Avalon Rare Metals Inc.

RESPONSE TO THE NOVEMBER 24, 2011 INFORMATION REQUESTS FROM THE MACKENZIE VALLEY ENVIRONMENTAL IMPACT REVIEW BOARD FOR THE THOR LAKE RARE EARTH ELEMENT PROJECT DEVELOPER'S ASSESSMENT REPORT

Submitted To:

MACKENZIE VALLEY ENVIRONMENTAL IMPACT REVIEW BOARD

December 2011

Avalon Rare Metals Inc. (Avalon) is pleased to provide the following responses to the information requests identified in the Mackenzie Valley Environmental Impact Review Board's (MVEIRB) letter to Avalon dated November 24, 2011.

IR Number:	**MVEIRB #1.1**
To:	Avalon Rare Metals Inc.
Source:	DAR Section 4.8.2, Section 6.5.2.2, Avalon's response to deficiency MVRB #8
Subject:	Change in Hydrometallurgical Facility Tailings

Preamble

DAR Section 4.8.2 describes the processing at the proposed HMF. DAR Section 6.5.2.2 describes the hydrometallurgical plant tailings solids (p. 726) and the tailings solution (Table 6.5-6).

Avalon's response (Part 1) to deficiency MVEIRB #8 says, in part,

> *As a result of Avalon's decision to complete the processing of the rare metals products produced at the Pine Point Hydrometallurgical facility at another processing plant to be located in the south, the previously identified leach residue will no longer be produced at the Pine Point Hydrometallurgical Plant site.*
>
> *More specifically all of the acid-baked residue will be shipped south and there will be no leach residue in the hydrometallurgical tailings that will be directed to the L-37 Pit. ...*
>
> *Regarding the anticipated concentrations of the constituents present in the hydrometallurgical tailings that will be directed to the L-37 Pit (HTF), Table 6.5-6 in the DAR summarizes the chemical properties of the water component of the tailings solution based on test work completed by SGS (2011).*

The decision to modify the process at the HMF would be expected to change the chemical concentrations in the tailings and the tailings solution.

<u>MVEIRB Request #1.1</u>

Please provide updated analysis and description of the expected chemical composition of the HMF tailings and tailings solution which would be discharged to the L-37 pit.

Avalon Response #1.1

Avalon recognizes that its decision to modify (simplify) the processing to be undertaken at the Pine Point Hydrometallurgical facility would be expected to result in some changes to the chemical concentrations in the tailings and the tailings solution.

These changes are reflected in the following updated, more detailed version of Table 6.5.6 of the DAR. Please note that all additional new parameters included in this table are identified in red text.

As previously indicated in Avalon's response to (Part 1) deficiency MVEIRB #8, it is important to note that the modified processing to be undertaken at the Pine Point Hydrometallurgical Plant will produce less tailings, approximately 100,000 t/a, compared to the 171,000 t/a quantity provided in the DAR. However, to be conservative in the assessment, it was decided to leave the higher, more conservative, quantity in the DAR.

TABLE 6.5-6: SOLUTION ANALYSIS RESULTS – HYDROMET SOLUTIONS

Parameter	Unit	*MMER (Max. Authorized Monthly Mean Concentration)	Calculated Tailings Characteristics (Conservative Estimate)
Radionuclide Analyses			
^{226}Ra	Bq/L	.37	0.1
^{228}Ra	Bq/L		<0.2
^{210}Pb	Bq/L		<0.1
General Analyses			
pH	Units	6.0-9.5	8.0-8.3
Alkalinity	mg/L as $CaCO_3$		---
EMF	mV		---
Conductivity	µS/cm		13,400
TDS	mg/L		33,622
TSS	mg/L	15.00	---
Cl	mg/L		10,674.6
SO_4	mg/L		24,596
F	mg/L		1.82
NO_2	mg/L		<0.6
NO_3	mg/L		<0.5
NO_2+NO_3	mg/L		<0.6
Total Reactive P	mg/L		0.07
TOC	mg/L		53.9
NH_3+NH_4	as N mg/L		91.7
Thiosalts	mg/L		<10
S_2O_3	mg/L		---

TABLE 6.5-6: SOLUTION ANALYSIS RESULTS – HYDROMET SOLUTIONS

Parameter	Unit	*MMER (Max. Authorized Monthly Mean Concentration)	Calculated Tailings Characteristics (Conservative Estimate)
Metal Analyses			**Diss**
Hg	mg/L		<0.0001
Ag	mg/L		0.00012
Al	mg/L		<0.01
As	mg/L	.50	0.0022
Ba	mg/L		0.0772
Be	mg/L		0.00002
B	mg/L		0.0971
Bi	mg/L		0.00008
Ca	mg/L		393
Cd	mg/L		0.000232
Co	mg/L		0.00402
Cr	mg/L		0.0188
Cu	mg/L	.30	0.0226
Fe	mg/L		0.15
K	mg/L		584.4
Li	mg/L		2.18
Mg	mg/L		1,530
Mn	mg/L		6.15
Mo	Mg/L		0.00902
Na	mg/L		5501.4
Ni	mg/L	.50	0.0701
Pb	mg/L	.20	0.00052
Sb	mg/L		0.0002
Se	mg/L		0.005
Si	mg/L		2.47
Sn	mg/L		0.00013
Sr	mg/L		11.2
Th	mg/L		0.002945
Ti	mg/L		0.0051
Tl	mg/L		0.0002
U	mg/L		0.0239
V	mg/L		0.00063
Y	mg/L		0.009046
Zn	mg/L	.50	<0.002
Ce	mg/L		0.00529
Dy	mg/L		0.0008
Er	mg/L		0.0004

TABLE 6.5-6: SOLUTION ANALYSIS RESULTS – HYDROMET SOLUTIONS			
Parameter	Unit	*MMER (Max. Authorized Monthly Mean Concentration)	Calculated Tailings Characteristics (Conservative Estimate)
Eu	mg/L		0.0001
Ga	mg/L		0.00049
Gd	mg/L		0.0009
Hf	mg/L		0.000638
Ho	mg/L		0.0002
La	mg/L		0.012
Lu	mg/L		<0.000001
Nb	mg/L		0.00465
Nd	mg/L		0.0037
Pr	mg/L		0.0009
Sc	mg/L		0.0012
Sm	mg/L		0.0007
Ta	mg/L		0.000088
Tb	mg/L		0.0001
Tm	mg/L		0.0001
Yb	mg/L		0.0003
Zr	mg/L		0.0351

Note:
1. Based on a wastewater volume of 2,000 m^3/day
* Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.

Regarding the composition of the Hydrometallurgical facility tailings, Avalon is pleased to provide the following Table 1, which summarizes the chemical composition and estimated quantities of tailings solids to be produced per day by the Hydrometallurgical facility. As indicated in the DAR, the processed tailings will be directed to the HTF which will be located in the historical L-37 mine pit.

As previously noted in the DAR and subsequent responses to Information Requests (IR), the bulk of the tailings is comprised of gypsum. All of the waste products are considered to be inert.

TABLE 1: TOTAL ESTIMATED DAILY SOLID TONNAGE OF HYDROMETALLURGICAL FACILITY TAILINGS		
	Conservative Estimate	
	Solid	%
$CaSO_4 \cdot 2H_2O$	230.1	75.10
CaF_2	18.8	6.13
$Al(OH)_3$	11.6	3.79
$Fe(OH)_3+Fe(OH)_2$	39.6	12.92
$Mn(OH)_2$	1.9	0.62
$Th(OH)_4$ from Th Removal stage	0.4	0.13
U_3O_8	0.0	<0.01
$Zr(OH)_2$	4.0	1.31
Subtotal	306.3	100.00
Total Solid Tonnage Per Day	**367.6**	

IR Number:	**MVEIRB #1.2**
To:	Avalon Rare Metals Inc.
Source:	DAR, Section 6.3.4.2 Mine Operations, Figure 6.3-6 DAR, Section 6.4.2.5 Model Results, Table 6.4-2 DAR, Appendix C.13, Thor Lake Project – (Updated) Feasibility Study Water/Solids Balance Analysis Results, p.3, Water Management Constraints Response to Deficiency MVEIRB #41 (Part 2)
Subject:	Tailings Management Facility Tracer Concentrations

Preamble

Avalon's response to Deficiency MVEIRB #41 states that "A key factor in the modeling is that the Thor Lake system, including Murky and Drizzle lakes, receives a large amount of freshwater from surface flows. Consequently, it was found that even after the full 20 years of mine operation, dilution of contaminants introduced in the tailings stream remained high, at a value of 1408:1."

DAR Figure 6.3-6 shows the estimated discharge from the concentrator plant to the TMF as 360,000 m^3/yr. Additional net inflows are shown in Figure 6.3-6 as only 75,100 m^3/yr. Appendix C.13 says "The TB [Tailings Basin] Minimum Supernatant Pond Volume for Years 1 and 2 is the volume of Ring Lake - 179,367 m^3, ...". DAR Table 6.4-2 indicates that the concentration of the inert tracer used in the model decreases from 1 to 0.00091 within the tailings pond in Year 1.

Since the volume of water in the tailings pond plus the first year net inflow equals only about 70% of the discharge from the concentrator plant, there does not appear to be sufficient water to account for the nearly 1100:1 Year 1 dilution rate.

Clarification of this calculation or model result is necessary to assess the concentrations of metals released from the TMF into the Thor Lake system and the environmental impacts of that effluent.

MVEIRB Request #1.2

Please provide an explanation of the apparent discrepancy between these figures.

Avalon Response #1.2

On behalf of Avalon, EBA investigated the apparent discrepancy referenced by the MVEIRB in Information Request #1.2 and we found that there was indeed a discrepancy and it was as follows:

EBA had inadvertently calculated the dilution ratios as well as the metal concentrations in the water bodies based on an assumed unit discharge of inert tracer with a concentration of 1.0 mg/L at the tailings inflow point. In EBA's proprietary H_3D model, EBA had actually modeled zinc concentration specifically, which was taken to be an increment of 0.007 mg/L (Day 5 decant concentration) at the concentration plant over the zinc concentration in the water withdrawn from Thor Lake.

In other words, the zinc concentration was the result of the mixing of the effluent from the concentration plant and Thor Lake water, reflecting the effects of recirculation on zinc concentration. The Day 5 decant concentration was used, reflecting the fact that a large fraction of zinc (and other metals) in the tailings will deposit with the solids that settle in the tailings pond. The Day 5 decant concentration thus represents zinc that is dissolved, and able to pass through the tailings pond and on to the other water bodies in the system.

The concentration of zinc at a moment in time at the inflow into the tailings pond is therefore expressed as follows:

$$[Zn]_{\text{tailings outflow point}} = [Zn]_{\text{Thor Lake}} + 0.007$$

At the onset of the mine operations, the zinc concentration in the outflow to the tailings pond would be 0.007 mg/L. For modelling purposes, the zinc concentration in the tailings pond was 0.0 mg/L at the commencement of mine operations.

Revised Tables 6.4-2 and 6.4-3 provided with this response correspond to the original Table 6.4-2 and Table 6.4-3 in the DAR, respectively.

The zinc concentrations as reported in Table 6.4-2 in the DAR were correct except for the plant discharge concentration, which should be 0.007 mg/L. This correction is reflected in the revised Table 6.4-2 provided with this response. In addition, the term 'Inert Tracer' in the title of Table 6.4-2 was also incorrect, and has also been changed and replaced with 'Zinc', to reflect the actual simulation that was conducted.

As a result of this revision, the modeled metal concentrations detailed in Table 6.4-3 in the DAR are unfortunately no longer valid and should be replaced with the values as shown in revised Table 6.4-3 as provided in this response. The metal concentrations were calculated as follows:

$$[Metal]_{\text{in water body Y}} = ([Zn]_{\text{in water body Y}} \ X \ [Metal]_{\text{decant day 5 at tailings discharge}})/ [Zn]_{\text{decant day 5 at tailings discharge}}$$

TABLE 6.4-2: AVERAGE CONCENTRATION OF ZINC IN THE THOR LAKE SYSTEM

Year of Simulation	Plant Discharge	Tailings Pond	Polishing Pond	Drizzle Lake	Murky Lake	Thor Lake
1	0.007	0.00091	0.00026	0.00004	0.00003	<0.00001
2	0.00701	0.00160	0.00073	0.00021	0.00017	0.00001
3	0.00704	0.00215	0.00119	0.00043	0.00037	0.00004
4	0.00709	0.00260	0.00164	0.00064	0.00058	0.00009
5	0.00716	0.00299	0.00208	0.00092	0.00085	0.00016
6	0.00724	0.00331	0.00241	0.00111	0.00104	0.00024
7	0.00731	0.00360	0.00269	0.00126	0.00119	0.00031
8	0.00738	0.00386	0.00292	0.00138	0.00132	0.00038
9	0.00744	0.00408	0.00313	0.00152	0.00144	0.00044
10	0.00750	0.00423	0.00330	0.00159	0.00152	0.00050
11	0.00757	0.00437	0.00342	0.00178	0.00159	0.00057
12	0.00758	0.00455	0.00355	0.00179	0.00166	0.00058

TABLE 6.4-2: AVERAGE CONCENTRATION OF ZINC IN THE THOR LAKE SYSTEM						
Year of Simulation	Plant Discharge	Tailings Pond	Polishing Pond	Drizzle Lake	Murky Lake	Thor Lake
13	0.00761	0.00466	0.00369	0.00180	0.00171	0.00061
14	0.00763	0.00477	0.00379	0.00185	0.00177	0.00063
15	0.00766	0.00485	0.00387	0.00190	0.00183	0.00066
16	0.00770	0.00492	0.00394	0.00199	0.00186	0.00070
17	0.00768	0.00500	0.00392	0.00194	0.00186	0.00068
18	0.00767	0.00500	0.00389	0.00191	0.00176	0.00067
19	0.00770	0.00504	0.00400	0.00199	0.00186	0.00070
20	0.00771	0.00508	0.00408	0.00207	0.00191	0.00071

As shown in revised Table 6.4-3 below, it should be noted that after 20 years of operation, all metals are projected to continue to meet the CCME guidelines in the directly downstream water bodies, including Thor Lake.

TABLE 6.4-3: MAXIMUM METAL CONCENTRATION IN THE THOR LAKE SYSTEM AND WATER QUALITY GUIDELINES FOR THE METALS OF CONCERN AFTER 20 YEARS OF MINE OPERATIONS					
Metal Species	Thor Lake	Murky Lake	Drizzle Lake	CCME Water Quality Guideline	MMER Effluent Criteria
Al (mg/L)	0.063	0.17	0.18	0.1	-
Fe (mg/L)	0.058	0.16	0.17	0.3	-
Cd (mg/L)	0.000007	0.000018	0.00002	0.00002 - 0.00013	-
Hg (mg/L)	0.00001	0.000027	0.00003	0.000026	-
Ag (mg/L)	0.000003	0.000008	0.000009	0.0001	-
As (mg/L)	0.00022	0.0006	0.00065	0.005	0.50
Cr (mg/L)	0.00011	0.0003	0.00033	0.0089	-
Cu (mg/L)	0.00023	0.00063	0.00068	0.002 - 0.004	0.30
Mo (mg/L)	0.0048	0.013	0.014	0.073	-
Ni (mg/L)	0.00071	0.0019	0.0021	0.025 - 0.150	0.50
Pb (mg/L)	0.000061	0.00016	0.00018	0.001 - 0.007	0.20
Zn (mg/L)	0.00071	0.0019	0.0021	0.03	0.50
U (mg/L)	0.00089	0.0024	0.0026	0.015	-
Th (mg/L)	0.00007	0.00019	0.00021	-	-
Ra-226(Bq/L)	0.001	0.0027	0.003	-	0.37

IR Number:	**MVEIRB #1.3**
To:	Avalon Rare Metals Inc.
Source:	DAR Section 6.14.1, Response to Deficiency MVEIRB #46 (Part 2) DAR, Section 6.14.1, Response to Deficiency MVEIRB #47 (Part 2)
Subject:	Aquatic Effects Monitoring Plan and Adaptive Management Plan

Preamble

The DAR states that monitoring "will be carried out according to requirements of the Water License and the MMER" and will be subject to "other monitoring requirements stipulated in relevant permits and approvals". The DAR also lists some of those monitoring requirements. These are threshold requirements and it is expected that all developers will carry out such monitoring. To assess the adequacy of Avalon's proposed monitoring programs and management plans, project specific monitoring plans are required.

Avalon's response to Deficiency #46 says, in part, "The comprehensive Aquatic Effects Monitoring Plan (AEMP) for the Avalon Project will be guided by ... " indicating that the AEMP was not complete at the time of the response.

The DAR alludes to adaptive management planning for "furbearers, waterfowl, large ruminants and large carnivores" but makes no similar statement about aquatic effects. Avalon's response to Deficiency #47 (which addresses adaptive management planning for aquatic effects) says, in part, "Avalon will therefore prepare contingency plans in the event that trends point toward potential negative changes in environmental indicators."

The purpose of adaptive management planning is to have procedures in place to deal with foreseeable but unexpected project impacts. The Review Board will need a draft Aquatic Effects Monitoring Plan with associated Adaptive Management Plan in order to determine whether impacts to the aquatic environment can be addressed for unexpected events during mine operations.

MVEIRB Request #1.3

Please submit a draft Aquatic Effects Monitoring Program that includes an Adaptive Management Plan for aquatic impacts.

Avalon Response #1.3

As requested by the MVEIRB, Avalon is pleased to provide a conceptual Aquatic Effects Monitoring Plan (AEMP) as Attachment 1 to this response.

As previously indicated in Avalon's response to MVEIRB Deficiency # 46, the AEMP for the Avalon Project will be guided by INAC's recently developed Guidelines for *Designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the Northwest Territories* (INAC 2009). Specifically, this will be achieved by adopting the environmental effects monitoring (EEM) requirements of the Metal Mining Effluent Regulations (MMER) as the primary elements of the AEMP.

The AEMP will also benefit from incorporation of the anticipated Surveillance Network Program (SNP) requirements that will be specified in the Mackenzie Valley Land and Water Board (MVLWB) Type A water licence that will subsequently be issued following completion of the MVEIRB process.

It should be noted that INAC (2009) recommends that a draft AEMP framework be developed as part of the EA Process and that the completed AEMP be submitted following issuance of the Water Licence. It is in this context that we have prepared an AEMP framework for consideration and review as part of the EA for this Project.

Reference

INAC. 2009. Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the Northwest Territories: Overview Report. June 2009 version.

IR Number:	**MVEIRB #1.4**
To:	Avalon Rare Metals Inc.
Source:	DAR Section 6.5.1.3 Estimated Groundwater Inflow, Figure 6.5-1
Subject:	Drawdown at Mine Site

Preamble

The modeling and analysis of groundwater flow into the mine does not address the impact or other effects of drawdown on the local and regional hydrogeology. DAR Figure 6.5-1 shows the extent of the predicted groundwater drawdown. The drawdown exceeds 10 meters in some areas, but the text does not describe what effects the drawdown would have on the area – especially surface water bodies, wetlands, permafrost and active layers. The interaction of surface water and groundwater response to the mine inflow is also not addressed.

MVEIRB Request #1.4

Please quantify and describe the effects the drawdown at the mine site may have on the surface water bodies, wetlands, permafrost, and active layers.

Avalon Response #1.4

The predicted localized drawdown of the groundwater level (phreatic surface) within the low permeability bedrock at the underground mine site, is not expected to affect the water levels for the surface water bodies or wetlands in the area. As previously shown in Figure 6.5-1 of the DAR, the main surface water bodies situated near the localized predicted change in groundwater level include: Thor Lake, Long Lake and Elbow Lake.

As demonstrated by the model described in Section 6.5.1.2 of the DAR and in Knight Piesold (2011f; Appendix C.17), the phreatic surface is predicted to be locally depressed by up to 10 m directly around the main underground workings. These depressed levels reduce to between 0 and less than 2 m in the vicinity of the Thor Lake, Long Lake and Elbow Lake shorelines. This large differential in the phreatic surface effects is attributed to the high quality and low permeability characteristics of the surrounding bedrock.

The water levels within the lakes and wetlands are primarily controlled by surface hydrologic inputs vs. various outputs to/from the system(s). The infiltration rate (i.e. seepage into mine) versus the net surplus water into the system from the water balance (i.e. recharge rates) controls the surficial water levels. A numerical model was used to estimate the quantity of water that flows from each of the lakes as a result of mine dewatering. The resulting loss of water into the mine working was low in comparison to the estimated inflows to the respective lakes from runoff and precipitation. In each case, the loss of water from each lake due to seepage into the mine was less than 10% of the inflow to the lake.

The presence of overburden and significant wetlands in the vicinity of the mine is limited. The area of influence is generally dominated by poorly drained shallow overburden pockets between bedrock exposures. Given these conditions and the low rates of surface water infiltration, it is judged that little to no impacts to wetlands, permafrost or active layer would be realized from the locally depressed phreatic surface in the vicinity of the mine.

IR Number:	MVEIRB #1.5
To:	Avalon Rare Metals Inc.
Source:	DAR Section 9.2 Tailings Dam Failure; Figure 4.7-8
Subject:	Tailings Management Facility – Dam Failure

Preamble

The DAR very briefly discusses the potential impacts of a dike failure on the discharge side of the tailings management facility (p.890), and does not consider the impacts of a failure of the dike on the upstream side at all.

MVEIRB Request #1.5

Please describe the potential for and quantify the potential impacts of a failure of the dike along the upstream (northwest) side of the TMF. The discussion should include the volume of a potential breach, the material characteristics of the outflow, and the path and destination of the lost material.

Avalon Response #1.5

The small embankment (dike) to be located on the northwest side of the TMF facility will be founded on an area of exposed, high quality bedrock as verified by recent geotechnical site investigations. This area is of naturally higher elevation than much of the southeastern portion of the TMF, with a maximum embankment height of less than 6 m. Tailings will be deposited in the area upstream of this embankment to direct the water towards the southeast side of the facility, thus maintaining relatively dry, stable beaches in the area with no free standing water directly upstream of the embankment.

Embankment failures are typically the result of either overtopping due to loss of freeboard (i.e. localized embankment settlement), water located upstream of the embankment (i.e. causing internal erosion), or unsuitable foundation conditions leading to lack of physical stability. None of these conditions are present at this location and subsequently there is very low potential for failure of the embankment at the northwest side of the TMF.

In the unforeseeable event of a failure at this location, it is anticipated that there would be very little migration of tailings or water to the downstream given the consolidated and relatively dry state of the tailings deposit in this area. Clean-up would be minimal and could be accomplished in a very short period of time.

Nevertheless, for the sake of assessing possible environmental consequences of such an unlikely event occurring, it has been assumed that a limited volume of relatively dry tailings, in the order of 100 - 300 m^3 could conceivably flow out of a hypothetical north tailings embankment breach into the immediate surrounding vegetated terrain.

As illustrated in Figure 3.2-1 of EBA (2010a – Appendix B.1), this area is characterized primarily by moderately well-drained Spruce Upland (BF – *Black spruce – feathermoss - crowberry upland forest*) and in the lower reaches, by relatively poorly-drained Treed Fen (BT – *Black spruce – tamarack – water sedge fen*). As a result, the released tailings would be expected to be deposited within these forested ecosystem types in the immediate vicinity of the breach. Any drainage associated with such a release would be expected to migrate slowly in the general direction of Den Lake, located approximately 350 m down-gradient from the north tailings dyke.

Avalon would respond to such an unlikely event in accordance with the company's Hazardous Materials Spill Contingency Plan (Appendix L.1 of the DAR) by concurrently containing and recovering any of the released tailings from the adjacent forested area and by undertaking any necessary repairs to the north tailings embankment. The environmental consequences of such a most improbable event would be minimal, primarily because of the limited deposition zone of the relatively dry tailings that could potentially be released and the essentially inert nature of the tailings.

IR Number:	**MVEIRB #1.6**
To:	Avalon Rare Metals Inc.
Source:	DAR Section 4.7.3.3 Flotation Plant Tailings; Tailings Delivery and Distribution, p. 498 DAR Section 4.8.3.1 Hydrometallurgical Plant Tailings, p. 520
Subject:	Tailings Delivery Pipeline Failure

Preamble

The DAR does not include any discussion of the potential impacts of the tailings delivery pipelines freezing, leaking, or rupturing. Freezing or failure of the flotation plant tailings delivery pipeline could cause uncontrolled slurry loss anywhere along the pipeline route at up to nearly 53 m3 per hour, including several locations uphill from and close to Fred, Cressy, and Thor lakes.

MVEIRB Request #1.6

Please describe the engineering safety features and operational controls designed to prevent or minimize the consequences of the tailings delivery pipeline freezing or failing. Please also describe the foreseeable potential impacts of a pipeline failure on the streams, wetlands, or surface water bodies along the routes of both the flotation plant and the hydrometallurgical plant tailings delivery pipelines.

Avalon Response #1.6

General Engineering Safety Features and Operational Controls

The tailings delivery pipelines operating at the Nechalacho Mine and Flotation Plant site will be a combination of HDPE lined steel pipe and HDPE pipe. At the Hydrometallurgical site the tailings delivery pipeline will be HDPE lined steel pipe. All tailings delivery pipelines for both the Flotation Plant and Hydrometallurgical Plant will be insulated and heat traced. The pipelines will be placed on graded and prepared ground surface and buried with backfill. The backfill will help to ensure that the pipes are not damaged, will not freeze to the ground surface, will provide additional insulation layer and increased anchorage for the pipe to reduce movement due to thrust forces. These engineering design features will greatly reduce the likelihood of the pipeline freezing or failing.

In the event of a plant shutdown, the preferred option for the tailings pipeline will be to purge the pipe with fresh water into the TMF/HTF to prevent blockage due to sedimentation. Back-up diesel generators will be available in the event of a power shutdown or malfunction. If purging of the pipeline with water to the TMF/HTF is not possible for some reason, drains at low points along the pipeline will be used and the tailings slurry will be drained into silt containment bags and allowed to drain. The residual tailings solids would then be excavated and hauled by truck to the TMF for disposal.

<u>Nechalacho Mine and Flotation Plant Site</u>

Figure 4.7-6 of the DAR (re-presented with this response) illustrates the general layout of the tailings delivery pipeline system from the perimeter of the Nechalacho Flotation Plant site to the most westerly portion of the TMF and the two branches of the pipeline around the north and south sides of the TMF. The length of the pipeline between the plant site and the TMF is approximately 3.2 km. This pipeline comes within approximately 50 m of the west side of Fred Lake, and about 100 m from the northwest side of Cressy Lake en route to the TMF.

The two branches of the pipeline consist of 3.4 km of pipeline around the north side and 1.2 km of pipeline around the south side of the TMF, respectively. As illustrated more clearly in Figure 4.7-8 of the DAR (re-presented with this response), in these areas, the pipeline will be located on the TMF-side of the access road that will run beside the pipeline. As a result, if the tailings delivery pipeline along either of these two branches failed for whatever reason, any tailings released from the pipeline would be expected to flow directly into the TMF and no tailings would flow into the adjacent receiving environment.

Thus the following discussion addresses the possible environmental implications of a tailings delivery pipeline failure extending from the Flotation Plant site to the most westerly side of the TMF.

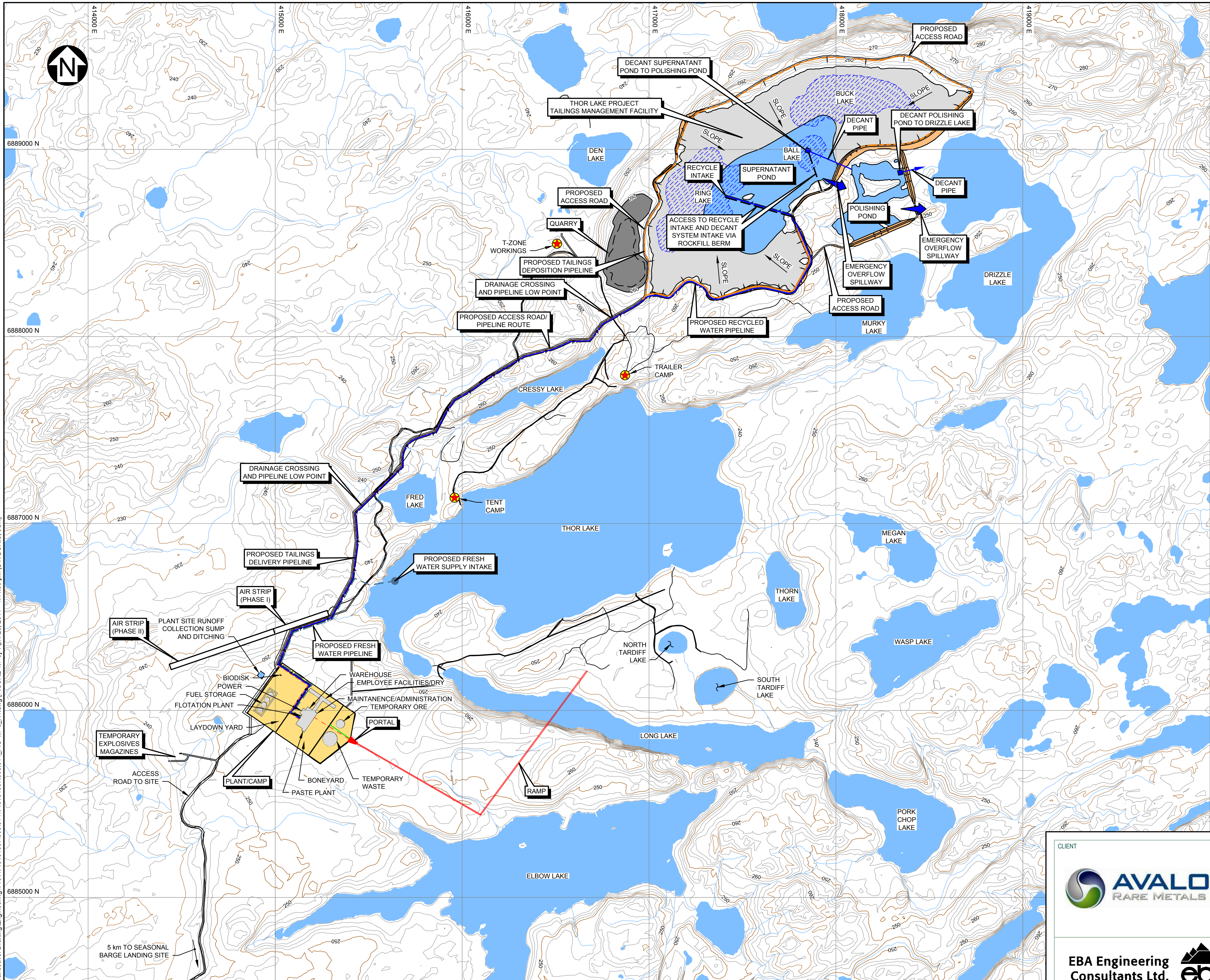
As discussed earlier in this response, the tailings delivery pipeline will be designed, operated and monitored to minimize the risks of pipeline failure. The plan to locate the tailings pipeline on the west/northwest side of the access road to the TMF will assist in ensuring that if there was a tailings delivery pipeline failure, the presence of the road would serve as a barrier to prevent the possible migration of any spilled tailings towards the nearby lakes, including Fred Lake, Cressy Lake and Thor Lake.

The presence of the access road would also help to contain any spilled tailings resulting from a tailings delivery pipeline failure to the immediate vicinity of the west/northwest side of the road.

The vegetation cover along the 3.2 km of tailings delivery pipeline extending from the Flotation Plant to the TMF is mainly dominated by moderately well-drained Spruce Upland (BF – *Black spruce – feathermoss - crowberry upland forest and* WA – *White spruce – green alder – prickly rose forest*), and Bedrock-Lichen ((LW – *Lichen-bearberry woodland*) in the higher areas, and by relatively poorly-drained Shrub Fen (SS – *Scrub birch – sweet gale – bog rosemary fen*) in lower areas.

As a result, any spilled tailings caused by a potential tailings delivery pipeline failure would be expected to be deposited alongside the access road within these forested ecosystem types in the immediate vicinity of the breach.

Avalon would respond to such an unlikely event in accordance with the company's Hazardous Materials Spill Contingency Plan (Appendix L.1 of the DAR) by concurrently containing and recovering any of the released tailings from the adjacent forested area and by undertaking any necessary repairs to the tailings delivery pipeline. The environmental consequences of such an unlikely event would be localized to the vicinity of the access road, and would be temporary and minimal, primarily because of the limited deposition zone of the tailings that could potentially be released and the essentially inert nature of the tailings.



LEGEND:

- WATER
- TAILINGS
- EXISTING LAKE FOOTPRINT
- EMBANKMENT
- PLANT/CAMP
- EXISTING ACCESS ROAD
- PROPOSED ROAD
- RAMP
- PROPOSED CAUSEWAY
- PROPOSED TAILINGS DELIVERY PIPELINE
- PROPOSED TAILINGS DEPOSITION PIPELINE
- PROPOSED RECYCLE WATER PIPELINE
- PROPOSED FRESH WATER PIPELINE
- PROPOSED POWERLINE
- DISCHARGE

NOTES:

1. COORDINATE GRID IS UTM (NAD83) ZONE 12N AND IS IN METRES.
2. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 2 METRES.
3. TAILINGS MANAGEMENT FACILITY FINAL LAYOUT (YEAR 20) DETERMINED FROM WATER/SOLIDS BALANCE ANALYSIS (MEMO NB11-00100).
4. FIGURE SOURCE IS KNIGHT PIÉSOLD CONSULTING REF. NB11-00139 FIGURE 1 DATED MARCH 10, 2011.

SCALE 1:20,000

200 0 200 400 800m

ISSUED FOR USE

CLIENT

AVALON RARE METALS INC.

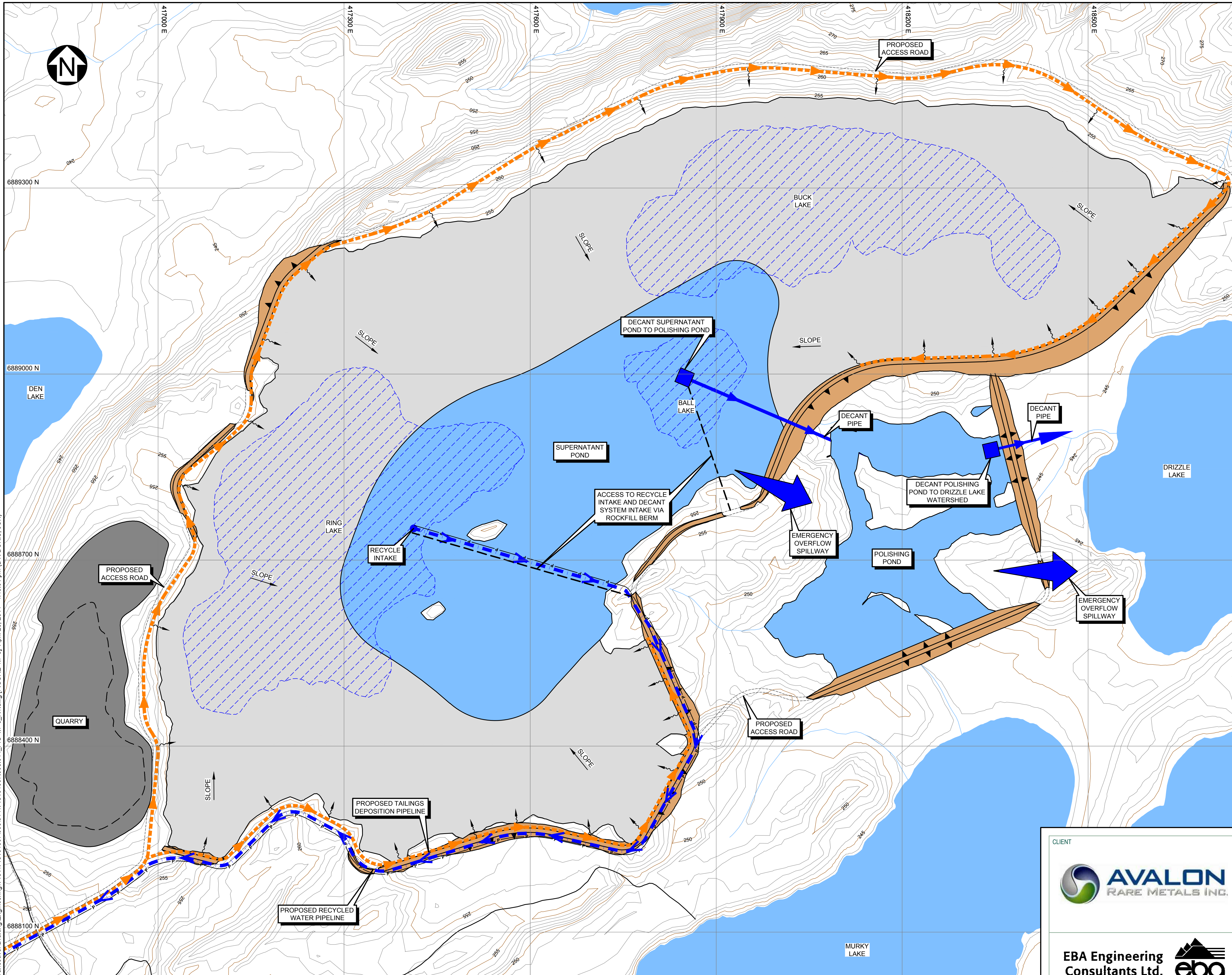
THOR LAKE PROJECT

Tailings Management Facility
Feasibility Design Summary
General Arrangement

PROJECT NO.	DWN	CKD	REV	
V15101007.006.014	JAB	RH	1	Figure 4.7-6
OFFICE	DATE			
VANC	April 28, 2011			

EBA Engineering Consultants Ltd.

Q:\Vancouver\Drafting\Engineering\V151\V15101007\006\014\V15101007.006.014_FIG 4.7-6_R1.dwg [FIGURE 4.7-6] April 28, 2011 - 4:44:30 pm (BY: BOKIC, JON)



LEGEND:

- WATER
- TAILINGS
- EMBANKMENT
- EXISTING LAKE FOOTPRINT
- EXISTING ACCESS ROAD
- PROPOSED ROAD
- PROPOSED CAUSEWAY
- PROPOSED TAILINGS DELIVERY PIPELINE
- PROPOSED TAILINGS DEPOSITION PIPELINE
- PROPOSED RECYCLED WATER PIPELINE
- PROPOSED POWERLINE
- DISCHARGE

NOTES:

1. COORDINATE GRID IS UTM (NAD83) ZONE 12N AND IS IN METRES.
2. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 1 METRE.
3. TAILINGS CONFIGURATION SHOWN REPRESENTS ESTIMATED LAYOUT FOR END OF YEAR 20 OF OPERATIONS. EMBANKMENT HEIGHTS ARE BASED ON RESULTS OF WATER/SOLIDS BALANCE ANALYSIS (MEMO NB11-00100).
4. FIGURE SOURCE IS KNIGHT PIÉSOLD CONSULTING REF. NB11-00139 FIGURE 3 DATED MARCH 10, 2011.

SCALE 1:6000

50 0 50 150 250m

ISSUED FOR USE

Q:\Vancouver\Drafting\Engineering\V151\V15101007\006\014\V15101007.006.014_FIG 4.7-8_R1.dwg [FIGURE 4.7-8] April 28, 2011 - 4:45:01 pm (BY: BOKIC, JON)

CLIENT

AVALON RARE METALS INC.

EBA Engineering Consultants Ltd.

THOR LAKE PROJECT

Tailings Management Facility
Feasibility Design Summary
Final (Phase 2) Tailings Facility Plan

PROJECT NO.	DWN	CKD	REV
V15101007.006.014	JAB	RH	1
OFFICE	DATE		
VANC	April 28, 2011		

Figure 4.7-8

Hydrometallurgical Plant Site

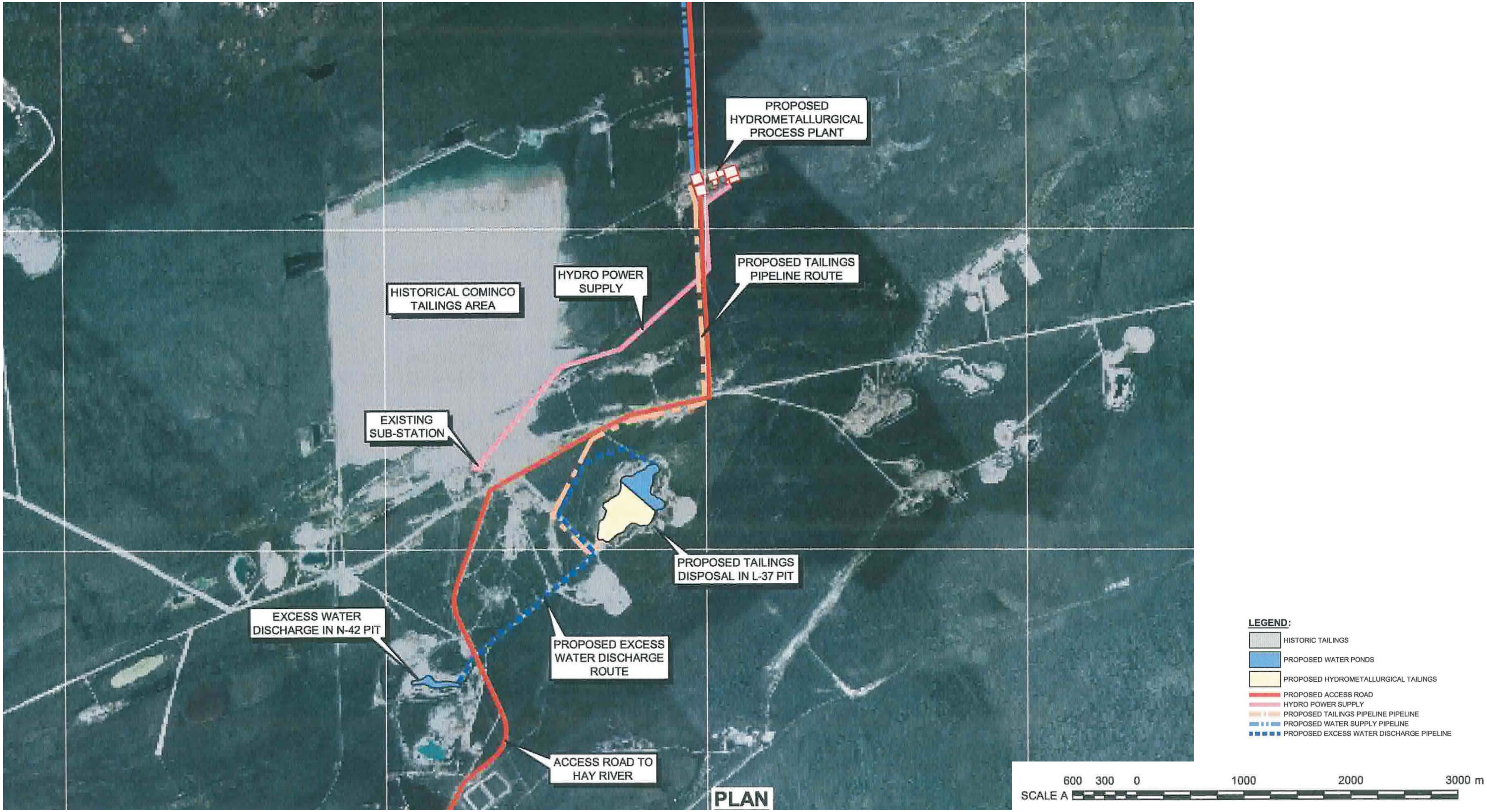
Figure 4.8-3 of the DAR (re-presented with this response) illustrates the general layout of the originally proposed tailings delivery pipeline system extending from the Hydrometallurgical Plant to the Hydrometallurgical Tailings Facility (HTF) to be located in the former L-37 Pit. As illustrated in this figure, the tailings pipeline alignment was located along existing roads and a previously cleared right-of - way. The length of the pipeline between the plant site and the HTF was approximately 4.1 km.

With Avalon's updated plan site (as described in an August 12, 2011 letter from Avalon to the MVEIRB) to relocate the Hydrometallurgical Plant directly adjacent to the existing Hydro-electric substation located in the much larger brownfields area of the former Pine Point Mine, the length of the tailings pipeline to the HTF, which follows an existing road, has been reduced to approximately 1 km. Figure GA -000 – 001 from the Application for Commissioner's Land – Commercial/Industrial Use, illustrates the proposed new location of the Hydrometallurgical Plant site and associated infrastructure.

The existing road from the new plant location to the HTF passes through a Labrador Tea – Subhygric Forest as shown in 2.10-4 of the DAR. Black spruce and jack pine are the common canopy components of this ecosystem type. However, the existing access road area has been extensively disturbed due to historic activities in the area. Thus, the entire pipeline alignment will be located on previously disturbed terrain.

As a result, any spilled tailings caused by a potential HTF tailings delivery pipeline failure would be expected to be deposited alongside the existing access road within the area of historically disturbed terrain.

Avalon would respond to such an unlikely event in accordance with the company's Hazardous Materials Spill Contingency Plan (Appendix L.1 of the DAR) by concurrently containing and recovering any of the released HTF tailings from the area and by undertaking any necessary repairs to the tailings pipeline. The environmental consequences of such an unlikely event would be localized, short term, and negligible.



NOTES

1. Coordinate grid is UTM (NAD83) Zone 11N.
2. Image provided by Avalon Metals Inc.
3. Figure Source: Knight Piesold Consulting, March 2011 (Ref No. NB11-00024, Figure 2).

ISSUED FOR USE

CLIENT

AVALON RARE METALS INC

EBA Engineering Consultants Ltd.

THOR LAKE PROJECT

Tailings Layout
Hydrometallurgical Plant Site

PROJECT NO.	DWN	CKD	REV
V15101007.006	SL	RH	0
OFFICE	DATE		
EBA-VANC	March 21, 2011		

Figure 4.8-3

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DRAFT

NOTES

REVISIONS

CHANGE	BY	DATE	CHECKED

AVALON RARE METALS INC.

PROJECT

Nechalacho

TITLE

Thor Lake Mine Site General Arrangement

DWG NO.

GA - 000 - 001

DATE: Jan 7, 2010	DRAWN BY: Delaney
SCALE: 1:10,000	CHECKED BY: Swisher

IR Number:	**MVEIRB # 1.7**
To:	Avalon Rare Metals Inc.
Source:	DAR 9.0 – Accidents and Malfunctions; Appendix L
Subject:	Impacts from Spills

Preamble

The DAR discusses mitigation measures to prevent and to minimize the consequences of accidental spills, but does not assess the impacts if such a spill were to occur.

MVEIRB Request #1.7

Please quantify the residual impacts to water quality, fish and fish habitat from major spills of process chemicals and/or concentrate at either project site, and also specifically at both minesite and hydrometallurgical loading/unloading open-water areas on Great Slave Lake.

Avalon Response #1.7

Section 9.0 (Accidents and Malfunctions) of the DAR discussed the possible environmental consequences associated with the most significant potential spills that could conceivably occur, in particular spills of concentrate and diesel fuel from barges along the proposed barge route in Great Slave Lake.

Regarding a possible spill of concentrates in the immediate vicinity of the Nechalacho or Pine Point dock facilities, the chance of such an incident occurring is considered to be extremely remote. To assist in describing the marine loading/barging operation, Avalon is pleased to provide a Transportation Assessment (Attachment 2) recently prepared by Red Sky Enterprise Inc.

As discussed in the Transportation Assessment, the 40 tonne containers of concentrate will be loaded onto and unloaded from the barges using 60 tonne Hyster 1050 Series Lift Trucks. The containers will be arranged on the barges fore and aft and centred to keep the barges level (in trim). As a result, it is considered to be most unlikely that a container of concentrate could fall into the water at the loading/unloading sites.

However, if such an unlikely event were to occur, because of the relatively shallow depths and sandy nature of the lake bottom in these areas (typically 3-5 m), it is most likely that the container would remain intact. Following such an incident, the partly or totally submerged container would subsequently be recovered using a crane. If the container was damaged and some concentrate were to be released to the lake bottom, efforts would be undertaken to recover as much of the concentrate as possible using an experienced contracted dive team equipped with suitable underwater suction capabilities such as a Venturi Suction System.

It must also continue to be noted that as discussed in the DAR, the rare earth metals concentrate to be produced at Nechalacho is considered to be essentially inert and thus the anticipated environmental effects on water quality, fish or fish habitat of any residual rare metals concentrates remaining on the bottom of Great Slave Lake at any location would be expected to be of a negligible and insignificant nature.

Regarding other contaminants such as process chemicals that could potentially be spilled, Table 4.7-1 of the DAR listed the reagents proposed for use at the Nechalacho Flotation plant. Subsequently, as part of Avalon's response to MVEIRB Deficiency List Request Number 21, an updated version of Table 4.7-1 was provided to the MVEIRB. Table 4.8-1 of the DAR listed the main process chemicals to be used in the Hydrometallurgical Plant process.

To assist with this response, the updated Table 4.7-1 and Table 4.8-1 are re-presented below.

TABLE 4.7-1: FLOTATION PLANT - AVERAGE REAGENT CONSUMPTION ESTIMATE

Reagent Scheme LCT F-6 & Minipilot	LCT F-6 Dosage (g/t)	Reagent Breakdown	Dosage (g/t)	Annual Consumption (tonnes per year)
Calgon	150	Calgon	150	109.5
Sodium silicate	150	Sodium silicate	150	109.5
Si/Fe aerosol	775	Sodium silicate	646	471.6
		Ferric chloride	129	94.2
MX3	475	Oxalic acid	190	138.7
		Citric acid	190	138.7
		Lactic acid	95	69.4
MLC6	300	Alginic acid	120	87.6
		Acumer 9400	120	87.6
		Alcomer 74A	60	43.8
KBX36	850	Flotinor 1682	340	248.2
		Flotinor S72	212.5	155.1
		Aero 845	170	124.1
		Stepanate SXS	127.5	93.1
Froth modifier	440	Froth modifiers	440	321.2
SOA	850	Ammonium oxalate	127.5	93.1
		Octyl phosphonic acid	255	186.2
		Ester alcohol	467.5	341.3
Flocculant		Magnafloc 156	50	36.5
		Sodium hydroxide	200	146.0

TABLE 4.8-1: HYDROMETALLURGICAL PLANT AVERAGE REAGENT CONSUMPTION ESTIMATE (TPA)	
Reagent	Life of Mine
	360 tpd@ 2,000 tpd Mining rate
Limestone	27,000
Lime	3,500
Elemental Sulphur (Used on site to produce acid and SO_2)	30,000
H_2SO_4 (produced on site from sulphur)	79,000
Flocculant	2.5
Sodium Sulphate	13,000

Nechalacho Flotation Plant Reagents

All chemical reagents to be used at the Nechalacho Flotation Plant will be shipped by barge in relatively small, sealed or otherwise secure containers packed in shipping containers or on pallets. For example, all liquid products will typically be contained in manufacturer-packaged drums, barrels, etc., while solid reagents (such as powders, pellets, prills) would be contained in manufacturer-packaged totes, sealed bags, etc.

Once on site, all reagent chemicals will be stored and used in accordance with applicable occupational health and safety requirements including WHMIS (Workplace Hazardous Materials Information System). These requirements convey responsibility to employers to ensure that controlled products used, stored or handled in the workplace are properly labeled, that material safety data sheets are made available to workers, and that workers receive education and site-specific training to ensure the safe storage, handling and use of controlled products in the workplace.

It is most unlikely that a potentially significant reagent chemical spill incident will occur in relation to any of the process reagents that will be transported by barge and truck/forklift to the Nechalacho Flotation Plant site. If a spill from a damaged reagent chemical storage container were to occur, the incident would be responded to immediately in accordance with Avalon's Hazardous Materials Spill Contingency Plan (Appendix L.1 of the DAR) and the specific MSDS specifications for containment, treatment/recovery.

The more likely locations where such an incident could potentially occur would be during loading and or unloading of the process reagent chemicals at developed staging sites, or in storage or use sites within the footprint area of the Flotation Plant site.

Avalon is confident that with the application of appropriate due diligence in safely transporting, storing and handling of the process chemical reagents, and with the effective implementation of the company's Hazardous Materials Spill Contingency Plan, any process reagent chemical spills that could potentially be spilled can be contained, treated and recovered as appropriate on-site.

In particular, immediate containment of the spilled reagent would be a priority to ensure that a spilled reagent could not flow into the nearby receiving environment, including the nearest waterbody. As a result, no residual impacts related to a possible spill of a process reagent to water quality, fish and fish habitat would be expected to occur at the Nechalacho Mine and Flotation Plant site.

Hydrometallurgical Plant Reagents

As shown in Table 4.8-1, the main process reagents to be used by the Hydrometallurgical Plant will be limestone, lime, elemental sulphur and sodium sulphate. All of these products will be transported in bulk by trucks to the Hydrometallurgical Plant site in accordance with Transport Canada regulations for the Transportation of Dangerous Goods. The sulphuric acid itemized in the reagent list will be produced on site.

As previously indicated, the Hydrometallurgical Plant has been recently relocated from a smaller brownfields site to the existing Hydro-electric substation located in the much larger brownfields area of the former Pine Point Mine. There are no fish-bearing lakes or streams in this general area.

Once on site, all reagent chemicals will be stored and used in accordance with applicable occupational health and safety requirements including WHMIS (Workplace Hazardous Materials Information System). These requirements convey responsibility to employers to ensure that controlled products used, stored or handled in the workplace are properly labeled, that material safety data sheets are made available to workers, and that workers receive education and site-specific training to ensure the safe storage, handling and use of controlled products in the workplace.

Potential spills of any of these reagents will be responded to immediately in accordance with Avalon's Hazardous Materials Spill Contingency Plan (Appendix L.1 of the DAR) and the specific MSDS specifications for containment, treatment/recovery. As there are no surface streams or fish-bearing lakes in the vicinity of the Hydrometallurgical Plant site, no residual impacts related to a possible spill of a process reagent to water quality, fish and fish habitat would be expected to occur.

Attachment 1: Conceptual Aquatic Effects Monitoring Plan Thor Lake Project, Northwest Territories. A report prepared by EBA a Tetra Tech Company, December 2011.

Attachment 2: Avalon Rare Metals Inc. Transportation Assessment. A report prepared by Red Sky Enterprises Inc. September 21, 2011.