site, providing details on flow, fish passage, sediment and erosion control measures and any monitoring plans.
9. Describe potential impacts to fish and fish habitat, including riparian zones, arising from construction, operation, maintenance and decommissioning of any watercourse crossing.
10. Discuss how accidents, malfunctions or impacts of the environment on the development could create additional impacts on fish and aquatic species, and how the developer will minimize the potential for these scenarios to occur and manage them via contingency plans if they do occur.

## Appendix F: Wildlife

For potential impacts to wildlife, the developer will do the following:

### Both sites

1. Describe the impacts the Nechalacho Project at both sites is likely to have on wildlife and wildlife habitat. For each species, and/or species group consider the following:
  - a. potential impacts to habitat, including degradation and fragmentation, with a focus on important wildlife habitat;
  - b. potential for increased mortality from all sources [including from vehicle collisions on the Pine Point-Hay River road] and changes to hunting access);
  - c. potential for increased attraction to both project sites, risk of bear-human encounters, risk to people and associated carnivore mortality;
  - d. potential for increased sensory disturbance from all sources (e.g., noise, odours, activity, vibrations, overflights, dust, transports trucks, locomotives). Predict effective habitat loss resulting from changed behaviour;
  - e. potential for disruption of movement and migration patterns;
  - f. potential for increased contamination of food and water, including bio-accumulation, from all sources; and
2. Describe the potential adverse impacts of both project sites on any “wildlife at risk” species known or suspected to reside in the environmental assessment study area or potential adverse impacts on their habitat including residences. Describe any management plans and specific mitigation commitments and monitoring proposed for any potentially affected species.
3. Describe how Nechalacho Project planning has considered potential impacts on wildlife and wildlife habitat at both sites, best management practices to minimize impacts on wildlife, and what mitigation commitments have been made, with specific consideration of:
  - a. rules for road use by employees and contractors, including on the highway between Hay River and Pine Point;
  - b. minimizing wildlife access to project components (e.g. by reducing attractants); and
  - c. spill avoidance techniques and spill response plans for the transportation routes.
4. Describe Avalon’s draft wildlife management plan for both sites, including discussion of:
  - a. which other interested parties have been involved in the development of the plan;
  - b. efforts to be undertaken to monitor wildlife in the area and report the presence of species to the appropriate authorities when necessary;
  - c. identification of measures to avoid or minimize potential impacts to wildlife;
  - d. wildlife monitoring, evaluation and adaptive management of the project activities;
  - e. how monitoring will be compatible with other current programs undertaken by responsible agencies; and
  - f. how monitoring results will be reported to regulators, responsible authorities and potentially-affected communities.

## Appendix G: Terrain

When assessing impacts and risks related to terrain:

1. Describe the existing geotechnical stability of the areas proposed for the mine rock management and tailings management areas at both sites, including:
  - a. soil and hydrological conditions;
  - b. permafrost, ground thermal conditions and ground ice conditions;
  - c. description of the physical and chemical characteristics of mine rock and tailings; and
  - d. topography and slope stability.
2. Describe potential impacts of Nechalacho Project operations on terrain stability at both sites and vice versa, in light of Avalon's analyses of accidents and malfunctions (see section 3.5). Consider:
  - a. geotechnical instability, especially of the mine rock management area, the tailings management area and the system of dykes and dams on site;
  - b. changes to ground thermal conditions and permafrost failure at the both sites from project-related activities; and
  - c. impacts to permafrost and ground thermal conditions from vegetation removal.
3. Describe how the geotechnical stability of all engineered structures at both Nechalacho project sites will be ensured against a range of climate, seismic and precipitation scenarios.
4. Identify any plans to mitigate and monitor against impacts on terrain, including:
  - a. erosion control measures;
  - b. prevention of permafrost degradation at both project site locations where it is found to be present;
  - c. how the geotechnical stability of the mine rock management area, tailings management area and the system of dykes and dams will be monitored, and for what extent of time;
  - d. how monitoring results will be reported to regulators and potentially-affected communities;
  - e. how monitoring data will be used to determine if action is required including definitions of any methodologies used such as critical values, thresholds and decision trees; and
  - f. adaptive management measures and contingency plans that will be adopted if terrain stability is compromised.

## **Appendix H: Air quality, including noise, light and viewshed**

While assessing impacts on air, describe:

### **Both sites**

1. Pre-development conditions including:
  - a. general climatology (typical temperatures, precipitation, air flows, etc.), terrain type and topography; and
  - b. baseline ambient concentrations of criteria air contaminants (total suspended particulates, particulate matter (PM<sub>10</sub>, PM<sub>2.5</sub>) nitrogen oxides, sulphur dioxide and carbon monoxide).
2. Potential impacts from project emissions during construction, operation and closure phases:
  - d. estimate criteria air contaminant emissions from all project sources including fugitive dust;
  - e. Provide test results and include the levels of uranium and thorium in fugitive tailings dust, or any other radioactive element from any mineral.
  - f. predict annual carbon emissions over the life of the mine and describe any offsets proposed to mitigate carbon emissions;
  - g. predict local and regional dispersion of the project emissions and resulting ambient concentrations and deposition of pollutants using an established air quality model;
  - h. compare predicted ambient concentrations and deposition rates to relevant ambient air quality guidelines and standards;
  - i. discuss potential sources and quantities of contaminants from the handling and transport of ore and concentrate, and their expected deposition range, including the expected impacts from any dust that may contain radioactive minerals of any kind; and
  - j. discuss and quantify any potential links between predicted air quality impacts and other valued components such as water quality, fish, wildlife and human health.
3. Monitoring, mitigation and adaptive management strategies:
  - a. use predicted ambient air quality concentrations to design an appropriate monitoring program and to develop mitigation and adaptive management strategies to minimize emissions of criteria air contaminants;
  - b. describe specific mitigation, adaptive management strategies and monitoring methods, to minimize contamination by fugitive dust from the handling and transport of raw ore and concentrate and the processing operations; and
  - c. develop and describe an incineration management plan that includes the expected levels of dioxins and furans released, and suggested mitigations.

### **Thor Lake**

- Describe existing noise, light and viewshed conditions at Thor Lake with particular reference to Blachford Lake Lodge.
- Predict impacts of noise, light and viewshed during mine construction and operations on Blachford Lake Lodge, with emphasis on the lodge's aurora viewing services.
- Describe mitigation measures to reduce impacts from noise, light and viewshed on Blachford Lake Lodge.



## **Appendix I: Vegetation**

While assessing impacts on vegetation, the developer will provide the following:

### **Both sites**

1. Estimate the total amount of land clearing required for the Nechalacho Project, with estimates of losses of trees and other plants. Include a description of how the soil materials will be removed, conserved or stored, and the likely impacts of loss of soil or compaction on long-term re-growth capacity.
2. Describe the potential for the Nechalacho Project to impact on rare plants.
3. Describe the potential impacts of Nechalacho Project operations on culturally or economically significant harvested plants.
4. Describe the potential impacts of vehicle, mine equipment and power plant emissions on vegetation around the mine site and roads.
5. Describe the potential impacts of dust generation on vegetation at the mine site, along roads, and downwind of the plateau.
6. Describe the likelihood that invasive species will be introduced, by what means, and potential impacts.
7. Describe best management practices for avoidance of impacts on vegetation, mitigation committed to, and where they differ, the rationale for not adopting best management practices.
8. Prepare a vegetation monitoring plan that will assist in achieving objectives described in a Closure and Reclamation Plan.

## **Appendix J: Biophysical environmental monitoring and management plans**

The developer is encouraged to provide a summary section with:

1. Reports of all discussions and agreements with communities, federal and territorial governments related to collaborative monitoring and adaptive management of impacts of the project on the environment.
2. A list all of its proposed monitoring and management plans, identifying:
  - a. where they are being adopted as commitments for the Nechalacho Project;
  - b. addressing previous comments expressed by interested parties about the adequacy of the plans; and
  - c. where plans are being strengthened or otherwise altered in light of changing circumstances or advances in best practice of environmental management (the developer will cite any specific best management plan being adopted).
3. If adopting an existing plan, policy or other commitment, the developer will provide a rationale for why that commitment is adequate in light of proposed changes to the development required for full-scale mining.
4. All conceptual monitoring and management plans as identified in the appendices, including:
  - a. An overall Waste Management Plan, including commitments for management of solid, liquid, hazardous and airborne wastes, and associated monitoring programs; and
  - b. A conceptual framework for an integrated Aquatic Effects Monitoring Plan developed in discussions with Fisheries and Oceans and Environment Canada.
5. Plans for communicating results of mitigation, monitoring and adaptive management programs to regulators, responsible government authorities and the public.
6. A summary table listing all biophysical environmental monitoring and management systems, where they are described in the Developer's Assessment Report, the length of time the monitoring is proposed for, and a rationale for each timeline.

## **Appendix K: Human environment**

### **K1 Employment and business opportunities**

*The developer will assess the potential impacts of the Nechalacho Project on the economy of the Mackenzie Valley, with a focus on the Akaitcho region generally and each potentially-affected community.*

In assessing access to employment and business opportunities, the developer will provide the following.

#### ***Employment***

1. An estimate of human resource requirements for the development that includes a listing of all direct and contract employment requirements by skills category for each phase of the life of the Nechalacho Project. The developer will identify the skill-levels that each position requires, and shall include employment in all aspects of the operation of the mine, including for example transportation and monitoring activities.
2. An assessment of the likely percentage of direct employment for northern and aboriginal residents at the Nechalacho Project, in light of the current and likely future (extending for the expected 15 year life of the mine) labour pool context (i.e., likely available numbers of workers in light of total regional economic activity), and identification of any target goals for Northern and Aboriginal employment.
3. A qualitative description of any barriers to direct or contract employment, advancement and retention for Mackenzie Valley residents, with particular emphasis on Akaitcho region residents, other Aboriginal and Northern people and women where possible. This description must include employee availability and employability in light of minimum skill requirements and an investigation of current training opportunities for community members. The developer will also discuss:
  - a. estimates of current skills gaps in the available labour pool that require additional training programs;
  - b. hiring and retention policies related to minimum education levels, criminal records and drug and alcohol use; and
  - c. any identified barriers to maximizing regional and Aboriginal employment.
4. The developer's plans, strategies and commitments for maximizing direct employment, advancement and retention of Akaitcho region residents, other Aboriginal and Northern people.
5. Employment policies for Aboriginal and other Northern women including training initiatives, measures for security and safety at the mine site and anti-harassment policies.
6. A description of any plans, strategies or other commitments the developer has to support increasing the mine-ready workforce, support career paths in mining, and assist training programs in related support activities. The developer will outline how these strategies will create or contribute to training opportunities for Northern and Aboriginal persons in general, and its employees in particular, over the life of the mine. The developer will also identify when any committed-to mitigations will be enacted, keeping in mind the lead time required for job-ready training programs.
7. A discussion of whether and how the developer's strategies and commitments for maximizing employment of Aboriginal and Northern residents will extend to its contractors.

### ***Business opportunities***

8. An estimate of all contractor and subcontractor goods and services that the Nechalacho Project will require, by project phase, as well as an estimate of what percentage of required goods and services can feasibly be sourced from local and regional businesses.
9. The developer's policies, plans, and commitments associated with maximizing contracting to Aboriginal and Northern-owned and operated businesses, with emphasis on assisting business development initiatives and joint ventures with Akaitcho region-based businesses.
10. An assessment of any barriers to maximizing the utilization of Northern businesses.
11. An assessment of what Avalon can do to employ Northerners with criminal records.
12. An assessment of how Avalon's Thor Lake operations will impact business operations at the Blachford Lake Lodge and suggested mitigations;
13. The developer's prediction for any training, education or other improvements necessary to maximize local and regional business capacity to benefit from the Nechalacho Project.

### **K2 Distribution of beneficial and adverse socio-economic impacts**

The developer will provide the following information and analysis:

2. Qualitative and quantitative estimates of all beneficial and adverse economic impacts from the Nechalacho Project, including at minimum:
  - a. capital costs associated with placing the Nechalacho Project in operation, broken down by major components (estimates should be in 2009 dollars CAD. and may be in a +/- 20% range);
  - b. annual operating costs during the life of the Nechalacho Project (estimates should be in 2009 dollars CAD. and may be in a +/- 20% range);
  - c. federal, territorial and municipal taxes that the developer may remit by year, as well as from linked economic development (a +/- 20% range is acceptable);
  - d. total employment impact on the Akaitcho region and Mackenzie Valley, including a prediction of employment multipliers from the development; and
  - e. a prediction of any adverse impacts the development may have on public infrastructure maintenance and associated costs, depending upon availability.
3. Discussion potential role of the Nechalacho Project on the following:
  - a. socio-economic impacts potentially resulting from increased disposable income and larger reliance on the wage economy;
  - b. any impacts on social services provision, infrastructure and costs (e.g., emergency medical care or family social services); and
  - c. whether and how the project may create or contribute to impacts on other organizations and businesses servicing the region through mobilization of local skilled labour away from smaller Nechalacho Project communities and associated impacts on maintenance of infrastructure and basic service provision.
4. The developer's policies, strategies, plans, and commitments, alone or in combination with other parties, for the mitigation of any adverse socio-economic impacts.

### **K3 Social impacts**

While conducting a social impact assessment, the developer will describe:

1. Potential impacts associated with the development on community wellness and population health issues such as:
  - a. population in- and out-migration;
  - b. alcohol and drug access and use;
  - c. sexually-transmitted infections rates;
  - d. crime rates;
  - e. access to child care;
  - f. language retention and other key indicators of cultural maintenance;
  - g. education completion rates by level; and
  - h. community cohesiveness and pride in cultural identity.

The description of community wellness and population health issues may consist of a review of publicly available quantitative statistics and key informant interviews with community health providers and social service providers where possible.

2. How each identified potential impact may affect individual potentially-affected communities.
3. The physical, mental, and cultural health of mine workers and mine workers' families, considering potential impacts of long-distance commuting and greater engagement in the wage economy based on a review of select and pertinent peer-reviewed studies and through key informant interviews with Akaitcho region residents currently working at mines in the NWT. This discussion should identify any alternative shift rotations considered by the developer, with the rationale for the chosen rotation.
4. Human resources management plans and programs the developer will offer at the mine site to identify and mitigate potential social problems associated with the Nechalacho Project, that will include but not be limited to discussion of:
  - a. increased income and money management;
  - b. potential stressors associated with long-distance commuting and stress management programs;
  - c. substance abuse and treatment policies;
  - d. cross cultural training and avoidance of cross-cultural conflicts at the work site; and
  - e. "home" – community and family - support programs.

### **K4 Cultural impacts**

*The analysis of heritage resources is inclusive of both sites and objects of cultural significance, and cultural impacts include both tangible and intangible aspects of culture.*

#### ***K4a Physical heritage resources***

The developer will report on:

1. Consultation with traditional knowledge holders, archaeologists, anthropologists, and the Prince of Wales Northern Heritage Centre, that the developer conducted during its cultural

impact assessment, indicating how such interactions influenced:

- a. heritage resource survey locations;
  - b. the identification of locations of known or high potential for heritage resources; or
  - c. heritage resource management plans.
2. Identification of all known archaeological and heritage resources, sites or areas of cultural significance, and areas of high potential for unfound heritage resources in the environmental assessment study area.
  3. All recommended mitigation measures that consultation produced for the protection of local known and high potential areas of physical heritage resources and other sites of cultural significance, and associated developer's commitments or reasons for not adopting recommendations.
  4. Describe how the developer will involve the Akaitcho region residents in heritage assessments and monitoring of impacts on culture.
  5. Describe any potential impacts from the Nechalacho Project on physical heritage near both project sites and any other point within the geographic scope of the development.

***K4b Traditional land use and wildlife harvesting***

The developer will:

1. Describe any potential impacts of the Nechalacho Project on traditional harvesting activities for Aboriginal residents of Akaitcho region communities, including changes from impacts to wildlife, changes in all-season access from Akaitcho region communities due to the Thor Lake mine site-Great Slave Lake access road, and any changes in access by non-resident hunters.
2. Provide a prediction of the total impact of the Nechalacho Project on traditional activities, and on the potential for increased or reduced harvesting success.
3. Identify all mitigation commitments by the developer, alone or in combination with other parties, to minimize adverse impacts on traditional land use and resource harvesting, or to compensate for losses that the developer cannot prevent. This should include discussion of:
  - a. how access along the Thor Lake mine site-Great Slave Lake access roads at both sites will be monitored and, if feasible, managed; and,
  - b. any plans for any ongoing monitoring, adaptive management and harvester compensation.
4. For visual and audible changes perceptible from the Great Slave Lake:
  - a. describe and illustrate any potential visual impacts to the viewshed as seen from Great Slave Lake;
  - b. describe any other points along remainder of the Great Slave Lake and islands where the Nechalacho Project will be visible or audible, illustrate and describe how it will look and sound;
  - c. describe any measures taken to minimize these sensory disturbances; and
  - d. describe how any remaining sensory changes will affect the traditional authenticity of users' experiences along the Great Slave Lake.
5. Describe potential impacts from the Nechalacho Project – including from barging activities – on traditional lifestyles, pursuits and activities on or near Great Slave Lake.

## **K5 Human environment monitoring and management plans**

1. Describe any commitments, plans and strategies to engage with responsible authorities and potentially-affected communities in monitoring impacts on the human environment such as:
  - a. success of local and regional residents and Aboriginal people in gaining employment at the Nechalacho Project, and the success of training initiatives;
  - b. success of local and regional businesses in providing goods and services to the Nechalacho Project, with identification of gaps to maximizing engagement;
  - c. employee retention;
  - d. worker and family wellness;
  - e. the contribution of the Nechalacho Project to beneficial and adverse social impacts at the regional and local levels across a spectrum of appropriate indicators to be determined in collaboration with Akaitcho region communities and government authorities; and
  - f. impacts on wildlife harvesting and practice of traditional culture on the land.
2. Identify relevant existing initiatives monitoring community wellness and investigate how it will engage with, contribute to, and consider results from these programs in its ongoing monitoring and adaptive management programs.
3. Describe how results from monitoring the human environment will be evaluated and reported to regulators, responsible authorities and potentially-affected communities.
4. Describe the adaptive management systems will be in place to deal with issues identified during monitoring.
5. Provide a summary table listing all human environment monitoring and management systems and where they are described in the *Developer's Assessment Report*.

## Appendix L: Closure and reclamation

The developer will:

### Both sites

1. Describe policies, regulations and industry standards that Avalon considered in the development of its *Conceptual Closure and Reclamation Plan*.
2. Provide a framework for Avalon's *Closure and Reclamation Plan*, which will include:
  - a. identification of the overall reclamation objectives, standards and criteria the Closure and Reclamation Plan is designed to achieve and over what time period;
  - b. a list of closure and reclamation components and activities including alternatives considered, a rationale for why Avalon chose a particular alternative and how it best meets the developer's reclamation objectives;
  - c. given the ostensibly long-term project life for the Nechalacho Project, a description of how climatic change was considered in the development of the Closure and Reclamation Plan in order to ensure long-term physical integrity of permanent structures;
  - d. an outline for the methods and locations for re-use or disposal of materials during reclamation;
  - e. a conceptual program and schedule for any progressive reclamation envisioned; and
  - f. a conceptual post-closure monitoring plan that includes a reporting strategy and a rationale for an "end-date" for monitoring.
3. In the *Conceptual Closure and Reclamation Plan*, discuss management and monitoring programs for any materials/locations (including the underground works) that may cause acid rock drainage or metals leaching. Include:
  - a. creating a sufficient barrier for the prevention of tailings and waste rock oxidation at closure;
  - b. the likely rate of movement of water (including groundwater) through the tailings, mine rock management area and underground workings, associated uptake of acids, metals or any other contaminants into groundwater or surface waters, and monitoring location requirements and contingency plans for greater than expected rates of contaminant release;
  - c. a description of how any water may interact with paste backfill after mine closure, under what conditions that interaction may lead to a breakdown of paste backfill, and a discussion of related impacts to water and suggested mitigations;
  - d. the long-term physical integrity of any permanent features; and
  - e. monitoring coverage required to track any other reasonably foreseeable post-closure contamination pathways.
4. Visually show how both project sites are expected to look at one, ten and 25 years after closure and reclamation of the mine compared to its present and operating conditions. Include a plan view of the site and an illustration of visual impacts on the viewshed as seen from Great Slave Lake.
5. Describe Avalon's plans for establishing the viability of a self-sustaining vegetation



community at both project sites after closure, including:

- a. re-vegetation techniques, with a discussion on what species the developer will consider for this activity;
  - b. an outline for how soon the area will return to a natural state of vegetation, if ever; and
  - c. discussion of how revegetation objectives will ensure wildlife is not attracted to the site where they may be exposed to risks.
6. At both sites, describe how closure and reclamation activities and monitoring will ensure long-term suitability of all fish-bearing waters potentially affected by the project for fish and fish habitat.
  7. Describe closure and reclamation plans associated with decommissioning of the access roads leading to Great Slave Lake from both the Thor Lake mine site and the Pine Point processing site, including stabilization and re-vegetation of banks near water crossings.
  8. Describe closure and reclamation plans associated with the airstrip.
  9. Describe how reclamation will manage ongoing hazards to wildlife at both the Thor Lake mine site and the Pine Point processing site, and how reclamation will affect wildlife movements.
  10. Within the record of consultation that Avalon has had with potentially-affected communities, Aboriginal groups and responsible government agencies (see section 3.2.6), identify where there arose any concerns related to closure, reclamation, and long-term monitoring issues, and how the developer has adapted its plans to address the parties' concerns.