



Memorandum

Environmental Protection

Mining Operations

Date: April 7, 2017

To: FILE 11678

Re: amendment application- jobs #355246, 353164, and 353170

Application

Mount Polley Mining Corporation ("MPMC"), the operator of Mount Polley Mine, has requested an amendment under Section 16 of the *Environmental Management Act* ("EMA") to effluent Permit 11678 (the "Permit"). A final application was submitted to the Ministry of Environment ("ENV") on October 28, 2016 making this request.

The amendment application requests authorization to discharge treated mine water to Quesnel Lake via a diffuser located at depth. The period of time requested for this discharge is the remainder of the permitted mine life, which is until the end of 2022 at the present milling rate.

The applicant requested an increase in the maximum discharge rate to Hazeltine Creek of 0.33 m³/s, and an average of 0.3 m³/s until the pipeline to Quesnel Lake is constructed. Once this pipeline is installed, MPMC requests a maximum rate of discharge to Quesnel Lake to be 0.6 m³/s, up to a maximum annual volume of 10,000,000 m³/yr. MPMC describes this discharge as an interim water discharge, to occur during the remaining mine operations. MPMC is developing further plans for permitting long term site water management for the post closure phase of mine life.

MPMC has also requested amendments to certain effluent quality limits as a result of changes to the management of source water at the mine, and to ensure a reliable means to release mine water from the site during freshet when turbid conditions may occur.

The application stipulates that British Columbia Water Quality Guidelines will be met at the edge of the initial dilution zone ("IDZ") in Quesnel Lake during the release of the treated mine water. The IDZ is described as that volume of water surrounding the diffuser within a 100 metre radius.

The application also requests a continuation of the use of Springer Pit to store surplus water in the event of a disruption in the ability to discharge to Quesnel Lake. This request acknowledges that some seepage out of the pit into the environment occurs.

The application deals with the discharge of effluent generated from ongoing mine activities within the permitted mine site. It does not deal with the ongoing effects and remediation from materials that escaped from the tailings facility to Polley Lake, Hazeltine Creek and Quesnel Lake from the August 4, 2014 tailings breach. That is the subject of ongoing remediation and investigation under Pollution Abatement Order 107461 and an order issued under section 88(1) of the *Water Act*.

Background

Mount Polley Mine is an open pit copper/gold mine with an underground component located near Likely, BC. The mine property encompasses over 19,000 hectares, comprised of seven mining leases and 45 mineral claims. The mine processes ore at an average rate of 22,450 tonnes per day. Mount Polley Mine is owned and operated by Mount Polley Mining Corporation, a subsidiary of Imperial Metals who own or have an interest in several other mines and mineral properties in BC.

Mount Polley mine commenced operations in 1997 after receiving a Mine Development Certificate in 1992 (later converted to Project Approval Certificate M96-07 under the *Environmental Assessment Act*) and permits under the *Mines Act* and *Waste Management Act* (later *Environmental Management Act*). Effluent discharge Permit 11678 was first issued May 30, 1997. The Permit has been amended several times over the life of the mine as development of the project proceeded. The mine was put in care-and-maintenance from 2002 to 2005 due to low copper prices, and again from August 2014 until August 2015 due to the breach of the tailings storage facility ("TSF").

The mine received authorizations in June 2016 under the *Mines Act* and EMA to return to regular mining operations, with the deposition of tailings into the repaired tailings storage facility. In September 2016 the Permit was amended to authorize a short-term water management plan that involved the release of treated mine effluent to Hazeltine Creek until November 2017. As part of the creek rehabilitation efforts, all water in Hazeltine Creek is collected upstream of Quesnel Lake in two settling ponds which feed into a submerged outfall in Quesnel Lake.

The current mine plan update addresses continued mining over approximately the next four years, in accordance with the Cariboo-Springer Pit Phase 4 development plan. The current mine plan includes tailings deposition in the TSF up to 970 metres above sea level elevation ("masl"). *Mines Act* Permit M-200 regulates the mine development, site disturbance and reclamation.

As part of the Long Term Water Management Plan ("LTWMP"), MPMC proposed a discharge of treated mine effluent via a pipeline to an existing diffuser installed in Quesnel Lake. The diffuser is over 200 metres from shore and about 45 metres deep. The discharge to the lake is intended to manage surplus water during the remainder of mine operations. Following mine reclamation site water is intended to be released to local water ways, with passive treatment replacing the active treatment plant.

A Consent Order for a material alteration was issued April 6, 2016 under condition 2 of Project Approval Certificate M96-07 to allow implementation of the LTWMP, including the interim discharge during operations to Quesnel Lake. The application complies with other aspects of the certificate, and the

original review process did contemplate collection and treatment of site runoff and wastewater to a level that would not cause BC Water Quality Guidelines to be exceeded in the receiving water.

The Mount Polley Mine is described as having a net positive water balance. Hydrological studies undertaken on behalf of MPMC indicate that the amount of precipitation falling onto the site is greater than the amount that is consumed by mining, lost to groundwater seepage, retained in the voids of the tailings storage facility, or lost by evaporation. In the past, excess water was released to Hazeltine Creek or stored on site. Storage was in the TSF or water pumped to inactive pits.

Due to the foundation failure resulting in the tailings breach in August 2014, past difficulties in managing surplus water by storage, and limited available options for storage of water as the mine operations proceed MPMC has identified the need to discharge surplus water. As the approach of storing surplus water year-over-year is no longer an acceptable approach, MPMC requires a reliable opportunity to release all surplus water that may be generated in a year off the site. The need to discharge beyond the expiration of the short term discharge is realized whether or not the mine is in operation.

Permits authorizing the introduction of waste into the environment are issued under Section 14 of the EMA. EMA has a general purpose of protecting the quality of the environment. It also has as a purpose to manage and provide a means to dispose of waste that is generated by activities such as mining. The rationale underlying the permitting of waste discharges is that one can use the environment's capacity to assimilate, dissolve, treat or otherwise deal with wastes within certain limits that do not cause significant impairment of the usefulness of the environment. The Permit provides a means to control, reduce and, where possible, eliminate the environmental impacts caused by effluent discharged from the mine.

The Ministry creates policy to provide guidance to the Director in making decisions under EMA. Water Quality Guidelines ("WQG") provide policy direction to decisions affecting water quality. WQGs are science-based benchmarks of physical, biological and chemical parameters that establish a high level of protection for designated water uses. WQGs represent safe levels of substances that protect different water uses, including: drinking water, recreation, aquatic life, wildlife and agriculture. Aquatic life guidelines are set to protect all forms and life stages of aquatic life.

WQGs are used to assess water quality, and potential risk to water uses can be assessed by comparison of existing or predicted water quality to WQGs. Exceeding a WQG does not mean that impacts will occur, but rather that the potential for adverse effects may be increased and additional investigation may be required.

WQGs may be used as the basis for determining the allowable limits in waste discharge authorizations. A use-protection approach for setting limits is a scientifically-defensible basis for establishing discharge standards. The approach involves identification of water quality characteristics of concern with respect to a proposed effluent discharge, identification of receiving water quality benchmarks, determination of the areal extent of the IDZ, and derivation of effluent discharge standards that ensure the water quality benchmarks are met at the edge of the IDZ. Dispersion modeling of the effluent is undertaken to predict expected low-flow and high-flow water quality.

Water quality policy also allows for establishing site specific water quality objectives that are different than WQG. For example, if a resource is unusually valuable or of special significance a more stringent level may be applied to protect existing water quality. While Quesnel Lake exhibits very good water quality, and is a valuable water body, there are currently no site specific water quality objectives developed for consideration relative to the this application by MPMC.

Environmental Setting

The application describes the receiving environments in Quesnel Lake and around the mine site. Quesnel Lake is as a large oligotrophic fjord lake of low primary productivity, and low total dissolved solids. Mean flushing rate is about ten years, although the West Basin, where the discharge is to occur has an estimated flushing rate of 90 days. The lake is situated between the interior wet belt of the Cariboo Mountains and the boreal pine forest of the interior plateau. Significant inflow occurs during the spring freshet period, with declining lake level over the fall and into the winter. Historically, water quality is very good. Impacts following the tailings impoundment breach have been documented, and additional work is underway to examine the residuals risk to aquatic ecosystems resulting from the spill.

Quesnel Lake supports twenty documented fish species, including migratory and resident salmonids (sockeye salmon, coho salmon, Chinook salmon, rainbow trout, bull trout, kokanee), benthic species (burbot, suckers, slimy sculpin), and forage species (northern pikeminnow, lake chub, dace). Most of these species are secure populations; however, bull trout are provincially blue-listed, and Interior Fraser coho are listed as threatened by the Committee on the Status of Endangered Wildlife in Canada.

Near the point of discharge, habitat assessments indicate that shoreline habitat is ranked between moderate to very high, with high juvenile rearing values along 20% of the shoreline.

Traditional Use Studies and other sources of information indicate extensive use of the area around Quesnel Lake by the Secwepemc. A wide range of uses by First Nations of the lands and resources along and around the west arm of Quesnel Lake are documented in materials available to government.

Quesnel Lake has a very high recreational value with significant use during summer months for boating, bathing, fishing, etc. There are nearby resorts and camping areas that are important to the local economy. Numerous cottages and year round residences are located along the shore of the lake. Residents and property owners value the natural and generally undisturbed setting of Quesnel Lake. The lake is also a primary source of potable water for many of these residences.

Since the mine opened in 1997, it has been an important part of the local economy and source of local employment. There is a long history of mining in the area, with placer mining occurring continuously since the 1860's. Operating from 1892 to 1942, the Bullion Pit Mine, located just downstream of the lake on the south shore of Quesnel River, was one of the largest placer gold mines in the world. To provide water for the hydraulic operations of the Bullion Pit Mine the creeks that drained the area around Mount Polley were diverted, resulting in long term changes to the drainage patterns. One of the

dams originally built for the Bullion Pit Mine, that re-directed the flow of Bootjack Lake to the north, was replaced by MPMC as fishery habitat compensation project, to maintain the habitat in Bootjack Lake.

Process and Consultation

CMDRC Review Process:

The Cariboo Mine Development Review Committee ("CMDRC") chaired by the Ministry of Energy and Mines ("MEM") undertook a review of the final application. MPMC presented the final application to the committee on December 15, 2016. Final comments from the committee were submitted by January 20, 2017. The committee met on February 20, 2017 to discuss the responses to comments from MPMC. A final meeting of the committee was held on March 9, 2017 to review the first draft of an amended permit. The review ended March 28, 2017 with completion of the final committee comments and responses from MPMC. A sharepoint site was established to save a comment tracking table that documents the exchange of committee comments and MPMC. Various agencies, local government, First Nations and the local community are represented on the committee. The views and recommendations from the committee were considered in making the decision on the permit amendment request.

Public review process:

Formal public notice was provided as required under the Public Notification Regulation on October 27, 2016 in the BC Gazette and by various other means on or about the same date. The public comment period was extended to December 23, 2016 to allow more time for submission of public comments. Public comments were submitted to MPMC, ENV or MEM. All comments were compiled and are reported in the Consultation Report submitted by MPMC dated February 28, 2017. MPMC provided substantial responses to many comments submitted by the public in the report. The comments have been reviewed and considered in the decision on the permit amendment request.

First Nations Consultation:

A duty to consult First Nations is triggered in connection with the proposed amendment to the permit. The Williams Lake Indian Band ("WLIB") and Soda Creek Indian Band (Xat'sül First Nation, "XFN"), the two most northerly Secwepemc communities, were consulted with at the deep end of the spectrum due to the strength of claimed rights in the area of the mine. The Red Bluff Indian Band (Lhtako First Nation) was consulted with at a lower level, as they claim a right to fish in Quesnel River, downstream of Quesnel Lake, but do not claim rights at the mine or discharge location. The Tsilhqot'in National Government ("TNG") was consulted with in accordance with the obligations of an agreement that manages consultation between the province and the TNG. A consultation record dated March 30, 2017 documents efforts made to meet the province's duty to consult with the above First Nations.

Both WLIB and XFN have a participation agreement with MPMC and engaged directly with the company through an implementation committee. In addition, both WLIB and XFN participated on the CMDRC, and a government-to-government Technical Working Group which provides a venue for direct engagement between ENV technical staff and representatives of the two communities. Joint comments on the draft

Technical Assessment Report (TAR) were provided to MPMC on August 23, 2016 in the form of a letter authored by ENV which included the input from both WLIB and XFN.

Written submissions were received from the TNG, and these were reviewed and considered in the amendment decision. Ministry staff met with the Lhtako First Nations and explained results of monitoring downstream of the mine, but no further comments were submitted from them.

The information received from First Nations was carefully considered. The comments and recommendations received from First Nations were given serious weight and did influence the amended permit. WLIB and XFN expressed a desire for the discharge to meet all WQG prior to release of effluent into Quesnel Lake. While the existing treatment plant is not currently capable of meeting this level of treatment, a program of continuous improvement is required as a condition of the permit to require achievable improvement in source control and the performance of the treatment works.

Relevant Issues Considered – Quesnel Lake Discharge

What are the potentially harmful characteristics of the discharge?

In order to ensure that water does not build up on the site MPMC applied for higher concentrations of some parameters and an increased rate of discharge to enable release of site water during periods of high flow (e.g. spring freshet) when there is greater dilution, but also difficulty in settling solids. Previously site runoff passed through the Springer Pit, which reduces peak flow and concentrations of all constituents. MPMC reports that this pit will not always be available for the remainder of operations as the Springer Pit will be drawn down to access ore.

Contaminants of concern requiring effluent permit limits are identified as those with the potential to exceed water quality guidelines at the end-of-pipe. Effluent discharge standards were assessed using a minimum 30-day dilution factor to determine concentrations of the contaminants of concern that have to be met to achieve WQGs at the edge of the IDZ. In addition, source water modelling was conducted to predict potential contaminants and determine if lower limits could be reliably achieved. Sensitivity analysis provided by MPMC in response to ministry reviewer's comments indicates that the water quality from the site is not sensitive to variation in precipitation and runoff scenarios.

Permit limits are set for all contaminants of concern, which include suspended solids, sulphate, ammonia, nitrate, nitrite, phosphorus, fluoride, and 11 metallic elements. These elements and compounds are derived from mining activity that results in exposed soil and rock being eroded, residue of blasting compounds, weathering of rock exposed from mining activities, and milling of ore.

Suspended solids are carried off the site by site water due to erosion and due to the small particle size of some materials that are difficult to settle. Controlling suspended solids reduces the risk of impacts from sedimentation in the receiving environment, and also reduces the quantity of sediment bound metals from entering the receiving environment.

The effluent must not be acutely toxic to aquatic life as required in the federal Metal Mine Effluent Regulation. Acute toxicity testing is done on representative aquatic species; rainbow trout for fish, and daphnia magna for invertebrates. The effluent quality must also meet the requirements of the MMR.

Concern has been raised about compounds used in the milling process that could enter the receiving environment. These materials have not been identified as contaminants of concern as they are not detected in the effluent due to the limited amount that reports to the TSF as they tend to report with the concentrate shipped off site. As well the reagents degrade naturally in the tailings impoundment.

Copper was specifically identified as a contaminant of concern relative to cumulative effects due to the potential effect of dissolved copper on the chemosensory function in the benthos, zooplankton and fish. MPMC pointed out in their public consultation report that negative effects have not been detected to date due to the copper in the tailings solids being hosted in stable minerals that do not dissolve in lake water. It was also noted by MPMC that dissolved copper may bind to organic carbon, which also limits effects. MPMC reports that the levels of dissolved copper in Quesnel Lake near the discharge location are below known thresholds for olfactory impacts on salmon.

While it is possible that chronic effects such as chemosensory impairment may occur in the IDZ, the concentration that copper must be reduced to at the edge of the IDZ through source control, treatment and dilution, will be below levels shown to affect aquatic life based on work done for MPMC at the Quesnel River Research Station on fish egg incubation, and a research paper cited by one public commenter that found effects on test organisms exposed to concentrations above 5 ug/L of dissolved copper. It is unlikely that fish merely passing through the IDZ would be affected, as the cited paper also notes that "fish experiencing copper-induced olfactory impairment can recover over a relatively short period of time in clean water."

Copper-Impaired Chemosensory Function and Behavior in Aquatic Animals', Human and Ecological Risk Assessment, 13:3, 492 – 505

A concern is the potential for biotransformation and bioaccumulation of selenium and arsenic in the aquatic environment. Although monitoring data for the effluent indicates that levels are well below the maximum permit limits, both of these elements can be bio-transformed by aquatic organisms, such as phytoplankton which are a major food source for the organisms of higher trophic levels in the lake food chain. Bioaccumulation of selenium and arsenic, and trophic transfer up the freshwater food chain is also a concern because of possible human health effects from dietary intake of affected fish. Results reported after the TSF breach indicated some risk of increasing arsenic and selenium in fish exposed to mine water, although concentrations of these elements in fish muscle tissue were reported to be at safe levels for human consumption. As a precautionary step MPMC will need to ensure that it is employing best practices and taking steps to limit the input of these elements to the lake, and the CEMP should include measures to monitor this risk.

The Permit requires further reduction in loading of the contaminants of concern if required to meet standards set for attainment at the edge of IDZ. The lowest applicable water quality guideline is selected as the standard to be attained. The most sensitive use is usually aquatic life, but for fluoride and molybdenum the wildlife guidelines of 1.0 mg/L of 0.05 mg/L respectively are used.

MPMC has questioned to the setting of attainment standards for the edge of the IDZ. They state that a simple exceedance is not reliable evidence that adverse effects or pollution are occurring. However, allowing exceedances of WQGs may increase risk to water uses, and MPMC have proposed a treatment process just sufficient to meet the objective of meeting water quality guidelines at the edge of the IDZ through mixing and dilution. There is also some uncertainty in the mixing models presented. MPMC predicted the dilution under certain conditions to be as low as 40:1, and there could be instances when the lake current direction can shift and the plume could flow back through the ID. For these reasons, the additional conservatism of attainment standards is required to protect the environment.

The permit does not require that MPMC ensure that the standards are met at the edge of the IDZ under any condition. The attainment standard is a further limitation on the quantity and quality of discharged effluent. Considering the normal water quality of Quesnel Lake, it is unlikely that factors other than the discharge would cause an exceedance of the attainment standard at the edge of the IDZ.

MPMC has also expressed concern about the prescriptive nature of the permit requirements relating to continuous improvement in the management of source water and effectiveness of the treatment system. These requirements are to ensure ongoing best practices and best achievable technology is employed, so the lake dilution is not solely relied upon. This is important not just because of the values of the lake and the use of lake water as a potable water source, but also to ensure efforts are made to reduce the risks from bioaccumulation in the lake system of some of the elements in the discharge.

How will the Contaminants of Concern impact the receiving environment?

A water quality model was developed to predict water quality concentrations resulting from the mine site discharges in the receiving environment. Modelling was done for the discharge to Quesnel Lake, as well as the seepage discharge from Springer Pit to Bootjack Lake during operations. The source water quality predictions were used to inform the IDZ models.

Water quality model verification done in 2016 compared the mixed effluent at the edge of the IDZ and ambient Quesnel Lake water. The observed dilution was determined, indicating that greater than 100:1 dilution occurred most of the time. The monitoring in September 2016 indicated slightly less than 100:1 dilution was occurring, but dilution was greater during other months.

Ministry reviewers identified some risk that site water concentrations of copper and selenium could exceed proposed permit limits and challenge the operation of the treatment plant and management of site water. Ministry staff recommended further data collection and ongoing water quality model refinements for planning future water management. The amended permit requires annual updates of the water balance, and water quality models and a calibration assessment of both models.

Ministry reviewers stated that if WQGs can be met at the edge of the IDZ, and with the use of a submerged diffuser, there would be very little potential interaction between the effluent and near-shore organisms in the high value littoral habitat. Additionally, by specifically requiring attainment standards set at the chronic aquatic life WQG for the edge of the IDZ, chronic effects although possible within the

IDZ, are expected to have minimal ecological significance. A comprehensive monitoring program is in place to detect and changes and to verify the application predictions.

The Selenium Management Plan included in the application reflects the uncertainty related to future levels of selenium in source water, and the need to implement treatment and/or further source control to address this element.

To address concerns about potential risk to Bootjack Lake if water stored in Springer Pit results in increased seepage, monitoring for acute toxicity of pit water when the water level is higher than 1025 masl. Increased seepage is a risk at water levels higher than this level. Monitoring of lake water quality for negative trends is required, so that action can be taken if increasing trends occur. Further hydrogeological investigation may be required to ensure a full understanding of the connection between site water quality and the quality of water in the lake. Ongoing monitoring of Bootjack Lake will continue, and if indicated by the monitoring, further action will be required.

Are there any particular sensitivities or special features of the receiving environment that should be taken into consideration?

Species of concern identified as potentially using the area around the discharge point are bull trout, a provincially blue-listed, and Interior Fraser coho, which are listed as threatened by the Committee on the Status of Endangered Wildlife in Canada. Habitats of value near the discharge point are the littoral areas of the lake. The use of submerged diffusers reduces potential interaction between the effluent and organisms in the near-shore and littoral habitat. The IDZ is not within an area of the lake important to either of the identified species of concern.

Quesnel Lake itself is identified by many as a unique and special body of water. It is a very deep interior fjord type lake, which hosts a diverse fishery and is a highly valued recreational water body. While discharging water to Quesnel Lake is identified through the options analysis to be the preferred option in the present circumstances, this may change as the remediation of Hazeltine Creek is completed and as technology for treatment is developed. A process for evaluation of technologies for effluent treatment is laid out in the permit reflecting the plans submitted by MPMC. The permit only authorizes the continued use of the Quesnel Lake outfall until the end of 2022. After that it is expected that MPMC will be able to present better options for treatment and disposal of mine water.

Some public reviewers, including Mining Watch, commented that a "non-degradation" approach be taken and that Quesnel Lake be given an "outstanding waters" designation. Examples of this approach from U.S. jurisdictions were provided. While the water quality management system in other jurisdictions differs from that in B.C. there are similarities. In Montana for example, their non-degradation policy includes a statement on the criteria for determining non-significant changes in water quality, "Whenever the change exceeds the trigger value, the change is not significant if the resulting concentration outside of a mixing zone designated by the department does not exceed 15 percent of the lowest applicable standard." [17.30.715 CRITERIA FOR DETERMINING NONSIGNIFICANT CHANGES IN WATER QUALITY, <http://deq.mt.gov/Water/wqinfo/Nondeg/LawsRules>]

Does the proposed discharge contribute to unacceptable cumulative effects?

Concern about the additive effect of the discharge and the residual effects from the materials released from the tailings breach were raised in the public consultation. Public commenters also noted concerns about residual sediment being re-suspended due to the discharge, and resultant exposure of aquatic biota to elements in the sediment. Reference was made by one public commenter to a paper written by UNBC researcher, shortly after the tailings impoundment breach, which concluded:

“While dilution effects and remediation efforts underway as part of the MPMC cleanup process may reduce the observable impact on the lake’s ecosystem, tailings and scour materials are and will continue to be transported throughout the lake. Also, twice annually (spring and autumn) the West Basin will experience isothermal conditions and overturn, potentially reentraining settled tailings and scour material into the water column. The nature of waste materials now present in Quesnel Lake presents a potential hazard to the metal content of aquatic food webs and the growth, survival, and behavior of important fish species.”

Pelticrew, E. L., et al. (2015). The impact of a catastrophic mine tailings impoundment spill into one of North America’s largest fjord lakes: Quesnel Lake, British Columbia, Canada, *Geophys. Res. Lett.*, 42.

Application of the precautionary principle has been suggested by some public commenters regarding these effects. A definition of this principle is as follow: *“where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation”*. The information provided in the application does not indicate a risk of serious or irreversible damage to the resources of Quesnel Lake arising from the discharge. The discharge must meet stringent limits, be non-acutely toxic, and the most stringent water quality guidelines must be met at the edge of the dilution zone to protect against chronic effects on aquatic life. The mine has implemented a treatment plant, and is required to ensure continuous improvement in operation of the plant, as well as implement a final water management plan in a reasonable amount of time. There is not a postponing of cost-effective measure to protect the environment.

The comprehensive environmental monitoring program will continue to measure and detect any changes and indicators of general Quesnel Lake water quality, including the impact of the mine discharge, and of the restoration work on Hazeltine Creek.

Are there preferable options for the discharge plan that could reduce the effects of the discharge?

MPMC did not develop alternative discharge schemes in sufficient detail to permit an alternative discharge option. However, to demonstrate the acceptability of the submitted application, MPMC undertook an assessment of the alternatives to the detailed plan put forth for approval, to support their assertion that they were pursuing the most effective means to manage mine water and protect water quality in the surrounding environment.

MPMC’s alternatives assessment is described in their application. The options analysis, presented in the TAR, identified six options, including effluent discharge to Quesnel Lake, pipeline to Quesnel River, and a distributed discharge around the site. MPMC reviewed alternatives based on consideration of various

factors including environmental, technical, social, and economic. The options analysis concluded that the Quesnel Lake discharge as applied for, best met the requirements for water management during mine operations. The discharge to Quesnel Lake was selected mainly due to the high dilution capacity available in the lake throughout the year. The process and method for assessment of alternatives is reasonable, as is the rationale that supports their conclusions.

A number of local residents thought a less sensitive discharge location should have been selected. They identified the Quesnel River option as more favourable. This discharge location leads to either a larger initial dilution zone than usually allowed, which might impinge fish spawning areas and resultant water quality risks, or a reduced annual discharge to the river. Golder, on behalf of MPMC reported that for a Quesnel River discharge the dilution in the IDZ is limiting when flow in the Quesnel River is less than 119 m³/s, which occurs about 62% of the time. To attain a 100:1 dilution of effluent at all times, this option would require increasing the maximum allowed discharge rate during high flow periods to ensure a reliable water management system to release all surplus water in a wet year from the mine. MPMC noted that Quesnel River is important habitat for fish species, and much of the river is spawning habitat. As well the Quesnel River option required a longer pipeline that resulted in additional linear disturbance, and a new diffuser located in the Quesnel River. MPMC provided supplemental information in response to public comments received in their consultation report.

The treatment system being used is designed to maximize removal of suspended particles. Because WQG for metal contaminants are often set for the total component, this strategy removes a high percentage of sediment bound metals to reduce concentrations to levels that can be discharged.

A number of public commenters questioned whether or not the selected treatment system represented best achievable technology. A MEND report was cited, indicating the possibility of lower limits for some contaminants of concern can be achieved. Ministry staff reviewed the MEND report and compared the limits set in the Permit to the suggested achievable limits for other metal mines indicated in the report. The limits set in the permit are comparable to the suggested achievable concentrations indicated in the MEND report for technologies identified as "best available technology economically achievable". In the summary of the MEND report the authors note, "Removal efficiencies and/or achievable effluent concentrations are based on reported operations data, literature values, and/or vendor data and may not be possible for every application. Ultimately, BATEA for any given mining operation is site-specific, as a result of the multitude of geographic and operational factors that influence effluent quality, impact the technical feasibility of treatment technologies, and dictate financial constraints on capital and operating expenditures that can be borne by operations while still maintaining economic viability." Study to Identify BATEA for the Management and Control of Effluent Quality from Mines, MEND Report 3.50.1, Hatch, 2014

The BC Wildlife Federation and Mining Watch Canada commented that the province should, "require a 'dry closure' to reduce risks and ensure long-term stability, as recommended by the Independent Expert Panel report on the 2014 Mount Polley dam breach and spill." While the Permit does not regulate the method of tailings disposal (this is done through *Mines Act* Permit M-200) it is worth noting that there still is a need to discharge effluent from mine sites with dry stack tailings, and there is often a greater risk of metal leaching with dry stack compared to subaqueous deposition of tailings. The panel report noted the Greens Creek Mine as an example of dry stack tailings. While dry stack disposal works well at

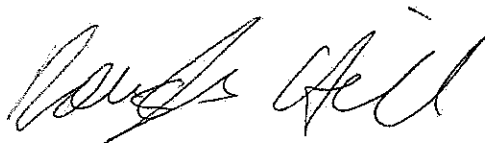
this small underground mine, there still is a need to discharge mine water at the Greens Creek Mine and to rely on dilution and an IDZ in the receiving waters to meet applicable water quality standards.

The development and implementation of the LTWMP was required in MPMC's effluent permit. That plan, which involves a distributed discharge of runoff around the site, has been accepted in concept, and the amended permit reflects the need to provide greater detail and certainty regarding implementation of the concept. Concerns were raised by some reviewers that a mine life extension in the future might delay work needed to develop a final water management plant that would be acceptable for the closure period. The amended permit includes requirements to ensure that MPMC meets key milestones in developing the details of a final water management plan, including development of expectations for application of best achievable technology, optimization of existing treatment works and source controls, and piloting of the proposed biochemical reactors.

Conclusion

For the reasons discussed above the permit is amended authorizing the discharge of treated mine water to Quesnel Lake subject to conditions contained in the amended permit necessary to protect the environment.

This memo summarizes the reasons for issuing the amended permit. Although all information presented was considered, this memo discusses only the key points and documents that were considered most relevant. Advice from the CMDRC and ministry staff was considered. CMDRC advice is reported in the committee comment tracking table dated February 9, 2017 as well as subsequent exchanges saved on the committee sharepoint site. Ministry staff documents relied upon are the assessment written by Mike Reiner, P.Ag., Environmental Protection Officer, finalized April 5, 2017; the impact assessment report dated March 23, 2017 written by Samuel Barnes, R.P.Bio., Impact Assessment Biologist; and, the hydrologist review, written by Erin Rainey, P.Eng. Hydrologist, dated March 22, 2017. A consultation record completed by Emily Watson, Acting Senior Advisor, First Nations Relations, FLNR dated March 30, 2017 describes the activities undertaken to meet the consultation duty for the application.



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