



**Avalon Rare Metals Inc.**

**RESPONSE TO THE DECEMBER 19, 2011 INFORMATION REQUESTS FROM  
FISHERIES AND OCEANS CANADA  
FOR THE THOR LAKE RARE EARTH ELEMENT PROJECT  
DEVELOPER'S ASSESSMENT REPORT**

**Submitted To:  
MACKENZIE VALLEY ENVIRONMENTAL IMPACT REVIEW BOARD**

**January 2012**

Avalon Rare Metals Inc. (Avalon) is pleased to provide the following responses to the information requests identified in Fisheries and Oceans Canada's letter to Avalon dated December 19, 2011.

**IR Number: DFO #1**

Source: Fisheries and Oceans Canada

To: Avalon Rare Metals Inc.

Subject: Ring, Ball and Buck Lakes – Tailings Management Facility

DAR Section: 2.8, 6.6.3.2, 6.6.4

ToR Section: 3.2.4(10), 3.3.5(4)

**Preamble**

Ring, Ball, and Buck lakes are within the footprint of the proposed Tailings Management Facility (TMF) and according to the Developer's Assessment Report (DAR) are not likely to be fish frequented. A summary of fisheries baseline is included in Table 2.8-8 of the main DAR and references the following report: *"Stantec Inc. 2010c. Thor Lake Rare Earth Metals Baseline Project Environmental Baseline Report: Volume 3 – Aquatics and Fisheries. Final Report. Report prepared for Avalon Rare Metals Inc., Toronto, ON"*. This document, dated January 2010, only includes the aquatics baseline information up to 2009. Table 2.8-8 refers to 2010 field data as well as Section 2.8.3 which states that aquatics field programs were also conducted in April, June, September and October 2010. This information has not been provided in the DAR. There is also mention of a 1989 report (Melville G., R. Godwin, D. Russell, and J. Polson. 1989. *Thor Lake Area (NWT) Environmental Baseline Survey. Saskatchewan Research Council Publication E-901- 1-E-89*) outlining work in 1988 that has also not been provided.

DFO has informed Avalon, in meetings as well as in our comments during the preliminary screening and on the Terms of Reference, that additional baseline information is required in order to make a determination on the fisheries status of those lakes within the footprint of the proposed TMF, and thus if there is a requirement for any of these lakes to be considered for addition to schedule 2 of the Metal Mining Effluent Regulations (MMER). This information includes, but is not limited to, fisheries assessment methods and effort, seasonal variability in fish presence, connectivity with surrounding lakes, and winter water chemistry data. It should be noted that DFO will consider an area to be fish habitat if it is seasonally used by fish, such as migratory corridors or flood-plains used during spring freshet.

**DFO Request #1**

DFO requires the following information in order to adequately assess Avalon's claim that the lakes within the footprint of the proposed TMF are non fish frequented:

- An updated report on all fisheries assessments conducted to date including 2010 field data. The report should include information on seasonal connectivity between lakes, as well as information on fishing methods and catch effort in each lake;

- Details from any aquatic assessments done in 2010 including parameters such as winter dissolved oxygen levels to determine if the lakes could support over-wintering fish populations;
- Provide a copy of Melville et al., 1989 (referenced above) with historical data on Ring Lake.

### **Avalon Response #1**

As requested, Avalon is pleased to provide as Attachment 1 a copy of Stantec's completed fisheries research program in the Thor Lake area in September 2011. The objective of the program was to collect additional information to determine fish species presence/absence in five lakes in the Thor Lake area. The program included a third year of fishing in Ring, Buck, Drizzle, and Murky lakes, and a second year of sampling in Ball Lake. The results of the sampling program supplement the data gathered in 2009 and 2010, which were presented in the baseline report 'Thor Lake Rare Earth Metals Baseline Project Environmental Baseline Report: Volume 3 — Aquatics and Fisheries (Stantec 2011) (Appendix A.1 of the DAR).

The 2011 fisheries program results supported the conclusions of the baseline report regarding the fish-bearing status of the five lakes. Ring, Ball and Buck lakes are non-fish-bearing: no fish have been captured in these lakes in three years of fishing effort (two years in Ball Lake); the lakes are isolated from downstream fish-bearing habitat; the winter dissolved oxygen levels are low (Ball Lake winter dissolved oxygen will be measured in March 2012); and large plankton species (e.g., *Daphnia galeata*, *Chaoborus* sp., and *Heterocope* sp.) were present (no plankton data for Ball Lake). The presence of large plankton species reflects a lack of predation by fish.

Murky Lake is fish-bearing. Fish have been captured and observed in Murky Lake in previous years, and another fish was captured in 2011. Due to its shallow depth (less than 2 m), low winter dissolved oxygen (0.44 to 1.50 mg/L), and seasonal connection to Thor Lake (Murky Out is passable during the spring freshet, but probably impassable in autumn in most years); Murky Lake is likely to be a sink habitat. A sink habitat is one that can be reached by in-migrating species, but that cannot support the species in the long term (i.e., over winter).

Drizzle Lake was considered fish-bearing in the baseline report, although no fish had been captured in this Lake. The 2011 fisheries program results confirmed that Drizzle Lake is indeed fish-bearing. However, Drizzle Lake is also likely a sink habitat for the same reasons as Murky Lake, discussed above. The winter dissolved oxygen levels measured in Drizzle Lake (0.39 to 0.60 mg/L) are lower than the levels measured in Murky Lake.

Previous winter dissolved oxygen data recorded for each of the 18 lakes sampled by Stantec are summarized in Table 2.8-9 of the DAR and Table 6-11 of Stantec (2011) (Appendix A.1 of the DAR).

In addition, as requested, Avalon previously provided a copy of the Melville et al., 1989 report prepared for Senes Consultants limited for the Saskatchewan Research Council (see Attachment 2). This document is available on the MVEIRB registry.

**IR Number: DFO #2**

Source: Fisheries and Oceans Canada

To: Avalon Rare Metals Inc.

Subject: Drizzle Lake and connectivity with other lakes

DAR Section: 2.5.2, 2.8, 4.3.3

ToR Section: 3.2.4 (10) (11)

**Preamble**

Water from the Tailings Management Facility (TMF) is proposed to be released to Drizzle Lake and will comply with the requirements of the Mackenzie Valley Land and Water Board as well as the federal Metal Mining Effluent Regulations.

In Table 2.8-9 called "*Fish Bearing Status and Designation Criteria*" (referenced to Stantec 2010c) it states that Drizzle Lake is fish bearing while in Section 4.3.3 it is stated that Drizzle Lake is not fish bearing. Furthermore, in Section 2.8.5.3 it is stated that "Drizzle Lake is technically considered to be a fish habitat due to its seasonal connection to Murky Lake through a defined channel."

In addition, Figure 2.8-11 states that connection between Egg and Drizzle is "to be determined" however this is not consistent with other parts of the DAR that state the "outlet stream from Egg Lake was investigated in May 2010 and found to drain mainly through the ground and consequently has no connectivity for fish passage to Drizzle Lake" (DAR Section 2.8.5.3) and that Egg Lake "has no surface connectivity to Drizzle Lake" (DAR Section 2.5.2). If Egg Lake is potentially connected to Drizzle Lake, and Egg Lake is found to be fish-frequented, there is a potential that fish from Egg Lake could move into Drizzle Lake.

**DFO Request #2**

1. DFO requests that Avalon provide clarification on the inconsistent statements found within the DAR relating to fish being present in Drizzle Lake.
2. DFO requests that Avalon provide clarification on information gathered to date relating to the potential connectivity between Egg Lake and Drizzle Lake and relating to the assessment of the fisheries potential of Egg Lake.

**Avalon Response #2**

Statements in the DAR that suggested some inconsistency related to the fish bearing status of Drizzle Lake reflected the available information that was reported in the DAR. As indicated in Section 2.8.4.6 of the DAR, no fish were captured in Drizzle Lake in two previous seasons of sampling. In addition, it is very shallow and anoxic in winter, and the stream connecting Drizzle to Murky is only passable during spring high flows. As such, it is unlikely to sustain fish populations and can be considered a sink habitat.

However Stantec's 2011 fisheries program results confirmed that Drizzle Lake is indeed fish-bearing. For assessment purposes in the DAR, Avalon had assumed that Drizzle Lake was potentially fish-bearing, and this has subsequently been reflected in the Conceptual Aquatic Effects Monitoring Program that was recently developed for the MVEIRB in response to MVEIRB IR# 1.3.

Regarding the matter of potential connectivity between Egg Lake and Drizzle Lake, Figure 2.8-11 in the DAR reflected the available information when that figure was created by Stantec and reproduced in the DAR. The subsequent statements referenced by DFO from the DAR in its preamble to the request, correctly stated that the "outlet stream from Egg Lake was investigated in May 2010 and found to drain mainly through the ground and consequently has no connectivity for fish passage to Drizzle Lake" (DAR Section 2.8.5.3) and that Egg Lake "has no surface connectivity to Drizzle Lake" (DAR Section 2.5.2).

**IR Number: DFO #3**  
**Source:** Fisheries and Oceans Canada  
**To:** Avalon Rare Metals Inc.  
**Subject:** Emergency Overflow Spillway  
**DAR Section:** 4, 6  
**ToR Section:**

### **Preamble**

Various figures throughout the DAR (such as Figure 4.7-6) show an “emergency overflow spillway” from the polishing pond area of the TMF into Drizzle Lake however no details have been provided on the design or operation of this structure.

### **DFO Request #3**

DFO requests that Avalon provide specific details on the intent, design, and operation of the “emergency overflow spillway” between the polishing pond and Drizzle Lake.

### **Avalon Response #3**

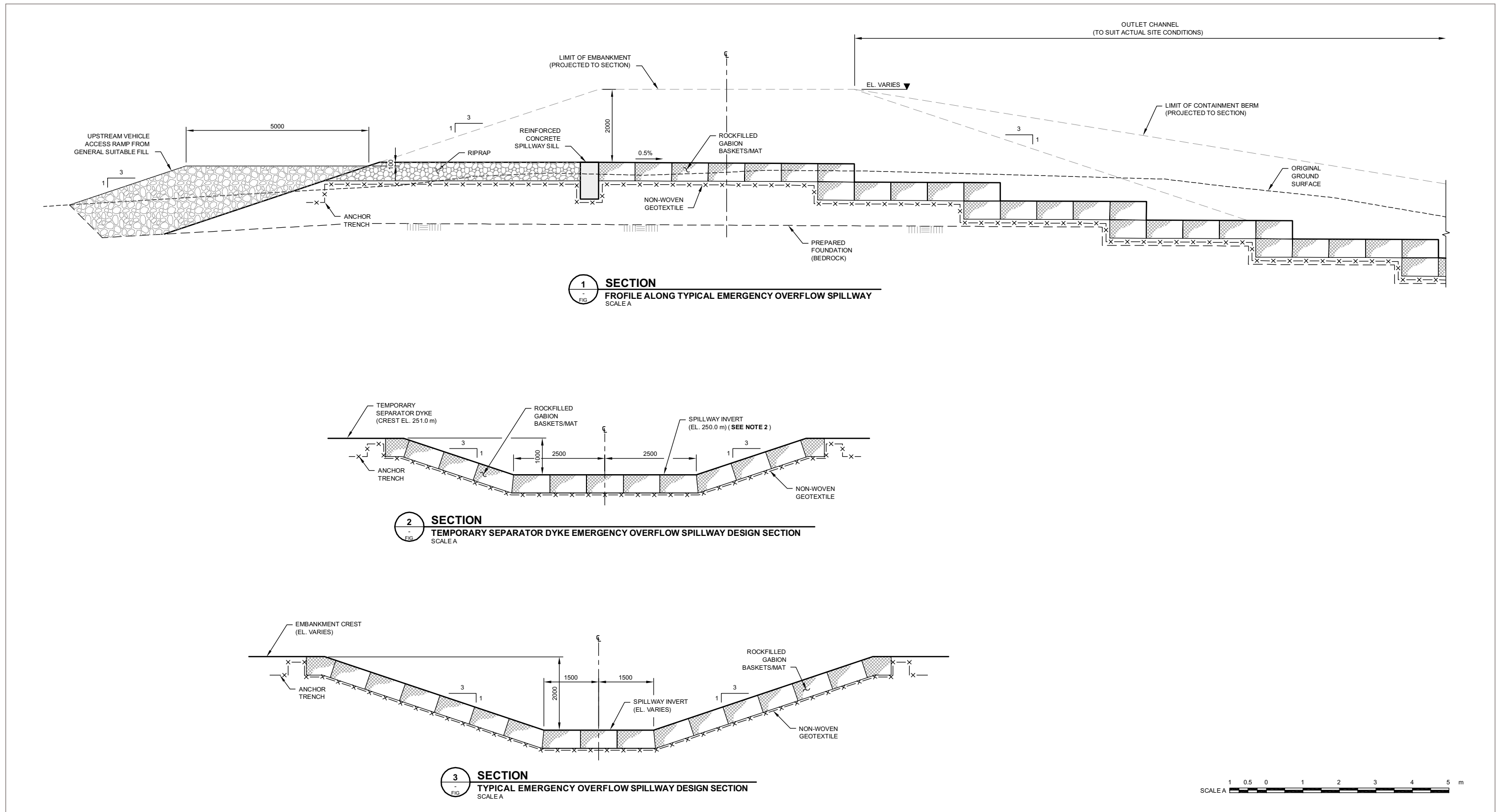
The TMF construction will be completed to ensure that there is always sufficient storage capacity available in the facility to avoid overtopping of the embankments and provide sufficient freeboard to safely accommodate the maximum operating pond and Environmental Design Storm (EDS) event, combined with wave run-up. Additionally, the Emergency Overflow Spillway is designed to safely pass the Inflow Design Flood (IDF) event during both operations and closure.

A review of the meteorology for the Thor Lake Site was previously completed and summarized in Knight Piésold memo NB11-00148 (Appendix C.13 of the DAR). Extreme event rainfall depths (i.e. EDS and IDF) used in the design of various storm water management facilities were estimated using the *Rainfall Frequency Atlas for Canada* (Hogg and Carr, 1985) in conjunction with a Gumbel distribution, and were summarized in NB11-00148. The relevant design storms are summarized as follows:

- EDS = 1 in 25 Year 24-hour storm (46.44 mm)
- IDF (Phase 1) = 1 in 100 Year 24-hour storm (57.37 mm)
- IDF (Phase 2) = 1 in 1000 Year 24-hour storm (75.36 mm)

The spillways have been designed to safely pass the IDF plus a freeboard allowance for wave run-up. The spillways will consist of a trapezoidal channel constructed through the embankment crest near the abutment. The intent will be to establish the invert of the spillway and outlet channel into competent foundation materials (i.e. bedrock), where possible, and therefore some field determination of the actual location and alignment will be required. Should it not be feasible to establish the invert into competent bedrock, the spillway and channel will be lined with a combination of riprap, geotextiles and rock filled gabion baskets/mats. The typical design details for the emergency overflow spillways are shown in Figure 1.

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## LEGEND

	ROCKFILLED GABION BASKET/MAT
	REINFORCED CONCRETE
	RIPRAP
	GENERAL SUITABLE FILL
	NON-WOVEN GEOTEXTILE

## NOTES

1. Dimensions are in millimetres and elevations are in metres, unless noted otherwise.
2. An upstream clay cutoff could be installed rather than a reinforced concrete spillway sill for the temporary separator dyke spillway.  
Figure Source: Knight Piesold (2012).

STATUS  
ISSUED FOR USE

## CLIENT



## THOR LAKE PROJECT

### Emergency Overflow Spillway and Outlet Channel Sections and Details

PROJECT NO. V15101007.004	DWN SL	CKD RH	APVD RH	REV 0
OFFICE EBA-VANC	DATE January 6, 2012			

Figure 1

**IR Number: DFO #4**  
Source: Fisheries and Oceans Canada  
To: Avalon Rare Metals Inc.  
Subject: Murky Lake Bypass  
DAR Section: 6.6.3.2  
ToR Section: 3.3.5(8)

### **Preamble**

In Section 2.7.5.1 of the original project description report submitted to the Mackenzie Valley Land and Water Board in April 2010 there is mention of a potential “Murky Lake bypass” which would direct water from Drizzle Lake directly into Thor Lake. The section states:

*“As a contingency for impact mitigation, a decant intake and pipeline has also been included to transfer excess water from Drizzle Lake to Thor Lake.”*

In contrast, Section 6.6.3.2 of the DAR states “all water from the TMF will return to Thor Lake via Drizzle and Murky lakes. No water bypass is contemplated in this design, thereby maintaining flow through all natural waterbodies downstream of the TMF”.

### **DFO Request #4**

DFO requests that Avalon confirm the status of the “Murky Lake bypass” as a component of the final project design.

### **Avalon Response #4**

DFO is correct in noting that the project plan for directing water flows from Drizzle Lake via Murky Lake to Thor Lake has evolved between the production of the Project Description Report and the subsequent DAR.

Avalon is pleased to confirm that the initial plan to use a pipeline to convey excess water from Drizzle Lake to Thor Lake has been eliminated in favour of the current plan, which is as stated in Section 6.6.3.2 of the DAR. “All water from the TMF will return to Thor Lake via Drizzle and Murky lakes. No water bypass is contemplated in this design, thereby maintaining flow through all natural waterbodies downstream of the TMF.”



<b>IR Number:</b>	<b>DFO #5</b>
Source:	Fisheries and Oceans Canada
To:	Avalon Rare Metals Inc.
Subject:	Water Intake
DAR Section:	
ToR Section:	3.2.5(2) (32)

### **Preamble**

Based on information presented in the DAR, a water intake is proposed to be installed in Thor Lake, which is known to be habitat for northern pike, lake cisco, and lake whitefish. Installation of a water intake requires in-water works which have the potential to impact fish and fish habitat. As well, permanent structures installed below the high water mark have the potential to impact fish habitat within its direct footprint.

### **DFO Request #5**

DFO recommends that Avalon provide conceptual designs of the water intake structure including precise location, installation methods, overall footprint, and a fish habitat assessment of the area, in order to assist in making any determination of potential impacts to fish and fish habitat.

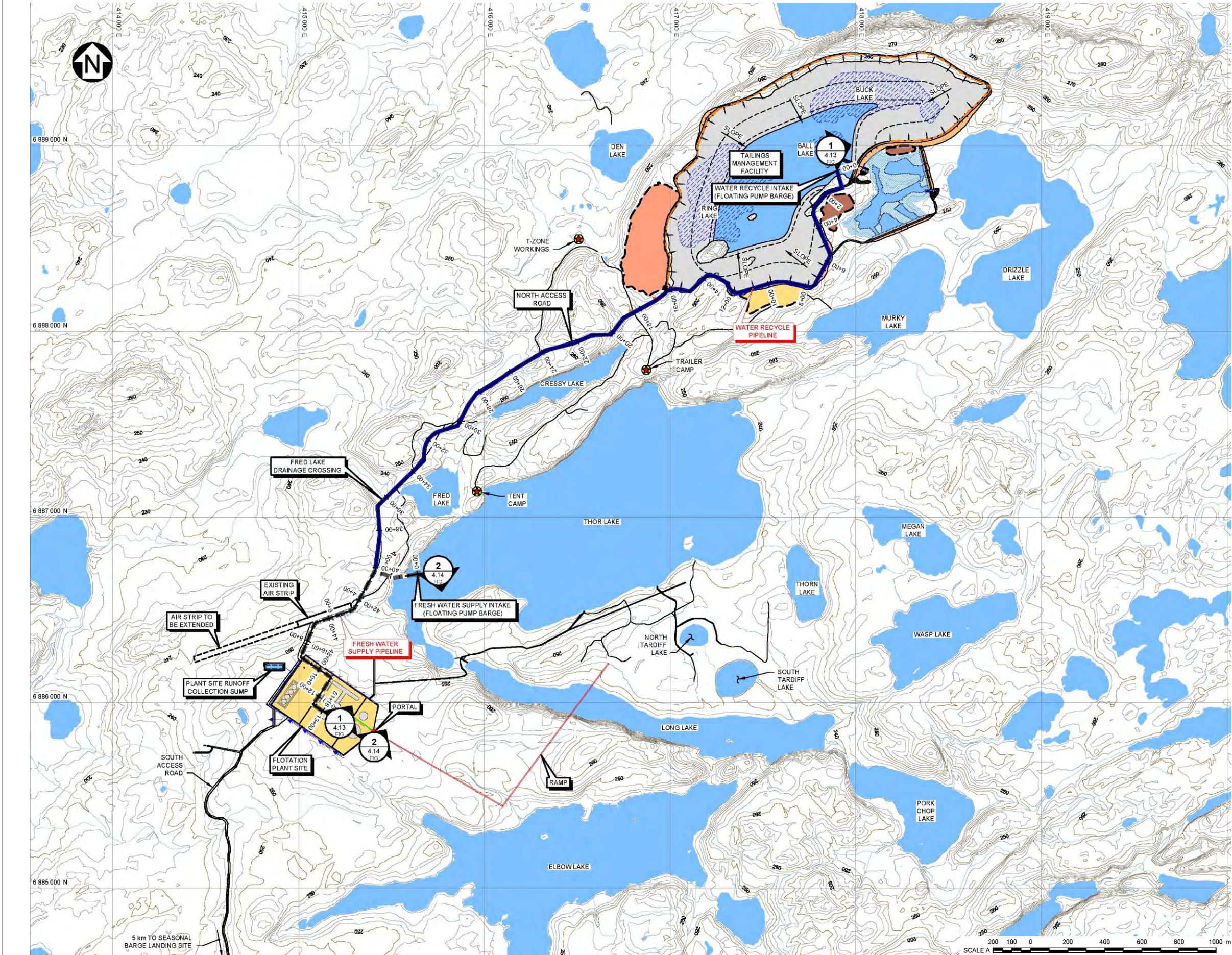
### **Avalon Response #5**

The proposed fresh water supply source is Thor Lake and the proposed supply intake location is on the west end of Thor Lake shown in Figure 2, where the water depth exceeds 10 m. The supply intake will be placed in the deep area of Thor Lake and an appropriate fish screen will be employed in conformance with the Department of Fisheries and Oceans Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO 1995). In addition, water withdrawal from Thor Lake will conform with the DFO Protocol for Winter Water Withdrawal in the Northwest Territories (DFO 2010).

The intake structure will be constructed as a pipeline that extends down the shoreline with a suspended pipeline (floating catwalk) out to the intake location (small barge). At the intake location (minimum of 10 m water depth) the intake pipe will extend vertically into the water column (above the lake bottom) to withdraw water. The general details for the barge and intake system are provided in Figure 3. As noted, the structure will be floating over the lake surface and will not be in contact with the lake bottom. As a result, no effects on fish or fish habitat are expected to occur.



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## LEGEND

- WATER
- TAILINGS
- ORIGINAL LAKE LIMITS
- EMBANKMENT FILL
- FLOTATION PLANT SITE
- POTENTIAL QUARRY
- POTENTIAL ORGANICS STOCKPILE AREA
- AREA TO BE RE-GRADED WITH EXCAVATED ICE RICH OVERBURDEN
- ALLOWABLE MAXIMUM WATER LEVEL
- EXISTING ACCESS ROAD
- PROPOSED ACCESS ROAD
- RAMP
- TAILINGS DELIVERY PIPELINE
- TAILINGS DEPOSITION POINT
- WATER RECYCLE PIPELINE
- FRESH WATER PIPELINE
- RUNOFF COLLECTION DITCH
- FRESH WATER INTERCEPT DITCH

## NOTES

- Coordinate grid is UTM (NAD83) Zone 12N and is in metres.
- Plan based on information provided by Avalon Rare Metals Inc.
- Contours are in metres. Contour interval is 2 metres.
- Tailings management facility final layout (Year 20) determined from water/solids balance analysis and tailings/water modelling.

Figure Source: Knight Piesold (2012).

STATUS  
ISSUED FOR USE

## THOR LAKE PROJECT

### Water Recycle and Fresh Water Supply Systems Layout

CLIENT



A TETRA TECH COMPANY

## FILE NO.

V15101007\_004\_Figure02\_WaterLayout.cdr

## PROJECT NO.

V15101007.004

## OFFICE

EBA-VANC

## DWN

SL

## CKD

RH

## APVD

RH

## REV

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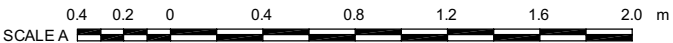
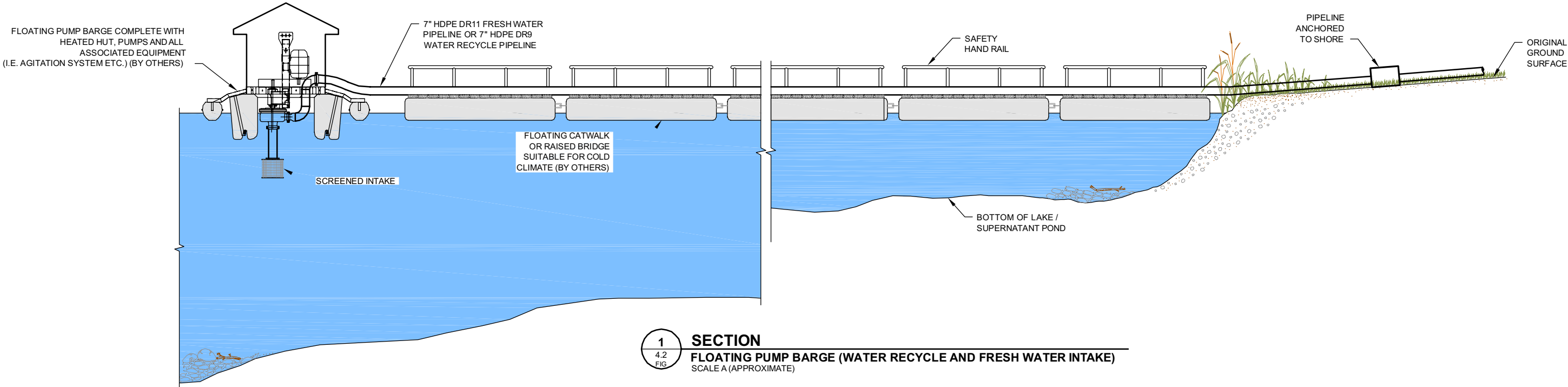
## DATE

January 6, 2012

Figure 2



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LEGEND

WATER

**NOTES**  
1. Elevations are in metres, unless noted otherwise.  
2. The second sump is to allow for water recycle potential in Phase 2.  
3. Buildings located at el. 250m in Phase 1.  
Figure Source: Knight Piesold (2012).

**STATUS**  
ISSUED FOR USE

CLIENT



THOR LAKE PROJECT

Water Recycle and Fresh Water Supply Systems Sections and Details

PROJECT NO. V15101007.004	DWN SL	CKD RH	APVD RH	REV 0
OFFICE EBA-VANC	DATE January 6, 2012			

Figure 3

<b>IR Number:</b>	<b>DFO #6</b>
Source:	Fisheries and Oceans Canada
To:	Avalon Rare Metals Inc.
Subject:	Decant Structure
DAR Section:	4, 6
ToR Section:	3.2.5(2)

### **Preamble**

In various figures (i.e. 2.7-4, 2.7-5) presented in the original project description report submitted to the Mackenzie Valley Land and Water Board in April 2010, a diffuser is proposed to be placed within Drizzle Lake. In contrast, various figures in the DAR (i.e. 4.5-1, 6.3-3) show a decant pipe discharging to land to the west of Drizzle Lake. From the information provided it is unclear as to the exact location and details of the decant pipe or whether a diffuser is still a component of the final project design.

### **DFO Request #6**

DFO requests that specifications of the decant pipe/diffuser should be provided in detail to assist in determining potential impacts to fish and fish habitat.

If there are any proposed in-water works for the decant pipe/diffuser, DFO requests that Avalon provide conceptual designs of the structure including precise location, installation methods, discharge velocity, overall footprint, a fish habitat assessment of the area, and mitigation for potential impacts to fish and fish habitat.

If the decant pipe is restricted to land, DFO requests that Avalon provide information of distance from Drizzle Lake, discharge velocity, and erosion and sediment control measures related to both the construction and operation of the pipe.

### **Avalon Response #6**

The need for a diffuser on the decant outlet system is currently not anticipated. Based on the low flows rates and in an effort to avoid in water works at Drizzle Lake, it is proposed that the 250 mm HDPE decant pipe will discharge into an excavated ditch near the toe of the Polishing Pond embankment. The ditch will be locally armoured with large riprap material (Figure 1) and graded at approximately -0.5% toward Drizzle Lake to reduce flow velocities. The ditch will terminate at the location of an existing drainage or where overland flow can be achieved downstream of the embankment. The ditch can be extended toward Drizzle Lake as required depending on the downstream topography and natural materials present.

The maximum required flow rate of decant water into the ditch is estimated to be 96 m<sup>3</sup>/hr during Phase 1 and 133 m<sup>3</sup>/hr during Phase 2 operations. The armoured ditch (riprap) will serve to reduce the velocity and energy of the decant water as it initially discharges from the pipe and drains toward Drizzle Lake. Alternatively, downstream of the initial segment of the ditch (where riprap armoured

is required to dissipate energy and reduce velocities), the ditch may be lined with finer rockfill or an erosion and sediment control matting (such as Erosion Control Blanket) to reduce the sediment load of the water reporting to Drizzle Lake, if necessary. Based on a 0.5% trapezoidal ditch lined with rockfill lining, the flow velocity would be less than 0.5 m/s based on the maximum flow of 133 m<sup>3</sup>/hr. During construction of the decant and ditch, silt fences will be employed, where required, to prevent sediment reporting to the natural drainage courses and Drizzle Lake.

The ditch will be inspected and maintained to ensure its integrity during operations and to verify that significant sediment is not reaching Drizzle Lake due to operations.

**IR Number: DFO #7**  
**Source:** Fisheries and Oceans Canada  
**To:** Avalon Rare Metals Inc.  
**Subject:** Crossings  
**DAR Section:** 4.7.5.6, 6.6.1.2  
**ToR Section:** 3.2.5(13), (22)

### **Preamble**

As stated in the Review Board's Deficiency List letter from August 25th, 2011, very little information was provided on the access road and watercourse crossings within the DAR. In *Avalon's Response to the Deficiency List for Thor Lake Rare Earth Element Project Developer's Assessment Report: Part 2* dated September 2011, there was additional information on the access road however no discussion of watercourse crossings.

The DAR only mentions a crossing at the outlet of Cressy Lake that was identified as non-fish bearing and not providing a migratory connection between Cressy and Fred lakes. During a visit to the Thor Lake site on August 17, 2010, DFO staff were taken to a crossing location between Thor Lake and Long Lake. It was stated at that time that the current crossing was built to accommodate a drill rig but that a larger access road may be required for mine operations. Thor Lake and Long Lake both support year round fish populations.

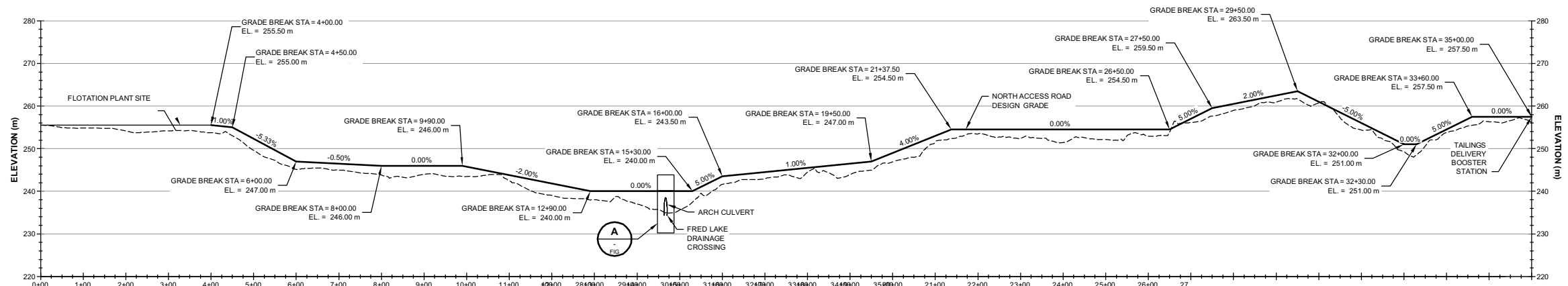
### **DFO Request #7**

DFO requests additional details on all water course crossings, including any upgrades and/or proposed new crossings. This includes information on proposed designs, potential fish habitat impacts and mitigation.

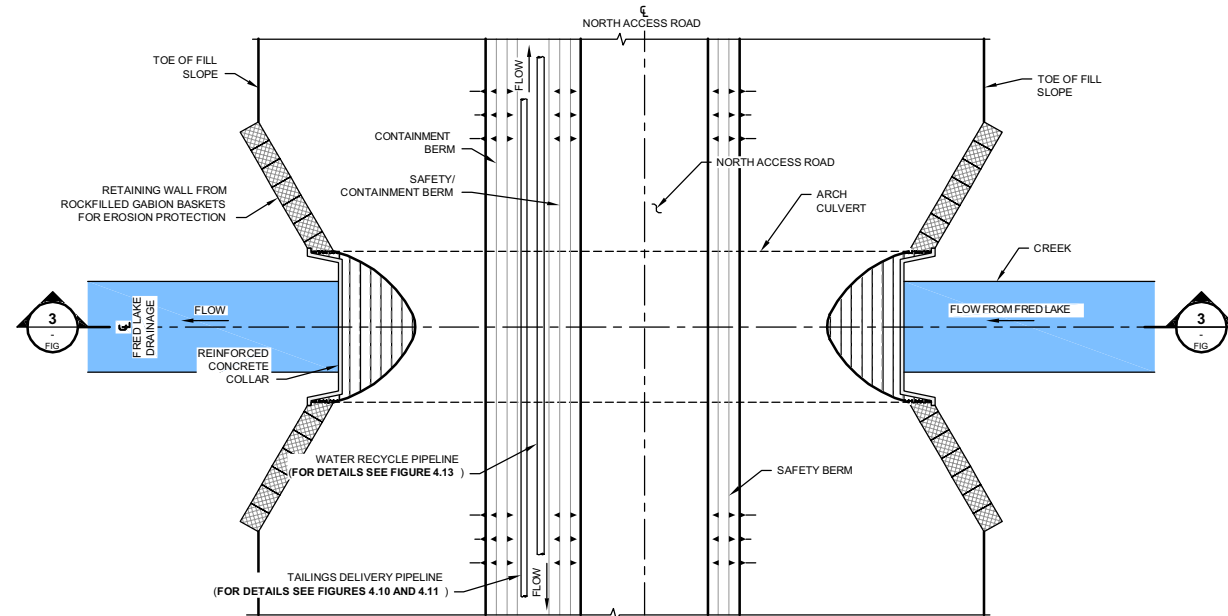
### **Avalon Response #7**

Downstream of Fred Lake, the access road and pipeline route will pass over a creek, where an arch culvert will be placed in order to prevent impacts to the existing creek bed and to maintain continuous roadway with continuous pipeline containment (safety berms). Details for this crossing are included in Figure 4. During installation of the culvert and associated earthworks near the drainage, silt fences will be employed to prevent sediment reporting to the natural drainage courses.

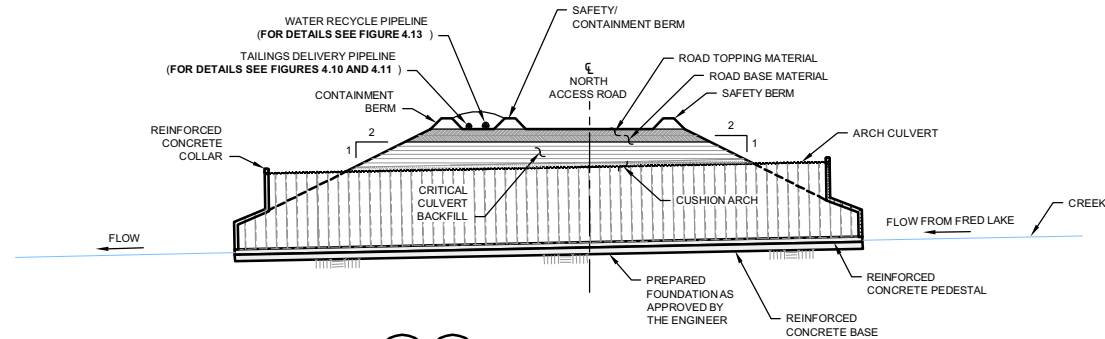
As part of the DAR description, ventilation raises will be required to supply fresh air to the underground workings and act as primary emergency escapeway for workers. These raises are planned in the area between Thor Lake and Long Lake requiring single lane access during construction for installation and operations for periodic maintenance inspections. The existing crossing between Thor lake and Long Lake will need to be upgraded, and a similar arrangement as that proposed for the Fred Lake crossing, namely the use of an arch culvert would be employed to protect and maintain the existing fish habitat at this crossing site.



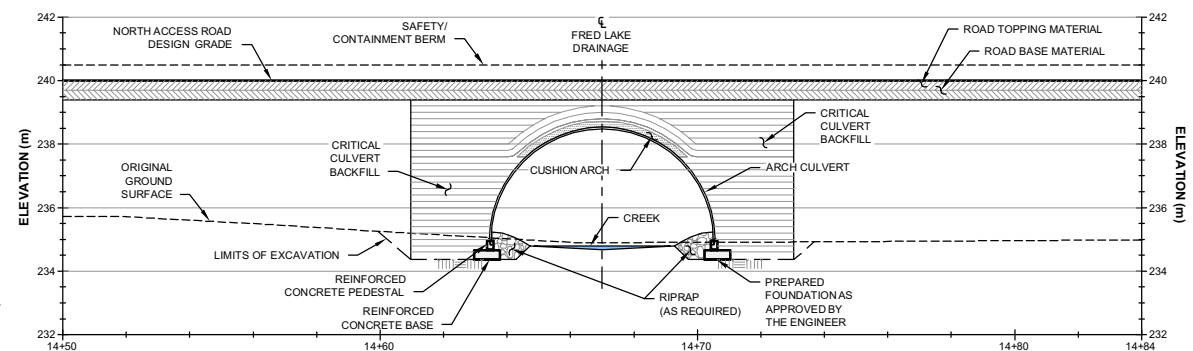
**1**  
FIG  
**SECTION**  
**PROFILE ALONG NORTH ACCESS ROAD**  
HORIZONTAL SCALE A  
VERTICAL SCALE B



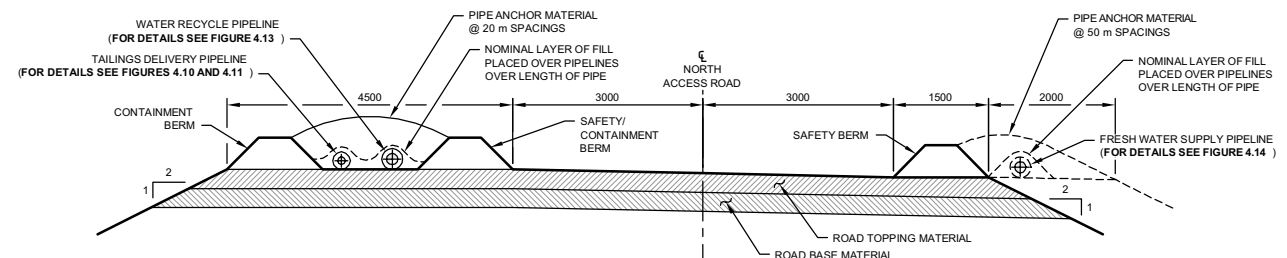
**PLAN VIEW**  
**FRED LAKE DRAINAGE CROSSING**  
SCALE E



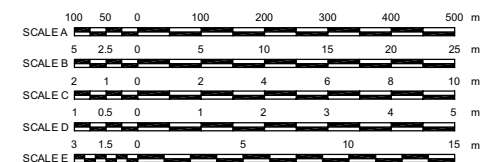
**3**  
FIG  
**3**  
FIG  
**SECTION**  
**FRED LAKE DRAINAGE CROSSING**  
SCALE E



**A**  
FIG  
**DETAIL**  
**FRED LAKE DRAINAGE CROSSING**  
SCALE C



**4**  
FIG  
**SECTION**  
**TYPICAL NORTH ACCESS ROAD DESIGN SECTION**  
SCALE D



## LEGEND

	WATER		CONCRETE
	CUSHION ARCH		RIPRAP
	CRITICAL CULVERT BACKFILL		ROCKFILLED GABION BASKET

## NOTES

1. Dimensions are in millimetres and elevations are in metres, unless noted otherwise.
  2. Actual crossing dimensions to be determined based on hydraulic design.
- Figure Source: Knight Piesold (2012).

## CLIENT



## THOR LAKE PROJECT

### North Access Road Profile, Sections and Details

<b>PROJECT NO.</b> V15101007.004	<b>DWN</b> SL	<b>CKD</b> RH	<b>APVD</b> RH	<b>REV</b> 0
<b>OFFICE</b> EBA-VANC	<b>DATE</b> January 6, 2012			

Figure 4

**STATUS**  
ISSUED FOR USE

**IR Number: DFO #8**

Source: Fisheries and Oceans Canada

To: Avalon Rare Metals Inc.

Subject: Docks

DAR Section: 6.6, 6.11

ToR Section: 3.3.5(10)

**Preamble**

Section 6.11 of the DAR provides a brief description of the barging/docking facilities to be used in support of Avalon's proposed mine. It is unclear from information provided (such as within Figure 4.8.8) as to the extent of work that will be completed below the high water mark.

In the Review Board's Deficiency List letter from August 25th, 2011 additional information was requested related to the dock area, however the information requested was limited to the footprint of the container laydown area and the total terrestrial project footprint at the dock facility.

**DFO Request #8**

DFO requests that Avalon provide detailed information on the precise location, footprint, and installation methods for the dock facilities at both sites including the extent of work to be completed below the high water mark.

**Avalon Response #8**

More detailed information on the location, footprint and installation methods to be employed for the proposed seasonal docks at both sites was provided in the Transportation Assessment prepared by Red Sky Enterprises, which was included as Attachment 2 to Avalon's response to MVEIRB IR# 1.7. A copy of that same report is provided as Attachment 3 to this response.

The following text, extracted from this report outlines the general plan for both sites.

Seasonal docks comprised of flat deck barges will be used at each site. A mooring arrangement will be developed to adequately secure the dock barges during the open water season. Careful consideration will be given to the configuration of the barge dock to enhance loading/offloading operations.

Under the current arrangement as described in the DAR, NTCL 1000 series barges are considered for use as dock barges and 1500 series barges for cargo. The moulded depth of each barge series differs by 0.77 metres (2.5 ft.), therefore ramping will be required, up or down, as the draft of the cargo barge changes.



Figure 3.1.1 in the Transportation Assessment (Attachment 3) describes the current proposed mooring arrangement at the Nechalacho Dock. One 1000 series barge is moored alongside the shore with lines running to 4 dead men (anchor points) ashore. A ramp can be set about amidships of the dock barge. One cargo barge is then moored alongside the dock barge for loading. Other barges in the tow (2) can be anchored nearby or tied to the shore and shuttled into the loading dock when barge 1 is loaded.

Figure 3.2 in the Transportation Assessment (Attachment 3) describes the current proposed mooring arrangement at the Pine Point Dock. Due to the shallow nearshore area that exists at this site, three 1000 series dock barges, secured in line, would be required to moor the cargo barge). A well planned securing arrangement for the dock barges will be required to withstand adverse weather conditions. Grounding the dock barges by ballast water is another possibility but would require further investigation and approval by the barging contractor.

**IR Number: DFO #9**

Source: Fisheries and Oceans Canada

To: Avalon Rare Metals Inc.

Subject: Sediment and Erosion Control

DAR Section: 6.6.2.1, 6.6.4

ToR Section:

**Preamble**

On p.735 of the DAR it states that “erosion and sediment control” will be implemented, and on p.742 that “riparian vegetation clearing and erosion control” will be conducted according to the Land Development Guidelines for the Protection of Aquatic Habitat. These guidelines were developed by DFO in collaboration with the Ministry of Environment, Lands and Parks in British Columbia and apply to a broad range of development activities. While some of the concepts presented in these guidelines may be applicable to Avalon’s proposed project, it should be noted that some measures may not be relevant or applicable in the northern context.

**DFO Request #9**

DFO requests that Avalon provide a conceptual erosion and sediment control plan as well as describe what aspects of the “Land Development Guidelines” it proposes to use, and how these guidelines are applicable in the Northwest Territories.

**Avalon Response #9**

As requested by DFO, Avalon is pleased to provide as Attachment 4, the Conceptual Erosion and Sediment Control Plan for the Nechalacho Mine site.

**IR Number: DFO #10**

Source: Fisheries and Oceans Canada

To: Avalon Rare Metals Inc.

Subject: SARA species (Shortjaw Cisco)

DAR Section:

ToR Section: 3.2.4 (13), 3.3.6

**Preamble**

In correspondence dated December 7th, 2010, the Review Board requested that DFO “*assist in determining the likelihood of adverse effects of the proposed project on Shortjaw Cisco and/or its critical habitat*” due to its designation as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and being considered for listing under the federal Species at Risk Act (SARA).

On December 10th, 2010 DFO requested that the proponent provide information on any threatened or endangered aquatic species that may occur in the study area as part of the Terms of Reference for the DAR. Avalon has not identified shortjaw cisco as being present or potentially impacted by the project.

It is DFO’s understanding that the shortjaw cisco is a deep-water species usually found in lakes ranging in depth from 20 m to 180 m and most often found in deeper waters of large lakes. The deepest lakes found within the project area are Thor Lake which has a maximum depth of 16m and Great Slave Lake. Given the depths of Thor Lake and its watershed as well as the lack of connection between this watershed and Great Slave Lake, it is unlikely that shortjaw cisco would be found in lakes near the mine site. The shortjaw cisco has been documented in Great Slave Lake but is usually found in deeper water. It is unlikely that the dock structures for this project would impact shortjaw cisco or its habitat. DFO would still recommend that mitigation measures be incorporated for any works in Great Slave Lake in order to protect all fish and fish habitat, including shortjaw cisco. More information on the shortjaw cisco can be found at: <http://www.sararegistry.gc.ca/species/speciesDetails e.cfm?sid=82>

**DFO Request #10**

DFO requests that, with the latest fisheries assessments from 2010 (see DFO\_01), Avalon consider the likelihood of the project to impact shortjaw cisco and its habitat, with particular focus on the dock structures within Great Slave Lake. Please also provide details on mitigation measures, if needed.

**Avalon Response #10**

Avalon is aware that the shortjaw cisco is designated as a species that is Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and being considered for listing under the federal Species at Risk Act (SARA). Avalon also concurs with DFO's understanding that the shortjaw cisco is a deep-water species usually found in lakes ranging in depth from 20 m to 180 m and most often found in deeper waters of large lakes including Great Slave Lake.

Given this information, Avalon concurs with DFO that it would be most unlikely that shortjaw cisco would ever occur in the shallow waters (<10 m) in the vicinity of either of the two proposed Thor Lake Project seasonal dock sites. It is also understood that shortjaw cisco typically spawn in the fall when barge operations will be nearing completion (before freeze-up).

On this basis, Avalon agrees with DFO that it would be most unlikely that the seasonal floating dock structures and mooring/anchoring arrangements being considered for this project would impact shortjaw cisco or its habitat. Nevertheless, Avalon is committed to working with DFO and implementing appropriate mitigation measures for any works in Great Slave Lake in order to protect all fish and fish habitat, including shortjaw cisco.

## ATTACHMENTS

- Attachment 1:** Stantec 2011. The Thor lake Fisheries Program 2011. A letter report prepared by Stantec for Avalon Rare metals Inc.
- Attachment 2:** Melville et al. 1989. Thor Lake Area (NWT) Environmental Baseline Study. Prepared for Senes on behalf of the Saskatchewan Research Council.
- Attachment 3:** Red Sky Enterprises Inc. 2011. Transportation Assessment A report prepared by Red Sky Enterprises for Avalon Rare metals Inc.
- Attachment 4:** Conceptual Erosion and Sediment Control Plan. A report prepared by EBA a Tetra Tech Company for Avalon Rare metals Inc.

## **Attachment 1**



**Stantec Consulting Ltd.**  
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## **VIA COURIER**

October 12, 2011

Project No: 1235-10673.203

### **Avalon Rare Earth Metals**

6165 Hwy 17, Unit 330  
Delta, BC V4K 5B8

**Attention: Mr. David Swisher**

Dear Mr. Swisher:

### **Reference: Thor Lake Fisheries Program 2011**

Stantec completed a fisheries research program in the Thor Lake area in September 2011. The objective of the program was to collect additional information to determine fish species presence in five lakes in the Thor Lake area. The program included a third year of fishing in Ring, Buck, Drizzle, and Murky lakes, and a second year of sampling in Ball Lake. The results of the sampling program supplement the data gathered in 2009 and 2010, which were presented in the baseline report<sup>1</sup> Thor Lake Rare Earth Metals Baseline Project Environmental Baseline Report: Volume 3 – Aquatics and Fisheries (Stantec, 2011). This letter summarizes the 2011 program methodology and results, and discusses the results in the context of previous fisheries baseline work completed in the Thor Lake area.

## **1 METHODOLOGY**

Stantec set one floating six panel gang gill net overnight in each of the five study lakes. Gang gill nets are 90 m long (made of six 15 m mesh panels) and 2.5 m deep. The six panels have different mesh sizes, ranging from 25 to 89 mm. The study lakes are all shallow (maximum depths ranged from 1.8 to 2.5 m), so the gill nets spanned the water column in each lake. The nets were generally set in the early afternoon and hauled in the late morning; the sets were long because the field staff

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<sup>1</sup> Stantec Consulting Ltd. 2011. Thor Lake Rare Earth Metals Baseline Project Environmental Baseline Report: Volume 3 – Aquatics and Fisheries. Prepared for Avalon Rare Earth Metals Inc.

**Reference: Thor Lake Fisheries Program 2011**

expected low capture rates based on previous years' fishing results. Table 1 presents sampling dates, fishing effort, and the depth range sampled within each lake.

**Table 1: 2011 Gill Net Fishing Effort**

Lake	Set Date and Time	Haul Date and Time	Effort (hours)	Depth Range (m)
Ring	Sept 8, 10:45	Sept 9, 10:50	24.1	0.5 – 1.2
Ball	Sept 9, 13:00	Sept 10, 9:15	20.3	1.8 – 1.0
Buck	Sept 9, 13:50	Sept 10, 9:45	19.9	1.5 – 2.0
Drizzle	Sept 9, 15:15	Sept 10, 10:10	18.9	1.5 – 2.5
Murky	Sept 10, 14:15	Sept 11, 9:55	19.7	1.5 – 2.0

A beach seine was also used in Ring Lake to sample littoral bedrock habitat.

The lengths of captured fish were measured using a ruler. The weights of dead fish were measured using an electronic scale. The weights of live fish were estimated and the fish were released; fish were held in the water until they could stay upright and swim away by themselves.

## 2 RESULTS

No fish were captured in Ring, Ball, or Buck lakes. Three northern pike (*Esox lucius*) were captured in Drizzle Lake, and one northern pike was captured in Murky Lake (Table 2).

**Table 2: Fish Captures**

Lake	Species	Fork Length (mm)	Weight (g)	Released
Drizzle	Northern pike	190	50	Yes
Drizzle	Northern pike	200	70	No
Drizzle	Northern pike	190	45	No
Murky	Northern pike	210	68	No

## 3 DISCUSSION

The 2011 fisheries program results support the conclusions of the baseline report regarding the fish-bearing status of the five lakes. Ring, Ball and Buck lakes are non-fish-bearing: no fish have been captured in these lakes in three years of fishing effort (two years in Ball Lake); the lakes are isolated from downstream fish-bearing habitat; the winter dissolved oxygen levels are low (Ball Lake winter dissolved oxygen will be measured in March 2012); and large plankton species (e.g., *Daphnia galeata*, *Chaoborus* sp., and *Heterocope* sp.) were present (no plankton data for Ball Lake). The presence of large plankton species reflects a lack of predation by fish.



**Reference: Thor Lake Fisheries Program 2011**

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Murky Lake is fish-bearing. Fish have been captured and observed in Murky Lake in previous years, and another fish was captured in 2011. Due to its shallow depth (less than 2 m), low winter dissolved oxygen (0.44 to 1.50 mg/L), and seasonal connection to Thor Lake (Murky Out is passable during the spring freshet, but probably impassable in autumn in most years); Murky Lake is likely to be a sink habitat. A sink habitat is one that can be reached by in-migrating species, but that cannot support the species in the long term (i.e., over winter).

Drizzle Lake was considered fish-bearing in the baseline report, although no fish had been captured in Drizzle Lake. The 2011 fisheries program results confirm that Drizzle Lake is fish-bearing. However, Drizzle Lake is likely a sink habitat for the same reasons as Murky Lake, discussed above. The winter dissolved oxygen levels measured in Drizzle Lake (0.39 to 0.60 mg/L) are lower than the levels measured in Murky Lake.

#### **4 CLOSURE**

We trust that this information meets your current requirements. If you have any questions or comments about the 2011 Thor Lake fisheries program, please contact Sandra Nicol at 778-331-0217, or by email at [sandra.nicol@stantec.com](mailto:sandra.nicol@stantec.com).

Respectfully submitted,

**Stantec Consulting Ltd.**

Reviewed by:

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Karen Munro, M.Sc., R.P.Bio.  
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SN/KM/pf

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