Avalon Rare Metals Inc.

RESPONSE TO THE JANUARY 13, 2012 INFORMATION REQUESTS FROM ENVIRONMENT CANADA FOR THE THOR LAKE RARE EARTH ELEMENT PROJECT DEVELOPER'S ASSESSMENT REPORT

Submitted To:
MACKENZIE VALLEY ENVIRONMENTAL IMPACT REVIEW BOARD

March 2012

Avalon Rare Metals Inc. (Avalon) is pleased to provide the following responses to Environment Canada's information requests provided via Mackenzie Valley Environmental Impact Review Board (MVEIRB) on January 12, 2012. Avalon's responses are found after each information request.

IR Number:	**EC #1**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Air Emissions – Ranking of emission sources
DAR Section:	6.2.2.3

Preamble

Table 6.2-9 and Table 6.2-10 identify project emission sources and ranks the sources as major, moderate or minor. Emissions from major and moderate sources are quantified and assess through air modeling. Minor source emissions are not quantified or modeled. Some of the sources categorized as minor (fuel combustion in vehicles, and fugitive dust emissions from haul truck/roads) have been found to be significant emission sources at other northern mines.

Quantified emission estimates should be provided for all sources.

EC Request #1

EC requests that the Proponent provide quantified emission estimates for all sources.

Avalon Response #1

The categorization of the sources was based on professional judgment and experience with similar projects. Emissions due to fuel combustion in vehicles and fugitive dust from haul roads are not expected to have a significant effect because there are insufficient vehicle movements for the roads to be considered a continuous source of emissions (unlike a major highway in an urban center) and because tailpipe and road dust emissions are emitted close to ground level and therefore have limited plume rise and, consequently, limited dispersion. Previous dispersion modelling using the roadway-specific CALINE line-source model for free-flowing traffic suggests that the effect of such roadway emissions tends to be limited to within approximately 200 m of the road, with the principle effects of dust occurring within 100 m of the road (DAR Section 6.8.3).

Nonetheless, to satisfy this request, emissions due to fuel combustion in vehicles and fugitive dust emissions from unpaved roads were estimated.

Emissions due to fuel combustion in on-road vehicles were estimated with emission factors, in units of grams of pollutant per mile travelled, obtained from the Canadian version of the US EPA MOBILE6.2 model, known as MOBILE6.2C. MOBILE6.2C emission factors are dependent on various user-specified factors such as climatic conditions, fuel characteristics, travel speeds and vehicle age. Environment Canada climate normals for Yellowknife Airport were used to estimate the annual relative humidity of 59% and annual average maximum and minimum daily average temperatures of -0.2°C and -9°C, respectively. The MOBILE6.2C default values were used for all

other parameters. The number of vehicles, location and route, speed and annual kilometers travelled are provided in Table 1.

TABLE 1: VEHICLE PARAMETER INPUTS FOR MOBILE 6.2

Vehicle Type	Number of Vehicles	Location/ Route	Purpose	Speed (km/h)	Annual Kilometres Travelled
Light-Duty Diesel Trucks	9	Mine	Employee transport on site	50	10,000
	2	Hydrometallurgical Plant		50	10,000
Heavy-Duty Diesel Trucks	1	Hydrometallurgical Plant to Hay River	Concentrate delivery	80	496,400
	1	Hay River to Hydrometallurgical Plant	Diesel fuel delivery	80	102,850
	1		Limestone delivery	80	186,150
	1		Sulphuric acid delivery	80	186,150

Emissions due to fuel combustion by haul trucks on site (from the flotation plant to the Thor Lake barge landing site and from the dock to the hydrometallurgical plant) were estimated with the US EPA NONROAD model. The emissions of the non-road haul trucks were based on hours of activity, load factors and the model year. Table 2 shows the information used in the NONROAD model to estimate haul truck emissions.

TABLE 2: INFORMATION USED TO ESTIMATE NON-ROAD HAUL TRUCK EMISSIONS

Truck Haul Route	Load Factor	Model Year	Annual Activity Hours
Flotation plant to Thor Lake barge landing site	31%	2000	803
Dock to hydrometallurgical plant	31%	2000	1,927

Haul trucks operating on unpaved roads result in the re-suspension of road dust particles. The magnitude of road dust emissions is dependent on vehicle weight and precipitation. Heavy vehicles will increase the magnitude of emissions and precipitation will decrease the magnitude of emissions. Particulate matter emissions from the use of unpaved roads were calculated following the method described in US EPA AP-42 Section 13.2.2 and summarized by the following equation:

$$E = k\left(\frac{s}{12}\right)^{a}\left(\frac{W}{3}\right)^{b}$$

where:

E = emission factor in pounds (lb) per vehicle-mile-travelled

k, a, b = empirical constants (Table 3)

s = surface material silt content (%)

W = mean vehicle weight (tons)

TABLE 3: EMPIRICAL CONSTANTS FOR EMISSIONS FROM USE OF UNPAVED ROADS

	TSP	PM_{10}	$PM_{2.5}$
k	4.9	1.5	0.15
a	0.7	0.9	0.9
b	0.45	0.45	0.45

Source: US EPA 2006c.

The unpaved road lengths are 5 km from the flotation plant to the Thor Lake barge landing site and 12 km from the dock to hydrometallurgical plant. The AP-42 default silt content of 8.4% was used for the haul road surface material. An average control efficiency of 75% was assumed for year-round road dust control. The use of a 75% control efficiency reflects an increase in the moisture content of the haul road surface to roughly twice that of the natural moisture level, as a result of watering activities and natural precipitation (AP-42, Figure 13.2.2-2).

Estimated emissions due to fuel combustion by vehicles and fugitive dust from unpaved roads are presented in Table 4. Also shown in Table 4 are emission estimates for other sources at the mine and flotation plant as presented in Tables 6.2-14 and 6.2-18 of the DAR, except that the diesel generator emissions at the mine have been updated as per the values presented in Table 7 of Avalon Response to GNWT IR #26.

Overall, estimated emissions at the mine site are much greater than at the hydrometallurgical plant, with the exception of SO_2 emissions. At the mine site, the largest sources of NO_x, CO and $PM_{2.5}$ emissions are the diesel generators; the largest sources of SO_2 emissions are the ventilation raises; and the largest sources of TSP are the ventilation raises and transfer and handling of material above ground.

The on-road vehicle emissions contribute less than 0.1% of total CAC emissions at the mine site. At the hydrometallurgical plant, on-road vehicles contribute 28% of NO_x, 22% of CO and 3% of fine particulate matter emissions. The on-road vehicle emissions contribute less than 1% of the total estimated SO_2 and TSP emissions at the hydrometallurgical site.

TABLE 4: EMISSIONS (t/y) AT THE THOR LAKE MINE AND HYDROMETALLURGICAL PLANT						
Location	**Source**	**NO_X**	**SO_2**	**CO**	**TSP**	**$PM_{2.5}$**
Mine	On-Road Vehicle Emissions (combustion, tire and brake wear)	6.3E-02	7.4E-04	7.2E-02	1.2E-02	9.8E-03
	Non-road Truck Haul Tailpipe Emissions	5.1	4.3E-03	1.1	0.2	0.2
	Road Dust	-	-	-	37	1.0
	Ventilation Raises	25	23	128	44	3.3
	Mine Air Heater	10	0.1	2.6	1.7	0.8
	Diesel Generators	778	0.56	225	16	14
	Transfer and Handling	-	-	-	44	3.3
	Subtotal	**818**	**24**	**357**	**143**	**22**
Hydrometallurgical Plant	On-Road Vehicle Emissions (combustion, tire and brake wear)	5.1	8.1E-03	7.6E-01	1.3E-01	1.1E-01
	Non-road Truck Haul Tailpipe Emissions	12	1.0E-02	2.7	0.7	0.7
	Road Dust	-	-	-	88	2.5
	Sulphuric Acid Plant	-	158	-	-	-
	Subtotal	**18**	**158**	**3.4**	**89**	**3.3**
Total		**836**	**181**	**360**	**231**	**26**

Haul truck tailpipe emissions at the mine contribute less than 1% of total CAC emissions estimated for the mine. At the hydrometallurgical site, haul trucks contribute 27% of fine particulate matter, 79% of CO and 67% of NO_x emissions.

Road dust from the unpaved haul roads contributes 26% and 99% of total TSP emissions at the mine site and hydrometallurgical plant, respectively. Road dust also contributes 5% and 76% of total $PM_{2.5}$ emissions at the mine site and hydrometallurgical plant, respectively. However, there is large uncertainty in the emission estimation method for fugitive road dust as it does not account for the fact that much of the material is deposited on the road and then re-entrained; the estimation method assumes that new material is constantly being emitted.

Avalon is committed to minimizing dust emissions through the diligent application of appropriate dust suppression strategies (in particular water spray) both above and below ground, as per the GNWT dust suppression guidelines. Additionally, in the normal course of mining, the mine will have higher relative humidity than experienced on surface due to the drilling, bolting and backfilling events that utilize water in their processes, which will increase the ambient moisture content in the mine.

IR Number:	**EC #2**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Air Emissions – Cumulative effects
DAR Section:	10.6.1

Preamble

The Tamerlane Venture's Pine Point Pilot Project and the Avalon Hydrometallurgical Plant site are both located at the old Pine Point mine site. In Section 10.6.1 of the DAR, the Proponent describes the location of the "Pine Point Pilot Project" as approximately 40 km away from the Hydrometallurgical Plant site. However, in Section 3.2.6.2, the Proponent states that the "Tamerlane Ventures Inc.'s zinc-lead plant is located adjacent to the Hydrometallurgical Plant site". To assess the potential for cumulative effects, the location of emissions sources from the Tamerlane Venture's Pine Point Pilot Project need to be compared to the locations of emission sources at the Hydrometallurgical Plant site.

EC Request #2

EC requests that the Proponent provide the following information:

1. The location of air emissions sources from the Tamerlane Venture Inc.'s Pine Point Pilot Project compared to the locations of air emission sources at the Hydrometallurgical Plant site.
2. An assessment of potential cumulative effects from air emissions from Tamerlane Venture's Pine Point Pilot Project and the Hydrometallurgical Plant site.

Avalon Response #2.1

The Pine Point Pilot Project, which is currently under evaluation for production, is located at 602425 mE 6734350 mN, zone 11. The proposed Hydrometallurgical Plant will be constructed at the brownfield site of Cominco's historic Pine Point Mine at 641896 mE 6753312 mN, zone 11, which is approximately 40 km away.

Avalon Response #2.2

As discussed in Section 10.6.1, since maximum predicted SO_2 concentrations due to emissions from the Pine Point Pilot Project were predicted to be less than 10% of the NWT ambient air quality standard beyond 2 km from that facility (RWDI 2008), the potential for cumulative effects with the Project, located 40 km away, is expected to be negligible.

IR Number:	**EC #3**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Air Emissions – Diesel generators
DAR Section:	6.2.2.5

Preamble

Diesel power generation accounts for more than 75% of the NO_x and 30% of the $PM_{2.5}$ emissions at the Nechalacho mine site (Table 6.2-18). The Proponent assumed a default load factor of 43% in the emission calculations for the diesel power generators. However it is not clear if this default load factor is applicable to this project. It is proposed that the mine site will use six 1.45MW diesel generators to meet the continuous power demand of 8.4MW. The combined maximum capacity of the six generators is 8.7 MW. At 43% load, the generators will produce 3.7 MW, less than half of the expected power demand. It is noted that other northern power plants have used load factors in the range of 75% to 100% for diesel generators when calculating air emissions. The assumed load factor directly affects air emission estimates: a generator at 43% load will emit 43% of the emissions than a generator at full load. The Proponent needs to justify the use of the 43% load factor in its emission estimates for diesel generators.

The total NO_x emissions at the Nechalacho mine site from diesel generation is 3.89 g/s (Table 6.2-19). The NO_x emissions per generator is 0.648 g/s (i.e., the total emissions divided by 6 units). The Fortune NICO mine is planning to use similar 1.45MW diesel generators but have assumed a 100% load factor. The Fortune NO_x emission estimates from one of its diesel generators is 4.98 g/s, more than 7 times greater than NO_x emission estimates for the diesel generators at the Nechalacho mine site. To understand the differences in the emissions estimates between these projects, EC requires further details on how the Proponent for this project has calculated emissions.

The Proponent assumed that the stack height of the diesel generators will be 20 m. At other northern mines, stack heights for similar generators were assumed to be 10 m. The assumed height of the stack will affect the predicted ground-level concentration of air pollutants. The Proponent needs to justify the assumed stack height of the generators.

EC Request #3

EC requests that the Proponent provide the following information:

1. Justification of the assumed load factors for the diesel generators;
2. Justification of the assumed stack heights for the diesel generators; and
3. Detailed information (including emission factors and activity rates) used to calculate emission estimates for all sources.

Avalon Response #3.1/2/3

The emissions associated with the diesel generators were previously estimated using US EPA NONROAD model assuming the default load factor of 43%. RWDI contacted Finning, the manufacturer of the diesel generators, and obtained emission factors for PM, CO and NO_x with load factor of 100% to meet the power demand of 8.4 MW. Emission factor for SO_2 was calculated using AP-42 Chapter 3 Section 4. Emission factor for $PM_{2.5}$ was calculated based on size distribution from stationary internal combustion engines AP-42 Appendix B.2.2. The revised emissions for diesel generators are presented in Table 5.

TABLE 5: EMISSIONS ASSOCIATED WITH DIESEL GENERATORS OPERATING AT FULL LOAD

	NO_X	SO_2	CO	TSP	$PM_{2.5}$
Emission rate per generator (g/s)	4.1	0.003	1.2	0.084	0.076
Emission inventory for six diesel generators (t/y)	778	0.56	225	16	14

At the DAR compilation stage, Avalon was still at the preliminary design stage. RWDI consulted with Finning, the manufacturer of the 1.45 MW generators. Finning indicated that an example from a previous project, which used similar equipment, used a stack height of 30 m. This was considered to be high and therefore was reduced to 20 m.

IR Number:	**EC #4**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Air Emissions – Contaminants
DAR Section:	6.2
TOR Section:	3.3.8

Preamble

The MVEIRB Final Terms of Reference (TOR) for this environmental assessment, Section 3.3.8, included the following items regarding potential contaminants from this project:

1 (b) provide test results for the general composition of and impacts from dispersion and deposition of dust from tailings facilities, stockpiles, waste-rock piles and similar dust producing components of the project. Include an analysis of the levels of uranium and thorium in fugitive tailings dust, or any other radioactive element from any mineral;

1 (c) 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 elements, minerals or substances of any kind;

MVEIRB identified the DAR as being deficient in addressing TOR 3.3.8-1b (MVEIRB, 2011). It is EC's opinion that the DAR is also deficient in addressing TOR 3.3.8-1c. In the DAR and in its response to MVEIRB (Request #43), the Proponent has defined fugitive dust as a minor source and has not provided an assessment of potential environmental impacts. The Proponent should provide information on the expected composition of fugitive dust from the various sources (such as road dust, the tailings management facility, mine activities, the handling and transport of concentrate), the quantity of the fugitive dust emissions, and an assessment of potential environmental impacts from these emissions.

Other potential sources of contaminant emissions (toxics, metals, and sulphuric acid mist) include the flotation plant, sulphuric acid plant, acid bake kiln, and product dryers. Contaminant emissions from these sources should be characterized, quantified, and assessed for potential environmental impacts.

A monitoring plan should be developed and implemented to assure that potential contaminant loading does not adversely impact the environment.

The results from the contaminant assessment and monitoring should be used in the wildlife and water quality assessments.

EC Request #4

EC requests that the Proponent provide the following information:

1. The composition and quantities of potential contaminant emissions (toxics, metals, and sulphuric acid mist) from fugitive dust sources (such as road dust, the tailings management facility, mine activities, the handling and transport of concentrate) and other sources (flotation plant, sulphuric acid plant, acid bake kiln, and product dryers);
2. Assessment of potential environmental impacts from contaminant loading; and
3. A monitoring and management plan for contaminant loading.

Avalon Response #4.1/2/3

The tailing facilities will remain moist throughout the year and, therefore, are not a source of dust emissions. The tailing facilities will be reclaimed after the operation phase has ceased. Samples of whole rocks from heads, tailings and concentrates were analyzed and speciation of rocks is detailed in Tables 9, 10 and 11 in *Avalon Rare Earth Metals Inc. – Nechalacho Rare Earth Element Project – Project 11806-007 Interim Report* (SGS Minerals Service 2011). The rocks mostly consist of SiO_2, Al_2O_3 and Fe_2O_3 and trace amounts of other minerals. The fugitive emissions are expected to have similar content as these rocks.

Avalon will have a set of procedures to minimize dust emissions from temporary stockpiles on the surface during construction and from the crushing area underground during operations. Dust emissions are usually generated when a load-haul-dump (LHD) vehicle dumps the materials in a stockpile near the face and crusher area. After blasting, the shot muck will be washed down by spraying water. The LHD can then load the wet ore and dump it at the designated stockpile. Should the shot muck dry up, water will be sprayed on the stockpile.

When production begins, the ore is transported by a conveyor through the main ramp. To minimize the dispersion and exposure to dust, water is sprayed on the crushed ore at the conveyor loadout.

The concentrate from the flotation plant will be placed in half-height intermodal containers. There should be little to no dust emissions generated within the enclosed loading area of the flotation plant and hydrometallurgical plant due to the concentrates moisture content between 10-12%.

The ore contains no or very tiny traces of radioactivity, which will not be a concern to airborne radioactive dust.

Dust will be generated when there is traffic on the access roads at Thor Lake and Pine Point. The heaviest traffic would be the road from the Thor Lake process plant to the dock facility, and the road from the dock facility at Pine Point to the hydrometallurgical plant. To suppress the dispersion of dust, magnesium chloride, water, or other commercially available, environmentally acceptable dust suppressants will be applied on the roads.

The air quality monitoring plan provided by RWDI can be found in DAR Appendix J Section 8. In response to a request by the GNWT, modelling was revised to include receptors inside the plant fencelines and to include revised diesel generator emissions. It should be noted that regulatory dispersion models such as CALPUFF were not designed to assess near-field effects and therefore there is greater uncertainty associated with predictions inside plant boundaries than outside the boundaries. Although no exceedances were predicted outside the plant boundaries, exceedances of SO_2 standards were predicted to occur less than 3% of the time inside the plant boundaries; exceedances of TSP standards were predicted to occur less than 17% of the time inside the plant boundaries. Therefore it is recommended that one passive SO_2 monitor be located at the location of predicted exceedance inside the plant fenceline at the mine site and that one be installed at the hydrometallurgical plant at the location of predicted exceedance. It is also recommended that TSP be monitored inside the fenceline of the mine site in the area of predicted exceedance for a minimum of one year, at which time the need for continued monitoring would be determined in consultation with Environment Canada and GNWT.

IR Number:	**EC #5**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Air Quality Modeling - Input and Output Data
DAR Section:	6.2.2

Preamble

The quality of model predictions is dependent on the quality of the input data used in the model. The selection of model options and the configuration of model domains and grids can also affect the quality of predictions.

To provide confidence in the air quality model predictions provided in the DAR, all input data and selected model options and configurations must be reviewed.

EC Request #5

1. EC requests that the proponent provide all input and control files used in the CALPUFF model to generate the air quality predictions presented in the DAR. All files should be in a format that can be used directly into CALPUFF. Please include all output files in the raw CALPUFF format.

Avalon Response #5

Model options and configuration of model domains and grids are consistent with the *Guidelines for Air Quality Dispersion Modelling in British Columbia* since no comparable document is available for dispersion modelling in NWT. The requested CALPUFF files are provided on two DVDs. One for the original modelling completed for the DAR and another for the revised modelling conducted in response to a request by the GNWT.

IR Number:	**EC #6**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Air Quality Modeling – Modeling Approach
DAR Section:	6.2.2.3

Preamble

The Proponent has stated that the air modeling was performed in accordance with the Guidelines for Air Quality Dispersion Modeling in BC (Section 6.2.2.3). The air quality assessment for this project was completed using the CALPUFF in a two dimension mode often referred to as CALPUFF-ISC. The BC modeling guideline recommends that CALPUFF-ISC only be used "in areas with uniform terrain and land use when spatial variability of the meteorological fields is not significant". For complex terrain and complex flow conditions, the BC modeling guideline recommends using CALPUFF in the full 3-dimensional mode with 3-dimensional wind fields.

The terrain at the mine site is not uniform and is relatively complex. The Proponent should justify its choice to use CALPUFF-ISC.

EC Request #6

1. EC requests that the Proponent justify its choice to use the 2-dimensional CALPUFF-ISC dispersion model to generate air quality predictions in the DAR.

Avalon Response #6

Terrain elevations inside the mine site study area range from 156 to 309 m above sea level, extracted from 1:250,000 scale Canadian Digital Elevation Data (see Figure 1 below). With a maximum elevation change of approximately 150 m in a 20 km by 20 km domain, the terrain in the study area is considered to be relatively uniform and the spatial variability of the meteorological fields is not expected to be significant. Therefore CALPUFF-ISC is considered to be an appropriate model for this study area. Examples of complex terrain, where use of CALMET would be required, are a mountain valley in the British Columbia interior or a coastal area with differences in terrain elevation on the order of several hundred metres.

Furthermore, there is only one meteorological station located inside the study area. The next closest station is the Yellowknife Airport station, which is located 100 km west-northwest of the Nechalacho Mine. The maximum radius of influence of a surface station (RMAX 1) is typically set at 10 to 20 km in CALMET and therefore data from a surface station located 100 km away would not influence the CALMET wind fields if incorporated. There is limited value in running CALMET with data from only one surface station particularly when there is so little variation in terrain elevation.

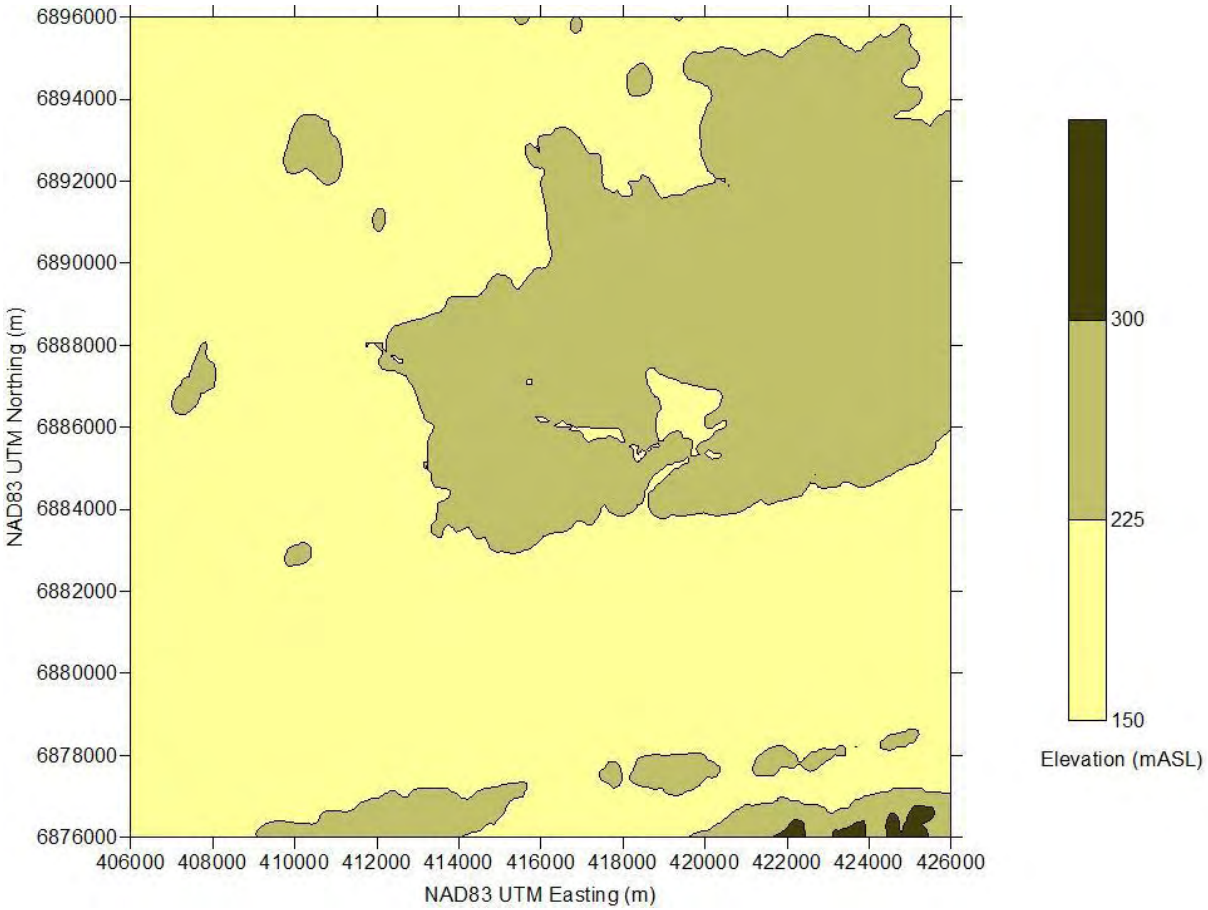

Figure 1: Elevation inside Nechalacho Study Area

IR Number:	**EC #7**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Waste Incineration
DAR Section:	11.2.8

Preamble

The Proponent has stated that Garbage will be collected daily and incinerated consistent with current industry good management practices. (DAR, Section 11.2.8). The Proponent also states that emissions of dioxins and furans from waste incineration should be minimized if guidance from the EC Technical Document for Batch Waste Incineration is followed (Avalon 2011, response to MVEIRB Request #44).

EC concurs. Therefore to minimize the emissions of dioxins and furans, the Proponent should develop and implement an incineration management plan that incorporates the guidance provided in the Technical Document.

EC Request #7

1. EC requests that the Proponent develop and implement an incineration management plan that incorporates the guidance provided in the Technical Document for Batch Waste Incineration.

Avalon Response #7

Avalon is pleased to commit to the preparation and implementation of an incineration management plan that incorporates the guidance provided in the Environment Canada *Technical Document for Batch Waste Incineration*. At this time, Avalon has taken the EC Technical Document into account when specifying the design requirements for the incinerator at the Nechalacho mine site. The dual chamber (two-stage process) selected will minimize emissions of persistent organic pollutants, including dioxans and furans.

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

IR Number:	**EC #8**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Quantitative estimates of habitat loss and effective habitat loss for bird VECs
DAR Section:	2.11, 2.11.6.1 (Upland Nesting Birds), 2.11.6.3 (Waterfowl and Waterbirds), 2.11.7.1 (Common Nighthawk), 2.11.7.2 (Olive-sided Flycatcher), 2.11.7.3 (Rusty Blackbird), 2.11.7.8 (Horned Grebe), 2.11.7.9 (Whooping Crane), 2.11.7.10 (Yellow Rail), 6.2.3 (Noise), 6.9.1.7 (Common Nighthawk), 6.9.1.8 (Olive-sided Flycatcher), 6.9.1.9 (Rusty Blackbird), 6.9.1.10 (Horned Grebe), 6.9.2.6 (Waterfowl), 6.9.2.7 (Whooping Crane), 6.9.2.9 (Yellow Rail), 6.9.2.11 (Common Nighthawk), 6.9.2.12 (Olive-sided Flycatcher), 6.9.2.13 (Rusty Blackbird), 6.9.2.14 (Horned Grebe), DAR Appendix B.1
TOR Section:	3.3.6 Wildlife – subsections 1.a,d and 2

Preamble

Section 3.3.6 of the Terms of Reference for the Thor Lake Rare Earth Element project require the developer to describe potential impacts to wildlife habitat, including degradation and fragmentation, as the potential for increased sensory disturbance and a prediction of effective habitat loss resulting from changed behaviour in response to sensory disturbance.

The Proponent has identified Wildlife Species at Risk and species of cultural importance as VECs for the assessment of project impacts. The Proponent's assessment of significance for direct habitat loss and effective habitat loss due to sensory disturbance include magnitude as one of the residual effects criteria. Categorical descriptors for the magnitude of residual effects rely on the concept of "baseline conditions" and "natural variation".

The Proponent has conducted point counts for upland birds, and ground-based surveys and aerial surveys for waterfowl and waterbirds. Appendix B.1 of the DAR provides habitat suitability rankings (High, Moderate, Low, Nil) for different habitat types for each of the bird VECs. Although the DAR provides the number of observations of each bird VEC and the habitat types in which they were detected at the Nechalacho Mine site and the Pine Point Hydrometallurgical Plant site, the Proponent has not provided a quantitative assessment of available habitat for each migratory bird VEC in the LSA and RSA at each site or quantitative estimates of habitat loss from the direct project footprint and effective habitat loss within an expected zone of influence from sensory disturbances (e.g. noise and dust). Current conclusions about the magnitude of effects from direct and effective habitat loss are thus purely qualitative. Without quantitative estimates of available habitat and projected habitat loss it is difficult to assess what baseline conditions are like, what the range of natural variation in density for each bird VEC is in each habitat type, and to what degree the project might cause a departure from either of these criteria.

EC Request #8

For Avalon Rare Metals Inc. to provide the following:

1. Based on point count surveys for terrestrial birds, please provided mean density estimates for individual species and all species combined for each habitat type surveyed and a measure of variation (e.g. SE, 95% CI) and the number of samples (i.e. point counts) in each habitat type.
2. Compare density estimates or presence/absence for bird VECs to the habitat suitability rankings provided in section 3.9 of Appendix B.1 (and Appendix E of Appendix B.1) to assess the level of concordance between species distribution and habitat suitability rankings.
3. Provide quantitative estimates of available High, Moderate, Low and Nil suitability habitats for each migratory bird VEC in the LSA and RSA at each project site.
4. Provide quantitative estimates of direct habitat loss and effective habitat loss within the predicted ZOI for sensory disturbances according to each habitat suitability category (or changes in habitat suitability category due to disturbance) for migratory bird VEC at each site. Habitat loss or changes in habitat suitability should be expressed as a percentage of the habitat available in the LSA and RSA.
5. Using these quantitative predictions, provide a re-assessment of the magnitude and significance of direct and effective habitat loss for each migratory bird VEC.

While EC has only requested this information for bird VECs, EC encourages the Proponent to provide similar information to that outlined above for remaining wildlife VECs that are included in the DAR.

For further guidance on impact assessment for migratory birds, EC recommends that the proponent consult the following document:

Hanson et al. 2009. A Framework for the Scientific Assessment of Potential Project Impacts on Birds. Canadian Wildlife Service Technical Report Series Number 508. 73 pp. Available at:

http://www.publications.gc.ca/collections/collection_2010/ec/CW69-5-508-eng.pdf

Avalon Response #8.1

Mean density estimates for individual bird species for the Nechalacho LSA (per km^2) are provided in Table 6. Mean density estimates for all bird species by habitat type are presented in Table 7.

TABLE 6: MEAN DENSITY ESTIMATES BY BIRD SPECIES FOR THE NECHALACHO LSA (PER KM²)

Species	Measure	Value	Comments
American Robin	Mean	40.9	
	Std Dev	14.9	
	Std Err Mean	4.0	
	Upper 95% Mean	49.6	
	Lower 95% Mean	32.3	
	N	18	
Blackpoll Warbler	Mean	31.8	No variance, exactly one territory was recorded in each respective plot.
	Std Dev	0.0	
	Std Err Mean	0.0	
	Upper 95% Mean	31.8	
	Lower 95% Mean	31.8	
	N	5	
Bohemian Waxwing	Mean	63.7	No variance, exactly one territory was recorded in each respective plot.
	Std Dev	---	
	Std Err Mean	---	
	Upper 95% Mean	---	
	Lower 95% Mean	---	
	N	2	
Cape May Warbler	Mean	31.8	No variance, exactly one territory was recorded in each respective plot.
	Std Dev	0.0	
	Std Err Mean	0.0	
	Upper 95% Mean	31.8	
	Lower 95% Mean	31.8	
	N	2	
Chipping Sparrow	Mean	44.2	
	Std Dev	16.0	
	Std Err Mean	3.8	
	Upper 95% Mean	52.2	
	Lower 95% Mean	36.3	
	N	25	
Common Yellowthroat	Mean	31.8	n=1, therefore no variance
	Std Dev	---	
	Std Err Mean	---	
	Upper 95% Mean	---	
	Lower 95% Mean	---	
	N	1	

TABLE 6: MEAN DENSITY ESTIMATES BY BIRD SPECIES FOR THE NECHALACHO LSA (PER KM²)

Species	Measure	Value	Comments
Dark-eyed Junco	Mean	35.8	
	Std Dev	11.3	
	Std Err Mean	4.0	
	Upper 95% Mean	45.2	
	Lower 95% Mean	26.4	
	N	9	
Gray Jay	Mean	47.8	
	Std Dev	22.5	
	Std Err Mean	15.9	
	Upper 95% Mean	250.1	
	Lower 95% Mean	-154.6	
	N	3	
Hairy Woodpecker	Mean	31.8	
	Std Dev	---	
	Std Err Mean	---	
	Upper 95% Mean	---	n=1, therefore no variance
	Lower 95% Mean	---	
	N	1	
Lesser Yellowlegs	Mean	31.8	
	Std Dev	---	
	Std Err Mean	---	
	Upper 95% Mean	---	n=1, therefore no variance
	Lower 95% Mean	---	
	N	1	
Lincoln's Sparrow	Mean	40.9	
	Std Dev	15.5	
	Std Err Mean	5.9	
	Upper 95% Mean	55.3	
	Lower 95% Mean	26.6	
	N	9	
Northern Waterthrush	Mean	63.7	
	Std Dev	---	
	Std Err Mean	---	No variance, exactly one territory was recorded in each respective plot.
	Upper 95% Mean	---	
	Lower 95% Mean	---	
	N	2	

TABLE 6: MEAN DENSITY ESTIMATES BY BIRD SPECIES FOR THE NECHALACHO LSA (PER KM²)

Species	Measure	Value	Comments
Olive-sided Flycatcher	Mean	42.5	
	Std Dev	26.0	
	Std Err Mean	10.6	
	Upper 95% Mean	69.8	
	Lower 95% Mean	15.2	
	N	8	
Orange-crowned Warbler	Mean	31.8	No variance, exactly one territory was recorded in each respective plot.
	Std Dev	0.0	
	Std Err Mean	0.0	
	Upper 95% Mean	31.8	
	Lower 95% Mean	31.8	
	N	2	
Palm Warbler	Mean	42.5	
	Std Dev	22.5	
	Std Err Mean	7.5	
	Upper 95% Mean	59.8	
	Lower 95% Mean	25.2	
	N	12	
Pine Grosbeak	Mean	31.8	n=1, therefore no variance
	Std Dev	---	
	Std Err Mean	---	
	Upper 95% Mean	---	
	Lower 95% Mean	---	
	N	1	
Ruby-crowned Kinglet	Mean	31.8	No variance, exactly one territory was recorded in each respective plot.
	Std Dev	0.0	
	Std Err Mean	0.0	
	Upper 95% Mean	31.8	
	Lower 95% Mean	31.8	
	N	6	
Spruce Grouse	Mean	31.8	n=1, therefore no variance
	Std Dev	---	
	Std Err Mean	---	
	Upper 95% Mean	---	
	Lower 95% Mean	---	
	N	1	

TABLE 6: MEAN DENSITY ESTIMATES BY BIRD SPECIES FOR THE NECHALACHO LSA (PER KM²)

Species	Measure	Value	Comments
Swainsons Thrush	Mean	44.4	
	Std Dev	18.1	
	Std Err Mean	3.4	
	Upper 95% Mean	51.4	
	Lower 95% Mean	37.4	
	N	39	
Swamp Sparrow	Mean	31.8	n=1, therefore no variance
	Std Dev	---	
	Std Err Mean	---	
	Upper 95% Mean	---	
	Lower 95% Mean	---	
	N	1	
Wilsons Snipe	Mean	31.8	No variance, exactly one territory was recorded in each respective plot.
	Std Dev	0.0	
	Std Err Mean	0.0	
	Upper 95% Mean	31.8	
	Lower 95% Mean	31.8	
	N	4	
Woodpecker sp.	Mean	31.8	n=1, therefore no variance
	Std Dev	---	
	Std Err Mean	---	
	Upper 95% Mean	---	
	Lower 95% Mean	---	
	N	1	
Yellow Warbler	Mean	31.8	No variance, exactly one territory was recorded in each respective plot.
	Std Dev	0.0	
	Std Err Mean	0.0	
	Upper 95% Mean	31.8	
	Lower 95% Mean	31.8	
	N	2	
Yellow-rumped Warbler	Mean	53.5	
	Std Dev	25.5	
	Std Err Mean	5.1	
	Upper 95% Mean	64.0	
	Lower 95% Mean	43.0	
	N	42	

TABLE 7: BIRD DENSITY ESTIMATES (ALL SPECIES) BY HABITAT TYPE		
Broad Habitat Type	**Measure**	**Value**
Bedrock-Lichen	Mean	118.29
	Std Dev	51.07
	Std Err Mean	19.30
	Upper 95% Mean	165.52
	Lower 95% Mean	71.06
	N	7
Mixed Upland	Mean	165.61
	Std Dev	108.93
	Std Err Mean	48.72
	Upper 95% Mean	300.86
	Lower 95% Mean	30.35
	N	5
Sedge Fen	Mean	191.08
	Std Dev	
	Std Err Mean	
	Upper 95% Mean	
	Lower 95% Mean	
	N	1
Shrub Wet	Mean	169.85
	Std Dev	78.01
	Std Err Mean	26.00
	Upper 95% Mean	229.81
	Lower 95% Mean	109.89
	N	9
Spruce Upland	Mean	185.29
	Std Dev	95.35
	Std Err Mean	28.75
	Upper 95% Mean	249.35
	Lower 95% Mean	121.24
	N	11
Treed Fen	Mean	153.93
	Std Dev	51.02
	Std Err Mean	20.83
	Upper 95% Mean	207.47
	Lower 95% Mean	100.38
	N	6

Avalon Response #8.2

The original habitat suitability rankings for each bird VEC are qualitative assessments based on three life requisites: food, security, and over-wintering habitat. One overall suitability ranking is assigned based on these individual scores to reflect the potential or expected use of an area by the species of concern. Although this analysis is not a wildlife habitat assessment exercise, it is certainly analogous in many areas of its methodological approach. Optimally, wildlife habitat assessment models are based on extensive knowledge about wildlife-habitat relationships in the ecological zone of interest. High quality models result from a long-term approach that includes thorough testing under a variety of conditions and locations. In reality, this level of detail and opportunity for verification is rarely available. Species specialists often serve as surrogates for multiple years of population and habitat data.

For this project, habitat suitability rankings were developed by northern wildlife biologists with extensive experience working with the species of concern and their respective habitat requirements. This technique relies upon the biologists' empirical wildlife knowledge, and their mental models of species' habitat requirements obtained through years of research and/or practical experience. A comparison of these habitat suitability rankings with presence/not detected survey data is presented in Table 8.

TABLE 8: COMPARISON OF HABITAT SUITABILITY RANKINGS WITH BIRD VEC PRESENCE/ NOT DETECTED BIRD SURVEY DATA

Broad Habitat Type	Area within Nechalacho LSA (ha)	Overall Suitability Ranking	Presence/ Not Detected Surveys	Incidental Observations	Comments
Upland Breeding Birds[a]					
Bedrock-Lichen	442.1	Moderate	27	63	
Spruce Upland	431.4	High	60	57	
Broadleaf Upland	0.8	High	ND	ND	
Mixed Upland	302.9	High	26	28	
Spruce Wet	1.1	Moderate	ND	3	
Treed Fen	175.2	High	27	14	
Shrub Wet	305.1	High	41	18	
Shrub Fen	38.7	Moderate	ND	ND	
Sedge Fen	30.7	High	5	5	
Open Water	435.4	Low	ND	3	
Anthropogenic	13.7	Nil	ND	11	
Herb Marsh	2.0	High	ND	ND	
Riparian Shrub	2.8	High	ND	3	
Rock	6.9	Nil	ND	ND	

TABLE 8: COMPARISON OF HABITAT SUITABILITY RANKINGS WITH BIRD VEC PRESENCE/ NOT DETECTED BIRD SURVEY DATA					
Broad Habitat Type	**Area within Nechalacho LSA (ha)**	**Overall Suitability Ranking**	**Presence/ Not Detected Surveys**	**Incidental Observations**	**Comments**
Yellow Rail[a]					
Bedrock-Lichen	442.1	Nil	ND	ND	No Yellow Rails observed.
Spruce Upland	431.4	Nil	ND	ND	
Broadleaf Upland	0.8	Nil	ND	ND	
Mixed Upland	302.9	Nil	ND	ND	
Spruce Wet	1.1	Nil	ND	ND	
Treed Fen	175.2	Nil	ND	ND	
Shrub Wet	305.1	Nil	ND	ND	
Shrub Fen	38.7	Low	ND	ND	
Sedge Fen	30.7	High	ND	ND	
Open Water	435.4	High	ND	ND	
Anthropogenic	13.7	Nil	ND	ND	
Herb Marsh	2.0	High	ND	ND	
Riparian Shrub	2.8	Moderate	ND	ND	
Rock	6.9	Nil	ND	ND	
Olive-sided Flycatcher[a]					
Bedrock-Lichen	442.1	Moderate	1	4	
Spruce Upland	431.4	Low	4	2	
Broadleaf Upland	0.8	Nil	ND	ND	
Mixed Upland	302.9	Nil	ND	1	
Spruce Wet	1.1	Low	ND	0	
Treed Fen	175.2	Low	2	1	
Shrub Wet	305.1	High	2	2	
Shrub Fen	38.7	Moderate	ND	ND	
Sedge Fen	30.7	Nil	ND	1	
Open Water	435.4	Nil	ND	ND	
Anthropogenic	13.7	Nil	ND	ND	
Herb Marsh	2.0	Nil	ND	ND	
Riparian Shrub	2.8	Low	ND	ND	
Rock	6.9	Low	ND	ND	

TABLE 8: COMPARISON OF HABITAT SUITABILITY RANKINGS WITH BIRD VEC PRESENCE/ NOT DETECTED BIRD SURVEY DATA					
Broad Habitat Type	**Area within Nechalacho LSA (ha)**	**Overall Suitability Ranking**	**Presence/ Not Detected Surveys**	**Incidental Observations**	**Comments**
Rusty Blackbird[a]					
Bedrock-Lichen	442.1	Nil	ND	ND	
Spruce Upland	431.4	Nil	ND	ND	
Broadleaf Upland	0.8	Nil	ND	ND	
Mixed Upland	302.9	Nil	ND	ND	
Spruce Wet	1.1	Nil	ND	ND	
Treed Fen	175.2	High	ND	ND	
Shrub Wet	305.1	Nil	ND	ND	
Shrub Fen	38.7	High	ND	ND	
Sedge Fen	30.7	Moderate	ND	ND	
Open Water	435.4	Nil	1	ND	
Anthropogenic	13.7	Nil	ND	ND	
Herb Marsh	2.0	Moderate	ND	ND	
Riparian Shrub	2.8	Moderate	ND	ND	
Rock	6.9	Nil	ND	ND	
Common Nighthawk[a]					
Bedrock-Lichen	442.1	High	ND	ND	
Spruce Upland	431.4	Low	ND	ND	
Broadleaf Upland	0.8	Nil	ND	ND	
Mixed Upland	302.9	Nil	ND	ND	
Spruce Wet	1.1	Low	ND	ND	
Treed Fen	175.2	Moderate	ND	ND	
Shrub Wet	305.1	Moderate	ND	ND	
Shrub Fen	38.7	Low	ND	ND	
Sedge Fen	30.7	Moderate	ND	ND	
Open Water	435.4	Moderate	ND	ND	
Anthropogenic	13.7	Nil	ND	1	
Herb Marsh	2.0	Moderate	ND	ND	
Riparian Shrub	2.8	Moderate	ND	ND	
Rock	6.9	Low	ND	ND	

TABLE 8: COMPARISON OF HABITAT SUITABILITY RANKINGS WITH BIRD VEC PRESENCE/ NOT DETECTED BIRD SURVEY DATA					
Broad Habitat Type	**Area within Nechalacho LSA (ha)**	**Overall Suitability Ranking**	**Presence/ Not Detected Surveys**	**Incidental Observations**	**Comments**
Horned Grebe[a,b]					
Bedrock-Lichen	442.1	Nil	ND	ND	
Spruce Upland	431.4	Nil	ND	ND	
Broadleaf Upland	0.8	Nil	ND	ND	
Mixed Upland	302.9	Nil	ND	ND	
Spruce Wet	1.1	Nil	ND	ND	
Treed Fen	175.2	Nil	ND	ND	
Shrub Wet	305.1	Nil	ND	ND	
Shrub Fen	38.7	Low	ND	ND	
Sedge Fen	30.7	High	ND	ND	
Open Water	435.4	High	ND	1	
Anthropogenic	13.7	Nil	ND	ND	
Herb Marsh	2.0	High	ND	ND	
Riparian Shrub	2.8	Nil	ND	ND	
Rock	6.9	Nil	ND	ND	
Waterfowl and Waterbirds[b]					
Bedrock-Lichen	442.1	Low	ND	ND	
Spruce Upland	431.4	Low	ND	ND	
Broadleaf Upland	0.8	Low	ND	ND	
Mixed Upland	302.9	Low	ND	2	
Spruce Wet	1.1	Low	ND	ND	
Treed Fen	175.2	Low	ND	ND	
Shrub Wet	305.1	Low	100	7	Large flyover group above survey plot near shore of Thor Lake
Shrub Fen	38.7	Moderate	ND	ND	
Sedge Fen	30.7	High	1	ND	
Open Water	435.4	High	486	60	
Anthropogenic	13.7	Nil	ND	4	
Herb Marsh	2.0	High	ND	ND	
Riparian Shrub	2.8	Nil	ND	1	
Rock	6.9	Nil	ND	ND	

NOTES:

a. Values are from Upland Breeding Bird Surveys - standard circular 100 m radius point-counts.

b. Values are from Waterfowl Surveys

ND = Not Detected

Avalon Response #8.3

Quantitative estimates of available bird VEC habitat within the Nechalacho mine site LSA and RSA are presented in Tables 9 and 10. Quantitative estimates of available bird VEC habitat within the Hydrometallurgical Plant LSA are not provided as the LSA is entirely located within a brownfield site, which has been previously disturbed (see Figure 4 in Avalon Response #15.1 that shows the area of disturbance).

TABLE 9: QUANTITATIVE ESTIMATES OF AVAILABLE BIRD VEC HABITAT IN THE NECHALACHO LSA (HA)

Bird VEC	Habitat Suitability Ranking			
	Nil	Low	Moderate	High
Upland Breeding Bird	6.9	435.4	481.9	1250.9
Yellow Rail	1679.2	38.7	2.8	468.1
Olive-sided Flycatcher	785.4	617.4	480.8	305.1
Rusty Blackbird	1939.4	0.0	35.4	214.0
Common Nighthawk	317.4	478.1	951.2	442.1
Horned Grebe	1682.0	38.7	0.0	468.1
Waterfowl/Waterbirds	23.3	1658.6	38.7	468.1

TABLE 10: QUANTITATIVE ESTIMATES OF AVAILABLE BIRD VEC HABITAT IN THE NECHALACHO RSA (HA)

Bird VEC	Habitat Suitability Ranking			
	Nil	Low	Moderate	High
Upland Breeding Bird	1110	10429	10981	22799
Yellow Rail	29839	3671	0	11809
Olive-sided Flycatcher	17502	12407	10981	4429
Rusty Blackbird	35741	0	1380	8198
Common Nighthawk	5693	11551	20765	7310
Horned Grebe	29839	3671	0	11809
Waterfowl/Waterbirds	1110	28729	3671	11809

Avalon Response #8.4

Quantitative estimates of direct habitat loss (footprint) and effective habitat loss (ZOI for noise/dust) are expressed as a percentage of the available habitat in the Nechalacho mine site LSA and RSA in Tables 11 to 14. The general ZOI adopted for this exercise (500 m) has been based on the ZOI developed by Environment Canada for estimated disturbance to Boreal Caribou. Avalon is confident that this is a rather conservative ZOI as applied to most wildlife and bird species that could frequent the Nechalacho mine area and it is our opinion that most wildlife species will not be disturbed or otherwise affected by noise or dust issues associated with activities related to the Thor Lake Project components.

TABLE 11: QUANTITATIVE ESTIMATES OF BIRD VEC HABITAT LOSS IN THE NECHALACHO LSA – DIRECT LOSS FROM FOOTPRINT (% OF AVAILABLE)

Bird VEC	Habitat Suitability Ranking			
	Nil	Low	Moderate	High
Upland Breeding Bird	4.9	7.5	5.7	8.2
Yellow Rail	7.2	7.0	0.2	8.9
Olive-sided Flycatcher	8.3	9.3	5.7	4.9
Rusty Blackbird	7.0	0.0	24.8	9.0
Common Nighthawk	7.4	9.1	7.7	5.5
Horned Grebe	7.1	7.0	0.0	8.9
Waterfowl/Waterbirds	6.5	7.2	7.0	8.9

TABLE 12: QUANTITATIVE ESTIMATES OF BIRD VEC HABITAT LOSS IN THE NECHALACHO LSA – EFFECTIVE LOSS DUE TO NOISE/DUST (% OF AVAILABLE)

Bird VEC	Habitat Suitability Ranking			
	Nil	Low	Moderate	High
Upland Breeding Bird	20.2	12.9	41.3	22.4
Yellow Rail	27.9	21.2	7.7	14.4
Olive-sided Flycatcher	18.6	42.5	28.1	0.2
Rusty Blackbird	24.8	0.0	31.6	24.1
Common Nighthawk	24.9	47.5	11.7	28.7
Horned Grebe	27.9	21.2	0.0	14.4
Waterfowl/Waterbirds	41.3	27.7	21.2	14.4

TABLE 13: QUANTITATIVE ESTIMATES OF BIRD VEC HABITAT LOSS IN THE NECHALACHO RSA – DIRECT LOSS FROM FOOTPRINT (% OF AVAILABLE)				
Bird VEC	Habitat Suitability Ranking			
	Nil	Low	Moderate	High
Upland Breeding Bird	0.0	0.3	0.2	0.5
Yellow Rail	0.4	0.1	0.0	0.4
Olive-sided Flycatcher	0.4	0.5	0.2	0.3
Rusty Blackbird	0.4	0.0	0.6	0.2
Common Nighthawk	0.4	0.4	0.4	0.3
Horned Grebe	0.4	0.1	0.0	0.4
Waterfowl/Waterbirds	0.1	0.4	0.1	0.4

TABLE 14: QUANTITATIVE ESTIMATES OF BIRD VEC HABITAT LOSS IN THE NECHALACHO RSA – EFFECTIVELOSS DUE TO NOISE/DUST (% OF AVAILABLE)				
Bird VEC	Habitat Suitability Ranking			
	Nil	Low	Medium	High
Upland Breeding Bird	0.1	0.5	1.8	1.2
Yellow Rail	1.6	0.2	0.0	0.6
Olive-sided Flycatcher	0.8	2.1	1.2	0.0
Rusty Blackbird	1.3	0.0	0.8	0.6
Common Nighthawk	1.4	2.0	0.5	1.7
Horned Grebe	1.6	0.2	0.0	0.6
Waterfowl/Waterbirds	0.9	1.6	0.2	0.6

Avalon Response #8.5

Avalon believes that the environmental assessment predictions as presented in the DAR remain valid. Avalon does not support the application of a theoretical ZOI approach to the components of the Thor Lake Project and finds this exercise to be atypical of the standard requirements of a DAR under the purview of the MVEIRB. With respect, it appears that Environment Canada may be trying to apply the higher standard of assessment normally reserved for a full Environmental Impact Review to the Thor Lake Project, which Avalon does not believe to be appropriate.

IR Number:	**EC #9**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Presentation of migratory bird VEC observations
DAR Section:	2.11 - Figures 2.11-14 to 2.11-19

Preamble

Figures 2.11-14 to 2.11-19 of the DAR indicate the location of bird VEC observations from baseline surveys or from the NWT Checklist database. The maps provide a broad overview that includes the Nechalacho Mine Site, the Hydrometallurgical Plant Site and the barge route. Unfortunately, the maps are at such a broad scale that reviewers cannot visualize where individual observations of these species occur relative to proposed project infrastructure at each site. Fine-scale maps would provide a more useful visual representation for baseline conditions and effects assessment for each of the project sites.

EC Request #9

1. For Avalon Rare Metals Inc. to provide revised maps that present observed locations of bird Species at Risk the Nechalacho Mine Site and the Hydrometallurgical Plant Site separately. Please include the habitat classification map as a base layer for each site as well as an overlay of the proposed project footprint at each site so that the location of observations of these species can be clearly visualized relative to habitat types and the project footprint. One map for each project site that uses different symbols to represent each of the bird VECS may be sufficient, rather than providing separate maps for each species. The map for the Pine Point Hydrometallurgical Plant site should also include potential breeding habitat for Whooping Crane.

Avalon Response #9

Avalon is pleased to provide revised figures displaying the location of bird Species at Risk for the Nechalacho Mine Site (Figure 2) and the Hydrometallurgical Plant Site (Figure 3).

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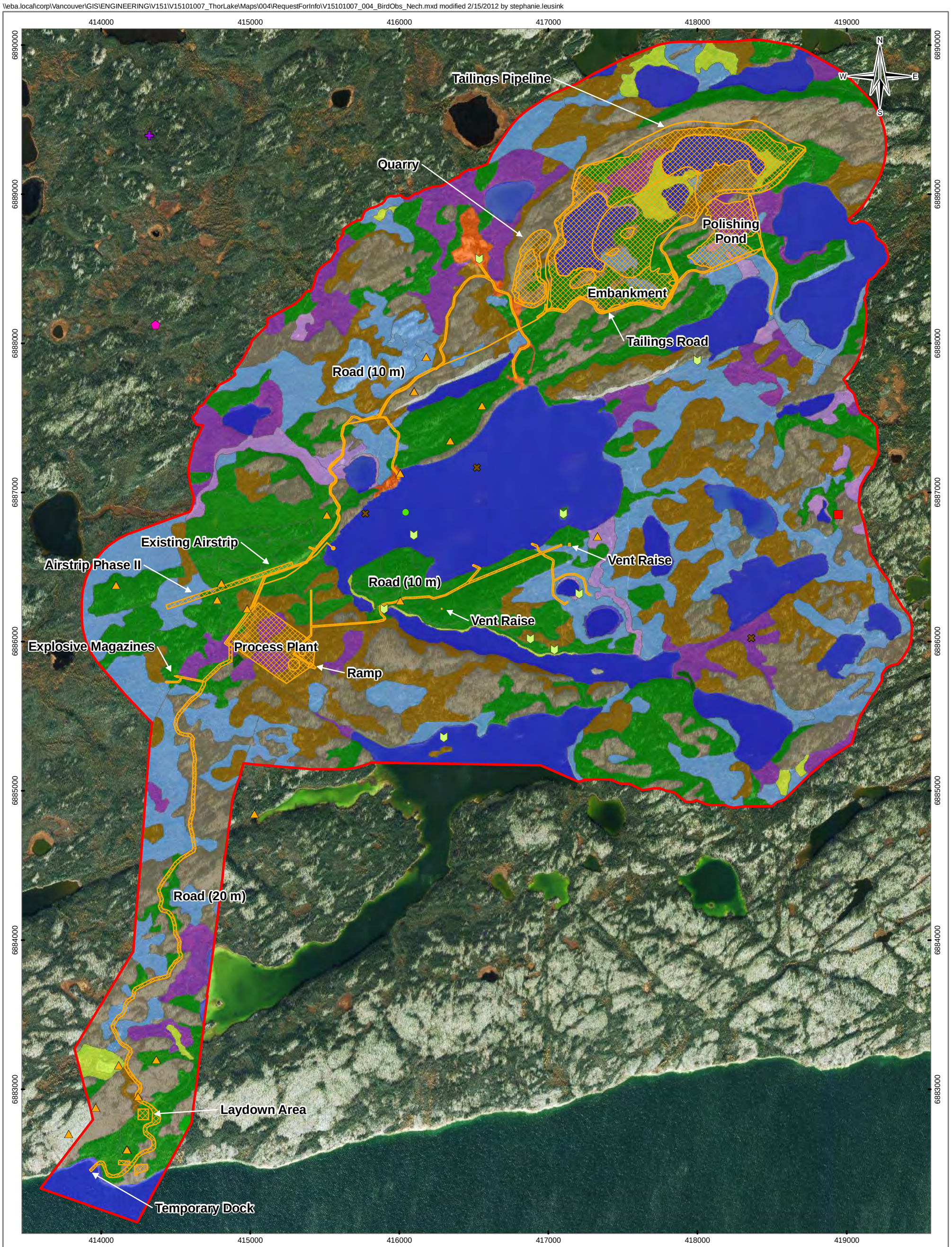

LEGEND

- Bald Eagle Observation[1]
- Common Nighthawk Observation[1]
- Horned Grebe Observation[1]
- Olive-sided Flycatcher Observation[1]
- Osprey Observation[1]
- Peregrine Falcon Observation[1]
- Rusty Blackbird Observation[1]
- Local Study Area
- Infrastructure Footprint

Broad Habitat Type

- Anthropogenic
- Open Water
- Rock
- Bedrock-Lichen
- Mixed Upland
- Broadleaf Upland
- Spruce Upland
- Spruce Wet
- Shrub Wet
- Sedge Fen
- Shrub Fen
- Treed Fen

NOTES

1. Bird observations from NWT Bird Survey Checklist database, EBA, and Stantec. Imagery provided by Avalon (October 2010).

STATUS
ISSUED FOR USE

THOR LAKE PROJECT

Nechalacho Mine Site Bird Observations

PROJECTION	DATUM	CLIENT
UTM Zone 12	NAD83	AVALON RARE METALS INC.

Scale: 1:24,000
500 250 0 500
Metres

FILE NO. V15101007_004_BirdObs_Nech.mxd

PROJECT NO.	DWN	CKD	APVD	REV
V15101007.004	SL	MEZ	SH	0

OFFICE	DATE
EBA-VANC	February 15, 2012

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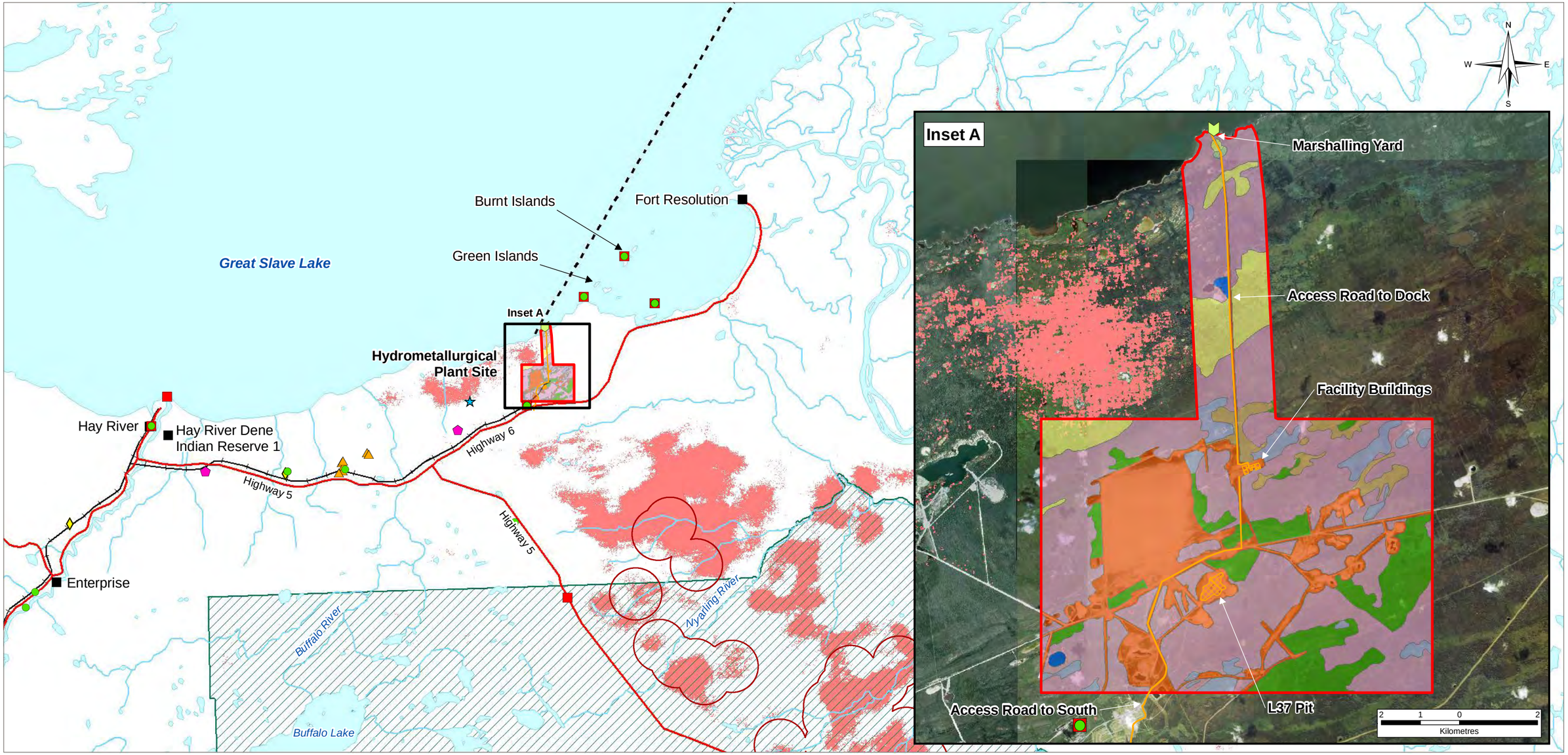
Figure 2



LEGEND

- Bald Eagle Observation[1]
- Common Nighthawk Observation[1]
- Olive-sided Flycatcher Observation[1]
- Peregrine Falcon Observation[1]
- Rusty Blackbird Observation[1]
- Whooping Crane Observation[1]
- Yellow Rail Observation[1]
- Whooping Crane 2010 Occupied Nest Territory[2]
- Whooping Crane Potential Nesting Habitat[2]

Broad Habitat Type

- Anthropogenic
- Open Water
- Bearberry - Jack Pine Forest
- Graminoid Fen
- Labrador Tea - Subhygic Forest
- Labrador Tea - Mesic
- Shrubby Fen
- Treed Fen

- Approximate Barging Route
- Local Study Area
- Infrastructure Footprint
- Wood Buffalo National Park
- Community
- Road
- Winter Road
- Railroad
- Watercourse
- Waterbody

NOTES
1. Bird observations from NWT Bird Survey Checklist database, EBA, and Stantec.
2. Whooping crane data provided by Wood Buffalo National Park.
Imagery provided by Avalon (October 2010).

STATUS
ISSUED FOR USE

THOR LAKE PROJECT

Hydrometallurgical Plant Site Bird Observations

PROJECTION	DATUM	CLIENT
UTM Zone 11	NAD83	AVALON RARE METALS INC.

Scale: 1:750,000
10 5 0 10 20
Kilometres

FILE NO. V15101007_004_BirdObs_Hydromet.mxd

PROJECT NO.	DWN	CKD	APVD	REV
V15101007.004	SL	MEZ	SH	0

OFFICE	DATE
EBA-VANC	February 15, 2012

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Figure 3

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IR Number:	**EC #10**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Sensory disturbances to wildlife
DAR Section:	6.2.3 (Noise), 6.9.1.7 (Common Nighthawk), 6.9.1.8 (Olive-sided Flycatcher), 6.9.1.9 (Rusty Blackbird), 6.9.1.10 (Horned Grebe), 6.9.2.6 (Waterfowl), 6.9.2.7 (Whooping Crane), 6.9.2.9 (Yellow Rail), 6.9.2.11 (Common Nighthawk), 6.9.2.12 (Olive-sided Flycatcher), 6.9.2.13 (Rusty Blackbird), 6.9.2.14 (Horned Grebe), DAR Appendix B.1
TOR Section:	3.3.6 Wildlife – subsections 1.a,d and 2

Preamble

Section 3.3.6 – subsection 1.d of the Terms of Reference for the Thor Lake Rare Earth Element project requires the developer to describe "potential for increased sensory disturbance from all sources (e.g., noise, odours, activity, vibrations from blasting, overflights, dust, transports trucks, locomotives, barge traffic)" and "predict effective habitat loss resulting from changed behaviour".

The proponent suggests that noise from the project will attenuate to a level of 40 dBA at a distance of 1.5 km from the site (DAR Section 6.2.3), that the principle effects of dust deposition will occur within 10 m of the project footprint and that dust effects may extend up to 100 m away (DAR Section 6.8.3). These expected zones of influence for noise and dust were not used to provide quantitative estimates of effective habitat loss for wildlife VECs. Although the proponent has provided an estimated number of trips per day for haul trucks on the Thor Lake-Great Slave Lake access road, a similar estimate has not been provided for the access road between Great Slave Lake and the Pine Point Hydrometallurgical Facility.

The proponent also has not provided estimates of sensory disturbance (both auditory and visual) from aircraft overflights or from aircraft approaching or departing from the proposed airstrip at Thor Lake. Mitigation measures to reduce sensory disturbance to migratory bird VECs from aircraft approaches, departures and overflights have not been provided.

EC Request #10

For Avalon Rare Metals Inc. to provide the following:

1. Flight frequency at the Thor Lake airstrip during different phases of the project.
2. An estimated zone of influence from the airstrip taking into account aircraft type, expected flight paths and altitude during approach and departure.
3. Estimated frequency of haul truck traffic along the access road from Great Slave Lake to Pine Point.

4. Expected zones of influence for noise and dust around different project components (e.g. roads, airstrip, mine infrastructure) in which effective habitat loss is expected for migratory bird VECs.

Avalon Response #10.1

During the construction phase Avalon anticipates approximately four (4) flights per week that will mainly transport supplies using aircraft like Curtiss C-46 or equivalent. During operations, Avalon expects approximately three (3) flights per week that will mainly transport personnel using aircraft like Dash 7 and Twin Otters. As operations advance over time, Avalon expects to minimize the amount of air traffic arriving and departing from the site.

Avalon Response #10.2

As noted in Avalon Response #10.1, only small aircraft will be used during the construction and operation of the Nechalacho Mine. The maximum noise levels associated with the airstrip will be produced during aircraft landings, take-offs and taxiing for short periods of time. Table 15, adapted from De Beers (2002), summarizes the predicted sound levels at various distances from the Snap Lake Mine airstrip that would be generated by small aircraft.

TABLE 15: PREDICTED SOUND LEVELS FOR AIR TRAFFIC AT VARIOUS DISTANCES FROM THE AIRSTRIP

Distance from Airstrip (km)	Predicted Sound Level (dBA)	
	Small Aircraft	
	5 min Leq	1 hr Leq
1.5	56.7	46.1
3	49.9	39.3
6	42.0	31.5
9	36.5	26.1

Source: Adapted from De Beers, 2002

Based on these predicted sound levels, the short-term noise produced during take-off (worst case) by small aircraft in the vicinity of the Nechalacho airstrip would be similar in sound level to the noise generated by a snowmobile pass-by at a distance of about 1 kilometre.

Reference:

De Beers Canada. 2002. Snap Lake Diamond Project Environmental Assessment Report, Part 1. Report submitted February 2002 to the Mackenzie Valley Environmental Impact Review Board.

Avalon Response #10.3

From July to October, Avalon anticipates approximately 3,600 round-trips on the road between Great Slave Lake and the Hydrometallurgical Plant. Each truck will carry one container as it is offloaded from the barges and taken to the plant. This will be roughly 30 trips a day during the barging season. During the off-season the road will occasionally be used for monitoring.

Avalon Response #10.4

Since this Information Request discusses both noise and dust, the following response addresses each issue separately.

Noise

As discussed in DAR Section 6.2.3 and as noted by Environment Canada in the preamble to this information request, noise from the project (all components) is generally expected to attenuate to a level of 40 dBA at a distance of 1.5 km from the site.

Noise generated by the Thor Lake Project components and associated activities will be variable and will continue for the life of the Project. Following cessation of Project-related activities, noise levels will immediately return to existing ambient conditions.

In a study that evaluated bird densities, Reijnen et al. (1995) found that sound levels above 50 dBA could be considered to have a negative impact on nesting birds, albeit only four birds species were included in these results. The authors concluded that the effects are not universal and need to be considered in terms of the surrounding habitat as well as species in question. Synanthropic bird species purposely exploit developments to their advantage, e.g., American Robin. Smith et al. (2005) bird study results at Ekati Diamonds, Northwest Territories, suggests that the mine, including noise generation, has had a relatively limited impact on the upland breeding bird community within 1 km of the footprint.

Some wildlife, including migratory birds, may show minor displacement behaviour and avoid the immediate Thor Lake Project development area during periods of particularly loud and irregular noises. The duration of such exposures are expected to be brief, perhaps lasting a few minutes to a few hours, and are reversible upon cessation of the activity or by moving away from the activity. The number and frequency of such exposures to noise disturbance by wildlife would be expected to be limited and sporadic.

The overall environmental consequences of noises generated by the Thor Lake Project development area and associated activities are expected to be low and the potential residual impact on the existing noise environment of the LSA and RSA is expected to be negligible.

Dust

Many mining activities, including blasting, quarrying, heavy equipment operations, traffic, and aircraft landings and take-offs generate dust. The impacts from dust disposition can be direct and indirect. Dust deposition will be greatest during the summer period and lesser during spring and fall; and is considered, for this project site, not significant during winter. Dust deposition will be restricted to areas adjacent to the project footprint.

As discussed in DAR Section 6.8.3, the principle effects of dust deposition are expected to occur within 10 m of the project footprint and that dust effects may extend up to 100 m away (DAR Section 6.8.3). Dust deposition on vegetation is not expected to have any significant impacts on migratory birds, but can potentially affect nesting birds. Extensive dust deposition can degrade

vegetation and result in reduced vegetation production or shifts in vegetation species composition over a given area, which in turn may affect bird species composition and distribution.

Indirect effects of dust include changes in snowmelt patterns. The darkened surface of snow within the dustfall area decreases reflectance and hastens melt. Consequently, areas within the dustfall zone will lose their snow cover earlier and more often than similar areas that are free of dust. Snowmelt within 30-100 m of the Dalton Highway in Alaska was advanced by 10-14 days over areas unaffected by dust (Walker and Everett, 1987). Where snowmelt is advanced, plant phenology will be accelerated, vegetation may be more productive, and food may become more readily available. Earlier snow melt may produce an amelioration of local or micro-climatic conditions that some species may exploit (Walker and Everett 1987).

The effects of dust on nesting birds have been are hard to quantify. TERA (1993) examined the use of habitat by nesting birds adjacent to roads within the Prudhoe Bay oil fields in Alaska. Two types of roads were evaluated, a heavily trafficked and lightly trafficked roads. Their results showed that there was no significant difference of species between the lightly and heavily dusted roadsides, and some bird guilds showed an increase in habitat usage adjacent to roads during post-breeding (TERA 1993). Bird studies conducted Smith et al. (2005) at Ekati Diamonds, Northwest Territories, found no evidence of reduced overall densities of birds adjacent to mine roads. Results from studies conducted at Prudhoe Bay found that birds displaced by the developments physical footprint, including roads, successfully breed in adjacent areas (Truett and Johnson 2000).

Impacts from dust depositions will be localized, minor, and generally limited to the margins of the project footprint. Dust related effects are anticipated to occur periodically throughout the life of the Project and are reversible. These effects have been assessed and rated as being of low consequence and are not significant, due largely to their localized and generally transient nature.

The primary mitigation measures to be employed in the proposed development areas will include the practice of applying water as needed.

References:

Reijnen, R., R. Foppen, C. Ter Braak, and J. Thissen. 1995. The effects of car traffic on breeding bird populations in woodland. III. Reduction in density in relation to the proximity of main roads. The Journal of Applied Ecology 32:187–202.

Smith, A.C., J.A. Virgl, D. Panayi, and A.R. Armstrong. 2005. Effects of a Diamond Mine on Tundra-Breeding Birds. Arctic, Vol. 58 (3): 295–304.

Troy Ecological Research Associates (TERA). 1993. Bird use of the Prudhoe Bay Oil Field. Unpublished report sponsored by BP Exploration (Alaska) Inc. Anchorage.

Truett, J.C. and S.R. Johnson. 2000. Synthesis. Pages 401-408 in J.C. Truett and S.R. Johnson, eds. The natural history of an Arctic oil field. Academic Press. 422pp.

Walker, D.A. and K.R. Everett. 1987. Road dust and its environmental impact on Alaskan taiga and tundra. Arctic and Alpine Research 19:479– 489.

IR Number:	**EC #11**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Residual effects assessment tables
DAR Section:	6.9.1.7 (Common Nighthawk), 6.9.1.8 (Olive-sided Flycatcher), 6.9.1.9 (Rusty Blackbird), 6.9.1.10 (Horned Grebe), 6.9.2.6 (Waterfowl), 6.9.2.7 (Whooping Crane), 6.9.2.9 (Yellow Rail), 6.9.2.11 (Common Nighthawk), 6.9.2.12 (Olive-sided Flycatcher), 6.9.2.13 (Rusty Blackbird), 6.9.2.14 (Horned Grebe), DAR Appendix B.1

Preamble

The proponent has provided a sample residual effects assessment table in Table 6.1-3, pg. 636 of the DAR and has applied this method to residual effects assessment for ecosystem types and plant species in the RSA (Table 6.8-7, pg. 760). This approach provides a useful summary of predicted residual effects and a ranking of their consequence. Such summary tables were not provided for residual effects assessment for any of the wildlife VECs.

EC Request #11

1. For Avalon Rare Metals Inc. to provide residual effects summary tables similar to Table 6.8-7 for residual effects predicted for each of the wildlife VECs.

Avalon Response #11

As stated in the DAR, Avalon believes that with adherence to the mitigation measures stated for wildlife VECs, no residual effects are anticipated for the following VECs:

- Common Nighthawk
- Olive-sided Flycatcher
- Waterfowl
- Whooping Crane
- Yellow Rail

Residual effects summary tables for wildlife VECs where residual impacts may occur are provided below (Tables 16 to 19). For each of the wildlife VECs, residual effects involve potential interactions with the Nechalacho mine Tailings Management Facility (TMF). This residual effect is considered to be low in magnitude, local in extent, and medium-term in duration. Frequency of interaction with the TMF is considered to be sporadic with a low likelihood of occurrence; the effect is considered reversible long-term as the closure and reclamation plan of the TMF will mitigate this potential residual effect. The most updated general concept for closure of the TMF is shown in Avalon Response #17.1 (Figure 7.1).

TABLE 16: RESIDUAL EFFECTS ASSESSMENT FOR MOOSE IN THE LSA (NECHALACHO MINE)													
Description of Residual Effect (after Mitigation)	**Evaluation of Residual Effect**												
	Magnitude	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Likelihood**							
								Consequence					
Interaction with Tailings Management Facility	Low	Local	Medium-Term	Sporadic	Reversible Long-term	Low	**Magnitude**	**H**					
								M					
								L		**X**			
									S	**M**	**L**	**I**	
									Duration				

TABLE 17: RESIDUAL EFFECTS ASSESSMENT FOR FUR-BEARERS (AQUATIC) IN THE LSA (NECHALACHO MINE)													
Description of Residual Effect (after Mitigation)	**Evaluation of Residual Effect**												
	Magnitude	**Geographic Extent**	**Duration**	**Frequency**	**Reversibility**	**Likelihood**							
								Consequence					
Interaction with Tailings Management Facility	Low	Local	Medium-Term	Sporadic	Reversible Long-term	Low	**Magnitude**	**H**					
								M					
								L		**X**			
									S	**M**	**L**	**I**	
									Duration				

TABLE 18: RESIDUAL EFFECTS ASSESSMENT FOR RUSTY BLACKBIRD IN THE LSA (NECHALACHO MINE)

Description of Residual Effect (after Mitigation)	Evaluation of Residual Effect						
	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Likelihood	
Interaction with Tailings Management Facility	Low	Local	Medium-Term	Sporadic	Reversible Long-term	Low	Consequence Magnitude: H / M / L S M L I Duration X

TABLE 19: RESIDUAL EFFECTS ASSESSMENT FOR HORNED GREBE IN THE LSA (NECHALACHO MINE)

Description of Residual Effect (after Mitigation)	Evaluation of Residual Effect						
	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Likelihood	
Interaction with Tailings Management Facility	Low	Local	Medium-Term	Sporadic	Reversible Long-term	Low	Consequence Magnitude: H / M / L S M L I Duration X

IR Number:	**EC #12**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Vegetation clearing, water drawdown, and mitigations to protect nests and eggs of migratory birds
DAR Section:	6.9.1.7 (Common Nighthawk), 6.9.1.8 (Olive-sided Flycatcher), 6.9.1.9 (Rusty Blackbird), 6.9.1.10 (Horned Grebe), 6.9.2.6 (Waterfowl), 6.9.2.7 (Whooping Crane), 6.9.2.9 (Yellow Rail), 6.9.2.11 (Common Nighthawk), 6.9.2.12 (Olive-sided Flycatcher), 6.9.2.13 (Rusty Blackbird), 6.9.2.14 (Horned Grebe)
TOR Section:	3.3.6 Wildlife – subsections 1.a and 2

Preamble

Section 6 (a) of the Migratory Birds Regulations states that no one shall disturb or destroy the nests or eggs of migratory birds. The best mitigation measure to ensure compliance is to conduct activities with a risk of disturbing or destroying nests or eggs outside of the migratory bird nesting season. High risk activities include disturbance of large amounts of habitat during the nesting season or conducting activities in areas with large concentrations of nesting birds.

The proponent has noted a number of mitigation measures to avoid disturbing or destroying the nests and eggs of migratory birds during vegetation clearing; however, the wording and application of such mitigation measures to migratory bird VECs varies throughout the DAR:

- "Avoid all known or suspected nest sites."
- "Avoid clearing during nesting season from May 15 to August 15."
- "Avoid clearing habitat from May 15 to August 15 to prevent accidental mortality of Olive-sided Flycatcher adults, eggs, and pre-fledged young (as well as other upland breeding birds)."
- "Avoid clearing activities from mid-May to late August."

It is unclear whether the proponent plans to conduct all vegetation clearing necessary for the project outside of the migratory bird breeding season, and if this mitigation measure will be feasible for all project components. EC notes that in the boreal region of the NWT, migratory birds may be found incubating eggs from May7-July 21, and young birds can be present in the nest until August 10.

In addition, it is unclear if and when Ring, Buck and Ball Lake will need to be de-watered prior to the construction of dykes for the Tailings Management Facility. Sudden changes in water level within these lakes or in other lakes downstream during the migratory bird breeding season could result in the abandonment or destruction of nests located near the waterline or built on floating vegetation mats in emergent vegetation (e.g. Horned Grebe).

EC Request #12

For Avalon Rare Metals Inc. to provide:

1. A detailed breakdown of when vegetation clearing and site preparation for different components of the project (mine site, air strip, access road, TMF, etc.) will occur during the construction phase.
2. Mitigation measures to protect the nests and eggs of migratory birds if vegetation clearing cannot be scheduled outside of the breeding season.
3. Details of any de-watering necessary for the construction of the TMF, such as timing, duration, and discharge rates to waterbodies downstream, and mitigation measures to protect migratory birds and their nests and eggs if such activities occur during the breeding season.

Avalon Response #12.1

A detailed schedule of when vegetation clearing and site preparation for the different components of the project (e.g., mine site, airstrip, access road, TMF, etc.) has not yet been developed, but as indicated in the DAR and in the preamble to this Information Request, Avalon is committed to avoiding to the extent possible:

- all known or suspected nest sites.
- clearing during nesting season from May 15 to August 15.
- clearing habitat from May 15 to August 15 to prevent accidental mortality of Olive-sided Flycatcher adults, eggs, and pre-fledged young (as well as other upland breeding birds).
- clearing activities from mid-May to late August.

Avalon Response #12.2

Please see response to Avalon Response #12.1 above. Should vegetation clearing be required between May 15 and August 15, Avalon will ensure that a wildlife biologist will assess the area prior to any clearing activities and develop mitigation plans if species of concern are identified. However, as stated, vegetation clearing during this period will be avoided to the greatest extent possible. Avalon would be pleased to discuss any concerns that Environment Canada may have regarding the proposed mitigation measures.

Avalon Response #12.3

Avalon wishes to advise that there will be no need to de-water Ring, Buck or Ball lakes prior to or during the construction of the TMF. Furthermore, as discussed in Avalon Response #12.1 above, any clearing of vegetation within the TMF area during migratory bird breeding season will be undertaken following an assessment of the area by a wildlife biologist and after mitigation measures are implemented.

IR Number:	**EC #13**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Waterfowl and waterbird – risk of exposure to contaminants or entrapment in the Tailings Management Facility
DAR Section:	6.9.1.10 (Horned Grebe), 6.9.2.6 (Waterfowl), 6.9.2.7 (Whooping Crane), 6.9.2.9 (Yellow Rail), 6.9.2.14 (Horned Grebe), Avalon Response #42 to MVEIRB Deficiency Statement Request #42
TOR Section:	3.3.6 Wildlife – subsection 1.f

Preamble

Section 3.3.6 – subsection 1.f of the Terms of Reference for the Thor Lake Rare Earth Element project require the developer to describe "potential for increased contamination of food and water, including bio-accumulation, from all sources" and to "discuss effects of tailings ponds on waterfowl, other aquatic birds and furbearers."

In response to the MVEIRB Deficiency Statement Request #42, the proponent has stated that it would be unlikely for Horned Grebe and other waterfowl to use the waterbody contained within the TMF due to availability of similar habitat throughout the LSA and RSA. It is unclear if the proponent considered whether the TMF would be subject to earlier thaw and later freeze-up than surrounding waterbodies, which might make the TMF attractive to waterfowl and other waterbirds during spring and fall.

The proponent further states that even if Horned Grebe or other waterfowl spend time on the water in the TMF they would not be harmed or contaminated as the effluent has been predicted to be non-toxic to fish and suspended tailings particles are expected to be inert.

While Table 6.4-3 of the DAR provides predicted concentrations of metals in the lakes downstream from the polishing pond (Drizzle, Murky and Thor Lake), expected concentrations of metals in the TMF sediment, supernatant pond, and polishing pond have not been provided.

The proponent has not provided an assessment of the risk to waterfowl and other waterbirds from using water or sediment within the Hydrometallurgical Tailings Facility at Pine Point.

As recently witnessed at the Meadowbank Gold Project site (Gebauer & Associates, 2010), waterfowl attempted to use open water pools within the tailings management facility during mid-May 2010 and one goose became stuck in the tailings and had to be euthanized. This suggests that the physical properties of deposited tailings can also pose a risk of entrapment to migratory birds.

EC Request #13

For Avalon Rare Metals Inc. to provide:

1. A table that summarizes estimated concentrations of metals along with comparisons to relevant CCME guidelines during operation of the Tailings Management Facility at the Thor Lake site for:
   - sediment in the Tailings Management Facility,
   - water in the supernatant pond (TMF), and
   - sediment and water in the polishing pond.
2. A table that summarizes estimated concentrations of metals along with comparisons to relevant CCME guidelines during operation of the Hydrometallurgical Tailings Facility at Pine Point for:
   - Sediment in the L-37 pit,
   - Water in the supernatant pond in the L-37 pit,
   - Excess supernatant water pumped to the N-42 pit.
3. An assessment of whether tailings management facilities at both sites will be subject to earlier thaw or later freeze-up than other water bodies in the LSA for each site
4. An assessment of whether the physical properties of deposited tailings may pose a risk of entrapment to migratory birds using the tailings facilities
5. A list of potential deterrent methods and devices that could be used to prevent birds and species at risk from coming into contact with tailings or water within tailings facilities should there be a risk of contamination or entrapment

References:

Gebauer & Associates. 2010. Meadowbank Gold Project – 2010 Annual Report. Appendix F – 2010 Wildife Monitoring Summary Report. 154 pp. Available at:

ftp://ftp.nirb.ca/03-MONITORING/03MN107-MEADOWBANK%20GOLD%20MINE/03-ANNUAL%20REPORTS/02-PROPONENT/2010/01-REPORT/Report%20to%20NIRB/

Avalon Response #13.1

As requested, Table 20 identifies the estimated concentrations of metals in the Flotation Plant tailings and in the tailings decant based on shake flask testing conducted by SGS (2011). This decant effluent is also anticipated to be very similar to the quality of the water to be released from the polishing pond. These data are also compared with available MMER and CCME guideline values.

Avalon appreciates that Environment Canada wants to ensure that any birds that may choose to land on the tailings management facility will not be harmed, but it should be noted that CCME guidelines are not typically applied to tailings facilities as such facilities are considered to be a treatment system, and are not considered to form part of the downstream receiving environment.

TABLE 20: NECHALACHO FLOTATION PLANT TAILINGS AND TMF DECANT COMPOSITION

Tailings Solids Component[2]			Parameter	Units	Tailings Liquid Component[1,2]	PP1 Tls Decant Day 5[2]	Regulations and Guidelines	
Parameter	Units	PP1 Tls			PP1 Tls	PP1 Tls	MMER	CCME Guideline Protection of Aquatic Life
SiO_2	%	60.2	Initial pH	units	9.28			
Al_2O_3	%	13.2	Final pH	units	8.81			
Fe_2O_3	%	10.7	**Radionuclide Analyses**					
MgO	%	2.43	226Ra	Bq/L	<0.01	<0.01	0.37	
CaO	%	0.85	228Ra	Bq/L	<0.3	0.3		
Na_2O	%	3.35	210Pb	Bq/L	<0.1	<0.1		
K_2O	%	6.05	**General and Metals Analyses**					
TiO_2	%	0.03	pH	units	7.95	8.20		6.5-9.0
$P2O_5$	%	0.04	Alkalinity	mg/L as $CaCO_3$		119		
MnO	%	0.09	EMF	mV		284		
Cr_2O_3	%	<0.01	Conductivity	µS/cm		617		
$V2O_5$	%	<0.01	TDS	mg/L		400		
LOl	%	1.54	TSS	mg/L		14		
Sum	%	98.5	Cl	mg/L	3.6	44		
Nb_2O_5	%	0.18	SO_4	mg/L		100		
ZrO_2	%	1.52	F	mg/L	1.83	4.43		
			TOC	mg/L		12.2		
			Hg	mg/L	<0.0001	<0.0001		0.000026
			As	mg/L	0.0199	0.0022	0.5	0.005
			Ca	mg/L	21.0	43.7		
			Cu	mg/L	0.0010	0.0023	0.30	Minimum[3] 0.002
			Fe	mg/L	0.041	0.570		0.3
			K	mg/L	8.76	28.8		
			Mg	mg/L	3.20	9.14		
			Mn	mg/L		0.0788		
			Na	mg/L	13.4	70.4		
			Ni	mg/L	0.0059	0.0070	0.50	Minimum[3] 0.025
			Pb	mg/L		0.00060	0.20	Minimum[3] 0.001
			Se	mg/L	<0.001	<0.001		0.001
			Si	mg/L	4.72	8.10		
			Th	mg/L	0.000832	0.000694		
			U	mg/L	0.00535	0.00880		0.015
			Y	mg/L		0.00877		
			Zn	mg/L	0.003	0.007	0.50	0.03

1. CCME guidelines are not typically applied to tailings facilities.
2. Source: SGS Minerals Services. August 30, 2011. Environmental Characterisation of Ore, Concentrate and Tailings from the Nechalacho Rare Earth Element Project – Phase #2. Prepared for Avalon Rare Metals Inc. (Project 11806-007) (Tables 10, 20, and 24)
3. The minimum guidelines have been expressed in this table. The CWQG copper and lead equations determine specific guidelines based on water hardness.
   [copper concentration guidelines = $e^{0.8545[\ln(\text{hardness})]-1.465} * 0.2$ µg/L; nickel concentration guidelines = $e^{0.76[\ln(\text{hardness})]+1.06}$ µg/L; lead concentration guidelines = $e^{1.273[\ln(\text{hardness})]-4.705}$ µg/L.]

Avalon Response #13.2

As requested, Table 21 identifies the solids components of the Hydrometallurgical Plant tailings, and the estimated concentrations of metals and other constituents in the liquid component of the tailings effluent. As clarified in the Part A responses to the MVEIRB, the tailings will consist primarily of inert materials, including gypsum (85%), excess limestone and several ferric and other insoluble hydroxide precipitates.

Avalon anticipates that the surface water in the Hydrometallurgical Plant Tailings Management Facility (L-37 pit), some of which will become the excess water to be directed to the N-42 pit, will be characterized by considerably lower levels of suspended solids (as the retention time of the water will allow the suspended solids to settle) and associated chemical constituents than the levels reported by the SGS (2011) shake flask test results. However, these analytical results are the only data available for comparison with CCME guideline values. It should also be noted that the excess water is expected to infiltrate into the groundwater of the Presqu'ile formation, and is not expected to come in contact with freshwater aquatic life once it infiltrates into this formation.

As indicated in the DAR, Avalon does not anticipate that the supernatant process water will require any further treatment (other than the settling of tailings solids in the HTF prior to discharge of excess decanted process water into the infiltration pit).

Avalon appreciates that Environment Canada wants to ensure that any birds that may choose to land on the TMF will not be harmed, but it should be noted that CCME guidelines are not typically applied to tailings facilities as such facilities are considered to be a treatment system, and are not considered to comprise part of the downstream receiving environment.

TABLE 21: HYDROMETALLURGICAL PLANT EFFLUENT SOLIDS AND SIMULATED EFFLUENT ANALYSIS RESULTS

Solids Component		
Parameter	**Unit**	
$CaSO_4.2H_20$	%	74.26
CaF_2	%	5.72
$Al(OH)_3$	%	4.04
$Fe(OH)_3$+$Fe(OH)_2$	%	13.79
$Mn(OH)_2$	%	0.66
$Th(OH)_4$	%	0.0411
$UO_2(OH)_2$	%	0.0074
$Zr(OH)_2$	%	1.39

Parameter	Unit	Effluent Component[1]	Regulations and Guidelines	
		Tailings of Hydromet Plant	MMER[2]	CCME[3] Guideline Protection of Aquatic Life
Radionuclide Analyses				
226Ra	Bq/L	0.10	0.37	
228Ra	Bq/L	<0.2		
210Pb	Bq/L	<0.1		
General Analyses				
pH	units	7.7	6.0 – 9.5	6.5-9.0
Alkalinity	mg/L as $CaCO_3$	120		
EMF	mV	210		
Conductivity	µS/cm	27,000		
TDS	mg/L	34,000		
TSS	mg/L	--	15	
Cl	mg/L	150		
SO_4	mg/L	25,000		
F	mg/L	2		
TOC	mg/L	54		
NH_3+NH_4	as N mg/L	92		
Metals Analyses				
Hg	mg/L	<0.0001		0.000026
As	mg/L	0.0022	0.5	0.005
Ca	mg/L	<500		
Cu	mg/L	0.0226	0.30	Minimum[4] 0.002
Fe	mg/L	0.15		0.3
K	mg/L	86.8		
Li	mg/L	2.18		
Mg	mg/L	3,400		
Mn	mg/L	6.15		
Na	mg/L	5,500		
Ni	mg/L	0.0701	0.50	Minimum[4] 0.025
Pb	mg/L	0.00052	0.20	Minimum[4] 0.001
Se	mg/L	0.005		0.001
Si	mg/L	2.47		
Sr	mg/L	11.2		
Th	mg/L	0.002945		
U	mg/L	0.0239		0.015
Zn	mg/L	<0.002	0.50	0.03

1. Source: SGS Minerals Services. August 30, 2011. Environmental Characterisation of Ore, Concentrate and Tailings from the Nechalacho Rare Earth Element Project – Phase #2. Prepared for Avalon Rare Metals Inc. (Project 11806-007) (Tables 23)
2. It is anticipated that MMER will not apply to the hydrometallurgical plant.
3. CCME guidelines do not apply to groundwater.
4. The minimum guidelines have been expressed in this table. The CWQG copper and lead equations determine specific guidelines based on water hardness:
   [copper concentration guidelines = $e^{0.8545[\ln(\text{hardness})]-1.465} * 0.2$ µg/L; nickel concentration guidelines = $e^{0.76[\ln(\text{hardness})]+1.06}$ µg/L; lead concentration guidelines= $e^{1.273[\ln(\text{hardness})]-4.705}$ µg/L.]

Avalon Response #13.3

In general, Avalon anticipates that the surface of the ponds that will form in each of the two facilities will freeze up and thaw out in a similar time frame to other shallow waterbodies in the LSA for each site. However, it is also anticipated that at the tailings decant site(s), where typically warm tailings are being actively discharged, localized areas of open water would be expected to occur, possibly throughout the cold weather period.

Avalon Response #13.4

Avalon contacted a colleague who works with the consulting company that reported the entrapment of a single goose in the tailings containment facility of the Meadowbank Gold Project site (Gebauer & Associates 2010), and viewed photographs of this most unfortunate incident.

Given the late winter conditions prevailing at the time of the incident, it appears from the photos examined by EBA, that the goose most probably became stuck in ice that formed around the bird, rather than being entrapped by the tailings. This could be expected to occur as the relatively warm water associated with the tailings discharge would cool as it moved across the shallow surface of the tailings pond.

More importantly, it was surprising to us that the parties involved determined that the best option for dealing with this incident was to shoot the goose (after several days) rather than attempting to extricate the bird. Given the time of year and the prevailing conditions, it would seem likely that the underlying tailings would perhaps still be frozen, or if not, could perhaps still be traversed by a person using snowshoes or some other approach to reach and free the goose.

Nevertheless, this incident emphasizes the importance of regular monitoring of the TMF, particularly during periods when migratory birds are moving through the area to ensure that appropriate mitigation measures could be taken to effectively deal with isolated incidents such as the one described in this IR.

Avalon Response #13.5

Standard deterrent methods and devices commonly used to prevent birds and Species at Risk from coming into contact with tailings or water within the TMF include:

- Removal of riparian and aquatic emergent vegetation to minimize attraction;
- Propane scare cannons;
- Pyrotechnics (scare pistols etc…);
- Alarm and distress audio systems; and
- Radar activated deterrent systems.

However, prior to the adoption of any possible deterrent method, if required, Avalon is committed to consulting with Environment Canada and GNWT ENR to determine the most appropriate method(s) to employ. It should also be noted that as indicated in the preamble to this IR, Avalon continues to maintain that any waterfowl that may choose to spend some time on the water in the TMF would not be harmed or contaminated, as the effluent has been tested to be non-toxic to fish and the tailings are expected to be inert.

IR Number:	**EC #14**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Power lines and other collision hazards for Whooping Crane at the Pine Point Hydrometallurgical Plant site
DAR Section:	6.9.2.7, 10.6.3.6
TOR Section:	3.3.6 Wildlife

Preamble

As noted in the Recovery Strategy for the Whooping Crane (*Grus americana*) in Canada (Environment Canada 2007), current threats to this species include collisions with human made objects such as power lines. It is stated in section 4.8.5.1 of the DAR that power will be provided through the existing NTHC power grid and substation located at the former Pine Point Mine site. It is not stated whether power lines connecting the substation to the hydrometallurgical facilities will be located above-ground or buried.

EC Request #14

1. Please describe the length, location, and design specifications of any power lines needed to provide power to facilities at the Pine Point site.
2. If additional power lines are required at the Pine Point, please describe mitigation measures that will be used to minimize the risk of collision of Whooping Cranes with these lines.
3. Please describe any other tall structures that may pose a collision risk to Whooping Crane at the Pine Point site, and mitigation measures to reduce avian collisions hazards for these structures.

References:

Environment Canada. 2007. Recovery Strategy for the Whooping Crane (*Grus americana)* in Canada . *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. vii + 27 pp.

Avalon Response #14.1

Avalon will use above-ground power lines to connect to the existing power line grid located directly adjacent to the proposed Hydrometallurgical Plant site. The length of the power line from the substation to the nearest building at the Hydrometallurgical plant is approximately 370 m. This area is a large brownfield site, and the land around the plant site is currently bare and flat. The power line would be supported by approximately 10.7 m (35 ft) poles.

Avalon Response #14.2

Avalon sited the Hydrometallurgical facility close to the substation. This minimizes the length of power line required. The power line crosses a barren area far removed from any wetlands where they could possibly interfere with whooping crane take-off or landings. If recommended, Avalon would be willing to install markers on the power line to increase the line's visibility for waterfowl.

Avalon Response #14.3

No other tall structures are planned for the Hydrometallurgical Plant site. The infrastructure at the hydrometallurgical facility is planned on a compact footprint, which minimizes the number of obstacles in whooping crane flight paths.

IR Number:	**EC #15**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Map and calculation of potential additional habitat disturbance within the NWT South boreal woodland caribou range
DAR Section:	2.11.5.3, 2.11.9.1, 6.9.2.1, 10.6.3.5
TOR Section:	3.3.6 Wildlife

Preamble

The proponent has noted that the Pine Point Hydrometallurgical Plant site is within the range of boreal woodland caribou, a species listed as Threatened on Schedule 1 of the federal *Species at Risk* Act. Although the hydrometallurgical plant and tailings facilities will be established on previously disturbed and reclaimed areas of the former Pine Point Mine, it is noted in section 6.9.2.1 of the DAR that the 8 km haul road from the seasonal dock facility to the plant site will result in the loss of a small amount of potential woodland caribou habitat.

Environment Canada posted a proposed "Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada" on the Species at Risk Public Registry on August 26, 2011.

National recovery strategies for federal Species at Risk are planning documents that must identify a species' critical habitat, to the extent possible, and approaches to stop or reverse the decline of the species. The intent of the SARA is to protect critical habitat from being destroyed wherever it occurs.

The proposed recovery strategy for boreal caribou identifies two local population ranges in the Northwest Territories (NWT). The NWT North boreal caribou population is classified as "Self-sustaining", while the NWT South boreal caribou population is identified as a population needed to maintain connectivity (classified as being as likely as not to be self-sustaining). The Pine Point Hydrometallurgical Plant site is located within the NWT South Range. For populations needed to maintain connectivity, critical habitat is defined as undisturbed habitat that will increase over time such that a targeted threshold of 65% of the range is undisturbed. Currently, the NWT South local population range is at 62% undisturbed habitat, already 3% below the 65% undisturbed threshold. Maps of the NWT North and NWT South boreal caribou local populations, range attributes and descriptions of the biophysical attributes of critical habitat are provided in Appendix F-1 and F-2 of the proposed Recovery Strategy available at:

http://www.sararegistry.gc.ca/document/default_e.cfm?documentID=2253

Construction of the Pine Point Hydrometallurgical Plant, tailings facilities, access road and docking facilities could reduce the amount of undisturbed habitat in the NWT South boreal caribou range. According to the proposed national recovery strategy, cumulatively, the total disturbed area in a range is calculated as the area of the anthropogenic footprint plus a 500 m buffer around the perimeter of the footprint (for linear features this equates to the width of the

feature plus a 500 m buffer on either side), plus areas where a fire has occurred in the past 40 years (no buffer applied). EC has made the disturbance data (shapefiles) for boreal caribou available online at:

http://www.data.gc.ca/default.asp?lang=En&n=5175A6F0-1&xsl=datacataloguerecord&metaxsl=datacataloguerecord&formid=F34DCB32-4845-4E88-B125-5AC03C6E4A7F,%20F34DCB32-4845-4E88-B125-5AC03C6E4A7F

Shapefiles are provided for both the buffered anthropogenic disturbance and unbuffered natural disturbance within each boreal caribou local population range across Canada.

EC Request #15

1. For the proponent to provide, using the shapefiles available at the website listed above, a map showing the existing buffered anthropogenic disturbance and unbuffered natural disturbance footprint for the NWT South local population at the Pine Point site, with an overlay of the proposed hydrometallurgical plant site facility and any new infrastructure associated with the project including the access road right of way to the docking site and the dock site facilities. A 500 m buffer around these features should be included on the map.
2. For the proponent to calculate the amount of new disturbance that the project adds to the NWT South boreal caribou local population range, accounting for overlap with the existing anthropogenic and natural disturbance footprint within this range.

Avalon Response #15.1

As requested, Avalon is pleased to provide a new figure (Figure 4), which shows the existing buffered anthropogenic disturbance and unbuffered natural disturbance footprint for the NWT South local population of boreal caribou in the general Pine Point area, with an overlay of the proposed Hydrometallurgical Plant site facility, and any new infrastructure associated with the Project, including the access road right-of-way to the docking site and the dock site facilities.

As can be noted, the limited footprint of the proposed Hydrometallurgical Plant and associated infrastructure (shown in black) are all located within the existing brownfields footprint of the former historic Pine Point Mine (shown in yellow), all of which is located within the much larger buffered anthropogenic disturbance and unbuffered natural disturbance footprint for this area (show in in brown).

Avalon Response #15.2

Based on the information provided above in Avalon Response #15.1, it is apparent that the Project will not add to the amount of existing buffered anthropogenic disturbance and unbuffered natural disturbance footprint in this portion of the South local population of boreal caribou range.

615000 620000 625000 630000 635000 640000 645000 650000 655000 660000

6760000 6755000 6750000 6745000

Great Slave Lake

J-44

L-36

N-42

N W E S

LEGEND

- Contour (20 m)
- Railway
- Road
- Watercourse
- Waterbody
- Vegetation
- Proposed Footprint (January 2012)
- Anthropogenic and 40 Year Fire Disturbance Footprint
- Existing Pine Point Mine Areas

NOTES

Base data source:
Government of Canada Open Data file "Anthropogenic disturbance footprint within boreal caribou ranges across Canada - As interpreted from 2008-2010 Landsat satellite imagery", 2011

STATUS
ISSUED FOR USE

THOR LAKE PROJECT

Anthropogenic Disturbance Footprint within Boreal Caribou Range in the Hydrometallurgical Plant Site Area

PROJECTION UTM Zone 11					**DATUM** NAD83
Scale: 1:125,000 2 1 0 2 Kilometres					
FILE NO. V15101007_004_CaribouDisturbance.mxd					
PROJECT NO. V1510100.012	**DWN** MEZ	**CKD** -	**APVD** RH	**REV** 0	
OFFICE EBA-VANC	**DATE** February 20, 2012				

CLIENT AVALON RARE METALS INC.

eba A TETRA TECH COMPANY

Figure 4

Q:\Vancouver\GIS\ENGINEERING\V15\15101007_ThorLake\Maps\004\RequestForInfo\V15101007_004_CaribouDisturbance.mxd modified 2/20/2012 by morgan.zondervan

IR Number:	**EC #16**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Post-closure Monitoring
DAR Section:	Section 11.1 & 11.4

Preamble

The proponent indicates that post-closure monitoring will be limited to evaluating the success of the re-vegetation effort and is currently envisioned to take place in years 1 and 5 post-closure. No information on whether other types of monitoring, such as water quality or wildlife use, will also be conducted during this time even though the need to monitor in order to establish that licensed criteria have been met prior to final clearance to abandon the site is mentioned.

EC Request #16

1. The proponent is asked to provide further details on the types of monitoring to be conducted in order to establish that licensed criteria have been met, as well as estimates of the length of time and frequency that monitoring activities will need to continue post-closure. Additionally, including a description of monitoring activities taking place during closure may be pertinent to understanding post-closure monitoring activities.

Avalon Response #16

Avalon currently anticipates that post-closure monitoring activities will occur for a five year period. However, this is partially dependent on the achievement of licensed criteria and closure goals that will be established for the Project. If the closure criteria are not being met, corrective action will be taken and the monitoring period may be extended.

The amount and frequency of post-closure monitoring required is expected to diminish as reclamation activities near completion and the results of monitoring indicate that environmental performance is meeting the established reclamation objectives. Monitoring will continue after reclamation is complete and will focus on re-vegetation efforts, surface stabilization efforts, and surface and groundwater quality. Post-closure monitoring is envisioned to be conducted at Year 1 and Year 5 post-closure, as a minimum.

IR Number:	**EC #17**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Tailings Management Facility Closure at Mine Site
DAR Section:	Section 11.2.2

Preamble

The aim of the reclamation strategy will be to return the facility area to a more natural condition. This will be done by capping the tailings surface, controlling surface runoff, and removing infrastructure. However, the strategy as written does not include any mention of the anticipated post-closure water quality or seepage potential from the facility.

EC Request #17

The Proponent is asked to:

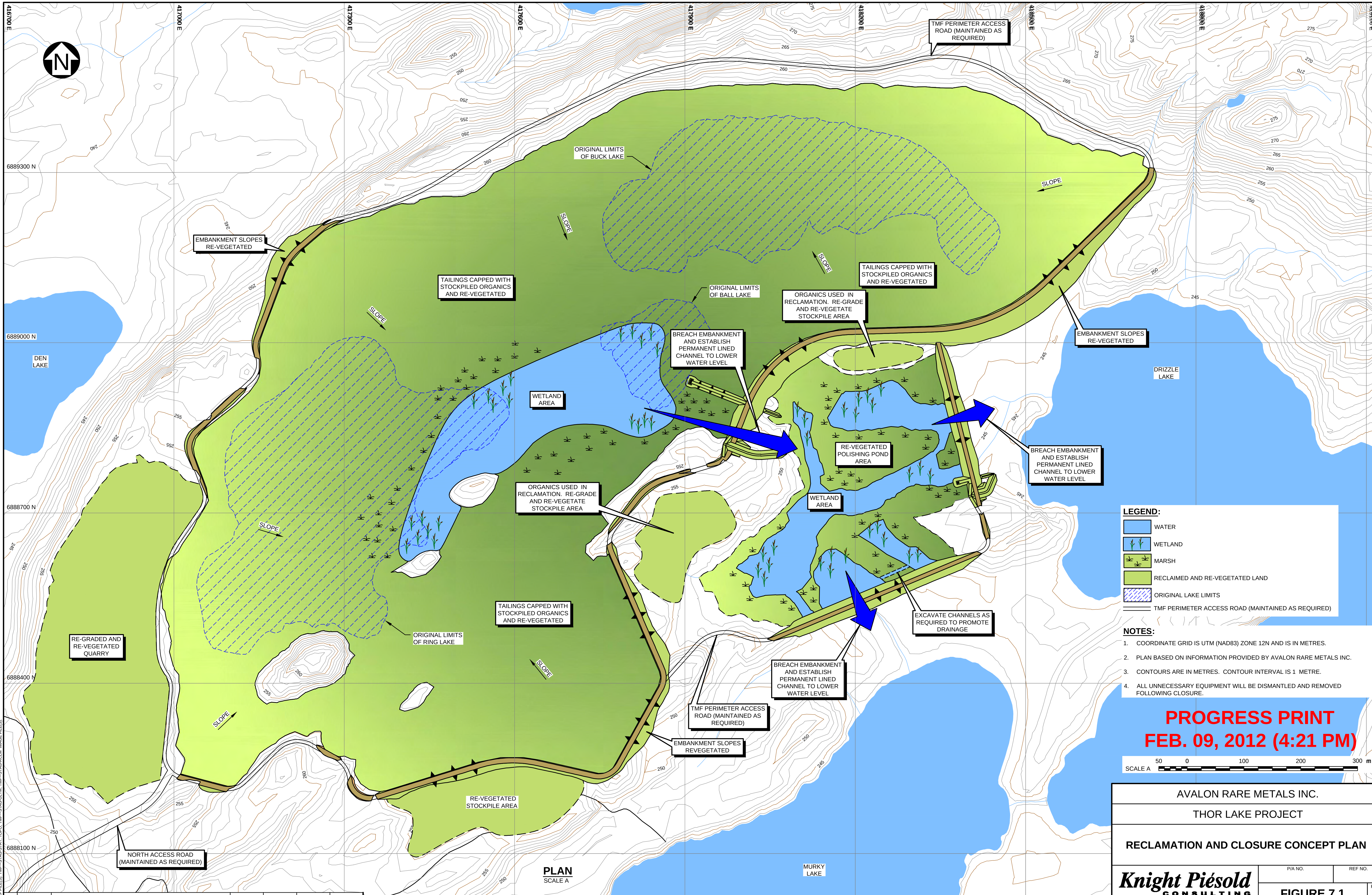
1. Elaborate on what is meant by a 'more natural condition'.
2. Improve the description of the cover design and having taken into account both potential surface runoff and seepage into the facility.
3. Provide a discussion of the anticipated water quality from the facility following post-closure.

Avalon Response #17.1

As indicated in Section 11.2.2 of the DAR and the Conceptual Closure Plan prepared for the Thor Lake Project, the term "more natural condition" is intended to mean that the primary objective of the closure and reclamation initiatives will be to transform the TMF area to its pre-mining usage and capability to the greatest degree practical. The conceptual closure plan will be regularly updated with the input of regulators, land users, stakeholders, and Aboriginal governments and organizations.

In this environment and at this location, closure and reclamation will focus on stabilizing and covering the exposed tailings surface and re-establishing surface flow patterns, while ensuring that acceptable downstream water quality is maintained. The most updated general concept for closure of the Nechalacho Mine TMF is shown in Figure 7.1.

As shown in this figure, the proposed closure of the TMF will include the re-development of several marsh and wetland areas and the re-establishment of surface flow patterns within the limits of the TMF and associated polishing pond.



AVALON RARE METALS INC.

THOR LAKE PROJECT

RECLAMATION AND CLOSURE CONCEPT PLAN

Knight Piésold CONSULTING

FIGURE 7.1

Avalon Response #17.2

Given the relatively inert and non-reactive nature of the Flotation Plant tailings that will be directed into the TMF, Avalon currently does not envisage the need for a complex tailings cover design. Instead, Avalon's current strategy is to focus on the development of a suitable vegetative cover that will enable the establishment of the marsh, wetland and vegetated upland conditions illustrated in Figure 7.1 (in Avalon Response #17.1). As discussed in Avalon Response #17.3, Avalon does not anticipate that there will be any water quality issues associated with the closure of the TMF.

Avalon Response #17.3

As reported in Section 6.4.2.6 of the DAR and various follow-up responses to the MVEIRB, AANDC and Environment Canada, the water quality modelling conducted for the Thor Lake Project during the operations period, indicates that in the downstream receiving environment, the CCME guideline values will be met over the entire 20 year simulation period.

Concentrations of metals reaching Thor Lake are predicted to be extremely low. For example, arsenic will be 0.034% of the CCME guideline; mercury 0.3% of the CCME guideline; and, copper, 0.04% of the MMER guideline.

Further dilution of water flowing out of Thor Lake is anticipated as it progresses through a series of wetlands, streams and lakes towards Great Slave Lake, comprising a watershed estimated to be more than three times the catchment of Thor Lake. As such, it is expected that metal levels in water entering Great Slave Lake will be similar to pre-development background levels.

Based on these results, Avalon is confident that closure and post-closure water quality conditions will be maintained. The post-closure water quality monitoring that will be conducted is anticipated to confirm this prediction.

IR Number:	**EC #18**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Settling Pond and Polishing Pond Closure at Mine Site
DAR Section:	Section 11.2.3

Preamble

A settling pond and polishing pond are included in the list of management components specific to the tailings management facility, but the closure of these items are not addressed in the reclamation strategy.

EC Request #18

1. Provide information on how the settling pond and polishing pond, which form part of the tailings management facility water management infrastructure, will be closed at the end of operations.

Avalon Response #18.1

The settling pond discussed in the DAR will be a small pond to be constructed in the vicinity of the Flotation Plant to collect run-off and drainage from the Flotation Plant footprint area. During closure, it is anticipated that it may be determined to be desirable to maintain this pond as a pond. Alternatively, the pond could be infilled and revegetated.

The current plan for reclaiming the Polishing Pond component of the Tailings Management Facility is to restore it to a marsh and wetland area as illustrated in an updated figure (Figure 7.1), which is provided in Avalon Response #17.1.

IR Number:	**EC #19**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Tailings Cover Design at Hydrometallurgical Plant Site
DAR Section:	11.3.2

Preamble

The main objective at the Hydrometallurgical Plant tailing management facility is similar to the tailing at the mine site in that the facility will be transformed into a more natural condition to the greatest degree possible, but what this means is not clearly defined. It is also of interest, what type of nearby waste and overburden material will be used for closure and what the anticipated final cover design will be.

EC Request #19

The Proponent is asked to:

1. Elaborate on what is meant by a 'more natural condition'.
2. Improve the description of the cover design, including type of cover material used, and having taken into account both potential surface runoff and seepage into the facility.

Avalon Response #19.1

As previously indicated in Avalon's Response #29 to MVEIRB's Deficiency List (Part 2), the existing "natural condition" of the L-37 pit is as generally illustrated in Photo 1.

Photo 1: L-37 Pit, looking southwest

For the future closure of the Hydrometallurgical Plant Tailings Management Facility (L-37 pit), the current plan is to place a cover, comprised of the readily available till over the top of the gypsum tailings to facilitate the establishment of a more natural vegetative cover over the impacted area. The most updated general concept for the future closure of the L-37 pit is shown in Figure 7.2. As shown in this figure, the proposed closure of the Hydrometallurgical Plant Tailings Management Facility will include the development of a pond/ wetland area and the establishment of a vegetated cover over the impacted area. The conceptual closure plan will be continually updated with the input of regulators, land users, stakeholders, and Aboriginal governments and organizations.

Avalon Response #19.2

Please refer to Avalon Response #19.1 above.

LEGEND:

- WATER
- WETLAND
- MARSH
- RECLAIMED AND RE-VEGETATED LAND
- ORIGINAL TILL STOCKPILE LIMITS
- ACCESS ROAD (MAINTAINED AS REQUIRED)

NOTES:

1. COORDINATE GRID IS UTM (NAD83) ZONE 11N AND IS METRES.
2. PLAN BASED ON INFORMATION PROVIDED BY AVALON RARE METALS INC., DATED NOVEMBER 1, 2010.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 0.5 METRES.
4. ALL UNNECESSARY EQUIPMENT WILL BE DISMANTLED AND REMOVED FOLLOWING CLOSURE.

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AVALON RARE METALS INC.

THOR LAKE PROJECT

RECLAMATION AND CLOSURE CONCEPT PLAN

Knight Piésold CONSULTING

P/A NO. REF NO. REV

FIGURE 7.2

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IR Number:	**EC #20**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Treatment of Tailings Management Facility (TMF) discharges and Nutrient Effects
DAR Section:	4.8.4.1; 6.3.5; 6.4.2.6; 6.4.3.3; Appendix A1 Figure 6-28 and Appendix B Table B-1; MVEIRB IR #32

Preamble

In the DAR, the Proponent states that tailings supernatant water from both facilities (the TMF and HTF) will be treated if necessary prior to release. Modeling of predicted metals levels was done, and it is anticipated that concentrations will be below levels regulated in the MMER, and will not result in receiving environment concentrations which exceed water quality guidelines. The response to MVEIRB IR #32 states that beyond settling and possible use of a polishing pond, further treatment of the TMF effluent is not envisaged.

The addition of nitrogen from blasting was also modeled, and it is predicted that seasonal algal blooms will change with an additional early bloom occurring, and summer blooms remaining similar to baseline, and a net overall increase in plankton biomass. However, the modeling does not include increases in phosphorus inputs, assuming concentrations will remain at about 0.001 mg/L in all inputs. Accordingly, it concludes that phosphorus will remain the limiting nutrient.

EC feels more realistic baseline and project-related increases in phosphorus in discharges need to be accounted for. Historical and baseline concentrations of total phosphorus range from 0.003 to 0.70 mg/L in the project area. Phosphorus loadings to the environment will increase due to inputs of bioavailable phosphorus from sewage and reagent use and total phosphorus from surface water inputs (i.e. runoff over disturbed areas) and mine water.

As a consequence of increased algal and zooplankton biomass, there would be an increased oxygen demand at the sediment-water interface due to the decomposition of plankton. The DAR notes that this will not be significant due to wind and wave mixing keeping the water well oxygenated, but does not evaluate winter conditions.

EC Request #20

Please address the following questions:

1. What discharge criteria for metals and nutrients does Avalon envision meeting, and what contingencies are planned for treatment processes?
2. The polishing pond at the TMF is described as an option, how will not incorporating this into the TMF affect discharge quality?

3. Water quality modeling does not predict discharge and receiving environment concentrations of phosphorus, please provide and evaluate.
4. Have nitrogen inputs from camp wastewater been factored into the predictions?
5. How will winter dissolved oxygen levels respond to the increased oxygen demand associated with the additional plankton decomposition?

Avalon Response #20.1

As discussed in Section 6.5.3.1 of the DAR and elsewhere, the effluent to be discharged from the TMF will be required to comply with the terms and conditions, including effluent quality criteria, of the future MVLWB Water Licence and the effluent quality criteria of the Metal Mining Effluent Regulations. In addition, aquatic environmental effects monitoring, which will also be required, will assist in ensuring that the downstream aquatic environment in the area of the Nechalacho Mine site will be protected.

Avalon Response #20.2

The Polishing Pond component of the Nechalacho TMF was described as an option because this component may not be needed if it is determined, based on initial effluent quality monitoring in the first year (prior to full development of the TMF), that all licensed criteria are consistently met without the need for a permanent polishing pond.

Avalon Response #20.3

As discussed in Section 6.4.3 of the DAR, because the response of phytoplankton to increased nitrogen is a complex process, related also to levels of phosphorous, water temperature and sunlight primarily, a numerical model of the phytoplankton population considering these additional processes was used to determine the possible effects of nitrogen enrichment on phytoplankton productivity during mine operations.

The dynamics of the phytoplankton population and possible changes were simulated through the use of a three-dimensional hydrodynamic model (H3D) coupled with the phytoplankton equations as employed in CE-QUAL-W2, (Cole and Wells 2008), supported by the Army Corps of Engineers, a widely used two-dimensional, laterally averaged hydrodynamic and water quality model. The water quality module is readily transported to three dimensional systems such as H3D.

The phytoplankton model also simulates the population of herbivorous zooplankton, which forms an essential part of the population dynamics of phytoplankton, the nitrogen and phosphorous uptakes by phytoplankton, and the regeneration of nitrogen and phosphorus from phytoplankton and herbivore respiration, metabolic products and death/decay.

As discussed above and in the DAR, phosphorus was incorporated in the modelling that was conducted and predicted phosphorus and nitrogen concentrations in the TMF and in Thor Lake were presented in Figures 6.4-8, 6.4-9 and 6.4-10 of the DAR.

Avalon Response #20.4

The nitrogen inputs from the camp wastewater were not specifically factored into the nutrient and numerical modelling effort because pilot plant effluent was used as the basis for determining effluent constituents. However, as indicated in the DAR, a state-of-the-art packaged RBC sewage treatment system (with nitrogen and phosphorous removal) will be used to effectively treat the domestic sewage that will be generated at the Nechalacho Mine and Flotation Plant site.

In addition, it is understood that the treated effluent contribution of the RBC sewage treatment system will comprise less than 2% of the Flotation Plant process effluent, which will be co-mingled prior to being pumped to the TMF.

Avalon Response #20.5

The following conclusions from the nutrient and phytoplankton modelling described in DAR Section 6.4.3.2, serve to inform the prediction of dissolved oxygen (DO) levels due to possible increases in nitrogen inputs to downstream waterbodies:

- the additional nitrogen introduced by the TMF decant water appears to trigger an additional early and short-lived spring bloom, followed by a more typical extended summer bloom;
- the summer bloom remains about the same as the existing baseline case;
- the main result of the addition of nitrogen to the system is to initiate algal production in the spring;
- phosphorous, which is not anticipated to increase in concentration, will continue to limit algal production;
- the annual peak phytoplankton biomass remains stable even as the annual peak nitrogen values rise in the system; and
- oxygen supply due to wind and waves is predicted to exceed oxygen consumption due to the decay of additional planktonic biomass.

Existing baseline data indicates that DO in Thor Lake is uniformly distributed through the water column in all seasons except winter (DAR Figure 2.6-2b), indicating relatively thorough mixing of oxygen due to the action of wind and waves. In winter, DO levels gradually diminish, reaching levels of <2 mg/L near the bottom. At ice-out and subsequent spring turnover, high oxygen levels at depth are quickly restored.

Changes in water quality due to cultural nutrient enrichment can result in modifications to phytoplankton community composition (Medupin 2011) and biomass, with potential cascading effects on higher trophic levels. Prolonged algal blooms would have the potential to increase biological oxygen demand, particularly in winter. However, since phosphorous is expected to limit phytoplankton production and is not anticipated to increase in concentration as a result of the Project, overall production in Thor Lake and further downstream is not predicted to increase significantly. It is apparent that oxygen levels during the open water season are more than adequate to satisfy demand. In winter, a depression of oxygen concentrations below baseline levels at depth is

not anticipated to occur, since the small increases in biomass in the spring will not likely lead to appreciable benthic accumulations of organic material.

These predictions will be validated during the operations phase of the mine by focussed monitoring, which will include winter water quality sampling to measure nutrient and oxygen levels.

Reference:

Medupin, Cecilia. 2011. Phytoplankton Community and Their Impact on Water Quality: An Analysis of Hollingsworth Lake, UK. J. Appl. Sci. Environ. Manage. 15(2) 347-350.

IR Number:	**EC #21**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Explosives Management
DAR Section:	6.6.2.3 Use of Explosives (P. 505); Table 4.7-6

Preamble

The main source of ammonia, nitrite and nitrate to wastewater is from blasting. Aquatic effects associated with nitrogen compounds are to be mitigated by the implementation of best management practices. Avalon has estimated a loss rate of 4% based on usage and the expectation of fairly dry mining conditions.

EC Request #21

1. Will the loss rate of 4% increase significantly if conditions are wetter than predicted?
2. Please provide an outline of an explosives management plan which describes best management practices.

Avalon Response #21.1

The loss rate calculation of 4% is based on the estimated amount of residual ammonia that may be released to the aquatic environment during normal operations regardless of the amount of water inflow. This is due in part by the explosives loading methods being done by mechanical and pneumatic means, which substantially reduces the possibility of overspill conditions as opposed to historic, manual methods.

Avalon Response #21.2

As requested, Avalon is pleased to provide the following outline for an explosives management plan:

1. Introduction
2. Blaster in Charge
3. Hazard and Risk Assessment
4. Explosives Storage
5. On-Site Explosives Transportation
6. Blast Design
7. Blast Planning
8. Drilling
9. Blast Loading
10. Initiation Hook Up Procedures

11. Blast Area Clearing and Security Procedures
12. Miss-Fire Procedures
13. Blast Emergency Plan
14. Blast Reports

Avalon will require the blasting contractor retained to provide this service to produce the necessary explosives management plan and to ensure that best management practices are employed while operating at the Nechalacho Mine and Flotation Plant site.

IR Number:	**EC #22**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Aquatic Effects Monitoring
DAR Section:	6.14.1, 11.4 (p. 950); MVEIRB IR #46

Preamble

The DAR states in several places that aquatic monitoring will be used to confirm modeling predictions, including predictions about primary and secondary productivity. Descriptions of the Aquatic Effects Monitoring Plan (AEMP) focus on the Metal Mining Effluent Regulations requirements, and reiterate information from the Environmental Effects Monitoring (EEM) Technical Guidance Documents. This format will not necessarily cover all the aspects which would form the broader AEMP typically required by a water licence. For example, the EEM program does not include plankton and sediment chemistry, and frequencies of monitoring vary.

The purpose of having a preliminary study design or framework for the project monitoring is to engender confidence that the proponent will have the ability to detect the changes predicted in the DAR, and to detect and mitigate changes which were unpredicted.

Ideally, some idea of the study design and statistical tests would be provided to allow for evaluation of the adequacy of baseline studies. One of the more powerful study designs utilizes the Before-After-Control-Impact approach, and by having details of how the monitoring would be set up, reviewers can ensure compatibility between pre- and post-disturbance monitoring studies. For example, the sediment baseline has 1-3 grabs for each sample site. MMER EEM recommends 5. Similarly, for benthic invertebrates, for the first EEM phase it is recommended that the survey consist of the following:

1) At least 2 study areas: reference and high effluent exposure area;
2) At least 5 replicate stations in each of the 2 study areas; and
3) A minimum of 3 field sub-samples to be taken at each station.

The methodology used in the baseline survey would not match this, 3 grabs per lake were taken and composited (p. 121).

The existing baseline provides a very useful background for environmental quality and developing predictions and effects, but it may be prudent to plan for a further field season to address any inconsistencies in sampling methods or sites prior to construction.

EC Request #22

1. How will baseline data be used and/or supplemented to design a more robust AEMP study? Will further sampling be done in advance of construction?
2. Please describe and define the local and regional study areas for water quality, sediment quality, zooplankton, productivity, benthos and fish.
3. Post-closure aquatic monitoring should be described.

Avalon Response #22.1 and #22.2

A Conceptual Aquatic Effects Monitoring Plan (AEMP) has been prepared for the Avalon Thor Lake Project. This document, which is included as Attachment 1, defines the boundaries, sampling locations, parameters, and sampling frequency of the aquatic monitoring studies. The table below, which is reproduced from Table 3 of the conceptual AEMP, summarizes the various components of the sampling program. In addition to the sampling identified in this table, periodic biological sampling (fish, benthic invertebrates) will be carried out in adherence to the schedule required by the MMER.

TABLE 3: SUMMARY OF AEMP SAMPLING PROGRAM

Reason for Sampling	Sampling for…	Location	Frequency
MMER	Effluent characterization (MMER regulated substances)	Final discharge point	Weekly
	Acute lethality testing	Final discharge point	Monthly
	Daphnia magna testing	Final discharge point	Monthly
	Cumulative effluent volume	Final discharge point	Monthly
	Effluent analysis (analyses other than MMER regulated substances)	Final Discharge Point	Quarterly
	Water quality (analyses other than MMER regulated substances)	Exposure area adjacent to final discharge point	Quarterly
	Sublethal testing of 4 trophic level organisms	Final discharge point	Twice yearly
	Biological monitoring studies (fish, invertebrates, sediments, water quality)	Murky, Thor, A, Kinnikinnick and Redemption lakes*	Variable (see Section 2.4.1.3) Usually every 3 years
SNP*	Water quality	13 locations in 10 lakes	Monthly
Avalon Initiative	Phytoplankton, zooplankton, benthic invertebrates	Same as SNP sampling sites	Annually

*Proposed

The availability of considerable background biological data from all potentially affected lakes and from two reference lakes provides the basis for a before-after control-impact (BACI) monitoring design to account for environmental variability and temporal trends found in both the control and exposure areas. In Thor Lake, for example:

- Water quality analyses are available for winter and fall in 2008; March, June, and September, 2009; and April, June, September and October, 2010.
- Phytoplankton and zooplankton samples were collected for analysis in June and September, 2009 and 2010.
- Benthic invertebrate sampling occurred in September 2009 and 2010.

This large set of baseline data, which has been collected from georeferenced locations in conjunction with the establishment of two control sites, will provide ample data for the identification of effects and trends. It should be noted that monthly Surveillance Network Program (SNP) sampling will commence prior to mine operational start-up, thereby providing further baseline data. As well, discharges from the TMF will not begin until several months following the commencement of operations, due to the time required to fill the facility, giving further time for the collection of additional water quality and aquatic biota sample collection.

Avalon Response #22.3

At post-closure, Avalon proposes to continue the SNP water quality sampling program for a three to five year period. The actual duration and sampling frequency will be determined during permitting discussions with the Mackenzie Valley Land and Water Board. Decisions regarding the sampling program will likely be influenced by monitoring results obtained during the life of the Project.

In addition, Avalon will adhere to the biological monitoring requirements stated in the MMER. Post-closure monitoring mimics the environmental effects monitoring (EEM) program conducted during the Project operations phase and must be conducted within six months of the submission of a Study Design, which is submitted following mine closure.

IR Number:	**EC #23**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	End of Pipe Effluent toxicity evaluation
DAR Section:	page 451; Table 6.4-3

Preamble

The last point of control for tailings effluent discharge will be the tailings pond or polishing pond going into Drizzle Lake. Although the DAR (p 451) says Drizzle is non-fish-bearing, it is downstream of the last point of control, represents the receiving environment, and drains into Murky Lake and other downstream waters which are frequented by fish.

The DAR provides predictions of various metal species in Murky, Thor and Drizzle Lakes, and for the parameters evaluated, it appears that effluent quality will meet guidelines for the protection of aquatic life. Guidelines however only evaluate single parameter effects and do not have provision for combinations of chemicals. Bioassay testing allows for an evaluation of the quality of the whole effluent.

EC Request #23

1. Has any acute and chronic toxicity testing been done with simulated effluent? Please provide results.

Avalon Response #23

Avalon is pleased to advise that preliminary acute toxicity testing was completed for the 5-day decant solution generated in the pilot plant testing program which was undertaken by SGS Canada Inc. in 2010. The acute toxicity test results were presented in Section 4.9 of the SGS report, which is available on the MVEIRB public registry. The interim report version of this document was provided as Appendix L of the DAR.

A summary of the test results is provided as follows. Acute toxicity testing was conducted in 2010 on the simulated 5-day decant (effluent) using Daphnia (*Daphnia magna*) and rainbow trout. The test work was carried out by Aquatox Testing and Consulting Inc., in accordance with the Daphnia Acute Lethality Toxicity Protocol EPS 1/RM/14 and the Acute Lethality of Liquid Effluents to Fish Protocol EPS 1/RM/13 of Environment Canada.

The test organisms (*Daphnia* and rainbow trout) were exposed to a range of effluent concentrations including 100%, 50%, 25%, and 6.3% and no mortalities occurred at any of the exposure concentrations or the controls. It was therefore determined that the 5-day decant solution tested was not acutely toxic to either Daphnia or rainbow trout.

Chronic toxicity testing was not completed at that time. Avalon has now directed SGS and its bioassay laboratory sub to complete a new round of both acute and chronic toxicity testing on Nechalacho Flotation plant effluent in conjunction with the next round of pilot plant testing expected to occur in March 2012 with tests taking 30-60 days.

IR Number:	**EC #24**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	Reagent list
DAR Section:	page 485

Preamble

During the processing and hydrometallurgical processes various reagents are used. Many of these are listed by their trade names with no indication of the chemical composition nor toxicity.

EC Request #24

1. Please provide Material Safety Data Sheets for reagents to be used at the processing plant and the hydrometallurgical plant.

Avalon Response #24

Avalon is pleased to advise that Appendix A of Avalon's Hazardous Materials Spill Contingency Plan contains the MSDS sheets for all reagents anticipated to be encountered at both sites. A copy of this Plan is provided as Attachment 2 to this Environment Canada response document.

IR Number:	**EC #25**
Source:	Environment Canada
To:	Avalon Rare Metals Inc.
Subject:	HTF Water Management
DAR Section:	4.8.3.1; page 518; Figure 4.8-7

Preamble

Fresh water for use in the hydrometallurgical plant will be drawn from the historic open pit designated T-37 and from the runoff settling pond. Tailings will be discharged to the L-37 pit where water will be collected at the north end and excess water piped to the N-42 infiltration pit.

EC Request #25

1. Has ice entrainment and ice cover on the supernatant pond been taken into account for the volume calculations?
2. Will available fresh water volumes be maintained in winter conditions?
3. Has consideration been given to recycling water from the HMF?

Avalon Response #25.1

In responding to this IR, it should be noted that as previously reported to the MVEIRB, the T-37 historic open pit is no longer the planned location for the freshwater supply. Since the location of the planned Hydrometallurgical Plant was moved from the location identified in the DAR to the larger brownfields area where the historic Pine Point smelter was located, the location of the fresh water supply also changed. The J-44 historic open pit is now proposed to be used as the fresh water supply pit.

Notwithstanding the change in location of the freshwater supply, ice entrainment into the tailings mass to be deposited into the Hydrometallurgical Plant Tailings Management Facility (HTF) (L-37 pit) mass is not considered to be an issue for the HTF.

With the exception of the first year of operation, the tailings level in the L-37 pit will rise between 1- 2 m each year, reducing to less than 1 m/year by Year 10. With this low rate of rise, any ice that may form within the tailings deposited during the winter (<1 m) is anticipated to be melted from the impacts of newly deposited tailings/supernatant and the ambient temperatures in the summer months.

Additionally, given that end-of-pipe discharge will be used for deposition, the concentrated flow of tailings will further reduce the potential for ice lens formation within the deposited tailings during the winter.

Note that no permafrost has been documented in the area directly around the L-37 pit (HTF) and thus combined with the low rate of rise and deposition method, long term ice entrainment is not considered to be an issue. During operations, should issues arise related to ice entrainment within the deposited tailings, depositional methods will be adjusted as necessary to ensure that ice entrainment does not occur.

Winter ice cover is always considered during water balance and volume calculations. For the case of the HTF, ice cover will have a negligible impact on operations due to the small pond area. The system has been designed with sufficient flexibility (i.e., water infiltration into HTF pit walls or excess water transfer to the N-42 pit) to allow all possible scenarios to be handled with relative ease.

Avalon Response #25.2

Avalon does not anticipate that there will be any difficulty with maintaining freshwater volume in winter conditions as both the former water source pit (T-37 pit) and the current water source pit (J-44) have large volumes of available water and are continuously fed by groundwater from the Presqu'ile formation. It has been assumed that either pit would have the capacity to provide the approximate 700 m^3 of fresh water required by the Hydrometallurgical Plant process per day consistently throughout the year.

As discussed in Section 6.5.2.1 of the DAR, a groundwater flow model (using visual MODFLOW software) was created to simulate the current hydrogeological flow conditions at the Pine Point site and to estimate the effects of implementing the water management plan for the Hydrometallurgical Site, including the pumping of water from the T-37 pit and the infiltration of excess water into the N-42 pit. The results of this were summarized in Knight Piesold (2010g), which was presented in Appendix C.10 of the DAR. Avalon is of the opinion that the modelling results for water withdrawal from the T-37 pit are equally applicable to water withdrawal from the J-44 pit.

Results of the groundwater flow model indicated that there is expected to be very little effect on the groundwater regime at the Pine Point site in response to the pumping and discharge/infiltration proposed as part of the Hydrometallurgical Site water management plan, given the rates used in the model. Groundwater drawdown in the vicinity of the T-37 pit was estimated to be approximately 1 m below the expected pre-pumping level after 20 years of pumping. Groundwater levels in the vicinity of the N-42 pit were expected to increase by approximately 0.1 m above the simulated pre-discharge conditions after 20 years of discharge/infiltration.

Avalon Response #25.3

Avalon is currently investigating the potential for recycling water from the HTF back to the Hydrometallurgical Plant, which would reduce flows to the infiltration pit. The DAR did not consider recycling water primarily because of the large volume of available groundwater, which is being used as the source water, and the negligible anticipated effect of groundwater use, as discussed in Avalon Response #25.2 above.

ATTACHMENTS

Attachment 1: EBA, A Tetra Tech Company (EBA). February 2012. Conceptual Aquatic Effects Monitoring Plan. A plan prepared by EBA for Avalon Rare Metals Inc.

Attachment 2: Avalon Rare Metals Inc. January 2012. Hazardous Materials Spill Contingency Plan: Response Procedures for Site Personnel. Prepared for the Thor Lake Project.