CENTER for SCIENCE in PUBLIC PARTICIPATION

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"Technical Support for Grassroots Public Interest Groups"

December 15, 2016

Province of British Columbia
Ministry of Environment
MtPolleyEnvironmental.Enquiries@gov.bc.ca

Re: Comments on Mt Polley Technical Assessment Report

The Center for Science in Public Participation provides technical advice to public interest groups, nongovernmental organizations, regulatory agencies, mining companies, and indigenous communities on the environmental impacts of mining. CSP2 specializes in hard rock mining, especially with those issues related to water quality impacts, reclamation bonding, and tailings dam safety.

GENERAL COMMENTS

Through the Technical Assessment Report (TAR) the Mount Polley Mining Company (MPMC) is asking the Ministry of Environment to significantly increase the discharge limits for Environmental Management Act Permit 11678 that was modified on September 19, 2016, to in part authorize the use of Quesnel Lake for dilution of mine effluent. The September permit also increased the discharge limits for copper, molybdenum, selenium and sulfate, and the criteria for cadmium eliminated. Quesnel Lake water is cleaner that in Hazeltine Creek, even before the accident.

The Initial Dilution Zone (IDZ) and lack of additional would allow MPMC to increase the amount of discharge of metals, over the amount allowed under the increased limits of the September 16, 2016 permit, by 724% for arsenic, 264% for chromium, 175% for copper, 809% for iron, 611% for zinc, 217% for ammonia, 251% for nitrate, and 54% for sulfate (270% over the June 7, 2013 permit).

The fundamental rationale for granting a discharge into Quesnel Lake at increased permit limits seems to be two-fold: (1) that an IDZ, a zone of mixing where water quality standards are exceeded, is standard operating procedure and should be granted the mine; and, (2) that the present treatment systems meets or exceed Best Available Technology requirements, and need not be improved. Neither of these arguments should be taken at face value, and will be addressed in the section-specific comments.

Treatment of the mine effluent to meet water quality standards is easily technologically achievable, and arguably should be required to minimize further damage to Quesnel Lake. In essence, asking for a dilution zone in Quesnel Lake is adding insult to injury.

Thank you for the opportunity to comment on the Technical Assessment Report. If you have any questions on my comments, please feel free to call at any time.

Sincerely:

David M. Chambers, Ph.D., P. Geop.

SECTION-SPECIFIC COMMENTS

3.4.4 Hazeltine Creek

Table 3-19 summarizes the existing water quality in Hazeltine Creek. It is noted that Hazeltine Creek exceeds the 30-day average BC Water Quality Guidelines for turbidity, total suspended solids, phosphorus, chromium, copper, and iron.

The measured water quality for Hazeltine Creek was within BC Water Quality Guidelines for 2012, and the levels of turbidity, total suspended solids, phosphorus, chromium, copper, and iron were all several times lower than measured in 2015-2016 (MPMC 2013). There is no mention or summary in the Technical Assessment Report of baseline water quality in Hazeltine Creek prior to the dam break.

These statistics are cited to demonstrate that prior to the dam failure, water going into Quesnel Lake was of significantly higher quality than that presently being discharged from Hazeltine Creek into the lake, and of even higher quality than the proposed discharge of treated water into Quesnel Lake.

3.6.5 Biological Tissue Sampling

In the section on Benthic Invertebrate Tissue Chemistry (Golder 2016, p. 81) that selenium levels in profundal samples were elevated, probably from natural sources. Nonetheless, even if the elevated selenium is due to "other than mine" influences, adding additional selenium through a discharge will only exacerbate the problem.

Recommendation: Sampling of benthic invertebrates in Quesnel Lake should be continued to insure that the additional selenium released from the spill, and from the proposed mine discharge, not increase the already elevated level of selenium in invertebrates.

4.1.2 Tailings Storage Facility

It is noted that "*At closure, … Approximately 15% of the surface area of the TSF basin is proposed to be covered with water, ...*"

As a result of the Mt Polley accident, the Mt Polley Expert Panel recommends the dry closure of all tailings facilities (Expert Panel 2016, Section 9.3.2 BAT Methods). It is not economically feasible to close the Mt Polley tailings facility in a dry manner, but since the tailings are not acid generating, it is not clear why any surface water is necessary or desirable for the tailings facility when closed.

There is no explanation for closing the tailings facility with a partial lake cover offered in the Technical Assessment Report. The tailings facility would be marginally safer if closed as close to dry conditions as possible.

Recommendation: The tailings facility should be closed with a dry surface, or at most a lined stream channel, unless justification is given for the necessity of a 15% surface lake area.

5.2.1.2 Quality of Discharge

For water treatment MPMC is employing an Actiflo treatment plant, which is described in Appendix E, Proposed Water Treatment Plan for Operations Phase Water Management. The Actiflo Treatment plant is meant to control TSS and turbidity, not metals (e.g. Cu or Mo) or metal leachates (As and Se).

It is also noted in Appendix E that "*Effluent TSS and turbidity levels achieved are consistently low, typically less than 10 mg/L for TSS, and turbidity ranges from 0.2 to 2 nephelometric turbidity units (NTU).*"

The predicted levels in the effluent for Total Suspended Solids (TSS) and turbidity are not modelled, nor data presented, in the TAR, so it is not possible to calculate the reduction in the Actiflo unit.

During operation the expected reduction in the level of copper from settling in the Actiflo unit is approximately 33% for copper and 10% for selenium in the Actiflo treatment system (Golder 2016, Appendix E, Table 1). A conventional lime treatment system can remove greater than 90% of the copper. Selenium is not reduced by lime treatment. Selenium is typically reduced in a biotreatment cell, which can reduce the level greater than 90%.

Recommendation: MPMC should employ conventional treatment to reduce metals, selenium, and arsenic before discharging effluent.

6.3 Tailings Storage Facility

It is noted that "*Because of the large freshet volumes, it will be necessary to utilize the TSF for temporary detention, ... When the volume of water in the TSF reaches 3.5 Mm^3, water is pumped to the Springer Pit.*"

In Section 4.1 it is stated that it is an objective to: "… *maintain adequate tailings beaches, with the goal of a minimum of 100-m-long beaches.*" Are these commitments, or just goals?

Recommendation: MPMC should be required to maintain a minimum tailings beach for dam safety.

6.3.2 Effluent Permit Limits

It can be seen from Table 1: 19Sep16 Permit-Predicted-Requested Water Quality Criteria (below) that MPMC is requesting a significant loosening of the discharge criteria, over what is required in the present permit.

Table 1:
19Sep16 Permit / Predicted / Requested Water Quality Criteria

	19Sep16 MoE Permit Requirement	Operational Quesnel Lake Predicted Max Effluent Concentration	TAR Request	TAR Request Multiple of Present Permit Limit (X times)
$Al_{dissolved}$	none	0.360	n/a	-
As	0.0034	0.014	0.028	8
$Cd_{disolved}$	none	0.00017	none	-
Cr	0.0011	0.002	0.004	4
Cu	0.012	0.049	0.033	3
Fe	0.11	0.76	1.0	9
Mo	0.20	0.18	0.36	2
Se	0.060	0.087	0.075	1
V	0.0081	0.036	n/a	-
Zn	0.0083	0.059	0.059	7
pH	6 - 9.5	n/a	6 - 9.5	-
NH_4	0.41	0.64	1.3	3
NO_2	9.7	17	34	4
P	0.090	0.004	0.090	1
SO_4	720	556	1110	2

As noted in the comments on section 3.4.4 Hazeltine Creek above, the discharge from Hazeltine Creek into Quesnel Lake was of considerably higher water quality than after the accident. The accident has impacted water quality in Hazeltine Creek. In the Technical Assessment Report MPMC is asking to significantly increase the concentrations of the contaminants in the discharge over that presently allowed in the 19Sep16 Permit.

Contaminant Summary:

- Aluminum (Al)
  - Aluminum is usually measured as a dissolved ion. Post-spill dissolved aluminum levels in Hazeltine Creek are approximately equal to pre-spill levels, but still approximately 10 times higher than in Quesnel Lake.
  - Aluminum can be toxic at levels predicted in the discharge (Golder 2016, Table 6-2), and is approximately 43 times higher than in Quesnel Lake.
  - Presently there is no requirement to measure or monitor Al. At a minimum, Al should be measured, if not given a permit limit.
- Arsenic (As)
  - MPMC is requesting a discharge limit approximately 8 times the present permit limit.
- Cadmium (Cd)
  - Cadmium in the discharge is predicted to be above BC Water Quality Guidelines (Golder 2016, Table 6-2).
  - Cd should be added to the list of permit limits.
- Chromium (Cr)
  - MPMC is requesting a discharge limit approximately 4 times the present permit limit.
- Copper (Cu)
  - MPMC is requesting a discharge limit approximately 3 times the present permit limit.
  - Copper levels in Hazeltine Creek prior to the dam failure were approximately 0.006 mg/L (MPMC 2013). The existing permit limit is 0.012 mg/L, which is significantly above the 2012 level. The water quality standard for copper can be met with additional treatment.
- Iron (Fe)
  - MPMC is requesting a discharge limit approximately 9 times the present permit limit.
- Molybdenum (Mo)
  - MPMC is requesting a discharge limit approximately 2 times the present permit limit.
- Selenium (Se)
  - MPMC is requesting a discharge limit approximately the present permit limit, which would allow them to keep discharging with no selenium treatment system.
  - Selenium levels in Hazeltine Creek prior to the dam failure were approximately 0.001 mg/L (MPMC 2013). The existing permit limit is 0.060 mg/L, which is 60 times the 2012 level. The water quality standard for selenium can be met with additional treatment.
- Vanadium (V)
  - Vanadium is included in the present permit. MPMC is asking that it be removed.
  - Vanadium in the predicted discharge to Quesnel Lake is 0.036 mg/L (Golder 2016, Table 6-2). The present level of Vanadium in Hazeltine Creek is 0.006 mg/L (Golder 2016, Table 3-19).
- Zinc (Zn)
  - MPMC is requesting a discharge limit approximately 7 times the present permit limit.

- Ammonia (NH4)
  - MPMC is requesting a discharge limit approximately 3 times the present permit limit.
- Nitrate (NO2-3)
  - MPMC is requesting a discharge limit approximately 4 times the present permit limit.
  - Nitrate can be reduced through biological treatment.
- Phosphorus (P)
  - The present Permit Limit is 6 times the BC Water Quality Guidance.
  - Predicted phosphorus in the effluent is approximately 0.03 mg/L (Golder 2016, Table 5-11).
  - Phosphorus is not present naturally, and is not a typical additive for mine processing.
- Sulfate (SO4)
  - MPMC is requesting a discharge limit approximately 2 times the present permit limit.
  - Quesnel Lake could be affected if the effluent is discharged at this limit since it is approximately 5 times the water quality standard (Golder 2016, Table 6-4).

Recommendation: The present permit limits are near the BC Water Quality Guidelines, and the BC Water Quality Guidelines are achievable with additional water treatment, which is not being proposed by the MPMC.

6.3.4.2 Study Boundaries and Assessment Nodes

It is in this section that the first detailed discussion of an Initial Dilution Zone (IDZ) is made. An IDZ is now authorized for: Quesnel Lake, for the discharge from the water treatment plant; and, for Bootjack Lake, which will receive contaminated groundwater from the Springer Pit when it is filled with water.

The IDZs was added to the September 19, 2016, permit. No initial dilution zone was authorized in the previous permit of June 7, 2013. And, at the present time there is no authorization for an IDZ in Bootjack Lake – that would need to be added to the revised permit.

Unfortunately, an IDZ in Bootjack Lake is inevitable, unless the pit is pumped dry in perpetuity. Groundwater flow from the Springer Pit into Bootjack Lake is projected to exceed BC Water Quality Guidelines for fluoride, sulfate, nitrate, nitrite, antimony, copper, selenium, and dissolved aluminum (Golder 2016, Table 6-2). The worst case dilution in Bootjack Lake is 28:1 for selenium (Golder 2016, Appendix J, Table 3.1).

As for the IDZ in Quesnel Lake, it is noted:

> *The IDZ is the initial portion of a larger mixing zone applied to a specific effluent discharge. The concept recognizes the role of dilution in mitigating the effects of effluents and that there is an accepted area of higher concentrations of contaminants prior to where full mixing occurs. [The Ministry of Environment]'s Best Achievable Technology (BAT) policy puts requirements on dischargers for treating effluents to a high standard and does not rely on dilution alone to mitigate potential impacts. IDZs are typically only allowed when BAT has been applied.* (Golder 2016, Appendix E, Attachment B)

According to their website, MoE currently defines BAT as: "*Best Achievable Technology means the technology which can achieve the best waste discharge standards, and that has been shown to be economically feasible through commercial application.*"

Golder has discussed Metal Mining Effluent Regulations (MMER) as guidance for treating the discharge (Golder 2016, Section 2.4.3). As noted, the MMERs are technology-based requirements. Technology-

based requirements are generally considered do-not-exceed levels, and are also generally not subject to dilution.

Golder also cites Pouw et al. (2015) for guidance on the efficiencies of 31 Canadian water treatment systems, as presented in the following table:

Table 1: Summary of Proposed BATEA for the Base Metal Subsector

Model Effluent Treatment Flowsheet	Proposed BATEA	Effluent Quality
■ hydroxide precipitation for metals ■ coagulant and flocculant dosing and pond-based settling for TSS ■ natural degradation of ammonia ■ pH adjustment with CO_2	model flowsheet *(model effluent treatment)* +: polymeric organosulphide reagents for metals polishing[(a)]	Al < 0.79 mg/L As <0.01 mg/L Cu <0.03 mg/L Fe <0.30 mg/L Pb <0.02 mg/L Ni <0.05 mg/L Se <0.04 mg/L Zn <0.02 mg/L TSS <10 mg/L NH_3/NH^{4+} <4 mg/L

a) This column describes the proposed augmentation of the model flowsheet to achieve the effluent quality in the column on the right. Stated in a different way, this is the additional treatment step that could be added to the model flowsheet that is proposed as an economically achievable means of achieving improved water quality in the effluent. In this case organosulphide reagents are proposed to lower metals concentrations.

Source: Pouw et al, 2015.

Kristin Pouw was the primary author on a large study funded by the Mine Environmental Neutral Drainage (MEND) secretariat of Natural Resources Canada completed in 2014. The table below presents the results from that study (Pouw 2014). The reference cited by Golder (Pouw 2015) for the table above is from a presentation given by one of the authors at the 10th International Conference on Acid Rock Drainage and the International Mine Water Association's Annual Meeting, ICARD-IMWA 2015. Santiago, Chile. It is odd that the Effluent Quality data cited by Golder are not identical with the MEND report data, since the authors are the same, and time period likewise similar.

Table 6-7: Treated Effluent Summary for the Base Metal Subsector

Parameters	Units	Effluent Concentration Basis	Minimum	Average	95th Percentile	Maximum
pH		Monthly Mean	3.7	7.8	9.0	12.3
Aluminum	mg/L	Grab/Composite	0.00005	0.11	0.39	28.1
Ammonia, total	mg-N/L	Grab/Composite	0.0015	0.94	3.95	39.1
Arsenic	mg/L	Monthly Mean	0.00005	0.0035	0.02	0.061
Copper	mg/L	Monthly Mean	0.0008	0.02	0.06	4.2
Cyanide	mg/L	Monthly Mean	0.0005	0.031	0.052	2.6
Iron	mg/L	Grab/Composite	0.001	0.64	1.82	104
Lead	mg/L	Monthly Mean	0.00002	0.005	0.015	0.2
Nickel	mg/L	Monthly Mean	0.00025	0.091	0.38	14.7
Radium-226	Bq/L	Monthly Mean	0.005	0.025	0.106	0.736
Selenium[10]	mg/L	Grab/Composite	0.00005	0.006	0.024	0.073
Zinc	mg/L	Monthly Mean	0.0001	0.06	0.25	17.5
TSS	mg/L	Monthly Mean	0.01	4.3	13	106

Notes:
Values reported as less than the method detection limit have been incorporated at 50% of the MDL value.
All metal concentrations are total metal concentrations, i.e., the sum of dissolved and suspended fractions.

The point to be made is that the data for Effluent Quality cited by Golder appears to be 95th percentile data, which is unduly biased up by (nominally) older, less efficient treatment systems. This can be easily seen by looking at the "maximum" value for each constituent in the MEND table.

"Average" in the MEND table would equate to an average performing treatment plant. Minimum in the MEND table should represent theoretical BAT technology. With the exception of zinc, the average values in the MEND table are all below the limits requested in the TAR. This would make the treatment system, and permit limits, less than "average" for Canadian base metal mine water treatment.

Recommendation: Since Quesnel Lake has already seen significant harm by an accidental discharge from the Mt Polley mine, an initial zone of dilution is not appropriate for the Mt Polley mine discharge, since the impacts of a discharge could never be differentiated from the impacts of the spill.

Appendix F: Closure Water Treatment Plan – Conceptual Design,
Attachment C - Selenium Target Derivation

It is noted in the TAR that zooplankton at Hazeltine Creek and Polley Lake were above BC dietary guidelines (Golder 2016, pp. 80-81)

Golder has cited several studies which show that selenium impact coldwater fish species at 10 mg/kg and above. Golder also noted:

> *"The initial uptake step is the largest and most variable part of this stepwise process, in which selenium concentrations increase on the order of 100× to 10,000× from parts per billion (µg/L) in water to parts per million (mg/kg dry weight [dw]) in algae. The magnitude of increase in the initial uptake step depends on aqueous selenium concentration and other site-specific factors such as sulphate concentration and biogeochemical conditions (Williams et al. 1994; Stewart et al. 2010; Lo et al. 2015).*

They evidently use the coldwater selenium tissue concentration with the uptake factors to then calculate a discharge concentration, and they conclude:

> *"Receiving waters at the Mount Polley Mine do not exhibit distinct patterns of selenium bioaccumulation compared to receiving waters at other mines (Section 3.1) and rainbow trout as the most abundant fish species in Hazeltine Creek are not expected to be more sensitive to selenium compared to benchmarks adopted elsewhere in BC (Section 3.2). Therefore, a total selenium concentration of 10 µg/L, if met in Hazeltine Creek, would not be expected to cause adverse effects to resident aquatic life."*

One would assume that BC and other regulatory agencies are also aware the studies cited by Golder in the TAR, and utilized these and additional research to establish the water quality guidelines/criteria published by the agency. Basing site-specific criteria on research other than the conservative approach taken by agencies in establishing water quality guidelines/criteria is short-circuiting the permitting process. If site-specific criteria are to be applied, those criteria should be based on site-specific research. The approach taken in the TAR to establishing site-specific criteria for selenium is fundamentally flawed.

Recommendation: There is no compelling evidence presented in the TAR to change the selenium criteria upward. Since there is no selenium-specific treatment being employed at the site, the selenium criteria should be returned to the value utilized in the June 7, 2013, Permit (MoE 2013).

Appendix L: Development of a Molybdenum Screening Value for the Impact Assessment

Golder notes:

> *"The US Fish and Wildlife Service proposed a molybdenum criteria for the protection of cattle (the most sensitive mammal) exposed via drinking water of less than 10 mg/L based on the minimum toxic concentration between 10 and 50 mg/L for calves from the Kincaid (1980) study (Eisler 1989)."*

and;

> *"Based on the available toxicity data for molybdenum discussed above, effects to livestock occur between 10 and 50 mg/L and effects to wildlife are at even higher molybdenum concentrations."*

It is not clear if Golder is accurate in using mg/L instead of ug/L, which would make more sense. The CCME Guideline for molybdenum in agricultural uses is 0.5 mg/L. Most other regulatory jurisdictions have a guideline of 0.01 mg/L for agricultural and irrigation uses (USEPA, South Africa, Food and Agricultural Organization).

The values for molybdenum concentrations that are protective of livestock and wildlife are very high in comparison with protective values published by other world regulatory sources.

Recommendation: The Golder research should be verified. 0.01 mg/L is the appropriate guideline to use for a criterion for molybdenum in Quesnel and Bootjack Lakes.

Table 2 - Comparison of Water Quality Guidelines, Permit Requirements, and Suggested Permit Limits, is attached as a quick reference to the various permit guidelines, existing and predicted water quality parameters referenced in the TAR.

References:

Expert Panel 2016. Report on Mount Polley Tailings Storage Facility Breach, Independent Expert Engineering Investigation and Review Panel, Province of British Columbia, January 30, 2015

Golder 2016. Mount Polley Mine Long Term Water Management Plan, Permit Amendment Application under the Environmental Management Act: Technical Assessment Report, Golder Associates, 17 October 2016.

MoE 2013. Amended Permit 11678, Environmental Protection Division, Ministry of Environment, June 7, 2013

MoE 2016. Amended Permit 11678, Environmental Protection Division, Ministry of Environment, September 19, 2016.

MPMC 2013. 2012 Water Quality Report, Mount Polley Mining Corporation, 28Mar13

Pouw 2014. Study to Identify BATEA for the Management and Control of Effluent Quality from Mines, MEND Report 3.50.1, Kristin Pouw, Kathryn Campbell, Lisa Babel, Hatch, September 2014.

Table 2 - Comparison of Water Quality Guidelines, Permt Requirements, and Suggested Permit Limits

Contaminant	(Units)	7Jun13 MoE Permit Requirement	19Sep16 MoE Permit Requirement	Water Quality Standard[1]	East Quesnel Lake 95th Percentile[2]	Operational Quesnel Lake Predicted Max Effluent Concentration[3]	TAR Request	TAR Request Multiple of Present Permit Limit (X times)	Comment
$Al_{dissolved}$	mg/L	none	none	0.05	0.0091	0.390	n/a	-	Post-spill dissolved aluminum levels in Hazeltine Creek are approximately equal to pre-spill levels, but still approximately 10 times higher than in Quesnel Lake. Aluminum can be toxic at levels predicted in the discharge (Golder 2016, Table 6-2), and is approximately 43 times higher than in Quesnel Lake. **Al should be added to the list of permit limits.**
As	mg/L	none	0.0034	0.005	0.00015	0.014	0.028	8	MPMC is requesting a discharge limit approximately **8 times the present permit limit.**
$Cd_{disolved}$	mg/L	0.025	none	0.0001	< 0.000005	0.00017	none	-	Cadmium in the discharge is predicted to be above BC Water Quality Guidelines (Golder 2016, Table 6-2). **Cd should be added to the list of permit limits.**
Cr	mg/L	none	0.0011	0.001	< 0.0005	0.002	0.004	4	MPMC is requesting a discharge limit approximately **4 times the present permit limit.**
Cu	mg/L	0.007	0.012	0.002	0.0012	0.049	0.033	3	MPMC is requesting a discharge limit approximately **3 times the present permit limit**. Copper levels in Hazeltine Creek prior to the dam failure were approximately 0.006 mg/L (MPMC 2013). The existing permit limit is 0.012 mg/L, which is significantly above the 2012 level. The water quality standard for copper can be met with additional treatment
Fe	mg/L	none	0.11	1	0.04	0.76	1.0	9	MPMC is requesting a discharge limit approximately **9 times the present permit limit.**
Mo	mg/L	0.05	0.20	0.25	0.00043	0.18	0.36	2	MPMC is requesting a discharge limit approximately **2 times the present permit limit.**
Se	mg/L	0.002	0.060	0.002	< 0.0005	0.087	0.075	1	Selenium levels in Hazeltine Creek prior to the dam failure were approximately 0.001 mg/L (MPMC 2013). The existing permit limit is 0.060 mg/L, which is significantly above the 2012 level. MPMC is requesting a discharge limit approximately the present permit limit, which would allow them to keep discharging with no selenium treatment system. The water quality standard for selenium can be met with additional treatment.
V	mg/L	none	0.0081	-	< 0.0005	0.036	n/a	-	Vanadium is included in the present permit. **MPMC is asking that it be removed.** Vanadium in the predicted discharge to Quesnel Lake is 0.036 mg/L (Golder 2016, Table 6-2). The present level of Vanadium in Hazeltine Creek is 0.006 mg/L (Golder 2016, Table 3-19).
Zn	mg/L	none	0.0083	0.0075	< 0.003	0.026	0.059	7	MPMC is requesting a discharge limit approximately **7 times the present permit limit.**
pH	s.u.	none	6 - 9.5	6.5 - 8.5	8	n/a	6 - 9.5	-	Drinking water criteria should be enforced in the permit limit.
NH_4	mg/L	none	0.41	1.8	< 0.5	0.64	1.3	3	MPMC is requesting a discharge limit approximately **3 times the present permit limit.**
NO_2	mg/L	3	9.7	3	0.15	17	34	4	MPMC is requesting a discharge limit approximately **4 times the present permit limit.** Nitrate can be reduced through biological treatment.
P	mg/L	none	0.090	0.015	0.0038	0.03	0.090	1	The present Permit Limit is **6 times the BC Water Quality Guidance**. Predicted phosphorus in the effluent is approximately 0.03 mg/L (Golder 2016, Table 5-11). Phosphorus is not present naturally, and is not a typical additive for mine processing.
SO_4	mg/L	309	720	218	6.5	556	1110	2	MPMC is requesting a discharge limit approximately **2 times the present permit limit.** Quesnel Lake could be affected if the effluent is discharged at this limit since it is approximately 5 times the water quality standard (Golder 2016, Table 6-4).
TSS	mg/L	none	15	+5 mg/L from background	< 3.0	n/a	15	1	Even though this limit is above background, Quesnel Lake will should not be significantly affected if the effluent is discharged at this limit.
Initial Dilution Zone (IDZ)	n/a	No Initial Dilution Zone (IDZ) in Quesnel Lake	Initial Dilution Zone of 100 meters in Quesnel Lake	n/a	n/a	n/a	n/a	n/a	**An IDZ is a zone where water quality criteria are exceeded for chronic effects. CSP2 recommends No IDZ in Quesnel Lake, since it is only being allowed to dilute the mine discharge with no significant increase in water treatment.**
Rainbow Trout	96hr LC_{50} % Mortality	Selenium 1 µg /g wet wt (mean)	50%	n/a	n/a	n/a	n/a	n/a	This is a measure of acute lethality in the effluent
Daphnia Magna	48hr LC_{50} % Mortality	-	50%	n/a	n/a	n/a	n/a	n/a	This is a measure of acute lethality in the effluent
Ceriodaphnia 7-day reproduction	inhibition of survival and reproduction	-	> 25%	n/a	n/a	n/a	n/a	n/a	This is a measure of chronic lethality in the effluent
Salmonid 7-day ELS toxicity	non-viable alevins	-	> 25%	n/a	n/a	n/a	n/a	n/a	This is a measure of chronic lethality in the effluent

[1] BC Drinking Water or Fresh Water Aquatic Life 30-day Guidelines used, except where noted (e.g., molybdenum, total aluminum). Maximum (Max) guidelines substituted where 30-d guidelines do not exist.

[2] No data presented for present water quality West of Cariboo Island, although it is the major portion of Quesnel Lake, and it is implied that water quality in the western portion of the lake is not as good as the water east of the Cariboo Island sill, which forms a barrier

[3] Table 6-2: Comparison of Predicted Untreated Mine Site Water Chemistry Relevant to the Quesnel Lake Discharge and Springer Pit Seepage to Maximum BC Water Quality Guidelines and Metal Mining Effluent Regulation Limits