AGNICO EAGLE

December 18, 2015

Phyllis Beaulieu
Manager of Licensing
Nunavut Water Board
Gjoa Haven, NU, X0E 1J0

Re: Type A Water Licence, No. 2AM-MEL Pre-Hearing comference commitment 20, 21 and 22

Dear Ms. Beaulieu,

We would like to thank the Environment Canada (EC) for their comments and review of the Type A Water Licence for the Meliadine Gold Project (Project). On November 12, 2015 Environment Canada, Agnico Eagle Mines Limited (Agnico Eagle), and Golder Associates Ltd. (Golder) met to address Pre-Hearing Conference commitment 20 (EC_6), 21 (EC_7) and 22 (EC_9). On December 8, 2015 Environment Canada, Agnico Eagle, and Golder met to discuss preliminary responses to outstanding technical comments. EC_6, EC_7, and EC_9 were considered outstanding issues that required resolution. Following the December 8, 2015 meeting, Agnico Eagle prepared final responses to these technical comments. A summary of the outstanding concerns, recommendations, and additional questions from Environment Canada, and Agnico Eagle's responses are provided below.

Topic: Commitment 20 - Effluent Quality Criteria (EQC) (EC_6)

Issue/concern from Environment Canada:

Environment Canada provided the following issue/concern in their technical comments in October 2015.

"All contact water, including site runoff from collection ponds, underflow sludge water, pre-treated landfarm and truck washbay water, will be managed in water management pond CP1. Treatment for suspended solids will be used and this will also reduce parameters associated with particulates. If water quality discharge criteria are met, effluent volumes in excess of that needed in the mill for use as make-up water will be pumped from CP1 to Meliadine Lake.

In developing the proposed list of parameters to have discharge criteria, the Proponent has focused on constituents regulated under the Metal Mining Effluent Regulations (MMER) and on those parameters which have predicted end-of-pipe concentrations above the Water Quality Objectives (either Site-Specific or CCME guidelines). This evaluation relies on the water quality predictions for which a reasonably comprehensive suite of parameters has been evaluated. Table 3-2 of Appendix H proposes limits for TSS, pH, total phosphorus, total cyanide, arsenic, copper, lead, nickel and zinc. The proposed list of Effluent Quality Criteria (EQC) should be broadened to include parameters which may vary due to modeling uncertainty and/or which carry environmental concerns, including total dissolved solids (TDS), ammonia (as nitrogen), aluminum, and Total Petroleum Hydrocarbons. BTEX are not expected to be an issue, but could be monitored rather than regulated.

Proposed EQC for several parameters are higher than the modeled end-of-pipe concentration (Appendix E, Table 2.3-3 Near-Field Modeling and Diffuser Design) that would be needed to achieve the edge-of-mixing zone water quality objectives. For example, the edge of mixing zone objective for copper is 0.004 mg/L and can be met with maximum discharge concentrations of no more than 0.19 mg/L. Setting a lower EQC than the proposed limits for copper of 0.3 mg/L Average Monthly and 0.6 mg/L Maximum Grab would be feasible, as these are higher than the predicted end-of-pipe concentrations of 0.0047 mg/L.

Similarly, lower EQC could be set for Total Phosphorus, Total Cyanide, arsenic, and zinc based on meeting water quality objectives at the edge of the mixing zone in Meliadine Lake. Note that the arsenic predicted EOP concentration is higher than the maximum discharge concentration that would achieve the receiving environment objective.

Where appropriate for environmental protection, and feasible for compliance, EQC should be set in accordance with meeting water quality objectives (WQO) within the proposed mixing zone."

Recommendation:

Environment Canada provided the following recommendation in their technical comments in October 2015.

"The Proponent is required to comply with the Fisheries Act, which prohibits the deposit of deleterious substances into bodies of water frequented by fish and requires end-of-pipe compliance. EC's recommendations for EQC parameters are in addition to the Metal Mining Effluent Regulations in order to include parameters which may vary due to modeling uncertainty and/or parameters which carry environmental concerns."

Additional Questions:

For most of the effluent parameters, agreement was reached on the average and maximum concentrations. For the remaining effluent parameters, Environment Canada requested Agnico Eagle to provide additional information to justify the proposed EQC values. A summary of the outcome of the EQC discussion is as follows:

- pH and Total Suspended Solids
    - Effluent will meet the MMER limits for pH and TSS (Government of Canada 2012).
- Total Dissolved Solids (TDS)

    - Propose a TDS limit with a breakdown of the proportion of ions and provide predicted hardness
    - Agnico Eagle is proposing a TDS_{meas} limit of 1,400 mg/L (both average [average monthly concentration] and maximum [maximum concentration in a single sample]
- Ammonia
    - Agnico Eagle is requesting an average and maximum limit of 14 and 18 NH_4-N mg/L.
    - Provide operational experience from Meadowbank to support this request.
    - Look into toxicity studies for ammonia limits that do not pose acute toxicity issues.
    - Determine if the predicted ammonia include cyanide degradation products.
- Total phosphorus
    - Environment Canada accepted the proposed 2 and 4 mg/L (average [average monthly concentration] and maximum [maximum concentration in a single sample]).
- Total Cyanide (CN)
    - Environment Canada accepted the proposed 0.5 and 1 mg/L (average and maximum)
- Aluminum
    - What is the predicted pH of the effluent, what are the toxicity concerns at the predicted pH, and what are the predicted forms of aluminum in the effluent?
    - EQC values of 2 and 3 mg/L (average and maximum) are proposed.
- Arsenic
    - Agnico Eagle accepted 0.3 and 0.6 mg/L (average and maximum).
    - Treatment may be required to achieve these values.
- Copper
    - Environment Canada prefers as low as possible, but will accept higher values (equal to or lower than proposed MMER; 0.2 and 0.4 mg/L [average and maximum]) if rationale is provided.
- Zinc
    - Environment Canada prefers as low as possible, but will accept higher values (equal to or lower than proposed MMER; 0.4 and 0.8 mg/L [average and maximum]) if rationale is provided.
- Hydrocarbons and BTEX
    - Agnico Eagle agreed to monitoring once per year in Collection Pond 1 (CP1) with limits as:
        - total petroleum hydrocarbons - 5 mg/L (maximum average and maximum in a grab)
        - Benzene – no value
        - Toluene – no value
        - Ethylbenzene – no value
        - Xylene – no value
- Toxicity
    - Effluent must be non-acutely lethal as determined by the results of the Rainbow Trout acute lethality test (Environment Canada 2000).

Agnico Eagle's Response to Comment:

Total Dissolved Solids (TDS)

The concentration of total dissolved solids (TDS) is a measure of the amount of dissolved major ions, such as calcium and chloride, in water. Total dissolved solids concentrations can be measured (TDS_{meas}) directly by evaporating a known volume of filtered water and measuring the mass of the residue left after evaporation. Alternatively, TDS concentrations can be calculated (TDS_{calc}) from the summation of major ions in the sample (APHA 2005).

Analytical laboratories routinely provide both TDS_{calc} and TDS_{meas} as part of their analysis package. TDS_{meas} is subject to laboratory interferences that can reduce the accuracy of the measurement (APHA 2005; Evaristo-Cordero 2011). Unlike TDS_{meas}, TDS_{calc} implicitly assumes the analytes exist in the sample in the forms analyzed, and thus are not influenced by any changes that may occur when taken out of solution. Using this method is more accurate given the practical limitations in handling and measuring TDS. Calculated TDS is used for the Snap Lake Mine in the NWT for consistency with Standard Methods (APHA 2005), and because this is required in their Water Licence (MVLWB 2014).

Environment Canada has requested that the licence for Meliadine explicitly state that the approved limit for TDS is TDS_{meas} and not TDS_{calc} as there is concern that TDS_{calc} can be less conservative if not all ions are measured in the solution. This is consistent with the historical water data collected to date from the Project.

Agnico Eagle accepts the recommendation by Environment Canada to include TDS_{meas} in the water licence. Agnico Eagle is requesting TDS_{meas} EQC limits of 1,400 mg/L (both average and maximum); this request is consistent with currently approved limits at Meadowbank. A TDS of 1,400 mg/L corresponds to 34% chloride (concentration of 480 mg/L, which is 75% of the 640 mg/L acute threshold value set by CCME [1999]), 21% sulphate (300 mg/L), 17% sodium (250 mg/L), 14% calcium (200 mg/L), 7% alkalinity (100 mg/L), 3.5% magnesium (50 mg/L), and 3.5% of three other ions (i.e., aluminum, potassium, and nitrogen as nitrate). These EQC limits assume that the saline groundwater is managed separately from surface contact water.

Based on the predicted concentrations of ions, hardness of the effluent is predicted to be 114 and 252 mg $CaCO_3$/L (average and maximum, respectively).

The rationale for the proposed limits of TDS are summarized as follows:

- the limit of 1,400 mg/L is consistent with the currently approved limits at Meadowbank;
- the proposed limit (with less than or equal to 480 mg/L of chloride) will not be acutely toxic on discharge;
- there are no human health concerns; the Health Canada (2012) guideline is aesthetic (e.g., for protection of corrosion) and would not be exceeded at the edge of the mixing zone; and,

- the proposed limit provides for operational variability, it is achievable, but is still protective of the environment based on water quality predictions at the edge of the mixing zone where TDS concentrations will not result in sublethal (i.e., chronic) toxicity (Table 1).

Table 1: Proposed Effluent Quality Criteria, Predicted End of Pipe concentration, and Predicted Edge of Mixing Zone Prediction

Constituent	Units	Proposed Effluent Quality Criteria		End-of-Pipe Predictions			Objective – Edge of Mixing Zone			Meliadine Lake[i]			Edge of Mixing Zone Predictions	
		Monthly Average	Maximum Grab	FEIS[b] Maximum	CP1[c] Average	CP1[c] Maximum	SSWQO[d]	Aquatic Life[e]	Drinking Water[f]	Minimum	Median	Maximum	FEIS[b]	Updated[j]
Conventional Constituents														
Total Dissolved Solids-measured	mg/L	1,400	1,400	4,685	200	425	-	-	500	21	35	91	68	(j)
Total Suspended Solids	mg/L	15 [a]	30 [a]	-	-	-	-	8	-	1	1.5	8	3.1	(j)
pH	-	6.0 to 9.5 [a]	6.0 to 9.5 [a]	-	-	-	-	6.5 to 9.0	6.5 to 8.5	6.7	7.4	8	-	-
Alkalinity, total	mg/L as $CaCO_3$	-	-	-	79	167	-	-	-	12	17	50	-	-
Hardness	mg/L as $CaCO_3$	-	-	-	114	252	-	-	-	13	19	54	-	-
Major Ions														
Bicarbonate	mg/L	-	-	-	10	13	-	-	-	12.6	18	57.1	-	-
Calcium	mg/L	-	-	-	36	80	-	-	-	4.3	6.1	16.8	-	-
Chloride	mg/L	-	-	1,142	20	33	-	120	250	2.7	6.4	25.2	14	(j)
Fluoride	mg/L	-	-	1.2	0.00020	0.00050	2.8	0.12	1.5	0.03	0.03	0.03	0.0084	(j)
Potassium	mg/L	-	-	-	7.2	17	-	-	-	<1	1	1.9	-	-
Magnesium	mg/L	-	-	-	5.8	13	-	-	-	0.6	1.0	2.4	-	-
Sodium	mg/L	-	-	295	5.5	9.5	-	-	200	1.7	3.2	7.5	5.3	(j)
Sulphate	mg/L	-	-	4,974	35	87	-	-	500	1.5	2.9	8.9	38	(j)
Nutrients														
Total Ammonia as Nitrogen	mg N/L	14	18	70	4.7	7.8	-	7	-	0.002	0.025	0.052	0.54	(j)
Nitrate Ion	mg N/L	-	-	29	5.7	9.7	-	13	45	0.013	0.11	0.22	0.25	(j)
Phosphorus (total)	mg-P/L	2	4	0.06	0.5	1.0	-	0.03	-	0.0028	0.0055	0.033	0.0049	0.03
Cyanides														
Total cyanide	mg/L	0.5	1.0	1	0.013	0.105	-	-	0.2	0.000001	0.001	0.003	0.009	(j)
Free cyanide	mg/L	-	-	0.05	-	-	-	0.005	-	-	-	-	0.00035	
Total Metals														
Aluminum	mg/L	2	3	0.98	1.2	1.2	-	0.1	0.1	<0.005	0.002	0.0111	0.0091	0.1
Antimony	mg/L	-	-	0.059	0.0028	0.0076	-	-	0.006	<0.0005	<0.00003	0.0003	0.00051	(j)
Arsenic	mg/L	0.3	0.6	0.5	0.19	0.45	0.025	0.005	0.01	<0.0005	0.0003	0.0009	0.0038	(j)
Barium	mg/L	-	-	9.9	0.021	0.033	-	-	1	<0.02	0.006645	0.0177	0.077	(j)
Cadmium	mg/L	-	-	0.0001	0.000012	0.000019	-	0.00005 [h]	0.005	<0.00001	<0.00001	0.0048	**0.00005**	(j)
Chromium	mg/L	-	-	0.1	0.0030	0.0030	-	0.0089	0.05	<0.001	<0.00006	0.0022	0.0011	(j)
Copper	mg/L	0.2	0.4	0.13	0.0037	0.0047	-	0.002	1	<0.001	0.00111	0.0031	0.002	(j)
Iron	mg/L	-	-	2.8	1.7	1.7	1.06	0.3	0.3	<0.03	0.0235	0.085	0.042	(j)
Lead	mg/L	0.2 [a]	0.4 [a]	0.0092	0.0050	0.0055	-	0.001	0.01	<0.001	<0.00005	0.0007	0.00015	(j)
Manganese	mg/L	-	-	0.48	0.13	0.25	-	-	0.05	<0.005	0.00285	0.0077	0.0055	(j)
Mercury	mg/L	-	-	0.00008	0.0000015	0.0000015	-	0.000026	0.001	<0.00001	<0.00002	<0.00002	0.00002	(j)
Molybdenum	mg/L	-	-	0.73	0.0052	0.011	-	0.073	-	<0.03	8.95E-05	0.0002	0.0052	(j)
Nickel	mg/L	0.5 [a]	1.0 [a]	0.29	0.0033	0.0043	-	0.029	-	<0.02	0.0006	0.0054	0.0027	(j)
Selenium	mg/L	-	-	0.0091	0.00040	0.00053	-	0.001	0.01	<0.001	<0.0001	0.0001	0.00016	(j)
Silver	mg/L	-	-	0.0001	0.000059	0.00012	-	0.0001	-	<0.00001	<0.0001	<0.0001	0.0001	0.0001
Thallium	mg/L	-	-	0.0076	0.0000064	0.000011	-	0.0008	-	<0.00001	<0.00004	<0.0002	0.0001	(j)

Constituent	Units	Proposed Effluent Quality Criteria		End-of-Pipe Predictions			Objective – Edge of Mixing Zone			Meliadine Lake[i]			Edge of Mixing Zone Predictions	
				FEIS[b]	CP1[c]	CP1[c]	SSWQO[d]	Aquatic Life[e]	Drinking Water[f]	Minimum	Median	Maximum		
		Monthly Average	Maximum Grab	Maximum	Average	Maximum							FEIS[b]	Updated[j]
Uranium	mg/L	-	-	0.15	0.00076	0.0017	-	0.015	0.02	<0.0002	<0.00005	0.00003	0.0011	[j]
Zinc	mg/L	0.4	0.8	0.26	0.012	0.017	-	0.03	5	<0.005	<0.0008	0.0372	0.0067	[j]
Dissolved Metals [k]														
Aluminum	mg/L	-	-	-	0.093	0.100	-	-	-	<0.005	0.0015	0.0077	-	-
Antimony	mg/L	-	-	-	0.0028	0.0076	-	-	-	<0.00003	<0.0001	<0.0005	-	-
Arsenic	mg/L	-	-	-	0.10	0.36	-	-	-	<0.0005	0.00039	0.00077	-	-
Barium	mg/L	-	-	-	0.012	0.024	-	-	-	<0.02	0.00662	0.00934	-	-
Cadmium	mg/L	-	-	-	0.000005	0.000012	-	-	-	<0.00005	<0.00001	0.000011	-	-
Chromium	mg/L	-	-	-	0.00001	0.00003	-	-	-	<0.001	<0.0001	0.0018	-	-
Copper	mg/L	-	-	-	0.0011	0.0021	-	-	-	<0.001	0.0009	0.0023	-	-
Iron	mg/L	-	-	-	0.0100	0.01	-	-	-	<0.03	0.01	0.025	-	-
Lead	mg/L	-	-	-	0.0012	0.0017	-	-	-	<0.0005	<0.00005	0.00049	-	-
Manganese	mg/L	-	-	-	0.12	0.23	-	-	-	0.00038	0.0013	0.0034	-	-
Molybdenum	mg/L	-	-	-	0.0051	0.011	-	-	-	<0.001	0.00007	0.000162	-	-
Nickel	mg/L	-	-	-	0.0024	0.0034	-	-	-	<0.001	0.00054	0.00079	-	-
Selenium	mg/L	-	-	-	0.00038	0.00052	-	-	-	<0.001	<0.0001	0.0001	-	-
Silver	mg/L	-	-	-	0.000054	0.00012	-	-	-	<0.00001	<0.00002	<0.0001	-	-
Thallium	mg/L	-	-	-	0.00000075	0.0000053	-	-	-	<0.00001	<0.00003	<0.0002	-	-
Uranium	mg/L	-	-	-	0.00074	0.0017	-	-	-	<0.0002	<0.00005	0.000035	-	-
Zinc	mg/L	-	-	-	0.011	0.015	-	-	-	<0.005	<0.001	0.0117	-	-

(a) Metal Mining Effluent Regulations (Government of Canada 2012).

(b) Table 7.4-20 from FEIS (Agnico Eagle 2014a); maximum predicted values, dissolved constituent concentrations.

(c) Maximum predicted values, total parameter concentrations assuming 15 mg/L Suspended Solids of mine waste composition (Agnico Eagle 2015b).

(d) Golder (2013).

(e) CCME (1999).

(f) Health Canada (2012).

(g) aesthetic guideline

(h) Hardness of 23 mg/L $CaCO_3$.

(i) Data from FEIS (Table 7.4-20; Agnico Eagle 2014a).

(j) Agnico Eagle (2015c); only updated the edge of mixing zone concentrations if the new end-of-pipe predictions are higher than those in the FEIS.

(k) Based on achieving TSS limit of 15 mg/L; should TSS be higher, total aluminum will be higher because a major component of the particulates are aluminum (an element in very high concentration in surrounding geology) and aluminum is used in the process to settle TSS.

"-" no value; MMER = Metal Mine Effluent Regulations; FEIS = final environmental impact statement for the Project; SSWQO = site-specific water quality objective.

Ammonia

Agnico Eagle is requesting total ammonia EQC limits of 14 and 18 mg-N/L (average and maximum). The rationale for the proposed limits of ammonia is based around operational experience, expected concentrations of total ammonia in the effluent, and an understanding of potential modes of toxicity.

The predicted concentrations of ammonia are based on operational experience at Meadowbank, which includes residual cyanide degradation products.

A compilation of ammonia (NH_3) and total ammonia (NH_3-NH_4) data from the Meadowbank Mine (2013 and 2014) is provided in Table 2. At Meadowbank, total ammonia in the contact water can be highly variable, particularly in waters that contact waste rock, such as pit sumps, waste rock storage facilities (WRSF) as well as in the tailings reclaim pond and the sewage treatment plant. Unionized ammonia is substantially lower under typical pH values that range from 6.5 to 8.0.

Table 2: Summary of Site Water Quality Monitoring Data from Meadowbank Mine, 2013 and 2014

Monitoring Location	Parameter	Ammonia (NH3)	Ammonia-Nitrogen (NH3-NH4)	TDS	Aluminum, Total	Aluminum, Dissolved	Daphnia Magna (LC50)	Rainbow Trout (LC50)
	Unit	mg-N/L	mg-N/L	mg/L	mg/L	mg/L	-	-
Portage Attenuation Pond Discharge (ST-9)	22-Aug-13	-	10	794	0.902	0.968	77.10%	>100%
	27-Aug-13	-	12.1	786	1.24	0.067	-	-
	2-Sep-13	-	11.6	818	0.812	0.056	-	-
	9-Sep-13	-	11.3	802	1.01	<0.006	>100%	>100%
	19-Sep-13	-	12	770	0.955	0.029	-	-
	27-Sep-13	-	12.1	808	0.931	<0.006	-	-
	2-Oct-13	-	10.6	804	2.16	0.029	-	-
	7-Oct-13	-	12.1	900	2.15	0.068	>100%	>100%
	16-Oct-13	-	12.2	932	0.074	0.032	-	-
	10-Jun-14	-	9.2	782	1.87	0.031	>100%	>100%
	16-Jun-14	-	6.6	583	1.14	0.064	-	-
	24-Jun-14	-	8.2	796	1.55	0.098	-	-
	30-Jun-14	-	7.6	740	1.62	0.6	-	-
	5-Jul-14	-	7.8	840	1.79	0.052	91.60%	>100%
Portage Attenuation Pond (ST-18)	4-Jun-13	0.18	-	379	-	-	-	-
	4-Jul-13	-	6.3	632	-	-	-	-
	8-Aug-13	0.35	9.8	779	-	-	-	-
	2-Sep-13	0.12	12.4	806	-	-	-	-
	3-Oct-13	0.11	-	814	-	-	-	-
	3-Jun-14	0.12	8.5	754	-	-	-	-
	1-Jul-14	0.2	8.4	2628	-	-	-	-
	5-Aug-14	0.00	9.7	1155	-	-	-	-
	7-Sep-14	0.18	-	1283	-	-	-	-
	13-Oct-14	0.19	11.8	1363	-	-	-	-

Note: from the 2013 and 2014 Annual report for Meadowbank (Agnico Eagle 2014b, 2015a).

- = no data

Toxicity testing has been completed at Meadowbank on rainbow trout, and in 2014 ammonia concentrations up to 12.1 mg-N/L were found to be not acutely toxic to rainbow trout (Table 2).

Average and maximum total ammonia in the effluent is predicted to be between 4.7 and 7.8 mg-N/L respectively (Table 1); however, higher EQCs are requested to allow for expected operational variability. For the pH range of 6.5 to 8, assumed effluent temperature at site of 5°C to 10°C, total ammonia of 14 to 18 mg-N/L, the calculated unionized ammonia (CCME 2010) in the sample would range from 0.005 to 0.32 mg-N/L. Toxicity testing of the effluent at 15°C would result in calculated unionized ammonia concentrations in the sample (for pH 6.5 to 8, and total ammonia of 14 to 18 mg-N/L) ranging from 0.012 to 0.47 mg-N/L. At the upper limit (i.e., pH of 8 and total ammonia of 18 mg-N/L) the effluent would not be acutely toxic. A discharge of 0.47 mg-N/L unionized ammonia would be diluted to approximately 0.007 mg-N/L unionized ammonia in the mixing zone, which is below the CCME long-term guideline of 0.019 mg-N/L (CCME 2010). Discharge of 0.47 mg-N/L unionized ammonia is unlikely worst case as effluent released from site would likely be less than 15°C and the water temperatures of Meliadine Lake are less than 15°C, much less so except for a few short months in the summer.

The rationale for the proposed limits of ammonia are summarized as follows:

- the limits of 14 and 18 mg-N/L are consistent with the current limits at Meadowbank;
- based on operational experience at Meadowbank, variability of ammonia in contact waters is expected, and thus flexibility for potential upsets is necessary;
- at these concentrations, and based on data from Meadowbank, the effluent will not be acutely toxic to rainbow trout; and
- from an operational perspective, these limits are achievable but still protective of the environment based on water quality predictions at the edge of the mixing zone where ammonia concentrations will not result in sublethal (i.e., chronic) toxicity.

Aluminum

Agnico Eagle is requesting aluminum EQC limits of 2 and 3 mg/L (average and maximum). The rationale for the proposed limits of aluminum are based around the understanding of potential modes of toxicity in the final effluent and operational experience (Table 2).

The pH of water in CP1 and therefore, of the effluent, is expected to be in the range of pH 7.0 to 8.5. In this pH range, aluminum is expected to be less soluble (Wilson 2012), and therefore present in a predominantly particulate rather than dissolved form. The solubility, and hence bioavailability, of aluminum increases outside of neutral pH. Aluminum toxicity to fish may occur under acidic (pH<6) or alkaline (pH>8) conditions due to increased solubility at these pH values (Wilson 2012). Aluminum species under alkaline pH conditions tend to be less toxic than under acidic conditions (Wilson 2012). In addition, effluent pH can be reduced as a management action if it rises above pH 8.0.

At neutral pH and under any redox conditions, aluminum will be primarily in the form of $Al(OH)^{-}_{4}$, where aluminum has a valence of +3.

It is the dissolved form of aluminum that is bioavailable and has the potential to cause toxicity to fish. Aluminum toxicity mainly occurs through waterborne exposure, with the toxic mechanism of aluminum impairment of the gill through disruption of ion regulation or respiratory dysfunction (Wilson 2012). Within the expected pH range of the water in CP1, the maximum and average dissolved aluminum concentration is 0.1 mg/L and 0.093 mg/L, respectively (Table 1), below the water quality guideline to be applied at the edge of the mixing zone.

Total and dissolved aluminum is highly variable at Meadowbank, but generally less than the average monthly concentration of 2 mg/L for total aluminum with dissolved aluminum less than 0.1 mg/L in most samples.

The rationale for the proposed limits of aluminum are summarized as follows:

- the models predicted a maximum of 1.2 mg/L of total ammonia, but to allow for operational flexibility (i.e., to account for the presence of aluminum in the surrounding geology, and the use of aluminum as a process reagent), EQC limits of 2 and 3 mg/L (average and maximum) are requested;
- for an effluent pH range of 7 to 8, the proportion of total aluminum that is bioavailable will be low, and thus acute effluent toxicity due to aluminum will be negligible;
- if effluent pH increases above 8, where acute toxicity could occur, the effluent pH can be adjusted downward as a preventative measure so that the effluent is non-acutely toxic; and
- from an operational perspective, these limits are achievable but still protective of the environment based on water quality predictions at the edge of the mixing zone where aluminum concentrations will not result in sublethal (i.e., chronic) toxicity both because of dilution and because of reduced pH on mixing with Meliadine Lake water.

Copper

Agnico Eagle is requesting copper EQC limits of 0.2 and 0.4 mg/L (average and maximum). The rationale for the proposed limits of copper is as follows:

- the ore and wasterock are relatively low in copper, but copper sulphate is a process reagent used to remove cyanide in the cyanide destruction process, thus flexibility is necessary in the event of upset conditions;
- the modelling predicts limited seepage from the dry stack tailings; however the exact amount of seepage will be dependent on final design and construction, thus flexibility is necessary;
- these limits will not cause acute effluent toxicity, particularly at predicted hardness in the effluent of 114 and 252 mg $CaCO_3$/L (average and maximum, respectively) as increased hardness reduces copper toxicity (Chapman 2008);
- from an operational perspective, these limits are achievable but still protective of the environment based on water quality predictions at the edge of the mixing zone where copper concentrations will not result in sublethal (i.e., chronic) toxicity; and

- Agnico Eagle is commited to releasing effluent that is non-acutely toxic.

Zinc

Agnico Eagle is requesting zinc EQC limits of 0.4 and 0.8 mg/L (average and maximum). The rationale for the proposed limits of zinc are as follows:

- predicted average and maximum concentrations of total zinc in the effluent are 0.012 and 0.017 mg/L;
- the ore and waste rock are relatively low in zinc, but zinc can be introduced to the waste stream from galvanized steel thus flexibility for potential upsets is necessary;
- predicted hardness in the effluent is 114 and 252 mg $CaCO_3$/L (average and maximum, respectively); hardness (in the predicted range for the Meliadine effluent) ameliorates the toxic effects of zinc on aquatic organisms (Chapman 2008; DeForest and Genderen 2012) thus these limits are not expected to cause acute effluent toxicity;
- from an operational perspective, these proposed limits are achievable but still protective of the environment based on water quality predictions at the edge of the mixing zone where zinc concentrations will not result in sublethal (i.e., chronic) toxicity; and
- Agnico Eagle is commited to releasing effluent that is non-acutely toxic.

Full Table of Proposed EQCs

The information presented above as well as the EQC's agreed upon with Environment Canada on November 12, 2015 has been consolidated into Table 1.

Topic: Commitment 21 - Selected Phosphorus Objective – Edge of mixing zone (EC_7)

Issue/concern from Environment Canada:

Environment Canada provided the following issue/concern in their technical comments in October 2015.

"Table 3-1 provides the predicted effluent concentrations and water quality at the edge of the mixing zone in Meliadine Lake. The phosphorus objective provided for the edge of the mixing zone in Meliadine Lake is 0.03 mg/L. According to the CCME Phosphorus Framework, this value corresponds to a trophic status in the meso-eutrophic range. Although an in-depth trophic status classification has not yet been completed, an oligotrophic status has been assumed for Meliadine Lake. Given this assumption, the more appropriate objective at the edge of mixing zone, in order to maintain the trophic status of the lake, would be 0.01 mg/L.

EC acknowledges that the increase in phosphorus concentrations compared to the Final Environmental Impact Statement (FEIS) prediction is a result of the change the Proponent now proposes in site water management, and that overall loadings would be similar to those evaluated in the environmental assessment. The main source is the treated camp wastewater.

Effluent from CP1 will be released during the short open water season and it will be important to ensure effluent mixing and dispersion. Biological monitoring should be done to detect any localized increases in productivity that could lead to problems such as algal blooms or winter oxygen depletion."

Additional Questions:

The outstanding questions and/or requests related to this topic identified by Environment Canada on November 12, 2015 are as follows:

- Provide the lake/basin flushing rate and annual TP load calculations.
- What is the adaptive management if TP concentrations trend outside of expectations?
- Agnico Eagle should review the early monitoring data from Kodiak Lake (initial sewage treatment plant [STP] receiving environment at Ekati) to understand potential changes to a receiving lake from discharge of water that is high in phosphorus.

Agnico Eagle's Response to Comment:

This document provides response to the additional questions and comments raised by Environment Canada.

The comment regarding maintaining the oligotrophic status of the basin where the diffuser is located in Meliadine Lake is acknowledged.

From the FEIS to the water licence (WL) application, there was a change in how camp wastewater is to be handled at the Project. In the FEIS, the treated camp wastewater was proposed to be directed to the Tailings Storage Facility. However, in the WL application, Agnico Eagle proposed a dry stack tailings facility, in part, to minimize water infiltration and seepage from the tailings mass. Environment Canada acknowledged that there are trade-offs resulting from the change in the tailings management strategy that require management to minimize environmental impacts.

All treated camp wastewater is now planned to be directed to collection pond 1 (CP1). The main source of TP to CP1 is the sewage treatment plant (STP); there is relatively little TP coming from the waste rock. Effluent quality for the STP used in the mine site water quality model, submitted as part of the WL application, came from Meadowbank operational data. Maximum total dissolved phosphorus (TDP) predicted at end-of-pipe was 1.0 mg-P/L and average TDP was predicted to be 0.5 mg-P/L (Appendix G of the Meliadine Project Water Management Plan); it was assumed that all of the phosphorus will be in the dissolved form.

Based on the conceptual diffuser design, dilution in the mixing zone is calculated to range from a low of 65x to a high of 1389x. To be conservative, the lowest dilution was used in the calculations of edge of mixing zone objectives. It is acknowledged that the calculations were made with a general understanding of natural flushing through the mixing zone and physical and chemical characteristics of the Meliadine Lake system. However, in natural systems and complex constructed systems, observed conditions can vary with respect to estimated conditions. Therefore, operational monitoring (i.e., real data) will be used to verify the assumptions used in the calculations and to verify the movement and assimilation pattern in the lake.

It is estimated that 310.67 kg of TP will be released from the Project to Meliadine Lake between June and October each year. Based on the expected average effluent concentration and flow, 153 days of discharge (June 1 to October 31), dilution in the mixing zone, natural inflows to the lake, and natural phosphorus loads to the lake, the phosphorus concentration in the east basin is predicted to be 0.008 mg-P/L, and the east basin is expected to remain oligotrophic.

The flushing rate (or turnover time) of the lake is not known with great certainty (and may vary with time), but is estimated to range from 1.74 to 3.48 years based on the following:

- the annual discharge from Meliadine Lake is 84,700,000 m^3/yr;
- the volume of the east and south basins are 98,851,000 m^3 and 48,429,000 m^3, respectively;
- the volume of the north basin is assumed to be at least equal to the east and south basins combined[1], which would equal a volume of 147,280,000 m^3.

Based on the combined volume of the east and south basins, the turnover rate is estimated to be 1.74 years; and based the combined volume of the east, south, and north basins, the turnover rate is estimated to be 3.48 years.

The change in TP concentrations in Meliadine Lake as a result of the Project will be limited to the period of effluent discharge (maximum of 153 days in any year, from June 1 to October 31). In every year of operations, there will be approximately seven months for assimilation, dilution, and dispersion of the effluent. Following the annual cessation of discharge, a decrease in TP concentration in Meliadine Lake is expected, as there will be time for the system to assimilate the added nutrients. There is evidence from other northern oligotrophic lakes enriched with nutrients returning to baseline concentrations within a couple of years after the cessation of nutrient enrichment (Schindler 1974, 2012; Welch et al 1989; O’Brien et al. 2005). It is expected that TP concentrations and trophic status in Meliadine Lake will return to baseline after mine closure.

Agnico Eagle will monitor TP in the effluent monthly during discharge (June to October), and monthly during discharge in the receiving environment providing conditions are safe to do so (July to September), and once during the under-ice period (January); dissolved oxygen will also be monitored at all stations within Meliadine Lake.

Adaptive management to an unanticipated increase in TP concentration in Meliadine Lake as a result of Project effluent discharges could include the following:

- additional site monitoring of TP to track sources (i.e., into and out of the STP);
- additional monitoring locations or frequency in the receiving environment; and

[1] The assumption is based on the surface area size of the north basin as compared to the combined surface area of the east and south basins.

- additional treatment for TP prior to release using technology that has been demonstrated in the north.

Data from the Ekati site were reviewed but as the receiving lake at Ekati is different than Meliadine Lake, the results are not relevant to this discussion.

Topic: Commitment 22 - Under-ice water quality sampling (EC_9)

Issue/concern from Environment Canada:

Environment Canada provided the following issue/concern in their technical comments in October 2015.

The table provided by the Proponent indicates that in the near field and the mid field exposure areas water sampling will be conducted once during the under ice period and monthly during the open water discharge period. However, in the reference areas, sampling is only proposed to be completed during the open water period (Reference Area 1- sampled monthly during the open water period; Reference Areas 2 and 3 sampled once per year in the late open-water period (although conflicting information is presented in the Section 5.1.2)). No under-ice sampling is proposed for any of the reference locations. Without sampling data from reference sites that matches the near field and mid field sites, the control-impact analysis cannot be conducted. The proposed before-after sampling should include reference site under-ice sampling to allow the Before-After-Control-Impact study design, which would be the strongest program to detect effects and whether they are mine-related.

Recommendation:

Describe a sampling program that will include reference areas during the under-ice period in order to provide data needed to detect mine-related effects in the receiving environment.

Additional Questions:

The outstanding questions and/or requests related to this topic identified by Environment Canada on November 12, 2015 are as follows:

- Environment Canada accepts the rationale for not sampling the reference areas during the winter (safety, no discharge in the winter, small discharge of effluent relative to lake volume and thus time before a detectable plume will reach the reference area), but requests a response on how data will be evaluated (exposure versus reference) for summer and winter.
- Environment Canada also requests a draft response on a possible trigger for adaptive management to be initiated.

Agnico Eagle's Response to Comment:

How will summer and winter data, for the exposure versus reference areas, be evaluated?
Data will be collected as part of the AEMP and evaluated to determine short- and long-term effects of the Project on the aquatic environment, evaluate the accuracy of predictions made in the FEIS, assess efficacy of planned mitigation, and identify the need for additional mitigation.

The general spatial and temporal water quality sample collection framework is summarized (Table 3). As described in the AEMP design plan, analysis and interpretation of Meliadine Lake water quality data will focus on answering two key questions:

- Question 1: Are concentrations of key parameters in Meliadine Lake consistent with water quality predictions[2] and less than AEMP Action Levels?
- Question 2: Are concentrations in the exposure area increasing over time relative to the reference areas?

Data are being collected to support a before-after-control-impact (BACI) design in the Near-field, Mid-field, and Reference Areas (Table 3). If additional stations are required after operations have started (e.g., if effluent is moving different than expected), data will be collected to support a control-impact (CI) study design.

Water Quality data will be evaluated relative to guidelines, benchmarks, and baseline concentrations[3]. Data collected in the Near-Field and Mid-Field areas will be examined for trends within and between years, and statistically compared to baseline concentrations. Data from Reference Area 1 will be compared statistically and visually to data from the Near-Field and Mid-Field areas for the open-water period (i.e., July, August and September), and data from Reference Areas 2 and 3 will be compared statistically and visually to data from the Near-Field and Mid-Field areas for the August open-water period.

Winter data will be collected in the Near-Field and Mid-Field areas. These data will be evaluated relative to guidelines, benchmarks, and baseline concentrations, examined for trends within and among years, and statistically compared to baseline concentrations. As part of the annual report, winter and open-water data from the Near-field and Mid-field areas will be examined together as a time series. The time series plots can be used to identify trends within and among years.

[2] Predictions for the edge of the mixing zone are provided in Table 1 under the response to EC_6; these will also be provided in the next iteration of the AEMP design plan (to be submitted in June 2016).
[3] The next version of the AEMP design plan will include a summary of the data included in the FEIS and data collected in 2015.

Table 3: Spatial and Temporal Study Design Framework for Collection of Water Quality Samples

Location	Under-ice	Open-water		
		July	August	September
Near-field	Samples collected	Samples collected	Samples collected	Samples collected
Mid-field	Samples collected	Samples collected	Samples collected	Samples collected
Reference Area 1	-	Samples collected	Samples collected	Samples collected
Reference Area 2	-	-	Samples collected	-
Reference Area 3	-	-	Samples collected	-

What is an example of a trigger that would initiate adaptive management?

Water quality data will be evaluated within the context of the response framework where there is a link to monitoring results and management actions. Within the response framework, there are three levels of pre-defined change (i.e., Low, Moderate, and High Action Levels). A possible Low Action Level trigger for water quality may include measured concentrations that exceed the measured baseline condition or a benchmark, or a consistent increasing trend toward conditions outside of baseline conditions. Using this approach, data can be evaluated qualitatively within and among sampling areas, and within and between sampling conditions (i.e., under-ice and open-water).

When a Low Action Level is identified, management responses may include the following:

- continue monitoring to confirm the trend and confirm the Low Action Level trigger;
- review AEMP best practices (e.g., sample collection procedures, sample handling procedures, follow-up with the laboratory);
- examine the ecological relevance of the detected water quality concentrations;
- conduct additional sampling within the mine or lake to identify the source of the constituent triggering the action level;
- re-evaluate sampling frequency and sampling locations;
- investigate existing mitigation and identify potential mitigation options; and/or
- re-evaluate the benchmark, and if necessary, revise.

Closure

Should you require any further information or questions please contact Stéphane Robert via email or by telephone.

Regards,

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