



# KIA Lands Department Technical Review

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**LICENCE:** Water Licence 2AM-MEL1631

**DATE:** April 14, 2020

**SUBJECT:** Review of Agnico Eagle’s Responses to KIA’s Technical Comments on the Application to Authorize the Release of Water from Containment Pond 1 (CP1) to Meliadine Lake

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## INTRODUCTION

On April 2, 2020, the Kivalliq Inuit Association (KIA) Lands Department provided seven technical comments on Agnico Eagle Mines Ltd.’s (Agnico Eagle) application for an amendment of the Meliadine Water Licence 2AM-MEL1631 to permit the release of waters from Control Pond 1 (CP1) in excess of the 1,400 mg/L discharge criterion for Total Dissolved Solids (TDS) set out in Part F, Item 3 of the existing licence. Agnico Eagle responded to those comments in a technical memorandum titled “Emergency Amendment Responses Meliadine Mine – Water Licence 2AM-MEL1631 dated April 6, 2020”. We provide our original technical comments, Agnico Eagle’s responses and the status of each issue in the following section.

KIA’s participation in this process should not be construed as support for Agnico Eagle’s proposal to discharge water from CP1 into Meliadine Lake with higher concentrations of TDS than permitted under the existing water licence. The KIA Lands Department acknowledges that Agnico Eagle recently provided technical information to support its claim that water levels in CP1 must be drawn down prior to freshet to avoid the “significant risk” to the CP1 dike. Agnico Eagle has not satisfied the Lands Department that it cannot manage the saline water in another way other than releasing it into Meliadine Lake starting in May 2020, and has not explained why they need to remove all of the water from CP1 to avoid the risk the dike will fail.

## STATUS OF TECHNICAL COMMENTS

<b>Review Comment Number</b>	KivIA-TC#1.
<b>Subject/Topic</b>	Justification of Risk to CP1 Dike
<b>References</b>	Agnico Eagle Mines Ltd. March 24, 2020. Request for Expedited Amendment to Permit Ministerial Approval of Amendment to 2AM-MEL1631 on or before May 1, 2020. Submitted to the Nunavut Water Board;



## KIA Lands Department Technical Review

	<p>All application documents submitted in support of Agnico Eagle’s Application to Authorize the Release of Water from Containment Pond 1 (CP1) to Meliadine Lake</p>
<p><b>Detailed Review Comment</b></p>	<p>Agnico Eagle requests that their amendment application be processed as an emergency as CP1 must be completely dewatered starting in May 2020 to prevent “<i>significant risk</i>” to the integrity of the CP1 Dike (DCP1). We note that while we agree that that “<i>CP1 is to be drawn down every year prior to freeze-up [to ensure] the site has capacity for the following freshet</i>” as outlined in their application, complete dewatering does not appear necessary to maintain freshet capacity each year nor to avert the potential for <i>significant risk</i> to the integrity of the CP1 Dike.</p> <p>Further, Agnico Eagle has not provided information in their amendment application to support their concern for the integrity of CP1 Dike (the source and nature of the significant risk) should they not be permitted to commence complete dewatering of CP1 starting in May 2020.</p>
<p><b>Recommendation</b></p>	<p>For Agnico Eagle’s amendment application be processed based on the “<i>significant risk</i>” to the CP1 Dike, the following information should be provided:</p> <p>Structural concerns with the CP1 Dike must be outlined and validated by a geotechnical engineer. A tentative timeline for when a “<i>significant risk</i>” to the CP1 dike would occur in 2020 and what the implications of those risks may be must also be provided. Agnico Eagle must further justify why complete dewatering is required as opposed to discharging water to Meliadine Lake with TDS in excess of the 1,400 mg/L effluent quality criterion at a rate sufficient to maintain the operational capacity for freshet.</p> <p>We understand that Agnico Eagle would prefer not to impact mining operations at Meliadine. However, Agnico Eagle must justify why a change in operations is either not feasible or would not result in a decrease in contact water reporting to CP1.</p> <p>Without this information, we do not see sufficient rationale to process the application as an emergency.</p>
<p><b>Agnico Eagle Response</b></p>	<p>Agnico Eagle has provided a technical memorandum as part of their response package titled “Attachment B: Assessment of Dike DCP-1, Meliadine Mine, Canada”</p>
<p><b>KivIA Lands Department Assessment</b></p>	<p>Agnico Eagle has satisfactorily demonstrated that there is an imminent risk to the CP1 dike unless the water level in CP1 is drawn down prior to freshet 2020. Specifically, Agnico Eagle’s report indicates that water levels must be maintained at or below 66.6 masl.</p> <p>Agnico Eagle has not however, demonstrated that CP1 must be completely dewatered to avoid risk to the infrastructure. Further information is required to support Agnico Eagle’s request to completely dewater CP1 in 2020.</p>



# KIA Lands Department Technical Review

<b>Review Comment Number</b>	KivIA-TC#2.
<b>Subject/Topic</b>	Source of High TDS water in CP1
<b>References</b>	<p>Request for Expedited Amendment to Permit Ministerial Approval of Amendment to 2AM-MEL1631 on or before May 1, 2020;</p> <p>Water Quality Management and Optimization Plan. Implementation Plan for Total Dissolved Solids, Appendix A Table A-4</p> <p>All application documents submitted in support of Agnico Eagle’s Application to Authorize the Release of Water from Containment Pond 1 (CP1) to Meliadine Lake</p>
<b>Detailed Review Comment</b>	<p>Agnico Eagle is seeking <i>“A time-limited amendment of the total dissolved solid (TDS) discharge criteria set out at Part F, Item 3 of Water Licence 2AM-MEL1631 (the Water Licence)”</i> to address <i>“The accumulation of the contact water in CP1... primarily related to the high volume of precipitation during the 2019 season and the stringent Water Licence TDS discharge criteria”</i>.</p> <p>We are concerned that Agnico Eagle has not provided an acceptable rationale as to why TDS has become elevated in CP1. High precipitation and associated contact water alone do not explain why the average TDS concentration measured within CP1 in 2017 and 2018 increased from 1,642 mg/L TDS to 3,902 mg/L TDS in 2019 and 2020.</p> <p>Agnico Eagle does note that <i>“The Mine has run into operational challenges with both the efficiency of the salt maker and securing large storage volumes for the brine produced by the reverse osmosis.”</i>, but this still does not explain the increase in TDS within CP1.</p>
<b>Recommendation</b>	Agnico Eagle must provide an explanation as to why TDS has increased within CP1 to the point at which discharges at the existing effluent quality criterion of 1,400 mg/L are no longer feasible. Additional mitigation measures (reduction at source) must also be investigated to ensure contact water with elevated TDS does not continue to pose a management problem on site and to reduce or eliminate the need for high salinity discharges to Meliadine Lake.
<b>Agnico Eagle Response</b>	<p>From CIRNAC 2: Agnico Eagle implemented mitigation to the TDS loading in CP1 since the beginning of the construction phase by building several water treatment systems such as evaporators, reverse osmosis, and desalination plants. Segregation of surface and underground water to improve treatment efficiency was review each year to optimize water management practices and reduce concentration at the source.</p> <p>In 2019, Agnico Eagle completed an investigation of the overall CP1 water quality issue. Results of this investigation showed that TDS is the only parameter of concern. Several different scenarios were evaluated to manage this situation in</p>



# KIA Lands Department Technical Review

	<p>2019 and different adaptive management measures were implemented during last summer to allow discharge CP1 water in Meliadine Lake such as improving the water treatment efficiency by increase RO permeate production and rerouting surface water on site to reduce inflows in CP1.</p> <p>Freshet Action Plan was review during the winter 2020 to evaluate potential new water management strategies required to manage CP1 water efficiently. The selected strategy consists of improving segregation of surface contact water with high TDS concentration from CP1 by capturing runoff reporting in CP1 upstream to the pond and use the access road as a temporary structure to hold this inflow. Even with the implementation of those mitigations, forecasted CP1 water TDS concentration will be above the 1,400 mg/L and volume of water in CP1 will be above the Maximum Operating Level.</p> <p>Agnico Eagle considers that the treatment and storage option is not a long-term solution as storage capacity is limited and CP1 water can't be discharge with the current TDS Effluent Quality Criteria (EQC). Agnico Eagle initiated in late 2019 a study to understand the potential effect of mine effluent TDS loading on the Meliadine Lake, which is presented in the Water Quality Management and Optimization Plan (WQ-MOP; Golder 2020). Results of that study showed that the 1,400 mg/L is over conservative and a temporary effluent discharge threshold of 3,500 mg/L would allow the site to manage CP1 water effectively and without any environmental effect in Lake Meliadine.</p> <p>Agnico Eagle developed the WQ-MOP based on the discussions held with mainly ECCC but also CIRNAC, KivA and NWB in 2019 and 2020. Different scenarios were evaluated for the revision of the TDS EQC with the parties and NWB recommend the proponent to apply for an Emergency Amendment as the standard amendment process would not be completed in time.</p> <p>Agnico Eagle also states: In the event that the construction and operation of the Waterline between Meliadine Site and the Melvin Bay is deemed approved by the Nunavut Impact Review Board, Agnico Eagle could consider the alternative of using this infrastructure to convey and discharge elevated concentrations of TDS CP1 water into Melvin Bay.</p>
<p><b>KivA Lands Department Assessment</b></p>	<p>Agnico Eagle has not satisfactorily described the source of elevated TDS within CP1. We note that Agnico Eagle's separate letter to the KIA stated that <i>"The increase in the salinity is primarily from the increase in precipitation in 2019 that flushed out the salinity from the construction activities. The flushing was previously known to occur, but under normal precipitation events that could be managed as contact water within the TDS concentration."</i></p> <p>It is unclear why greater than average precipitation would result in increased salinity reporting to CP1 rather than diluting contact water to a lower overall concentration.</p>



# KIA Lands Department Technical Review

<b>Review Comment Number</b>	KivIA-TC#3.
<b>Subject/Topic</b>	Alternative Management Strategies for Excess CP1 Water
<b>References</b>	Request for Expedited Amendment to Permit Ministerial Approval of Amendment to 2AM-MEL1631 on or before May 1, 2020;  All application documents submitted in support of Agnico Eagle’s Application to Authorize the Release of Water from Containment Pond 1 (CP1) to Meliadine Lake
<b>Detailed Review Comment</b>	Agnico Eagle proposes to discharge water with high salinity to Meliadine Lake but have not considered alternatives, most notably, trucking of the water to the marine outfall location, thereby avoiding any impact to Meliadine Lake.
<b>Recommendation</b>	Please provide a discussion and analysis of potential alternatives to the Meliadine Lake discharge.
<b>Agnico Eagle Response</b>	<p>Agnico Eagle completed a risk assessment of the situation in November 2019. The following list of items summarize the different actions and mitigations evaluated:</p> <ul style="list-style-type: none"> <li>• Increase allowable effluent TDS criteria for discharge to Meliadine Lake;</li> <li>• Aggradation of brine water in frozen structure;</li> <li>• Upgrade Reverse Osmosis system to treat brine under CP1 ice cap;</li> <li>• Ice removal from CP1 (leaving brine);</li> <li>• Optimize water management to minimize inflows to CP1 during freshet;</li> <li>• Segregation and direct discharge of freshet runoff;</li> <li>• Snow management optimization;</li> <li>• Use CP1 water as make-up water in the Mill,</li> <li>• Installation of a spillway on D-CP1 to prevent an uncontrolled discharge;</li> <li>• Strategies waste rock deposition to minimize leaching of solutes to CP1; and</li> <li>• Solidification of brine with a polymer.</li> </ul> <p>Agnico Eagle understands from the recent communication with the NWB that every adaptive management options need to be submitted to the NPC and NIRB and these options cannot be implemented in a timely fashion to complete the approval process. Agnico Eagle would like to continue working with the parties to develop a legal framework that would allow the implementation of effective adaptive management in Nunavut. However, the way the current Meliadine Licence is drafted, it does not allow this flexibility.</p>
<b>KivIA Lands Department Assessment</b>	<p>We appreciate the summary of other alternatives considered by Agnico Eagle. However, we do not agree with their assessment that every adaptive management option would need to be submitted to both the NPC and NIRB, and that these options cannot be implemented in a timely fashion.</p> <p>We note that Agnico Eagle’s application indicated an awareness that TDS was of concern as early as 2017, stating <i>“Since 2017 various treatment and water management options have been evaluated and implemented in order to limit the</i></p>



## KIA Lands Department Technical Review

	<p><i>increase of TDS at CP1. The Mine has run into operational challenges with both the efficiency of the salt maker and securing large storage volumes for the brine produced by the reverse osmosis". This would appear to provide ample time for discussions with the three co-management boards to gain additional operational flexibility to manage water in CP1.</i></p> <p>We also note that upgrading the RO system to treat brine under ice, improve treatment efficiency during the open water season or further optimizing water management to decrease TDS reporting to CP1 all appear to be within the scope of currently licenced activities.</p>
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<b>Review Comment Number</b>	KivIA-TC#4.
<b>Subject/Topic</b>	Insufficient Characterization of High TDS Water in CP1
<b>References</b>	Water Quality Management and Optimization Plan. Implementation Plan for Total Dissolved Solids; Appendix A Supporting Information for the Interim TDS Targets
<b>Detailed Review Comment</b>	<p>Agnico Eagle has summarized water chemistry measured at MEL-14 between September 2017 and October 2019 providing summary statistics for all major constituents in the Meliadine Mine Effluent. This information is used as supporting evidence that chloride comprises up to approximately 50% of effluent discharged to Meliadine Lake. Based on the composition of TDS in the Meliadine Effluent, chloride is expected to be the primary driver of toxicity. Additional support for the composition of the Meliadine effluent is also provided in Table A-3 and Table A-4 which outline the relative contribution of chloride to TDS in water collected from CP1 as well as at the pre and post treatment sampling station (MEL-12 and MEL-14) for chronic and acute toxicity testing respectively.</p> <p>Agnico Eagle does not however, provide a fulsome characterization of water chemistry from CP1. We are concerned with Agnico Eagle’s application of these results to characterize the high TDS water that may be discharged to Meliadine Lake. Water chemistry reported for CP1 appears to have been collected from a discrete location and may not accurately reflect the water chemistry in CP1 as high TDS water may resist mixing with lower TDS water. It is therefore unclear whether samples reported from CP1 and MEL-12 adequately reflect the potential influent the treatment system will need to treat in order to meet the proposed 3,500 mg/L TDS discharge criterion.</p>
<b>Recommendation</b>	A full chemical analysis of water quality in CP1 is still required. Characterization of the components (e.g. major ions, trace metals) comprising the total dissolved solids throughout CP1 are needed to understand the potential environmental risk associated with the CP1 discharges.



## KIA Lands Department Technical Review

	<p>Specifically, we request Agnico Eagle collect physicochemical water column profiles from multiple locations within CP1 to determine whether the pond is fully mixed. A discrete sample should be collected from the depth at which the maximum conductivity was measured if the water column profile suggests that CP1 is not fully mixed; a depth composite sample is otherwise sufficient. Results from that sample should be applied as the worst-case scenario concentrations to determine potential environmental effects associated with the proposed discharges from CP1. This full characterization is particularly important as Agnico Eagle is proposing a 3,500 mg/L TDS discharge criterion as a maximum average concentration rather than a fixed value.</p> <p>The samples used to provide this characterization of water within CP1 must have been collected no earlier than December 2019 as results from CP1 presented in Table A-4 indicate measured TDS concentrations in December 2019 and after increased significantly as compared to earlier water quality measurements. If this information has already been collected, we request Agnico Eagle provide it to all intervenors for review.</p>
<p><b>Agnico Eagle's Response</b></p>	<p>Water quality of MEL-12 discharged between June to October 2019 is representative of the effluent characterization for CP1 freshet discharge in 2020. A full chemical analysis for MEL-12 data collected between June to October 2019 is provided in Attachment A. During freshet discharge fully mixed conditions in CP1 are expected; although this statement is based on similar water chemistry in samples collected concurrently between the discharge pipeline and surface water grabs, fully mixed conditions would be expected during open water conditions due to its relatively small size (i.e., volume, ~660,000 m<sup>3</sup>; mean depth, ~2 m).</p> <p>Higher TDS concentrations were observed in CP1 in winter 2020 because the winter water quality measurements are subject to cryo-concentration from the ice overlying the collection pond (i.e., at the end of March, the ice volume represented approximately 70% of the volume capacity of CP1, which means the measured water quality parameter concentrations were subject to almost a 3.5-fold increase in concentration). As this ice melts, and the collection pond receives freshet inflows of snow and ice in the pond's drainage system, the TDS concentrations are anticipated to substantially reduce to levels below the MAEC; predicted TDS concentrations in CP1 discharge under different precipitation conditions for 2020 range from 1,491 to 2,542 mg/L (refer to CIRNAC-1, Response 1). However, even under elevated TDS concentration of &gt;3,500 mg/L in CP1, acute toxicity has not been observed. Acute toxicity data collected in 2020 from CP1 for nine samples with calculated TDS concentrations from 3,695 to 4,925 mg/L indicated no acute toxicity (LC50 &lt;100% vol/vol) and 0% mortality in full-strength sample (100% vol/vol) to Rainbow Trout and Daphnia magna (see response to ECCC-2, Table 2).</p>
<p><b>KIA Lands Department Assessment</b></p>	<p>We tentatively agree with Agnico Eagle's statement that <i>"During freshet discharge fully mixed conditions in CP1 are expected; although this statement is based on similar water chemistry in samples collected concurrently between the</i></p>



## KIA Lands Department Technical Review

	<p><i>discharge pipeline and surface water grabs, fully mixed conditions would be expected during open water conditions due to its relatively small size”, but request to see referenced water quality data.</i></p> <p>We note that Agnico Eagle provided data from MEL-12 and a single corresponding sample from CP1 in October 2019 suggesting that the datapoints are comparable and MEL-12 data is representative of conditions in CP1. A larger dataset is requested to justify Agnico Eagle’s conclusions that CP1 is sufficiently mixed such that MEL-12 data is representative of the entire pond. Accounting for cryoconcentration, the comparative dataset between MEL-12 and CP1 must have been collected no earlier than September 2019; concentrations of TDS reported in Table A-1 of Agnico Eagle’s response package indicate concentrations of TDS stabilized in September 2019.</p> <p>We appreciate Agnico Eagle’s reiteration that acute toxicity has not been observed in the reported tests on Meliadine effluent, but stress that our toxicological concerns are primarily focused on ensuring sufficient dilution of the effluent to prevent chronic toxicity at the edge of the mixing zone and changes within the downstream environment.</p>
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<b>Review Comment Number</b>	KivIA-TC#5.
<b>Subject/Topic</b>	Dilution Factor to Meet Interim TDS Target at Edge of Mixing Zone
<b>References</b>	Water Quality Management and Optimization Plan. Implementation Plan for Total Dissolved Solids; Section 2.2 Interim TDS Target at the Edge of the Mixing Zone; Appendix A Supporting Information for the Interim TDS Targets Table A-4
<b>Detailed Review Comment</b>	<p>Agnico Eagle has conducted a plume delineation study under operating conditions <i>“based on specific conductivity results in 2018 in the near-field region of Meliadine Lake as part of the Environmental Effects Monitoring (EEM)/Aquatic Effects Monitoring Program (AEMP). The EEM plume delineation study used field surveys of specific conductivity to evaluate effluent dispersion with distance from the diffuser”</i> The study evaluated dilution factors at a series of monitoring stations up to, and extending beyond, 250 m from the diffuser, based on the specific conductivity of the effluent and the measured field values through the water column at each the stations.” The results of this study as presented in <i>“Table 1: Dilution Factors in the Near-field Exposure Area at Meliadine Lake”</i> indicate that the effluent mixed well with water in the receiving environment, achieving dilution factors of at least 71x by 100 m from the diffuser.</p> <p>This dilution factor is used to provide confidence that discharges of TDS concentrations up to an average maximum concentration (MAC) of 3,500 mg/L will be fully assimilated by the receiving environment. We note however that TDS in 2018 at MEL-14, presented in Table A-4, was measured at a maximum</p>



## KIA Lands Department Technical Review

	<p>concentration of 1,360 mg/L, significantly lower than the proposed discharge concentrations of a 3,500 mg/L MAC. Effluent at the higher TDS concentration will not mix with the low TDS receiving water as easily as the 2018 effluent used in the plume delineation study. High TDS effluent is more likely to travel from the diffuser as a consolidated plume rather than achieving the mixing ratios presented in the Assimilative Capacity Evaluation.</p> <p>We therefore lack confidence that sufficient dilution will occur within the mixing zone allowing Agnico Eagle to achieve the proposed <i>“interim target of 1,000 mg/L (as calculated TDS) to apply in the receiving environment at the edge of the mixing zone... for the protection against chronic toxicity to representative aquatic species”</i>. This may result in deleterious effects on aquatic life outside the 100 m regulatory mixing zone.</p>
<b>Recommendation</b>	<p>We request Agnico Eagle provide hydrodynamic modelling results to demonstrate the behavior of the plume using 3,500 mg/L TDS as an input. We further request Agnico Eagle provide a second model run using 4,000 mg/L TDS as a model input given the discharge concentration will be regulated as a MAC. This modelling is intended to provide confidence that dilution of effluent discharged at MAC of 3,500 mg/L TDS will be achieved sufficient to meet the 1,000 mg/L TDS target at the edge of the mixing zone. We further request Agnico Eagle specify the intended effluent discharge rate and apply that to the hydrodynamic model.</p>
<b>Agnico Eagle Response</b>	<p>Agnico Eagle is of the opinion that hydrodynamic modeling is not required at this stage of decision-making for the proposed amendment discharge. In the WQ-MOP (Golder 2020), evidence was provided on the efficiency of the existing diffuser’s capacity to disperse discharge. This evidence is based on a plume delineation survey conducted in 2018 in the near-field region of Meliadine Lake as part of the Environmental Effects Monitoring (EEM)/Aquatic Effects Monitoring Program (AEMP) (Golder 2019) and a diffuser performance assessment conducted by Tetra Tech (Tetra Tech 2018). These studies confirmed the anticipated performance of a conceptual diffuser included in the FEIS stage of the project in 2015 (Agnico Eagle 2015).</p> <p>The modelled and assessed dilution factors at the 100 m mixing zone boundary for the FEIS and to 2018 have been very similar (65:1 in Agnico Eagle [2015]; an average of 72:1 for Scenario A in Golder [2019]; and 72:1 for the first year of discharge in Tetra Tech (2018)). Tetra Tech (2018) also included a dilution factor (23:1) based on multi-year simulations. If the lower dilution factor (23:1) is used for the discharge, the mixing of water from CP1 through dispersion in the mixing zone would still be expected to consistently meet the interim target of 1,000 mg/L. The table below shows the required TDS concentration at the effluent to trigger the interim target of 1,000 mg/L at the edge of the mixing zone for each of those models. As observed, the required effluent TDS concentration to trigger potential chronic toxicity is greater than the proposed target of 3,500 mg/L.</p>



# KIA Lands Department Technical Review

	Model	Dilution Factor	Required TDS concentration at the effluent to trigger the interim target of 1,000 mg/L at the edge of the mixing zone (mg/L)
	FEIS (Agnico Eagle, 2015)	65:1	65,000
	Scenario A (Golder 2019)	72:1	72,000
	First year discharge (Tetra Tech, 2018)	72:1	72,000
	Multi-year simulation (Tetra Tech, 2018)	23:1	23,000

  

<b>KIA Lands Department Evaluation</b>	<p>We do not agree that hydrodynamic modelling is not required. We are still concerned that a higher TDS plume (i.e. MAEC 3,500 mg/L TDS) will behave differently than the lower TDS plume observed as part of the 2018 plume delineation study. It is not clear that a plume discharged at a MAEC of 3,500 mg/L TDS will achieve sufficient mixing and dilution at the edge of the mixing zone to prevent chronic toxicity.</p> <p>Agnico Eagle has also not provided a maximum discharge rate in their application or within their response to the KIA.</p>
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<b>Review Comment Number</b>	KivIA-TC#6.
<b>Subject/Topic</b>	Chronic Toxicity Concerns
<b>References</b>	<p>Water Quality Management and Optimization Plan. Implementation Plan for Total Dissolved Solids; Appendix A Supporting Information for the Interim TDS Targets,</p> <p>A1.1.3 Site-Specific Composition,</p> <p>Table A-2: Chronic toxicity testing dataset for Snap Lake TDS SSWQO as summarized by Chapman and McPherson (2015),</p> <p>A1.4 Site-Specific Chronic Toxicity Data</p> <p>CCME (Canadian Council of Ministers of the Environment). 2011. Canadian water quality guidelines for the protection of aquatic life: Chloride. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.</p>
<b>Detailed Review Comment</b>	<p>Agnico Eagle outlines the results of chronic toxicity testing in Table A-3 using water both from the treatment system's influent (MEL-12) and effluent (MEL-14). A relatively limited dataset is provided for tests using concentrations reflective of the 1,000 mg/L interim TDS target intended for application at the edge of the mixing zone. Of the test on effluent collected at MEL-14, sublethal effects were observed on reproduction in 50% of tests on <i>Ceriodaphnia dubia</i> (1/2) and on 7 day biomass in 20% of tests on <i>Lemna minor</i> (1/5). Chronic effects observed at TDS concentrations ~1,000 mg/L indicates a potential for aquatic life to</p>



# KIA Lands Department Technical Review

	<p>experience chronic toxicity outside the mixing zone at the higher discharge concentrations proposed.</p> <p>This concern is exacerbated by the potential for a plume migrating outside the 100 m mixing zone with concentrations in excess of 1,000 mg/L TDS as outlined in KivIA-TC#4: Dilution Factor to reach Interim TDS Target at Edge of Mixing Zone.</p> <p>We further note that unlike the comparative example of Snap Lake outlined in Table A-2, chronic toxicity tests were not conducted on <i>Daphnia magna</i> using effluent from Meliadine. <i>Daphnia magna</i> are sensitive to chloride exposure with chronic toxicity observed at 421 mg/L (CCME 2011). Chronic toxicity testing of <i>Daphnia magna</i> is therefore particularly important to assess the potential range in chronic toxicity associated with the 1,000 mg/L interim target TDS target for a range of species. Chloride comprises up to 50% of the TDS in Meliadine effluent and may therefore be a primary driver of toxicity in the receiving environment.</p>
<p><b>Recommendation</b></p>	<p>We request additional chronic toxicity testing to assess the potential for aquatic life exposed to effluent from the Meliadine site to experience deleterious effects should Agnico Eagle be permitted to discharge effluent from CP1 at a MAC of 3,500 mg/L TDS. Specifically, we request serial dilution chronic toxicity tests using water currently in CP1. Test water must be collected directly from CP1 at the depth where conductivity is measured at the highest concentration as determined by a conductivity profile collected from the deepest point of the pond.</p> <p>Serial dilution tests should be run on all species listed in Table A-3 as well as <i>Daphnia magna</i> at the following dilutions: 100%, 75%, 50% and 25%, 12.5%. Note that no tests need be run at TDS concentrations lower than 500 mg/L.</p> <p>We further request Agnico Eagle provide a discussion of the feasibility of either a) lowering the interim TDS target for the edge of the mixing zone and b) using a chloride based interim target for the edge of the mixing zone</p> <p>Finally, we request Agnico Eagle propose a maximum effluent concentration associated with the currently proposed 3,500 mg/L TDS MAC and clarify the time over which the average would be calculated.</p>
<p><b>Agnico Eagle Response</b></p>	<p><b>Response 1</b></p> <p>Additional chronic toxicity testing with CP1 is not proposed at this time based on the following:</p> <ul style="list-style-type: none"> <li>• Agnico Eagle has proposed an interim target for effluent of 3,500 mg/L TDS as a Maximum Average Effluent Concentration (MAEC).</li> <li>• The results of plume delineation survey conducted in the near-field region of Meliadine Lake in 2018 is presented in the WQ-MOP (Golder 2020). Dilution factors at 100 m distance from the diffuser (representing the edge of the mixing zone) ranged from 23:1 to 101:1.</li> </ul>



## KIA Lands Department Technical Review

- At a MAEC of 3,500 mg/L TDS, and assuming a background concentration of 35 mg/L TDS, the TDS concentration at the edge of the mixing zone is predicted to range from 48 to 185 mg/L.
- As presented in Appendix A of the WQ-MOP (Golder 2020) there are multiple lines of evidence (literature based toxicity data and benchmarks for similar ionic composition to Meliadine and site specific toxicity data) that indicate negligible effects to aquatic life at TDS concentrations of less than or equal to 1,000 mg/L. Therefore, additional chronic toxicity testing with CP1 is not proposed at this time, but will be conducted during the discharge event, as discussed below.

Additional monitoring to validate the proposed interim TDS target at the edge of the mixing zone will be undertaken as part of the freshet discharge monitoring program. Although the test species and protocols have not yet been finalized, we understand the importance of including a sensitive crustacean in the test battery for chronic toxicity endpoints. Therefore, the validation monitoring program will consider inclusion of the 21-day *Daphnia magna* survival and reproduction test (ASTM 2004) and/or the three brood *Ceriodaphnia dubia* survival and reproduction test. The data collected for validation during this monitoring program will further reduce uncertainty related to potential for effects to aquatic life in the receiving environment. Note that data are already available for the three brood *Ceriodaphnia dubia* survival and reproduction test that indicate no chronic toxicity above the proposed interim concentration of 1,000 mg/L.

The *D. magna* 48-hour acute toxicity test, including dilutions over a range of TDS (and component ions) is already incorporated in routine testing of pit water and will be retained in the validation program for effluent toxicity at the point of discharge. This is in addition to the chronic toxicity testing of crustaceans described above for the receiving water testing.

### **Response 2**

The proposed interim target is based on the best available scientific data, and at this time the data do not support reducing the interim TDS target for the edge of the mixing zone. Data collected during the validation program will be used to further evaluate the proposed interim TDS target at the edge of the mixing zone and to further confirm that the interim target does not result in chronic toxicity. Importantly, the interim target was developed considering that the ionic composition of effluent discharged during spring freshet would fall within the bounds of the ionic composition of historical effluent and pond water and near-field receiving water. The ionic balance has been stable over several years of monitoring and it is not anticipated to deviate during the freshet discharge. A stable ionic balance is suited to development of a single interim target for TDS, without requiring development of individual benchmarks for component ions. Furthermore, lowering of the interim TDS target for the edge of the mixing zone would diverge from the available technical information on chronic toxicity and



# KIA Lands Department Technical Review

	<p>could be misinterpreted to convey that the lower number is required for protection of aquatic life.</p> <p>The interim TDS target incorporates contributions from chloride (along with other ionic components) and is therefore predicted to be protective against overall TDS toxicity as well as toxicity from individual ions within the TDS mixture (e.g., chloride). Evidence from site-specific Pit water samples and from other northern mine sites with similar ionic composition indicate that the proposed interim target for TDS, including component ions, is protective. Therefore, Agnico is not proposing to develop a chloride-based interim target at the edge of the mixing zone at this time.</p> <p><b>Response 3</b></p> <p>At this time, concentrations up to 4,925 mg/L calculated TDS are the maximum observed concentration in Collection Pond 1 (refer to ECCC-2; Table 2) and it is not anticipated that TDS would exceed currently observed conditions during the discharge event. This is because the winter water quality measurements are subject to cryo-concentration from the ice overlying the collections pond. As this ice melts, and the collection pond receives freshet inflows of snow and ice in the pond's drainage system, the TDS concentrations during CP1 2020 discharge indicate TDS will range from 1,491 to 2,542 mg/L. Therefore, although there is a possibility that TDS concentrations above the MAEC of 3,500 mg/L may occur during the discharge event, the MAEC is expected to be consistently met. Occurrences of discharge above the MAEC will be adequately dispersed by the diffuser, even if the lowest dilution factor occurs (23:1; Tetra Tech 2018), with the interim target of 1,000 mg/L still being met.</p>
<p><b>KIA Lands Department Assessment</b></p>	<p><b>Response 1</b></p> <p>KIA Lands Department still requests chronic toxicity testing using <i>Daphnia magna</i> to evaluate the potential for chronic toxicity at the edge of the mixing zone. However, we acknowledge that the need for this test prior to approval of the amendment application circumvented if the plume behaves as outlined in the 2018 delineation study and a 1:71 dilution ratio (the minimum observed in the 2018 plume delineation study) is achieved at the edge of the mixing zone. Chloride concentrations under the 2018 or similar dilution scenarios will be much lower than the toxicological threshold for <i>Daphnia magna</i> to chloride reported in the literature.</p> <p>We therefore reiterate our request for hydrodynamic modelling to provide confidence that there is limited potential for chronic toxicity at the edge of the mixing zone.</p> <p><b>Response 2</b></p> <p>Our original technical comment identifies concerns with Agnico Eagle's proposed 1,000 mg/L TDS limit based on the chloride toxicity data presented in the amendment application, and assert that a lower limit may indeed be required to protect aquatic life. This concern is not alleviated by Agnico Eagle's response and</p>



## KIA Lands Department Technical Review

	<p>reassert that a lower interim TDS target (or lower associated chloride target) for the edge of the mixing zone may be warranted based on data presented by Agnico Eagle.</p> <p><b>Response 3</b> Agnico Eagle has stipulated that TDS concentrations in CP1 in 2020 are expected to range below the 3,500 mg/L MAEC. This does not provide rationale as to why a regulated maximum grab sample concentration is not warranted.</p>
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<b>Review Comment Number</b>	KivIA-TC#7.
<b>Subject/Topic</b>	Robust Effluent Monitoring for 2020
<b>References</b>	Water Quality Management and Optimization Plan. Implementation Plan for Total Dissolved Solids; Section 3.0 Phase 2: Conduct Validation Study
<b>Detailed Review Comment</b>	<p>Agnico Eagle has provided details on a Plume Delineation Study, Water Quality Monitoring and Toxicity Testing for 2020 intended to validate that effluent discharged at a concentration above the current 1,400 mg/L TDS effluent quality criterion behaves as predicted in the WQMOP. Specifically:</p> <ul style="list-style-type: none"> <li>• That the whole effluent is not acutely lethal,</li> <li>• The effluent is diluted to at least 1,000 mg/L TDS at the edge of the mixing zone,</li> <li>• Chronic exposure to TDS concentrations up to 1,000 mg/L will not results in deleterious effects on aquatic life, and</li> <li>• Effluent is fully assimilated within the receiving environment such that no changes are observed at the mid field or far field monitoring locations.</li> </ul> <p>Details of the plume delineation study, water quality monitoring program and toxicity testing are outlined in Table 3. We provide several recommendations to refine the proposed validation studies.</p>
<b>Recommendation</b>	<p>We provide the following recommendations to refine Agnico Eagle’s proposed validation studies if the amendment is granted:</p> <p><b>Plume Delineation Study</b> Water quality samples collected as part of the plume delineation study within the receiving environment should include samples collected both at surface (grab) as well as at the point of highest conductivity in the water column as determined by a physico-chemical water column profile. This is intended to ensure the plume is appropriately characterized at depth within the mixing zone.</p> <p><b>Water Quality Monitoring</b> We request a more robust sampling regime as part of validation sampling for discharges of Meliadine effluent with a MAC of 3,500 mg/L TDS. Specifically, we request weekly sampling at both MEL-12 and MEL 14 for the test parameter</p>



# KIA Lands Department Technical Review

	<p>categories outlined in Table 3. We request weekly triangulated water quality samples be collected from the edge of the mixing zone for at least the first four weeks of discharges at the new TDS effluent quality criterion. Four weekly samples should also be collected at the midfield monitoring areas. Monthly water quality samples should be collected from the far field and reference areas.</p> <p>Physico-chemical profiles should be added to the list of test parameters as part of water quality monitoring in the receiving environment. Water quality samples should be collected from the surface (grab) as well as from the depth with the highest measured conductivity at each station at the edge of the mixing zone.</p> <p>A working group hosted by the NWB consisting of the KivIA and other key parties (e.g. ECCC, CIRNAC, DFO) should be established to review and evaluate the effluent and environmental monitoring data with the first meeting scheduled two weeks following the commencement of discharges from CP1. Adaptive management and mitigation options should be provided by the proponent for each meeting if a) there has been any instances of noncompliance with the effluent quality criterion of 3,500 mg/L MAC TDS as measured at MEL-14, and b) if there have been any instances of noncompliance with the interim TDS threshold applied to the edge of the mixing zone.</p> <p><b>Toxicity Testing</b>  <i>Daphnia magna</i> should be added as a test species for chronic toxicity testing performed on the effluent and samples collected at the edge of the mixing zone. Toxicity test samples at the edge of the mixing zone should be collected from the depth in the water column at which the highest conductivity was measured through a water column profile conducted concurrent with the collection of water for those tests.</p>
<p><b>Agnico Eagle Response</b></p>	<p><b>Plume Delineation Study</b>  Water quality samples will be collected after the physico-chemical water column field measurements are collected taken at each station. The number of samples collected at each of sampled stations will be determined based on the total water depth. For example, if the total depth at a station is less than or equal to 5 m at a station, samples were collected at the surface (e.g., 0.3 m below the bottom of the surface) and at the depth of highest conductivity. If the total depth is greater than 5 m at a station, water samples will be collected at the surface, mid-depth and bottom. For the mid-depth and bottom, either will be substituted for the depth of the highest measured conductivity as applicable.</p> <p><b>Water Quality Monitoring</b>  Agnico Eagle are of the opinion that the proposed monitoring program through discharge is reasonable (see response to ECCC-3). The focus of the monitoring program is on water quality at the end-of-pipe and the edge of the mixing zone, which will be sampled on a weekly basis. Mid-field, and even potential farfield, sampling is limited to the plume delineation study, which will be conducted as soon as it is safe to access Meliadine Lake after ice-off. Should monitoring data</p>



# KIA Lands Department Technical Review

	<p>identify that thresholds are being approached the monitoring program may be revised to accommodate increased sampling frequency and/or further afield monitoring (see response to CIRNAC-4). In addition to the monitoring described specifically for the amendment discharge, supplemental data will be accessed from coincident monitoring in the receiving environment, such as the AEMP, and included in the evaluation.</p> <p>Field physico-chemical water column profile measurements (specifically temperature and specific conductivity) through the water column will be collected at each station as part of the edge of mixing zone sampling program and the plume delineation study. These data will be integral to identify the depths for water sample collection (see above) profiles.</p> <p>Agnico Eagle agrees that meetings with NWB and other parties is an appropriate mechanism to disseminate data and to seek feedback. Agnico Eagle therefore propose to host monthly meetings with NWB, KivIA, ECCC, and CIRNAC to present a summary of the collected CP1 and receiving environmental monitoring data available at the time. The first meeting will be scheduled two weeks following the commencement of discharge from CP1. At this meeting adaptive management and mitigation options will be presented (as per the response to CIRNAC-4), as well as a summary of collected data (discharge rates and end-of-pipe water quality). At subsequent meetings, these station data will be supplemented by edge of mixing zone and plume delineation data.</p> <p><b>Toxicity Testing</b> The 21-day Daphnia magna survival and reproduction test (ASTM 2004) is being considered for inclusion in the validation study for the interim TDS target at the edge of the mixing zone. Agnico Eagle agrees that toxicity test samples collected at the edge of the mixing zone will be collected from the depth with the highest conductivity as measured using in situ water quality meters. Water quality samples will be collected concurrently with toxicity samples from the same depth.</p>
<p><b>KIA Lands Department Assessment</b></p>	<p><b>Plume Delineation Study</b> We appreciate Agnico Eagle’s clarifications and consider our concerns raised with the plume delineation study resolved.</p> <p><b>Water Quality Monitoring</b> We appreciate Agnico Eagle’s clarifications and are satisfied with the proposed monitoring at the end of pipe and at the edge of the mixing zone. We assert that that more robust monitoring is required for the mid and far field areas to evaluate the effects of Agnico Eagle’s proposed discharge concentrations on the receiving environment.</p> <p><b>Toxicity Testing</b></p>



## KIA Lands Department Technical Review

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	<p>We appreciate Agnico Eagle's response but stress the importance of including <i>Daphnia magna</i> as a test species to assess chronic toxicity associated with discharges of water from CP1 at the higher proposed TDS effluent quality criterion. We specifically request that <i>Daphnia magna</i> be included rather than considered in the test suite.</p>
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### CLOSING

We thank the Agnico Eagle for responding to our technical comments, and the NWB for this opportunity to continue the discourse on Agnico Eagle's amendment application. We look forward to further discussions to ensure the environmental and economic interests of both the proponent and beneficiaries are protected.

If you have any questions regarding this memorandum, please contact Luis Manzo of the KivIA ([lmanzo@kivalliginuit.ca](mailto:lmanzo@kivalliginuit.ca)) or Richard Nesbitt of Hutchinson Environmental Sciences Ltd. ([Richard.Nesbitt@environmentalsciences.ca](mailto:Richard.Nesbitt@environmentalsciences.ca)).