Review Comment Table

Board:	WLWB
Review Item:	Ekati - AEMP - 2019 Aquatic Effects Monitoring Program (AEMP) Annual Report (W2012L2-0001)
File(s):	W2012L2-0001
Proponent:	Dominion Diamond Mines ULC
Document(s):	Part 1 - Evaluation of Effects (23 MB) Part 2 - Data Report (1 of 2) (23 MB) Part 2 - Data Report (2 of 2) (20 MB) Part 3 - Statistical Report (12 MB) Part 4 - Summary Report (16 MB) Data File (757 KB) Cover Letter (80 KB) Appendix A - Historical Lake Water Quality (2 MB) Appendix B - Historical Stream Hydrology (509 KB) Appendix C - Lake Residence Time (143 KB) Cujo 2019 DO Memo (4.1 MB)
Item For Review Distributed On:	Oct 27 at 16:03 Distribution List Oct 28 at 08:38 Distribution List
Reviewer Comments Due By:	Dec 8, 2020
Proponent Responses Due By:	Dec 22, 2020
Item Description:	Dominion Diamond Mine ULC (Dominion) submitted its 2019 Aquatic Effects Monitoring Program (AEMP) Annual Report (the Report) on June 30, 2020. This Report is required by Part J, Condition 7 of Water Licence W2012L2-0001. The Report consists of several parts: Summary Report, Evaluation of Effects (Part 1), Data Report (Part 2), and Statistical Report (Part 3). Additionally, Dominion has provided tabular data in excel format, in response to the Board's January 25, 2018 Direction. In addition, Dominion provided a fellow-up memorandum regarding Cujo Lake Dissolved Oxygen (DO) concentrations as per the commitment made by Dominion in the September 2018 Memorandum. The Board's January 24, 2019 Decision Letter recommended the follow-up memorandum be submitted with the 2019 AEMP Annual Report. **Using the Online Review System (ORS), reviewers are invited to submit comments and recommendations on the documents linked below by the review comment deadline specified. Reviewers may also wish to consider providing an overarching recommendation regarding whether the Board should approve the submission, to provide context for the comments and recommendations and assist the Board with its decision. If reviewers seek clarification on the submission, they are encouraged to correspond directly with the Applicant prior to submitting comments and recommendations.**

	All documents that have been uploaded to this review are also available on our public Registry. If you have any questions or comments about the ORS or this review, please contact Board staff identified below.
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Comment Summary

Environment and Climate Change Canada: Cari-Lyn Epp			
ID	**Topic**	**Reviewer Comment/Recommendation**	**Proponent Response**
1	General	**Comment** ECCC has no comments at this time. **Recommendation** N/A	
Fisheries and Oceans Canada: Nicholas Wasilik			
ID	**Topic**	**Reviewer Comment/Recommendation**	**Proponent Response**
1	Ekati - AEMP - 2019 Aquatic Effects Monitoring Program (AEMP) Annual Report	**Comment** Fisheries and Oceans Canada has reviewed the report and has no comment at this time. **Recommendation** Fisheries and Oceans Canada has no recommendations at this time.	**Dec 22:** NA
GNWT - ENR - EAM (Environmental Assessment and Monitoring): Central Email GNWT			
ID	**Topic**	**Reviewer Comment/Recommendation**	**Proponent Response**
1	General File	**Comment** (doc) ENR Letter with Comments, Recommendations and Attachment **Recommendation**	
7	General File	**Comment** (doc) Attachment: Zajdlik Associates Inc. Memo - DDULC - W2012L2-0001 - Review of 2019 AEMP Annual Report – December 6, 2020 **Recommendation**	
2	Topic 1: Third Party Review	**Comment** ENR retained Zajdlik Associates Inc. to conduct a review of Dominion Diamond Mines' (Dominion) 2019 AEMP Annual Report. ENR has extracted and summarized the comments and recommendations from the memorandum and provided them below. ENR has also included the memorandum which provides additional background for the Board's information. **Recommendation** 1) ENR recommends the Board refer to the	**Dec 22:** NA

		attached memorandum for additional background and context supporting ENRÃ¢Â€Â™s comments and recommendations.	
3	Topic 2: Equation 1 Terms	**Comment** Equation 1 in Section 1.1.1.1 of Part 3, Statistical Report contains a redundant term. It appears as though one of the site*year interaction terms should be site*year2. **Recommendation** 1) ENR recommends Dominion review and correct the equation.	**Dec 22:** Thank you for pointing out this typographical error. The second Site*Year interaction term should be Site*Year2. Equation 1 should be: y = Site + Year + Year2 + Site*Year + Site*Year2. The equation will be corrected for the 2020 AEMP report.
4	Topic 3: Presentation of Statistical Model Results	**Comment** ENR notes that the inclusion of a quadratic term in the series of models used to assess temporal trends induces a parabolic trend line that may be misleading if model coefficients are not carefully assessed. As model coefficients and their standard errors are not provided (a recommendation on this topic follows), this careful assessment is not possible. It would be helpful for reviewers if some sort of smoothing function could be applied to summarize temporal trends in the main body of the AEMP report. **Recommendation** 1) ENR recommends that statistical model results continue to be plotted in the statistical report and that some form of smoothing function be applied to summarize temporal trends in the main body (i.e. Part 1 Ã¢Â€Â“ Evaluation of Effects) of the report.	**Dec 22:** The reviewer's concern with the models used to assess change through time in the AEMP is provided in the response to ID5 - GNWT. With regard to the current comment (ID4 - GNWT), the reviewer recommends that a different curve be applied to figures in the main body of the report than is used in the statistical evaluation of effects. This change would make interpreting and reviewing the AEMP more challenging. Correct interpretation and understanding of the statistical results can only be achieved in conjunction with graphical analysis of the data and models used in the statistical analysis. The figures provided in the AEMP Statistical Report are smaller and more challenging to interpret compared with the formatted versions in the Main Body which include additional features (e.g., separate panel for reference lakes and zoomed in parts of the graph when necessary). In addition, reviewers would need to view the graphs in the statistical report for every analysis; currently, reviewers are directed to the Statistical Report when necessary to facilitate understanding of the results and interpretation. Finally, this change is likely to lead to misinterpretation because many reviewers are expected to only view the statistical summaries and figures in the Main Report. No change to the figures in the AEMP report are necessary.
5	Topic 4: Quadratic Function	**Comment** The quadratic function itself may not be the most appropriate curvilinear model because of shape limitations. In some graphics an increasing trend is induced by the model form that does appear to be supported by the raw data. See for example ERM (2020, Figure 3.2-10a: Total P, Kodiak Lake). ENR notes that a more flexible shape could be considered. **Recommendation** 1) ENR recommends Dominion consider a more flexible model shape to improve observed lack of fit.	**Dec 22:** Given the long history of the project and the statistical analysis framework, further investigation would be required to fully understand the consequences that may arise from a model update. Consideration of a model update would have been more appropriate during the AEMP Re-evaluation when due care and consideration would have been devoted to the subject. The last AEMP Re-evaluation was submitted to the Board in December 2019 and is currently under review. A more flexible model shape may better characterize the data for specific parameters and lakes. A flexible model could also overfit the data, particularly for sites with greater natural variability for certain variables. For example, some variables may exhibit statistically significant

			differences simply due to natural variability that was picked up by the more flexible fit and not be representative of meaningful change and potential project-related effects. The number of spurious statistically significant results is also likely to increase when natural variability creates opposing trends between monitored sites and reference sites. Though a quadratic function is more restrictive in the shape that it fits compared to a more flexible model, it allows for the assessment of any overall increasing or decreasing change in monitored sites relative to reference sites. From this perspective, the quadratic model is well suited to the evaluation of effects and the primary goal of the AEMP, the detection of potential mine-related changes in the Receiving Environment. No change to statistical methods required or justified at this time. Dominion would like to reiterate that design and methodology changes to the AEMP should be restricted to the three year AEMP Re-evaluation process, unless results of the AEMP indicate that a change is required to ensure that the AEMP continues to be able to detect mine-related changes in the Receiving Environment. Continuous changes to methods or design in the AEMP will only serve to undermine the integrity of the AEMP, particularly if they are not given the same rigorous consideration as changes proposed as part of the AEMP Re-evaluation process.
6	Topic 5: Model Coefficients	**Comment** Section 2.2.1.4 presents statistical modeling summary results for the analysis of total phosphorus during the open water season for sampling locations in the Koala watershed. The results presented show that several observations for Kodiak Lake are poorly fitted on the natural scale and that even after transformation, one observation is still poorly fit. The overall model proportion explained variance is low. However, because only modeling summaries are presented in "Part 3 - statistical results section", it is not possible to judge the significance of specific terms. In this example, the specific terms of interest are the linear and quadratic slope terms and their standard errors and, the interaction terms and their standard errors for Kodiak Lake. **Recommendation** 1) ENR recommends that Dominion provide estimated model coefficients and their standard errors so that readers can assess the significance of specific terms. This very large body of information could be presented with rudimentary formatting with a monospaced font to reduce reporting effort.	**Dec 22:** The objective of fitting the statistical models is to statistically evaluate differences in the level of each variable in the monitored lakes and streams against reference lakes and streams which is accomplished via the statistical tests. The statistical tests of interest involve multiple model terms and results are reported in the AEMP Statistical Report for each analyzed variable. Listing model coefficients and their standard errors for interpretive purposes in the report would likely provide limited value as the inclusion of higher order and interaction terms do not allow for straight-forward interpretation of the individual model coefficients. This is more likely to lead to confusion and misinterpretation than assist the majority of reviewers. No change to the AEMP Statistical Report is required.

Independent Environmental Monitoring Agency: Marc Casas			
ID	**Topic**	**Reviewer Comment/Recommendation**	**Proponent Response**
1	General File	**Comment** (doc) Agency comments on 2019 AEMP annual report **Recommendation**	
2	Under-ice oxygen in Cujo Lake	**Comment** Dissolved oxygen (DO) levels continued to remain below CCME guidelines for protection of fish under ice at depths below 3.4 m in Cujo Lake, consistent with Cujo's historical DO profiles. The AEMP report states this is consistent with DO concentrations at lower depths in reference lakes Counts and Nanuq. However, the Agency suggests this comparison is not entirely accurate and may lead to misinterpretation of results. Low-oxygen conditions were measured at much shallower depths in Cujo Lake, which also has a lower total water volume, than in the two reference lakes. Overall, these factors result in Cujo Lake providing a smaller oxygen-rich habitat for fish than in the reference lakes. White Lake, another reference lake used for the 2019 Cujo Lake Aeration Strategy follow-up, also had DO levels greater or equal to CCME guidelines, which extended several times deeper into the water column than in the East-Main basin of Cujo Lake for the same spring months (Feb 19, 2019 Dominion memo to WLWB). Meaning that the reference lakes had more well oxygenated areas than Cujo. Comparison of DO profiles between Cujo and reference lakes are essential elements in determining whether anoxic conditions under ice in Cujo Lake are driven by mining activity, or natural processes. **Recommendation** Recommendation 1: Based upon comparisons of DO levels between Cujo and relevant reference lakes, the AEMP should re-evaluate the conclusion that Cujo Lake has similar oxygen levels as lakes unaffected by the Ekati mine.	**Dec 22:** Dissolved oxygen (DO) concentrations in a lake are affected by numerous physical factors (e.g., lake morphology, ice phenology) and biological processes (i.e., photosynthesis and respiration). The conclusion made in the AEMP that there was no mine-related effect on under-ice DO concentrations in Cujo Lake was based on direct comparisons of under-ice 2019 concentrations to baseline and historical concentrations observed in this lake. The observation that under-ice DO concentrations also declined to levels below the CCME guideline in the reference lakes Nanuq and Counts was not introduced as evidence that under-ice DO concentrations in Cujo lake were similar to concentrations in the reference lakes, and thus naturally occurring. Rather the reference lake trends were discussed to make the point that "deeper sections of unimpacted sub-Arctic lakes are sometimes below the CCME guideline during the ice-covered season" and that this is a "common phenomenon in Arctic lakes". Under-ice DO trends in Cujo Lake and the references lakes are broadly similar in that DO concentrations decrease at depth in all these lakes, but no direct comparisons are drawn between the measured DO concentrations or the depth at which DO drops below the CCME guideline as it is understood that the AEMP reference lakes differ from Cujo Lake in important ways that would be expected to affect DO concentrations (e.g., depth, volume, area). To further investigate the factors controlling under-ice DO concentrations in Cujo Lake, under-ice DO monitoring was initiated in White Lake in 2019 to control as much as possible for morphological characteristics since White Lake is similar in volume, area, and depth to Cujo Lake, but White Lake does not receive direct inputs from mining. Looking at the DO profile collected in White Lake on April 17, 2019 (which is closest in time to the DO profile collected in Cujo Lake as part of AEMP monitoring on April 16, 2019), DO concentrations dropped below the CCME guideline at approximately the same depth as in Cujo Lake (3.5 m in White Lake compared to 3.4 m in Cujo Lake). These similar trends are not interpreted as conclusive evidence that reduced under-ice DO concentrations in Cujo Lake are solely due to morphological

			characteristics rather than a mine effect. However, this finding does support the conclusions of the detailed investigation of cause presented in the Ekati Diamond Mine Aquatic Response Plan for Under-ice Dissolved Oxygen Version 1.2, which found that the lake morphology and ice-cover phenology were the primary drivers of low-oxygen conditions in Cujo Lake. Although White Lake and Cujo Lake are morphologically similar, under-ice profiles collected throughout 2019 were not always similar between lakes. This is to be expected as lake morphology is not the only factor affecting under-ice DO. While comparisons to reference lakes are important to the evaluation of effects, they do not form the sole basis for the conclusion of effects because no reference lake is identical to an exposure lake in every way except for mine inputs.
3	Aquatic Response Framework (ARF)- Selenium Levels in Fish Tissues	**Comment** The 2017 AEMP report, the last sediment quality monitoring year, concluded the potential exists for aquatic life in Leslie Lake to be adversely affected due to sediment selenium concentrations exceeding British Columbia Ministry of the Environment (BC MOE) sediment guidelines1. In response to previous Agency inquiries and the Wek'heezi Land and Water Board's directive to investigate "the relationship between sediment quality, water quality, and fish tissue concentrations for selenium"2 the company examined this in its Re-evaluation of the Aquatic Response Framework. In the Re-evaluation Report, a positive statistical relationship was reported between selenium concentrations in sediment and fish tissue in lakes downstream of the Long Lake Containment Facility (LLCF) and King Pond3. Concentrations were higher in sample locations closer to the discharge point, suggesting mining activity as the source. The Fish Response Plan v 2.0 determined that "Since the primary route of exposure to selenium in fish is through dietary uptake, the Action Level exceedances for fish were likely caused by food web exposure resulting from elevated water column and/or sediment concentrations". Fish sampling in 2018 supported this. Selenium levels in some individual slimy sculpin and lake whitefish in Leslie lake exceeded the US EPA guideline for fish health and the BC MOE Human Health Guidelines. The fish study also found mean selenium levels in lake trout tissue were increasing from previous monitoring years, although they were not yet above guideline levels. The Agency is very concerned by these findings and believes that Dominion needs to move quickly	**Dec 22:** This comment and recommendations are not relevant to the review process for the 2019 Aquatic Effects Monitoring Program (AEMP) report which did not include fish, and is not the document within which response actions are defined. The AEMP is a monitoring tool designed to detect potential mine-related changes in the Receiving Environment while responses to these monitoring results are addressed through the Aquatic Response Framework (ARF) and associated Response Plans. The comment response process for the Fish Response Plan is the appropriate forum for recommendations regarding response actions associated with selenium in fish tissues and the comment response process for the AEMP Re-evaluation (including the updated AEMP Design Plan which incorporates the ARF) is the appropriate forum for recommendations regarding the addition of Action Levels for sediment or benthos. The most recent versions of the Fish Response Plan (Version 2.0) and AEMP Re-evaluation were submitted to the Board on October 31, 2019 and December 13, 2019, respectively, and are under review with the Wek'èezhìi Land and Water Board (the Board).

		to reduce selenium at its source and disrupt the pathway that appears to be resulting in elevated levels of selenium in fish tissues. **Recommendation** Recommendation 2: Dominion investigate the potential sources (e.g., LLCF discharge) and pathways (e.g., food chain transfer; in-lake processes that increase selenium bioavailability) that are driving increases of selenium in fish tissues. Recommendation 3: Once the potential sources and pathways have been identified, Dominion should determine mitigation that will ultimately reduce selenium concentrations in fish tissue and develop early warning triggers to prevent effects on fish in lakes downstream of the mine. This work should be incorporated into the Fish Response Plan, with triggers (i.e. for sediment and or benthos) to be included into the Aquatic Response Framework. Note: To see footnotes please refer to attached letter.	
4	Aquatic Response Framework (ARF)- Selenium Levels in Fish Tissues	**Comment** continued from above; The data lead the Agency to believe the source of selenium in fish is indirectly through sediment, which enters the food chain through the benthos (benthic invertebrates). This needs to be confirmed, and if found to be correct, mitigation which targets the reduction of concentrations in sediment and/or the benthos needs to proceed, especially those invertebrate species favored by slimy sculpin and whitefish. Mitigation that is currently mentioned in Fish Response Plan 2.0 is vague, suggesting at reduction in lakes downstream of the LLCF by pumping wastewater to Panda and Koala Pits rather than the LLCF. The Agency believes this will only delay the effects since the water in Panda and Koala will ultimately need to be pumped back into the LLCF to make room for the fresh water cap in pit lakes at closure. Once selenium has reached fish tissues it is too late to halt the harm to these important Valued Ecosystem Components. It seems that effective benchmarks with action levels need to be put in place for sediment or benthos in the Aquatic Response Framework. In the past Dominion has raised issues with the ability to determine a sediment benchmark for selenium, however there are other industry examples where benchmarks have been established. For example, the Diavik Diamond Mine Inc. has developed a strategy in its Aquatic Response Framework for establishing a sediment quality benchmark for selenium and other metals. In addition to the method described by Diavik, there are existing guidelines for	**Dec 22:** Response Actions including mitigation measures are defined through the Response Plans. The Fish Response Plan Version 2.0 includes mitigations measures deemed appropriate for the current Action Level exceedances for selenium in fish tissues (ERM 2019b). The Fish Response Plan Version 2.0 is currently under review with the Board. The topic of whether sediment quality benchmarks should be included in the ARF has been previously addressed on multiple occasions, most recently as part of the 2019 AEMP Re-evaluation. The Agency notes Diavik as an industry example where a framework for determining a sediment benchmark for selenium has been established; however neither Diavik's 2019 AEMP annual report, submitted in April 2020, or Diavik's AEMP Design Plan Version 5.2, approved in October 2020, include a sediment quality benchmark for selenium (Golder 2020a and 2020b). Golder (2020b) notes that sediment quality benchmarks are derived primarily using CCME and Ontario Ministry of Environment and Energy guidelines; however, neither of these sources have established a selenium guideline for sediments. Furthermore, while a framework to establish select sediment benchmarks exists for Diavik, it is not necessarily functional for many variables, as seen with the recent conclusion for bismuth; "Diavik attempted to derive a toxicity-based sediment effects benchmark for bismuth and found that it was not possible based on available information and that guidelines has not been developed in North America (Golder

		selenium sediment concentrations from BC MOE and US EPA, both at 2.0 mg/kg, that could also be used. The 2017 mean selenium sediment concentration in Leslie Lake was 2.03 mg/kg (2017 AEMP Part 1 Evaluation of Effects p 3-166). As mentioned above, the Agency is concerned that selenium levels in fish are already elevated and will take a long time to decline since selenium released as a result of mining activities appears to be held in the sediments of Leslie Lake and not the water column. **Recommendation** None	2018)". Several rationale outlining why sediment quality is not a recommended component of the ARF were recently provided (ERM 2019a), these included: 1) Water quality in the Receiving Environment is (appropriately) monitored more frequently than sediment quality. Sediment quality is monitored every three years whereas water quality is monitored multiple times annually. Thus, changes in water quality can be detected more quickly (on an annual or seasonal basis); 2) Few changes in sediment quality in the Receiving Environment have been observed, and generally, corresponding changes in water quality variables also exist; 3) Sediment quality variables that have changed as a result of mine operations to date are assessed in the ARF as part of the water quality component; 4) Sediment quality was not identified as a VEC in the 1995 Environmental Impact Statement or 2000 Environmental Assessment; 5) Sediment quality was not identified as a key environmental risk in the most recent Environmental Impact Report; 6) Few relevant sediment quality guidelines are available; 7) Water quality variables are a reasonably sensitive predictor of the risk for potential sediment quality effects; 8) There are challenges with applying sediment quality guidelines to AEMP lake sediments, including concentrations of some variables that are naturally greater than available guidelines, the absence of baseline data for some variables, and difficulty in defining the level of change in AEMP lakes due to sediment heterogeneity and a change in sampling method; and 9) the current sediment concentrations for variables that were concluded to be increasing or potentially increasing in some AEMP lakes in 2017 pose a negligible risk to aquatic biota, with the potential exception of selenium in fish, which is most appropriately addressed through the ARF fish variable for fish tissue selenium and the Response Plan for Fish. The sediment guideline for selenium referenced in the 2017 AEMP was an "alert concentration" of 2 mg/kg published by British Columbia Ministry of Environment and Climate Change Strategy (BC MOECCS 2014). The 2 mg/kg alert concentration is based on a threshold recommended by Lemly and Ohlendorf (2002). The Lemly and Ohlendorf (2002) recommendation was based on sediment concentrations associated with body burdens in benthic macroinvertebrates that could potentially result in toxicity to fish from dietary exposure (i.e., bioaccumulation). If the 2 mg/kg alert concentration is exceeded, BC MOECCS recommends the measurement of tissue concentrations in fish to

			ensure that bioaccumulation and trophic transfer are not occurring in aquatic food webs (BC MOECCS 2014). At the Ekati Diamond Mine, fish tissue samples are collected as part of the AEMP regardless of the sediment selenium concentrations. Thus, recommended actions associated with exceedance of the BC MOECCS alert concentration are already implemented. While the BC MOECCS sediment alert concentration was presented in the 2017 AEMP report for context, it is not the most reliable 'threshold' available to assess the potential for adverse effects in the aquatic receiving environment. Due to limited data on the toxicity of selenium in sediment to aquatic organisms, the BC MOECCS alert concentration was originally classified as an interim guideline (i.e., not an approved guideline) at the time of its development in 2001. Since 2001, the BC MOECCS has failed to find sufficient supporting data in the toxicological literature to approve the interim sediment quality guideline for selenium. Consequently, the interim selenium sediment quality guideline was reclassified as an alert concentration during the latest update to the selenium water quality guidelines in 2014 (BC MOECCS 2014). As stated in Lemly (2002): "the most important aspect of selenium residues in sediments is not direct toxicity to benthic organisms themselves, but rather the dietary source of selenium they provide to fish and wildlife species that feed on them". This statement is consistent with current US EPA selenium water quality guidelines for the protection of aquatic life, which are based predominantly on selenium toxicity to fish rather than lower trophic levels (US EPA 2016). The Fish Response Plan Version 2.0 incorporates the most scientifically robust and defensible selenium guidelines for the protection of aquatic life (including fish), the US EPA's Selenium Water Quality Criteria (US EPA 2016). The US EPA water quality criteria for selenium (including water- and tissue-based toxicity thresholds) are considered superior indicators of the potential for adverse effects to sensitive aquatic receptors than the available sediment quality thresholds provided by the BC MOECCS (2014) and Lemly and Ohlendorf (2002). In particular, tissue-based thresholds are the most relevant thresholds for assessing potential effects in fish, as tissue concentrations are direct measurements of selenium exposure irrespective of the route of selenium uptake (i.e., be it from sediment, water, or diet). In summary, reviewers should direct comments and recommendations to the appropriate document for review; Dominion has recently

			responded to similar comments and no new information has been provided by the reviewer in support of their recommendations; sediment triggers are not a recommended component of the ARF for the reasons stated above; and the Fish Response Plan already includes Action Levels based on the most appropriate thresholds using the current state of scientific understanding for selenium. No changes to the Fish Response Plan are required and no additional Action Levels are necessary. References: BC MOECCS. 2014. Companion Document to: Ambient Water Quality Guidelines for Selenium Update. Prepared by British Columbia Ministry of Environment, Science and Information Branch: Victoria, British Columbia. ERM. 2018. Ekati Diamond Mine: 2017 Aquatic Effects Monitoring Program Part 1 - Evaluation of Effects. Prepared for Dominion Diamond Ekati ULC by ERM Consultants Canada Ltd. Vancouver, BC ERM. 2019a. Ekati Diamond Mine: 2019 Aquatic Effects Monitoring Program (AEMP) Re-evaluation. Prepared for Dominion Diamond Mines ULC by ERM Consultants Canada Ltd. Vancouver, BC ERM. 2019b. Ekati Diamond Mine: Response Plan for Fish Version 2.0. Prepared for Dominion Diamond Mines ULC by ERM Consultants Canada Ltd. Vancouver, BC Golder. 2018. Aquatic Effects Monitoring Program Design Plan Version 5. Prepared for Diavik Diamond Mines (2012) Inc., Yellowknife, NW. Golder. 2020a. Aquatic Effects Monitoring Program 2019 Annual Report. Prepared for Diavik Diamond Mines (2012) Inc. by Golder Associates Ltd. Calgary, AB. Golder. 2020b. Aquatic Effects Monitoring Program Design Plan Version 5.2. Prepared for Diavik Diamond Mines (2012) Inc. by Golder Associates Ltd. Edmonton, AB Lemly, 2002. Selenium Assessment in Aquatic Ecosystems: A Guide for Hazard Evaluation and Water Quality Criteria. US Forest Service, Blacksburg, VA. Lemly, A. and H. Ohlendorf. 2002. Regulatory implications of using constructed wetlands to treat selenium-laden wastewater. Ecotoxicology and Environmental Safety 52 (1): 46-56. US EPA. 2016. Aquatic life ambient water quality criterion for selenium - freshwater. EPA 822-R-16-006. U.S. Environmental Protection Agency: Washington, DC.
5	Aquatic Response Framework (ARF)- Fish Response Plan	**Comment** The Fish Response Plan sets a benchmark for mercury in fish of 0.46 mg/kg (0.00046 mg/gm) methylmercury. The Agency is concerned that this benchmark is not appropriate if fish harvesters using AEMP lakes in the future ate fish at weekly rates higher than those assumed (e.g., 3 servings/week rather	**Dec 22:** Response to recommendations 4 and 5: The reviewer has indicated that Dominion has set a benchmark of 0.46 mg/kg methylmercury dry weight in the Fish Response Plan. However, Dominion has not set any benchmark for methylmercury in the Fish Response Plan. The Fish Response Plan, Version 2.0 uses the

		than the assumed 1 serving) and/or in larger serving portions (e.g., 500 gm rather than the assumed 200 gm). Fish consumption at these higher, but still realistic rates, would require a USEPA/FDA guideline of 0.15 mg/kg (0.00015 mg/gm) methylmercury, and BC Health guideline of 0.2 mg/kg (0.0002 mg/gm) total mercury. To improve human health protection benchmarks for metals in fish tissue in the Fish Response Plan the company has committed to an investigation of fish consumption rates in its Impact and Benefits Agreement communities. The Agency supports this positive initiative to refine Fish Response Plan action levels. Until that study is completed however, the Agency believes that Dominion should use an interim protective level of 0.15 mg/kg methylmercury or 0.2 mg/kg total mercury in fish tissue as the site-specific screening value for development of Medium (MAL) and High Action Levels for total mercury in AEMP fish. The Agency also argues that setting the MAL for mercury at 70% of the benchmark is not adequately conservative. Dominion states that background concentrations of mercury in fish from AEMP lakes have occasionally exceeded 70% of the screening value (0.46 mg/kg methylmercury dry weight) and that the frequency of MAL exceedances will increase if this value is lowered to 50%. Dominion argues that a 70% action level makes the fish MAL consistent with the MAL for water quality variables. **Recommendation** Recommendation 4: Until such time as Dominion has completed a study of the fish consumption habits of residents in impacted communities, an interim benchmark of 0.15 mg/kg methylmercury or 0.2 mg/kg total mercury in fish tissue should be established in the Fish Response Plan. Recommendation 5: The Medium Action Level for mercury in fish should be set at 50% of the benchmark rather than 70%. This would better reflect the bioaccumulative nature of mercury and the interests of ensuring and preserving the safety of fish for consumption by Indigenous land users after the Ekati mine is closed. Recommendation 6: The frequency of harvestable fish monitoring should be re-evaluated, with the consideration of an increase in frequency from once every 6 years to once every 3 years.	United States Environmental Protection Agency (USEPA)/Food and Drug Administration (FDA) recommended screening value of 0.46 mg/kg wet weight in Section 2.4: Ecological Implications of Action Level Exceedance and Relation to Significance Thresholds. This value was used to provide an assessment of the current risk of human health effects from fish consumption based on currently observed mercury concentrations (low Action Level exceedance). The USEPA/FDA guidance was relied on for this assessment over other available guidance because the scientific rationale was transparent, which was not the case for guidance provided by Health Canada and the British Columbia MOECCS (ERM 2019). The screening value is reasonably consistent with Health Canada's total mercury tissue guideline of 0.5 mg/kg ww for the protection of human consumers of fish (Health Canada 2018). The reviewer proposes a benchmark using an unsubstantiated fish consumption rate without reference to specific engagement regarding fish consumption in the proximity of the Ekati Diamond Mine. Applying an alternative benchmark based on an unsubstantiated fish consumption rate is not appropriate. Small lakes like Leslie and Kodiak lakes are less likely to be targeted by land users, given the proximity of bigger lakes such as Lac de Gras or Lac du Sauvage, traditionally known for their usage as fishing spots (BHP and Dia Met 1995, Rescan and and Points Lakes Heritage Consulting Ltd 1999). Dominion has already committed to engage with Indigenous Governments on fish consumption rates, in order to properly assess the potential risks according to their traditional use of the area. The Fish Response Plan, Version 2.0 indicated that medium and high Action Levels for mercury in fish tissue would be based on site-specific human consumption screening values at site-specific consumption rates that would be calculated according to USEPA/FDA guidance and consumption advisory screening values; defined values were not provided because the information needed to calculate these values is not yet available (ERM 2019). The Fish Response Plan Version 2.0 states that the site-specific human consumption screening value for mercury will also consider site-specific consumption data, Health Canada's recommended human characteristics (e.g., recommended bodyweight of adults and toddlers), and site-specific methylmercury to total mercury fish tissue proportion s, if available (ERM 2019). Action Levels developed in this manner are considered conservative and protective of human health at the

			Ekati Diamond Mine given that US EPA/FDA guidance is based on epidemiological studies and includes an uncertainty factor of 10 (ERM 2019, US FDA 2019). Therefore, an unsubstantiated interim benchmark is not required and the assessment of the level of risk associated with the current low Action Level exceedances continues to be valid. The medium Action Level based on 70% of the site specific human consumption screening value calculated using USEPA/FDA guidance is inherently conservative as outlined above (70% of a guideline that already includes an uncertainty factor of 10) and in the Fish Response Plan Version 2.0 (ERM 2019) and already considers the bioaccumulative nature of mercury such that 70% of the screening value is appropriate. Once the Fish Response Plan Version 2.0 is approved by the Board, screening values are calculated, and the Fish Response Plan is updated, reviewers will have another opportunity to comment on the proposed Action Levels for mercury in fish tissue.
6	Aquatic Response Framework (ARF)- Fish Response Plan	**Comment** continued from above; The Agency believes that making fish action levels for mercury reflect action levels developed for water quality variables has not been properly justified. Contaminant levels of metals that bioaccumulate in fish take far longer to decrease than in the water column. Early warning systems like the ARF should have lower, not higher, action levels for media that respond more slowly. In addition, water quality response plans use annual water quality monitoring data, while the Fish Response Plan relies on data collected every 6 years for large-bodied fish, and 3 years for small bodied fish. This results in greater information gaps and a less robust data set for fish, making it harder to accurately identify and predict trends in contaminant loadings. The Agency believes that harvesters must be assured that fish in affected lakes will be safe to eat following mine closure. In stating this, the Agency notes that lake trout in Ekati lakes have been found to live to over 25 years of age, so it is conceivable that if young trout were to be contaminated by metals at the mine shortly before closure completion those trout would be available for harvest a number of years post closure when the Ekati site is accessible to land users once more. The Agency believes that the frequency of harvestable fish monitoring should be re-evaluated. Reducing the length of time between sampling events (i.e., increase monitoring frequency), at least on a temporary basis	**Dec 22:** IEMA has recommended that Dominion consider increasing the frequency of sampling large-bodied fish from once every six years to once every three years. This recommendation does not appear to consider the detrimental effects that a higher frequency sampling program has been demonstrated to have on fish populations. Initiating large-bodied sampling at a three-year frequency would be irresponsible and would ignore the demonstrated sensitivity of this Arctic ecosystem. Most AEMP lakes are small and support a slow growing and small population of large-bodied fish. Decreases in Catch per Unit Effort (CPUE) have already been linked to past fishing pressure in the Ekati system. Dominion has since adapted its monitoring program to reduce this effect in several ways: the addition of Slimy Sculpin sampling every three years, the associated reduction of large-bodied fish sampling from once every five years to once every six years, and the collection of tissue plugs from Lake Trout rather than lethal sampling. Reverting to a shorter sampling interval would intentionally disregard the historically demonstrated harm in the Receiving Environment associated with increased sampling. Additionally, it would go against feedback received from Traditional Knowledge holder engagement, which directed Dominion to do as little harm to large bodied fish populations as possible . Unnecessary non-lethal sampling is also not recommended. Even with non-lethal sampling, incidental

		while metal levels are at levels of concern, would result in a more robust data set and greater confidence in impact predictions. In order to minimize effects on fish populations, non lethal sampling should continue to be used. **Recommendation** None	mortalities are expected, especially for Round Whitefish. As previously outlined in Rescan (2011), "While tissue biopsy sampling is touted as being a non-lethal method to sample for metals in the tissue of fish, for a species such as Round Whitefish that is sensitive to handling, it is unlikely that tissue plug sampling can replace lethal sampling as mortalities are inevitable". Therefore, Lake Trout is the only species that can be sampled using the non-lethal tissue plug approach. However, gillnetting is still required in order to capture the Lake Trout, which still results in mortalities to other fish species (including Round Whitefish) despite Dominion's best attempts at reduced timeframes for setting and retrieving the nets. Putting unnecessary pressure every three years on the large-bodied fish populations (incidental mortalities, non-lethal injuries from the gillnet, invasive dermal punches, handling stress, etc.) is not justified by the results of the AEMP. Furthermore, over harvesting of large-bodied fish populations in these small lakes would not only have a detrimental effect on fish populations but could impede the ability of the AEMP to detect change (i.e., few fish remaining in the Receiving Environment to monitor). The increase in mercury concentrations in large-bodied fish has triggered the development of a Fish Response Plan and is being appropriately addressed via the Aquatic Response Framework. Dominion has and continues to engage extensively with communities and the information received has directly influenced the current versions of the AEMP Design Plan and is a key reason that Dominion is committed to limiting the effect on large-bodied fish communities by the appropriate use of a sentinel species (i.e., Slimy Sculpin) every three years. Dominion disagrees with this recommendation; there is no evidence to support increased frequency of sampling of large-bodied fish as part of the AEMP and it would be irresponsible to do so. References: BHP and Dia Met. 1995. NWT Diamonds Project: Environmental Impact Statement. Kelowna, British Columbia, Volume IV, Impacts and Mitigation. ERM. 2019. Ekati Diamond Mine: Response Plan for Fish Version 2.0. Prepared for Dominion Diamond Mines ULC by ERM Consultants Canada Ltd. Vancouver, BC Health Canada. 2018. Canadian Standards (Maximum Levels) for Various Chemical Contaminants in Foods. https://www.canada.ca/en/health-canada/services/food-nutrition/food-safety/chemicalcontaminants/maximum-levels-chemical-contaminants-foods.html Rescan and Points Lakes

			Heritage Consulting Ltd. 1999, Five years of archeological research for the BHP Diamonds Inc at the Ekati Diamond Mine, Northwest Territories, 1994-1998, Prepared for BHP Diamonds Inc. Rescan. 2011. Ekati Diamond Mine: Summary Evaluation and Proposed Work Plan for the Fish Component of the 2012 Aquatic Effects Monitoring Program. Prepared for BHP Billiton Canada Inc. by Rescan Environmental Services Ltd.: Yellowknife, Northwest Territories. US FDA. 2019. Technical Information on Development of FDA/EPA Advice about Eating Fish for Women Who Are or Might Become Pregnant, Breastfeeding Mothers, and Young Children. https://www.fda.gov/food/metals/technical-information-development-fdaepa-advice-about-eatingfish-women-who-are-or-might-become (accessed July, 2019).
North Slave Metis Alliance: Adelaide Mufandaedza			
ID	**Topic**	**Reviewer Comment/Recommendation**	**Proponent Response**
1	General File	**Comment** (doc) Dominion Diamond Ekati ULC 2019 AEMP Annual Report **Recommendation**	
Wek' eezhii Renewable Resources Board: Laura Meinert			
ID	**Topic**	**Reviewer Comment/Recommendation**	**Proponent Response**
1	2019 AEMP Annual Report	**Comment** The WRRB has no comments at this time. **Recommendation** The WRRB has no recommendations at this time.	
WLWB: Meaghan MacIntyre-Newell			
ID	**Topic**	**Reviewer Comment/Recommendation**	**Proponent Response**
1	2019 Cujo Lake Aeration Strategy Follow-up	**Comment** In the 2019 Cujo Lake Aeration Strategy Follow-up Memo, Dominion states "monitoring efforts were expanded to include White Lake in 2019 to address the theory that low under-ice DO in Cujo Lake may be a natural occurrence." It is unclear why the comparison was limited to White Lake and why one year of monitoring data in the comparison lake is sufficient to determine that "low DO concentrations measured in late winter may also be a natural phenomenon in Cujo Lake." **Recommendation** (1) Please provide rationale for why the comparison was limited to White Lake and provide decision-making criteria if any other lakes were considered for comparing under-ice DO concentrations. (2) Can Dominion provide rationale for why one year of monitoring data in White Lake is sufficient to	**Dec 22:** Monitoring was proactively initiated in White Lake in 2019 as a component of a larger program aimed at investigating the driving factors of low under-ice DO concentrations. A list of ten lakes in the Ekati Mine Claim Block were assessed for morphological similarity to Cujo Lake based on location, area, volume, shoreline distance, maximum depth, mean depth, and depth ratio, in additional to a visual assessment of lake bathymetry. Monitoring was initiated in White Lake (which does not receive direct mine inputs) due do its proximity and morphological similarity to Cujo Lake. The first year of monitoring was 2019 and additional monitoring has been completed in 2020. The suggestion that low DO concentrations measured in late winter may be a natural phenomenon in Cujo Lake is not based exclusively on the similarities between White

		support the theory that low under-ice DO concentrations may be a natural phenomenon?	Lake and Cujo Lake following one year of concurrent monitoring. Rather, this statement is based on multiple lines of evidence that morphology is an important factor contributing to low under-ice DO concentrations in Cujo Lake. The detailed investigation of cause presented in the Ekati Diamond Mine Aquatic Response Plan for Under-ice Dissolved Oxygen Version 1.2 concluded that lake morphology and ice-cover phenology (which is also expected to be affected by lake morphology) were the primary drivers of low under-ice DO conditions in Cujo Lake. The similarity in morphological characteristics and under-ice DO profiles between Cujo and White lakes during the ice-covered season support the conclusion of the detailed investigation; however, the use of the word "may" in the AEMP Report that was quoted by the reviewer indicates that based on current information it cannot be definitively concluded that low under-ice DO concentrations in Cujo Lake are a natural phenomenon.

December 8, 2020

Joseph Mackenzie
Chair
Wek'èezhìı Land and Water Board
#1-4905 48th Street
Yellowknife, NT
X1A 3S3

Dear Mr. Mackenzie,

Re: Dominion Diamond Ekati ULC (Dominion)
Water Licence – W2012L2-0001
2019 Aquatic Effects Monitoring Program (AEMP) Annual Report
Request for Comment

The Department of Environment and Natural Resources (ENR), Government of the Northwest Territories has reviewed the report at reference based on its mandated responsibilities under the *Waters Act* and provides the following comments and recommendations for the consideration of the Board.

Topic 1: Third Party Review

Comment(s):

ENR retained Zajdlik Associates Inc. to conduct a review of Dominion Diamond Mines' (Dominion) 2019 AEMP Annual Report. ENR has extracted and summarized the comments and recommendations from the memorandum and provided them below. ENR has also included the memorandum which provides additional background for the Board's information.

Recommendation(s):

1) ENR recommends the Board refer to the attached memorandum for additional background and context supporting ENR's comments and recommendations.

Topic 2: Equation 1 Terms

Comment(s):

Equation 1 in Section 1.1.1.1 of Part 3, Statistical Report contains a redundant term. It appears as though one of the site*year interaction terms should be site*year^2.

Recommendation(s):

1) ENR recommends Dominion review and correct the equation.

Topic 3: Presentation of Statistical Model Results

Comment(s):

ENR notes that the inclusion of a quadratic term in the series of models used to assess temporal trends induces a parabolic trend line that may be misleading if model coefficients are not carefully assessed. As model coefficients and their standard errors are not provided (a recommendation on this topic follows), this careful assessment is not possible. It would be helpful for reviewers if some sort of smoothing function could be applied to summarize temporal trends in the main body of the AEMP report.

Recommendation(s):

1) ENR recommends that statistical model results continue to be plotted in the statistical report and that some form of smoothing function be applied to summarize temporal trends in the main body (i.e. Part 1 – Evaluation of Effects) of the report.

Topic 4: Quadratic Function

Comment(s):

The quadratic function itself may not be the most appropriate curvilinear model because of shape limitations. In some graphics an increasing trend is induced by the model form that does appear to be supported by the raw data. See for example ERM (2020, Figure 3.2-10a: Total P, Kodiak Lake). ENR notes that a more flexible shape could be considered.

Recommendation(s):

1) ENR recommends Dominion consider a more flexible model shape to improve observed lack of fit.

Topic 5: Model Coefficients

Comment(s):

Section 2.2.1.4 presents statistical modeling summary results for the analysis of total phosphorus during the open water season for sampling locations in the Koala watershed. The results presented show that several observations for Kodiak Lake are poorly fitted on the natural scale and that even after transformation, one observation is still poorly fit. The overall model proportion explained variance is low. However, because only modeling summaries are presented in "Part 3 - statistical results section", it is not possible to judge the significance of specific terms. In this example, the specific terms of interest are the linear and quadratic slope terms and their standard errors and, the interaction terms and their standard errors for Kodiak Lake.

Recommendation(s):

1) ENR recommends that Dominion provide estimated model coefficients and their standard errors so that readers can assess the significance of specific terms. This very large body of information could be presented with rudimentary formatting with a monospaced font to reduce reporting effort.

Comments and recommendations were provided by ENR technical experts in the Water Management and Monitoring Division and the North Slave Region and were coordinated and collated by the Environmental Assessment and Monitoring Section (EAM), Environmental Stewardship and Climate Change Division.

Should you have any questions or concerns, please do not hesitate to contact Patrick Clancy, Environmental Regulatory Analyst at (867) 767-9233 Ext: 53096 or email patrick_clancy@gov.nt.ca.

Sincerely,

Patrick Clancy
Environmental Regulatory Analyst
Environmental Assessment and Monitoring Section
Environmental Stewardship and Climate Change Division
Department of Environment and Natural Resources
Government of the Northwest Territories

Att: Zajdlik Associates Inc. Memo - DDULC - W2012L2-0001 - Review of 2019 AEMP Annual Report – December 6, 2020

Ekati 2019 Aquatic Effects Monitoring Program Review

Prepared for:

L. Malone
Government of the Northwest Territories
Environment and Natural Resources

Prepared by:

Zajdlik & Associates Inc.

December 6th, 2020

Table of Contents

List of Tables

Table 1-1: Acronym Definitions

AEMP	aquatic effects monitoring program
DDEC	Dominion Diamond Ekati Corporation
GNWT ENR	Government of the Northwest Territories Environment and Natural Resources
LLCF	Long Lake Containment Facility
PDC	Panda Diversion Channel
WLWB	Wek̀èezhìi Land and Water Board

1 Introduction

Zajdlik & Associates Inc. was retained by the Government of the Northwest Territories, Environment and Natural Resources (GNWT ENR) to review the 2019 aquatic effects monitoring program (AEMP) report for the Ekati Diamond Mine:

ERM. 2020. Ekati Diamond Mine 2019 Aquatic Effects Monitoring Program, June 2020.

Overall, the AEMP report is well organized and thoughtfully executed. The review focuses on AEMP results for the Koala watershed because kimberlite from all DDEC mining activities is processed at the main Ekati site, with discharge to the Koala watershed via the Long Lake Containment Facility (LLCF).

2 Observed Effects in the Koala Watershed

Mine related effects were found for nitrite and nitrate downstream to Moose Nero Stream and elevated concentrations of ammonia attributable to the mine were detected in Leslie Lake during the open water season and in Moose and Nema lakes during the ice-covered season (ERM 2020, Part 1, Table 3.4-1). ERM (2020, Part 3, §2.1.2.4 Subsection 4.1) shows that temporal trends in total P under-ice in Kodiak, Leslie, and Moose lakes show significant deviation from a slope of zero. ERM (2020, Part 3, §2.1.2.4 Subsection 4.2) which contrasts trends in total P in exposure lakes with total P in reference lakes shows significant differences for the following lake pairs: Kodiak-vs-Nanuq, Kodiak-vs-Counts, Kodiak-vs-Vulture, and Leslie-vs-Vulture. A nominally insignificant result was also observed for differences in trends between total P in Moose (exposure) and Vulture (reference) lakes. Although the summary of aquatic effects in the Koala-Watershed concludes that there are no mine-related effects of total P[1] (ERM, 2020, Part 3, Table

[1] Total P in lakes proximal to the LLCF exhibits a general temporal pattern similar to other analytes (an increase to 2015 through 2017 followed by stabilization and/or decrease). See for example Figure 3.2-10a, b (ERM, 2020). This would be a useful addition to Table 3.4-1 which states merely that total P remained below the AEMP benchmarks.

3.4-1) effects are detected at the two immediate downstream receiving lakes. Together, as a body of evidence, the nitrogen and phosphorous results suggest the potential for eutrophication-related effects, at least in the immediate vicinity of discharge from the LLCF and PDC (Panda Diversion Channel).

One measure of eutrophication is chlorophyll *a*. Changes in chlorophyll *a* downstream of the Ekati facility are summarized stating that: "Mean 2019 concentrations were greater than the benchmark range in Kodiak, Leslie, Moose, Nema, and Slipper lakes, and site S2 in Lac de Gras. The mean concentration also exceeded the benchmark in one reference lake, Counts Lake." (ERM, 2020, Table 3.4-1). Elevated chlorophyll *a* concentrations are declared for Kodiak, Leslie and location S2 (ERM, 2020, Part 3, §2.2.1, subsection 4.1). A mine-related effect is not noted due to a "lack of consistent trends". Outcomes of the statistical modelling paradigm presented in (ERM, 2020, Part 3, Figure1.1-1) are presented in (ERM, 2020, Part 3) but details[2] of fitted models are not provided. A recommendation on this topic is presented in §4, herein. Because details are not provided, readers must rely on visual examination of the fitted trends presented. With respect to chlorophyll *a*, ERM (2020, Part 3, §2.2.1, subsection 6, Observed and Fitted Values) shows that, with the exception of Moose Lake, chlorophyll a concentrations are increasing in all exposure locations since approximately, 2009. Rates of increase do vary and, the form of increase (quadratic versus linear) also varies. However, the fitted trend lines presented are internally consistent.

ERM (2020, Part 1, §2.2.1) defines a mine effect as follows: "Changes deemed significant were assessed to determine whether they were likely to be the result of mine-related activities, sampling activities, or natural variation. The identification of a change as a mine related effect required the existence of plausible mechanisms that could link mine-related activities and change. For example, consider a situation where hypothetical water quality variable y has increased in a lake that is the third monitored lake downstream of a point source (e.g., the LLCF), but there has been no change in variable y in lakes that are closer to the point source. The lack of a clear spatial gradient (e.g., decreasing concentrations with increasing distance downstream of the point source) indicates that the observed change is unlikely related to the

[2] Those details include regression coefficients, standard errors and Wald-type tests of significance.

point source and thus, would not be considered a mine related effect. Benchmarks and biological trends were important in interpreting the ecological significance of detected mine-related effects".

Although locations identified as having significantly elevated chlorophyll *a* concentrations relative to reference lakes (Leslie, Kodiak and S2, See ERM 2020, Part 3, §2.2.1, subsection, 4.1) are not in direct flow order, both Leslie and Kodiak lakes are the first lakes either affected by discharge from the Ekati facility or subject to site disturbances and activities due to proximity. It is not surprising given the limited sampling conducted[3], that changes in chlorophyll *a* are not statistically detectable in all lakes (i.e. those between location S2 in Lac de Gras and Leslie and Kodiak lakes). What is telling, is that the two closest lakes to the Ekati main site show elevations in chlorophyll *a* and, that temporal trends are visually at least, consistent. It is notable that total P and N are also elevated in these two lakes. As a body of evidence, the results provide plausible mechanisms (discharge of nutrients) that link mine-related activities (direct discharge, surficial losses, site activities and dust deposition) and effects (local increase in chlorophyll *a*). The local increase in productivity may be accelerating the cycling of metals such as Hg (Lavoie et al. 2013) that led to action level exceedances for Hg[4] and Se in fish tissues in the first two lakes in the Koala watershed receiving discharge from the Long Lake Containment facility (ERM 2020; Zajdlik 2020).

ERM (2020, §3.4) states: "Thus, despite increases in evaluated water quality, the comparison of observed 2019 water quality data to benchmark values suggests that toxicological and nutrient enrichment type effects as a result of the observed water quality concentrations of the evaluated variables in the Koala Watershed and Lac de Gras are not expected." The conclusion reached using spatial patterns of changes presented above, differs from that based simply on comparison to benchmark values in that a local nutrient enrichment effect is observed. Note that ERM does acknowledge that "changes could occur in biological communities downstream of the LLCF as

[3] The limitations of sampling have been presented in the past. The primary weakness is the lack of sampling effort within seasons; especially for biotic variables such as chlorophyll *a* that are driven by species composition and overall species abundance which both vary over the open water season.

[4] We note that DDEC has committed to including Hg as an evaluated water quality variable in the 2020 field season (DDEC 2019 §4.7.1) and Se is already an evaluated water quality variable; hence no recommendation on this topic (evaluated water quality variables) is presented.

far as site S3 in Lac de Gras based on relative competitive abilities of different species under different environmental conditions". This idea is further expanded upon with references to macronutrient ratios conferring competitive advantages to certain taxa.

Some thought was given to providing a recommendation to more formally[5] incorporate distance from the discharge site (LLCF) in the data interpretation paradigm. That recommendation was made in 2008 and rejected by the WLWB (2010). However, the recommendation was misunderstood. The intent was not to test for significant differences in response variables (water and sediment quality or biotic variables (integrative measures of plankton composition, fish tissue residues, etc.)) with distance from the LLCF, but rather to describe changes down the primary flow path. This type of description, whether it takes the form of spatial plot, spatial plot and superimposed smoothing functions (i.e. Figure 2-1, herein) and/or more formal (i.e. ordinal regression analyses), would augment the temporal trend analyses. As an example[6] only, the 2019 open water measurements for nitrate, phosphorous and chlorophyll a are presented by lake sampling station order in the Koala watershed, downstream of the LLCF. For each measurement, the lake-specific median of replicates and depths is scaled by the maximum median to simplify this presentation. A smoothing function is used to improve visualization.

[5] Within annual AEMP reports, distance is presented using colours following a heat palette (ERM, 2020 §2.2.4.1). This is useful but not as explicit as presenting results over space as shown in Figure 2-1, herein. ERM (2020) also mentions the use of spatial gradients "if statistical analyses were not possible because assumptions or data requirements were not satisfied".

[6] The graphic could usefully present other measurements such as taxonomic density; improve treatment of data collected at different depths, use more appropriately scale measurements, etc. The graphic should not be construed as a definitive statement regarding eutrophication effects.

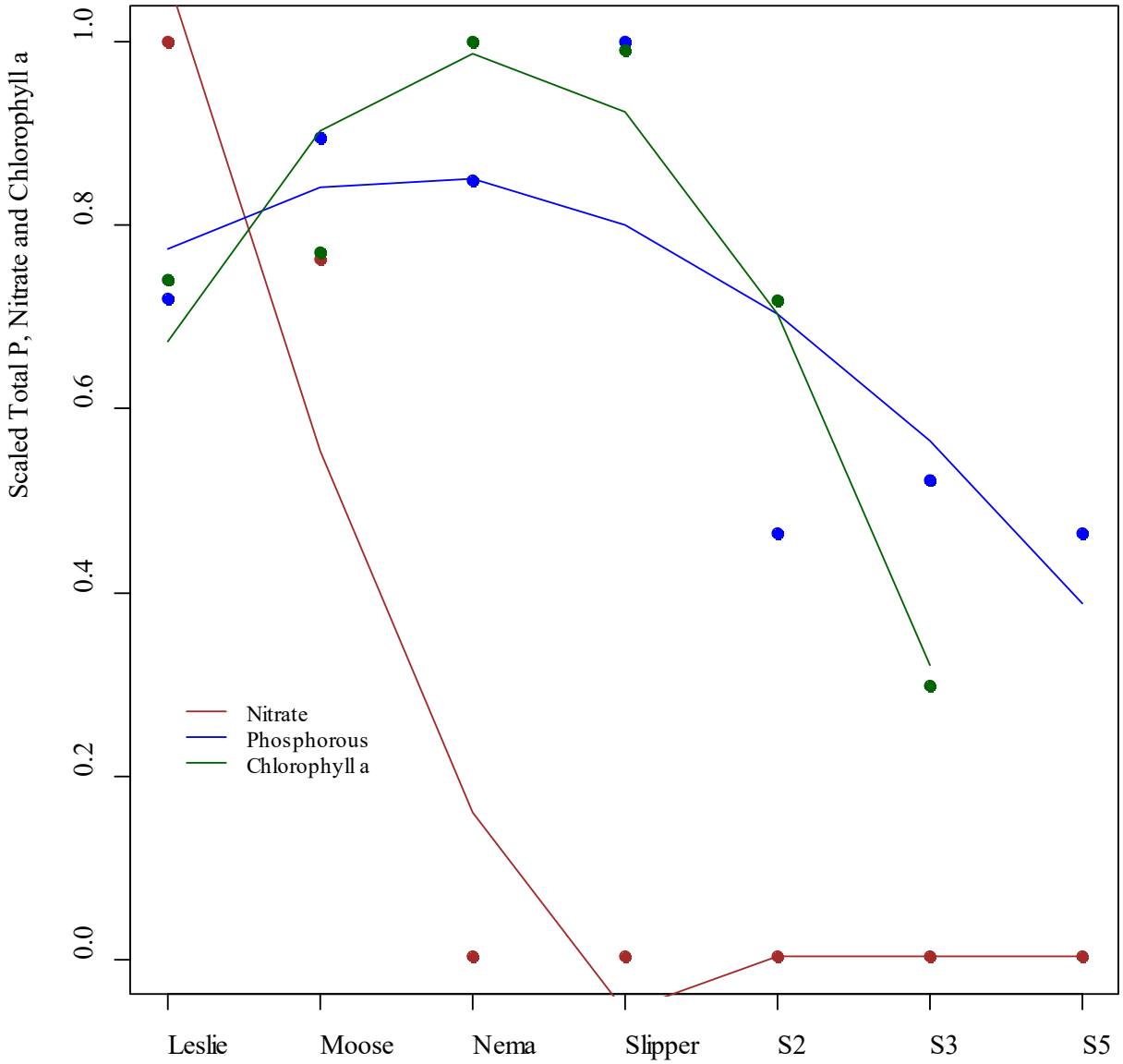

Figure 2-1: Open Water Nutrient Enrichment Variables Downstream of the LLCF

The spatial presentation seems[6] to confirm the local eutrophication hypothesis for the 2019 open water season. Formal statistical analyses were not conducted at this time. Explicit spatial presentations can be used to investigate hypotheses suggested to an inquisitive data analyst that are not captured by requiring a strict and complete set of significant temporal effects along the flow path.

3 Observed Effects in the King-Cujo Watershed

Mine-related effects are noted for nitrate (open water season), total ammonia (ice-covered season), total P (open water season) and chlorophyll *a* (only assessed during open water season), in Cujo Lake (ERM 2020, Table 4.4-1). As noted in §2 herein, the local increase in productivity may be a contributing factor in the elevated tissue metal residues noted in Cujo Lake.

4 General Recommendations

The following recommendations are provided in no particular order.

- Equation 1 (ERM 2020, Part 3 Statistical Report, § 1.1.1.1) contains a redundant term. It is likely that one of the site*year interaction terms should be site*year^2. DDEC (Dominion Diamond Ekati Corporation) should correct the equation.

- In some cases, best professional judgement is used to assess fitted models. The inclusion of a quadratic term in the series of models used to assess temporal trends induces a parabolic trend line that may be misleading if model coefficients are not carefully assessed. As model coefficients and their standard errors are not provided (a recommendation on this topic follows), this careful assessment is not possible. It is recommended that statistical model results continue to be plotted in the statistical report and that some form of smoothing function be applied to summarize temporal trends in the main body (i.e. Part 1 – Evaluation of Effects) of the report.

- The quadratic function itself may not be the most appropriate curvilinear model because of shape limitations. In some graphics an increasing trend is induced by the model form that does appear to be supported by the raw data. See for example ERM (2020, Figure 3.2-10a: Total P, Kodiak Lake). DDEC should consider a more flexible model shape to improve observed lack of fit.

- Statistical modelling summary results presented for the analysis of total P during the open water season for sampling locations in the Koala watershed are presented in ERM (2020, Part 3, §2.2.1.4). The results presented show that several observations for Kodiak lake are poorly fitted on the natural scale and that even after transformation, one observation is still poorly fit. The overall model proportion explained variance is low. However, because only modelling summaries are presented in statistical results section (ERM 2020, Part 3) it is not possible to judge the significance of specific terms. In this example, the specific terms of interest are the linear and quadratic slope terms and their standard errors and, the interaction terms and their standard errors for Kodiak Lake. DDEC should provide estimated model coefficients and their standard errors so that readers can asses the significance of specific terms. This very large body of information could be presented with rudimentary formatting with a monospaced font to reduce reporting effort.

5 References

DDEC (Dominion Diamond Ekati Corporation). 2019. Ekati Diamond Mine 2019 Aquatic Effects Monitoring Program (AEMP) Re-evaluation Including the Aquatic Response Framework Re-evaluation and Proposed 2020 to 2022 AEMP Design Plan Version 7.0.

ERM. 2019. Ekati Diamond Mine: Response Plan for Fish Version 2.0. Prepared for Dominion Diamond Ekati ULC by ERM Consultants Canada Ltd.: Yellowknife, Northwest Territories.

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Lavoie, R.A., T. D. Jardine, M. M. Chumchal, K. A. Kidd, and L. M. Campbell. 2013. 2013 Biomagnification of Mercury in Aquatic Food Webs: A Worldwide Meta-Analysis. Environ. Sci. Tech. 47(23):13385-13394.

Zajdlik, B. A. 2020. Review of DDEC AEMP Fish Response Plan, Version 2.0. Prepared for B. Pain, GNWT ENR. Prepared by Zajdlik & Associates Inc., February, 2020.

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December 2, 2020

Joseph Mackenzie
Chair, Wek'eezhii Land and Water Board
#1-4905 48th St
Yellowknife, NT X1A 3S3

Re: 2019 Ekati Aquatic Effects Monitoring Plan Annual Report

Dear Joseph Mackenzie,

The Independent Environmental Monitoring Agency (Agency) has reviewed the Dominion Diamond Mines ULC (Dominion) 2019 Ekati Aquatic Effects Monitoring Plan (AEMP) Annual Report. As has been the case for several consecutive years, the Agency is satisfied the document adequately reports on all aspects of aquatic environmental impacts downstream of the Ekati mine.

After completing our review, the Agency has the following specific comments and recommendations on the Annual Report.

Under-ice oxygen in Cujo Lake

Dissolved oxygen (DO) levels continued to remain below CCME guidelines for protection of fish under ice at depths below 3.4 m in Cujo Lake, consistent with Cujo's historical DO profiles. The AEMP report states this is consistent with DO concentrations at lower depths in reference lakes Counts and Nanuq. However, the Agency suggests this comparison is not entirely accurate and may lead to misinterpretation of results. Low-oxygen conditions were measured at much shallower depths in Cujo Lake, which also has a lower total water volume, than in the two reference lakes. Overall, these factors result in Cujo Lake providing a smaller oxygen-rich habitat for fish than in the reference lakes. White Lake, another reference lake used for the 2019 Cujo Lake Aeration Strategy follow-up, also had DO levels greater or equal to CCME guidelines, which extended several times deeper into the water column than in the East-Main basin of Cujo Lake for the same spring months (Feb 19, 2019 Dominion memo to WLWB). Meaning that the reference lakes had more well oxygenated areas than Cujo Lake. Comparison of DO profiles between Cujo and reference lakes are essential elements in determining whether anoxic conditions under ice in Cujo Lake are driven by mining activity, or natural processes.

Recommendation 1: Based upon comparisons of DO levels between Cujo and relevant reference lakes, the AEMP should re-evaluate the conclusion that Cujo Lake has similar oxygen levels as lakes unaffected by the Ekati mine.

Aquatic Response Framework (ARF)

Selenium Levels in Fish Tissues

The 2017 AEMP report, the last sediment quality monitoring year, concluded the potential exists for aquatic life in Leslie Lake to be adversely affected due to sediment selenium concentrations exceeding British Columbia Ministry of the Environment (BC MOE) sediment guidelines[1]. In response to previous Agency inquiries and the Wek'heezi Land and Water Board's directive to investigate "*the relationship between sediment quality, water quality, and fish tissue concentrations for selenium*"[2] the company examined this in its Re-evaluation of the Aquatic Response Framework.

In the Re-evaluation Report, a positive statistical relationship was reported between selenium concentrations in sediment and fish tissue in lakes downstream of the Long Lake Containment Facility (LLCF) and King Pond[3]. Concentrations were higher in sample locations closer to the discharge point, suggesting mining activity as the source.

The Fish Response Plan v 2.0 determined that "*Since the primary route of exposure to selenium in fish is through dietary uptake, the Action Level exceedances for fish were likely caused by food web exposure resulting from elevated water column and/or sediment concentrations".* Fish sampling in 2018 supported this. Selenium levels in some individual slimy sculpin and lake whitefish in Leslie lake exceeded the US EPA guideline for fish health and the BC MOE Human Health Guidelines. The fish study also found mean selenium levels in lake trout tissue were increasing from previous monitoring years, although they were not yet above guideline levels. The Agency is very concerned by these findings and believes that Dominion needs to move quickly to reduce selenium at its source and disrupt the pathway that appears to be resulting in elevated levels of selenium in fish tissues.

The data lead the Agency to believe the source of selenium in fish is indirectly through sediment, which enters the food chain through the benthos (benthic invertebrates). This needs to be confirmed, and if found to be correct, mitigation which targets the reduction of concentrations in sediment and/or the benthos needs to proceed, especially those invertebrate species favored by slimy sculpin and whitefish. Mitigation that is currently mentioned in Fish Response Plan 2.0 is vague, suggesting at reduction in lakes downstream of the LLCF by pumping wastewater to Panda and Koala Pits rather than the LLCF. The Agency believes this will only delay the effects since the water in Panda and Koala will ultimately need to be pumped back into the LLCF to make room for the fresh water cap in pit lakes at closure. Once selenium has reached fish tissues it is too late to halt the harm to these important Valued Ecosystem Components. It seems that effective benchmarks with action levels need to be put in place for sediment or benthos in the Aquatic Response Framework.

In the past Dominion has raised issues with the ability to determine a sediment benchmark for selenium, however there are other industry examples where benchmarks have been established. For example, the Diavik Diamond Mine Inc. has developed a strategy in its Aquatic Response Framework for establishing a sediment quality benchmark for selenium [1]and other metals. In addition to the method described by Diavik, there are existing guidelines for selenium sediment concentrations from BC MOE and US EPA,

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[1] Ministry of Environment Province of British Columbia: Ambient Water Quality Guidelines for Selenium. Technical Report Update. 2014. BC Ministry of Environment

[2] Reasons for Decision for the Ekati 2017 AEMP Annual Report, WLWB meeting of November 19, 2018

[3] 2019 Ekati AEMP Re-evaluation Report Appendix A - section 3.1.2.2

both at 2.0 mg/kg, that could also be used. The 2017 mean selenium sediment concentration in Leslie Lake was 2.03 mg/kg (2017 AEMP Part 1 Evaluation of Effects p 3-166). As mentioned above, the Agency is concerned that selenium levels in fish are already elevated and will take a long time to decline since selenium released as a result of mining activities appears to be held in the sediments of Leslie Lake and not the water column.

Recommendation 2: Dominion investigate the potential sources (e.g., LLCF discharge) and pathways (e.g., food chain transfer; in-lake processes that increase selenium bioavailability) that are driving increases of selenium in fish tissues.

Recommendation 3: Once the potential sources and pathways have been identified, Dominion should determine mitigation that will ultimately reduce selenium concentrations in fish tissue and develop early warning triggers to prevent effects on fish in lakes downstream of the mine. This work should be incorporated into the Fish Response Plan, with triggers (i.e. for sediment and or benthos) to be included into the Aquatic Response Framework.

Fish Response Plan

The Fish Response Plan sets a benchmark for mercury in fish of 0.46 mg/kg (0.00046 mg/gm) methylmercury. The Agency is concerned that this benchmark is not appropriate if fish harvesters using AEMP lakes in the future ate fish at weekly rates higher than those assumed (e.g., 3 servings/week rather than the assumed 1 serving) and/or in larger serving portions (e.g., 500 gm rather than the assumed 200 gm). Fish consumption at these higher, but still realistic rates, would require a USEPA/FDA guideline of 0.15 mg/kg (0.00015 mg/gm) methylmercury, and BC Health guideline of 0.2 mg/kg (0.0002 mg/gm) total mercury.

To improve human health protection benchmarks for metals in fish tissue in the Fish Response Plan the company has committed to an investigation of fish consumption rates in its Impact and Benefits Agreement communities. The Agency supports this positive initiative to refine Fish Response Plan action levels. Until that study is completed however, the Agency believes that Dominion should use an interim protective level of 0.15 mg/kg methylmercury or 0.2 mg/kg total mercury in fish tissue as the site-specific screening value for development of Medium (MAL) and High Action Levels for total mercury in AEMP fish.

The Agency also argues that setting the MAL for mercury at 70% of the benchmark is not adequately conservative. Dominion states that background concentrations of mercury in fish from AEMP lakes have occasionally exceeded 70% of the screening value (0.46 mg/kg methylmercury dry weight) and that the frequency of MAL exceedances will increase if this value is lowered to 50%. Dominion argues that a 70% action level makes the fish MAL consistent with the MAL for water quality variables.

The Agency believes that making fish action levels for mercury reflect action levels developed for water quality variables has not been properly justified. Contaminant levels of metals that bioaccumulate in fish take far longer to decrease than in the water column. Early warning systems like the ARF should have lower, not higher, action levels for media that respond more slowly. In addition, water quality response plans use annual water quality monitoring data, while the Fish Response Plan relies on data collected every 6 years for large-bodied fish, and 3 years for small bodied fish. This results in greater information gaps and a less robust data set for fish, making it harder to accurately identify and predict trends in contaminant loadings.

The Agency believes that harvesters must be assured that fish in affected lakes will be safe to eat following mine closure. In stating this, the Agency notes that lake trout in Ekati lakes have been found to live to over 25 years of age, so it is conceivable that if young trout were to be contaminated by metals at

the mine shortly before closure completion those trout would be available for harvest a number of years post closure when the Ekati site is accessible to land users once more.

The Agency believes that the frequency of harvestable fish monitoring should be re-evaluated. Reducing the length of time between sampling events (i.e., increase monitoring frequency), at least on a temporary basis while metal levels are at levels of concern, would result in a more robust data set and greater confidence in impact predictions. In order to minimize effects on fish populations, non lethal sampling should continue to be used.

Recommendation 4: Until such time as Dominion has completed a study of the fish consumption habits of residents in impacted communities, an interim benchmark of 0.15 mg/kg methylmercury or 0.2 mg/kg total mercury in fish tissue should be established in the Fish Response Plan.

Recommendation 5: The Medium Action Level for mercury in fish should be set at 50% of the benchmark rather than 70%. This would better reflect the bioaccumulative nature of mercury and the interests of ensuring and preserving the safety of fish for consumption by Indigenous land users after the Ekati mine is closed.

Recommendation 6: The frequency of harvestable fish monitoring should be re-evaluated, with the consideration of an increase in frequency from once every 6 years to once every 3 years.

Should you have any questions concerning these comments, the Agency is pleased to discuss these at your convenience.

Sincerely,

Jaida Ohokannoak
Chairperson

Cc: Dominion Diamond– Claudine Lee, Lynn Boettger
Tłı̨chǫ Government – Violet Camsell-Blondin
Yellowknives Dene First Nation – Sarah Gillis
Łutsel K'e Dene First Nation – Glen Guthrie
North Slave Metis Alliance – Adelaide Mufandaedza, Jessica Hurtubise
Kitikmeot Inuit Association – Geoff Clark
Government of the Northwest Territories – LeeAnn Malley, Laurie McGregor
Crown-Indigenous Relations and Northern Affairs Canada – Michael Roesch

NORTH SLAVE MÉTIS ALLIANCE

PO Box 2301 Yellowknife, NT X1A 2P7

December 8, 2020

Joseph Mackenzie,
Chair
Wek'èezhìi Land and Water Board
1-4905 48th Street
Yellowknife, NT

Dear Mr. Mackenzie

Re: Dominion Diamond Ekati ULC (Dominion) Water License -W2012L2-0001
2019 Aquatic Effects Monitoring Program (AEMP) Annual Report

North Slave Métis Alliance (NSMA) has reviewed the 2019 Aquatic Effects Monitoring Program (AEMP) Annual report submitted by Dominion Diamond Ekati ULC.

NSMA is the only Indigenous group in the Northwest Territories that has received judicial recognition of its members' common law Aboriginal rights as Métis. NSMA's very raison d'être is to advocate for the rights of the Métis of the Great Slave Lake area. NSMA members are a distinct constituency of the contemporary Métis collective of the Great Slave Lake area, a constituency which aspires to exercise and protect its Métis practices and customs on traditional Métis lands. The historical record is clear that the community of Métis of the Great Slave Lake area hunted and trapped over a wide-ranging area of the NWT.

NSMA has been a member of the Independent Environmental Monitoring Agency (IEMA) since its inception and for technical matters we rely on the technical expertise of IEMA. NSMA supports the IEMA's technical recommendations as laid out in the letter dated December 2, 2020.

Sincerely,

Adelaide Mufandaedza
Environment Manager

adelaide@nsma.net