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## MINISTRY ASSESSMENT

To: Douglas Hill

Date: October 26, 2012

From: Karen Moores

File: PE-11678

<b>Application:</b> major amendment		<b>Pre-Application Date:</b> April 3, 2007
<b>SIC:</b> 0612	<b>Production Capacity:</b> 22,000 tpd	<b>Application Date:</b> August 21, 2009
<b>Applicant:</b> Mount Polley Mining Corporation		
<b>Location of Facility:</b> Likely, BC		

- **Application Request**

The applicant has requested to include an additional point of release for mine effluent, to Hazeltine Creek with a maximum flow rate of 18,150 m<sup>3</sup>/day.

**History**

The Environmental Assessment review of the proposed Mount Polley Mine, owned by Imperial Metals was initiated in 1989. The mine was proposed to be a 'zero discharge' tailings impoundment in all weather conditions. The only planned discharge was the waste rock dump runoff water and mill site water treated in a settling pond.

Although it was considered unlikely that tailings pond water would need to be discharged Imperial Metals Corporation made a commitment to design and install whatever treatment system would be necessary to ensure that any discharge of tailings supernatant or open pit water, if required, would meet appropriate discharge requirements (April 8, 1991 letter to MEMPR from Rad Pesalj, P.Eng, Imperial Metals Corporation).

The company agreed to recycle as much of the pit water and tailings as possible to the mill. In addition, the company committed to measures, such as the use of water for dust suppression combined with evaporative techniques, to allow it to maintain a negative balance in the tailings pond. The table of commitments included:

- The Waste Management Permit will not authorize a discharge from the tailings pond or pits to the receiving environment. Imperial Metals has committed to maximum recycle of tailings and pit water, evaporation enhancing techniques and, if necessary, raising the tailings pond berm height to maintain an allowable freeboard to achieve a negative balance in the tailings pond.
- If recycle and other water conservation efforts are not successful, Imperial Metals will be required to apply for an amendment to its

permit. The Ministry of Environment, Lands and Parks will at that time decide whether to authorize a discharge and assign the terms and conditions of the discharge

(October 1992, Mine Development Assessment Process, MEMPR)

The Mine Development Certificate 92-13 was issued on October 6, 1992.

The Mine Plan and Reclamation Permit M-200 was issued on August 3, 1995.

On March 28, 1996 Imperial Metals applied for an effluent discharge permit under the Waste Management Act to operate a tailings and waste disposal system for mill tailings, mill site run off, run off from waste dumps, pit water and septic tank effluent. The permit review was held in abeyance until outstanding baseline monitoring information was submitted.

The effluent discharge permit was issued on May 30, 1997 authorizing discharge to land of 35,000 m<sup>3</sup>/d of tailings slurry. It was noted in the Ministry's Technical Assessment that a review of climate data using the records for the Likely weather station indicated that the area has about 150 mm/year more precipitation than the estimated evaporation for Mt. Polley suggesting that enhanced evaporation or enlarging the depth of the tailings impoundment will have to be implemented before the end of mine life to maintain a negative tailing impoundment water balance and avoid discharge.

A concern during the mine review process was the need to avoid extracting make up water from Polley Lake, particularly during the early years of operation. While some water was extracted, collection of dump and mill site runoff water for use in the mill was undertaken to reduce the demand for makeup water from Polley Lake.

Amendments to permit PE-11678:

- October 20<sup>th</sup>, 1997 amendment to reflect an increased milling rate resulting from a mine plan of 14 years which increased the discharge rate to 45,000 m<sup>3</sup>/d of slurry along with minor changes to monitoring requirements.
- February 1, 2000 amendment to add an additional ball mill to improve the productivity of the mill to 23,000 tpd which would also increase the rate of slurry deposit to 49,500 m<sup>3</sup>/d. Minor changes to the monitoring program were also included in this amendment.
- August 17, 2001 letter amendment allowed for processing of metal concentrate contaminated soil from the Pacific Environment Centre site in North Vancouver. This site is adjacent to the shipping facility that handles the concentrate from Mount Polley Mine.
- October 18, 2001 letter amendment allowed discharge of supernatant into the Cariboo Pit for one month, to a maximum of 750,000 m<sup>3</sup>, commencing October 20, 2001.
- A December 21, 2001 amendment for minor monitoring program changes.
- February 7, 2002 amendment for entering into the care and maintenance phase for transfer of supernatant from the tailings impoundment to the Cariboo Pit, and release of effluent from the perimeter embankment and main

embankment seepage ponds to nearby surface water courses. The perimeter embankment seepage flowed into a tributary of Hazeltine Creek, and the main embankment would flow into the Northeast Edney Creek Tributary to a maximum of 2,000 m<sup>3</sup>/d. The approach to managing water was requested noting that dam raises would not be feasible during shut down conditions. Reduction of sampling frequency was also requested for some sites where mine activities were curtailed, and the elimination of monitoring associated with the now deferred west dumps was approved.

- May 4, 2005 amendment was issued for restarting the mine, and milling new ore in the northeast Zone called the Wight Pit. The amendment included increasing monitoring frequency for the active phase and included pumping of pit water to the tailings impoundment; removal of the perimeter embankment settling pond discharge as this source was now pumped back to the tailings impoundment; increase in dissolved sulphate from 100mg/l to 200mg/l for discharge from main embankment seepage pond to unnamed tributary of Edney Creek and diversion of upgradient groundwater to be released to Polley Lake. The mine had also requested discharge from the Tailings Impoundment to Polley Lake but this was not included in the amendment.
- April 17, 2009 amendment was issued to allow the supernatant from the tailings impoundment and runoff water to fill the Cariboo and Bell Pits to 1108 meters above sea level with minimum of 0.5 meters of water cover over the PAG material. This was a short term water storage solution to avoid a discharge to the environment.

Although Mount Polley has maximized water recycling the water balance is such that they now have an annual surplus of approximately 1.4 Million cubic meters and a discharge is required. The proposed discharge is to Hazeltine Creek.

Closure of the mine is now anticipated to be 2023, at which time the mine will need to discharge site water to the environment. The current application for discharge to Hazeltine Creek will provide the opportunity to ensure a robust and effective discharge strategy is implemented before mine closure.

• **Consultation Report**

**Consultation Report Acceptable:**

Yes	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>	N/A	<input type="checkbox"/>
Yes	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>	N/A	<input type="checkbox"/>

**Environmental Quality Section Consulted:**

The permittee provided an adequate public consultation report dated July 2009 and has published the required advertisements in the local newspaper and gazette, public postings and two public meetings in the community of Likely. In addition the Permittee has included the public consultation for this amendment into the public liaison committee meetings.

The July 2009 Consultation Report documents the initial public consultation which began in 2007 to July 2009. Twenty-eight letters of concern were received from local organizations and individuals subsequent to the August 13, 2007 information session in Likely. The majority of concerns were regarding the safety of drinking water from Quesnel Lake. Some of the other letters stated concerns with levels of parameters above the BC Water Quality Guidelines; potential

erosion from increased flows; spawning and rearing habitat for rainbow trout and potential risk to salmon runs. In response to these letters the interested parties were invited to attend a Pre-Application Meeting held with the Ministry of Environment on September 13, 2007. An additional public meeting was held in Likely on November 26<sup>th</sup>, 2007 and open invitations were issued and mine tours given to interested parties.

The public liaison committee meeting were held on June 17, 2010; November 24, 2010; August 17, 2011; and May 23, 2012.

In 2011 thirteen letters/e-mails of concern were received by Environmental Protection Division from the public regarding this amendment application. The majority of letters raised concerns regarding the safety of drinking water from Quesnel Lake. Some of the other letters raised concerns about baseline data in the creeks and the need for detailed monitoring plan and contingency plan; management of the effluent discharge and potential for bioaccumulation. Many of the letters also stated that they were not aware of the mines public liaison committee meetings schedule. In response to these letters Environmental Protection Division sent out a letter and e-mails on November 23 & 24<sup>th</sup> of 2011 informing the interested parties that more information could be obtained at the next public liaison committee meeting and encouraged them to sign up for the contact list so they would be notified directly of the next meeting date. This resulted in only one additional member signing up for the contact list. The next public liaison committee meeting was held in Big Lake on May 23, 2012. Karen Moores, Sr. Environmental Protection Officer discussed the concerns that had been raised by the public and how they would be addressed in the draft permit (see meeting minutes).

Based on the information submitted the drinking water in Quesnel Lake will not be compromised with this discharge as it will be managed for aquatic standards which are more conservative. The environmental concerns have been evaluated in the Environmental Quality Section Review.

The Environmental Protection Division (EPD) First Nation Contact Summary is attached in spreadsheet format. The proponent has been delegated the task of informing First Nations about the details of the application with oversight from the Environmental Protection Division.

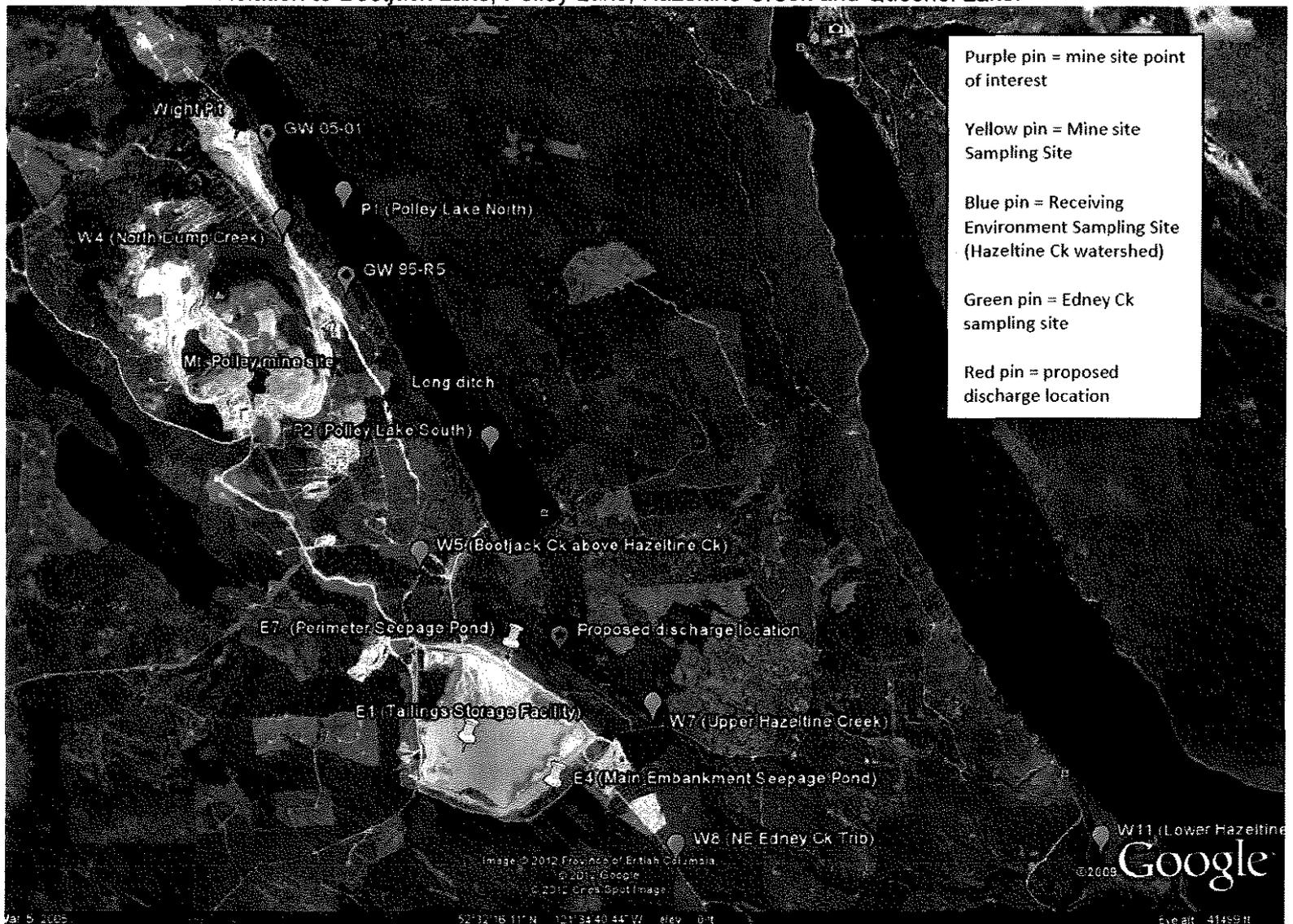
### **Environmental Quality Section Review**

The Water Quality Impact Assessment Report was completed by Chris Swan (CS), Impact Assessment Biologist. This report considered the application documents as well as the 2010 annual report and the Olding & Associate (2011) report. The CS report is based on a discharge from the Perimeter pond (E7) to Hazeltine Creek.

As of 2009, the storage capacity of the Tailings Impoundment was approx. 3.5 Million cubic meters and the Cariboo Pit had capacity for approx. 3 Million cubic meters; Dust Suppression used approx. 300,000 cubic meters/year. Currently the excess water is approximately 1.4 Million cubic meters/year. In addition, the Cariboo pit will need to be drained to the Tailings Impoundment if additional mining occurs in this area.

The receiving environment is Hazeltine Creek which is 10.3 km long, situated between Polley Lake and Quesnel Lake with an average flow of 0.19 m<sup>3</sup>/sec and a seasonal range of 0.05 m<sup>3</sup>/sec to 0.74 m<sup>3</sup>/sec. Edney Creek is a tributary to Hazeltine Creek and increases the upstream flow between 3-8 times. Rainbow Trout utilize the full length of Hazeltine Creek and the creek contains substrate for spawning and egg incubation. There is a fish barrier between Reach 5 and 6 which prevents other species of fish from utilizing upper Hazeltine Creek. Coho and Sockeye salmon spawn in the fall and in the lower reaches of this creek. Coho and Chinook fry can spend one year in this creek as rearing habitat until smolting and subsequent migration.

Below is a figure from the assessment report which shows the mine orientation in Relation to Bootjack Lake, Polley Lake, Hazeltine Creek and Quesnel Lake.



CS has recommended that the location of the discharge site should avoid the gravel bar/braided area in the creek to ensure adequate mixing in the creek at low flows. Linda Sheffield, Lands Officer has forwarded the Lands Act application (5407625) and the Water Act Approval (A5-4397) and Forest Act approval for the discharge pipeline to EPD which confirm that the proposed discharge location would be upstream of the gravel bar/braided area.

The increase in flow from this discharge is well within the natural variation of the stream. Furthermore, it is recognized that Hazeltine Creek had significantly higher flows until Bootjack Lake was diverted.

Water chemistry concerns respecting this permit amendment application are focused on the protection of aquatic life from long-term chronic effects. Acute effects are not anticipated from the effluent based on results from acute bioassays (96hr LC50 RT @ 100% effluent – Table 2.6 Technical Assessment Report)

The predicted tailings impoundment effluent water quality in the application is from a combination of sources. The 2010 annual report shows that some of these predictions have been exceeded since the original application in 2009. Further data is required for the longer term 'most probable' and maximum predictions of the effluent quality. This information is critical to determining if treatment of the effluent will be required, or if dilution can achieve the receiving environment water quality targets proposed in the draft permit.

CS recommended that the discharge be limited to dam filtered water from the seepage collection ponds, at least in the start up phase of the discharge. This water source has significantly better quality and is less variable than long ditch water which is largely dump runoff. Limiting the discharge to dam filtered water will require that the mine separate the long ditch water, which currently flows to the perimeter pond at E7 from the perimeter toe drain water.

An annual discharge plan is needed for the following reasons:

- The effluent quality and rate of discharge will need to be managed to provide adequate long-term protection of aquatic life in Hazeltine Creek. A reduced rate of discharge may be required to achieve the receiving environment targets. Water volumes could be increased if water treatment improves the quality of the discharge.
- Provisions in the permit to deal with the cumulative effects in the stream should be considered.
- Seasonal effluent quality limits may be useful for parameters of concern to reflect the variable receiving environment and the creek hydrology.

Sulphate, cadmium and selenium were identified to likely exceed BC Water Quality Guidelines (BCWQG) for the protection of aquatic life. The permittee proposed a site specific water quality objective for sulphate of 500 mg/l in Hazeltine Creek. The current BCWQG level is 100 mg/l. CS recommended that the BCWQG be used as the permit limit in the creek. For cadmium, the permittee proposed a limit of 0.06 µg/l. Currently the BCWQG is 0.025 µg/l based on 73 mg/l hardness. CS recommended an annual target of 0.025 µg/l. For selenium the permittee proposed no limit but that a biological monitoring program based on ovary tissue be implemented. CS recommended BCWQG targets for water, sediment and tissue as well as a biological monitoring program for Selenium.

A site-specific objective for copper was proposed. CS agreed with a site-specific objective of 0.07 mg/l based on the lowest water effects ratio.

## **Discussion:**

The primary concern for this discharge is chronic effects. This concern is addressed by including target limits at W7 in Hazeltine Creek that are protective of sensitive life stages as outlined in the CS report.

To ensure protection of acute effects within the initial dilution zone from the discharge point to W7 (approximately 800m) acute toxicity tests for rainbow trout and daphnia have been included in the draft permit. A TSS limit of 25 mg/l has been included, based on the BCWQG for turbidity, which will prevent sediment bound metals from moving into Hazeltine Creek. The draft permit includes a pH range of 6 to 9.5, which reflects the requirements in the Metal Mine Effluent Regulation, has been included.

A comparison was made of the proposed target limits for W7 in Hazeltine Creek and the tailings impoundment and seepage pond water quality data for 2011. Based on this information for seepage pond water, the applicant should be able to meet the targets in Hazeltine Creek, provided they manage the discharge rate with flows less than 35% of Hazeltine Creek flows. The additional treatment of the settling pond should improve the water quality of the discharge further through settling of sediment bound metals and some biological treatment. The mine has recently stated that they would like to construct a tank to mix the seepage pond water which will allow them to closely monitor the effluent quality. The clause for authorized works in the draft permit allows for a settling pond or tank. Should the effluent quality change in the future additional treatment works and/or reduced discharge rates may be required.

Effluent quality during the first year will be managed by restricting the discharge to dam filtered water, which has significantly better quality and is less variable. Limiting the discharge to this source will also reduce the rate of discharge. In addition to limiting the source water for discharge into Hazeltine Creek, water quality targets in the draft permit are proposed at station W7 downstream of the point of discharge to ensure the protection of aquatic life. Other source water may be approved by the Director in subsequent years after review of the monitoring data.

The creek has variable flows and has natural variation in concentrations for some parameters. The discharge rate will be managed through an annual discharge plan approved by the Director. If a target is exceeded, the permittee must cease discharging. The discharge may resume if the discharge plan is amended to ensure the targets can be achieved.

To ensure protection against possible chronic effects, a number of protective measures have been incorporated in to the draft permit:

- The discharge will be limited to a maximum of 35% to ensure chronic effects to embryo/alevin are avoided, as was suggested in the whole water testing of tailings impoundment and seepage water (Technical Assessment Report, July 2009, pg.54).
- Chronic bioassays:
  - IC25 for Early Life Stages of Salmonid Fish, embryo/alevin testing will be required twice a year using effluent and Hazeltine Creek water upstream of the discharge as dilution/control water. This test will estimate the percent of effluent which result in non-viable alevins. A failure of this test would be equal to or less than 35%

- effluent concentration is estimated to cause greater than 25% nonviable alevins. This test can also be used to satisfy the federal requirement for the Metal Mines Effluent Regulation.
- Chronic daphnia toxicity bioassays for 7 day Ceriodaphnia dubia reproduction will also be required. A failure of this test would be equal to or less than 35% effluent concentration is estimated to cause greater than 25% inhibition of reproduction.
  - If a test fails the Permittee must investigate to determine the cause of the toxicity failure. Every effort must be made to obtain preliminary and in progress results from the analytical laboratory for the toxicity testing. The Permittee must make immediate arrangements to retest. The Director may require additional toxicity testing.
- A biological monitoring plan will be required which must include monitoring for selenium in water, sediment and biota.
  - 30-day mean values for target levels are included for targets at W7. One exception is total cadmium, which has a target for an annual mean because of the large variability and values below method detection limits in the existing baseline data for Hazeltine Creek.

***A discussion of the recommended permit clauses for the discharge to Hazeltine Creek are as follows:***

Source Water

Effluent from the Tailings Impoundment is the source water requested for discharge to Hazeltine Creek. Based on the 2011 annual report the concentration of the key parameters in the effluent have increased since the 2009 application and would likely exceed the targets set for Hazeltine Creek. This water would not be suitable for discharge at this time. However, dam filtered water from the seepage collection ponds are of significantly better quality and should be able to meet the targets in Hazeltine Creek.

The discharge effluent should be limited to dam filtered water or other source water as approved by the Director. Limiting the source water to dam filtered water will require the mine to ensure that long ditch water does not mix with the seepage water. Initially limiting the source water will reduce the volume of effluent that can be discharged and will allow the mine some time to establish an efficient and reliable system of operation. Other source waters could be approved by the Director and must still meet the targets in Hazeltine Creek.

Discharge Rate

The seepage rate through the toe drains to the seepage ponds ranges from approximately 0.02 to 0.04 meters<sup>3</sup>/second based on the 2011 annual report, or approximately 801,000 m<sup>3</sup>/year. Consequently, until the discharge system is finalized, the mine will need to find other methods of managing water onsite.

The mine has confirmed that in the short term they will be able to manage water onsite, allowing them the opportunity to demonstrate that they can operate this

discharge to Hazeltine Creek appropriately prior to the Director considering other source water. It is anticipated that the mine will want to discharge water from the long ditch and perhaps the tailings impoundment in the near future. This may be acceptable depending on the water quality and discharge plan.

The discharge period is restricted from April to October to avoid the low flow months. The flow must not exceed 35% of Hazeltine Creek flow based on the predicted chronic effects (Technical Assessment Report, pg 54). Although the maximum authorized rate of discharge on an annual basis is 1.4 million cubic meters a more detailed annual plan for monthly discharge rates must be submitted each year based on the current hydrology and snowpack information and mine water balance. This information must be used to determine how the mine will ensure that the water quality targets are met. The maximum annual discharge is set so that the mine must apply to amend the permit for any increase beyond the current surplus water balance and the annual plan will deal with the flow variation within the watershed for this discharge.

#### TUS (Traditional Use Study)

The draft includes a requirement that the discharge is not authorized until the TUS required by the Mines Act permit is completed has been included in the draft permit. This clause is included to address concerns by First Nations that the TUS should also be linked to this permit amendment. Environmental Protection Division cannot evaluate the content or adequacy of the TUS but this clause will require that the TUS is completed.

#### Authorized Works

The authorized works include a settling pond or tank, pipeline, flow control valve continuous flow meter and outlet structure. The Permittee has noted that they have an experimental anaerobic biological reactor (ABR) which they intend to include as part of the treatment works in the future. The mine has a commitment for three more years to the Genomic research project and are planning to build a smaller reactor to try and resolve the outstanding performance issues (May 14, 2012 conversation between KJM and Art Fry, Mount Polley Mine). The use of the ABR was not considered in this permit application and the predicted water quality did not include this treatment method. However, if the research results show promise for long-term passive treatment of mine water, a subsequent amendment could be include the ABR in the authorized works clause.

#### Characteristics of Discharge

Acute toxicity bioassays and a limit for TSS and pH are included in the draft permit to ensure any acute effects are prevented within the initial dilution zone between the discharge point and W7 on Hazeltine Creek.

### Contingency Plan

Ambient target levels for parameters of concern in Hazeltine Creek at W7 as shown below in Table 2 have been set as recommended in the CS report. These targets are to address chronic effect limits. In the event of exceedance of these limits occur the mine must cease discharging as soon as possible.

**Table 2 – Target levels for Hazeltine Creek at W7**

<b>Parameter- water sample</b>	<b>Units</b>	<b>30-day Mean</b>
Nitrate	mg/l	3
Total Cadmium	µg/l	0.025*
Total Copper	mg/l	0.007
Total Molybdenum	mg/l	0.08
Total Selenium	mg/l	0.002
<b>Parameter –water sample</b>	<b>Units</b>	<b>Maximum</b>
Sulphate	mg/l	100
<b>Parameter – sediment sample</b>	<b>Units</b>	<b>Mean</b>
Total Selenium	µg /g dw	2
<b>Parameter – Fish Muscle Rainbow Trout</b>	<b>Units</b>	<b>Mean</b>
Total Selenium	µg /g wet wt	1
<b>Parameter – creek substrate</b>	<b>Units</b>	<b>Maximum</b>
Phosphorus – Chlorophyll a	mg/m <sup>2</sup>	100

\* annual mean based on a calendar year

In addition the pH of the effluent discharge must be within the range of 6.0 to 9.5 units. The Director may amend these target levels upon review of the monitoring data and any other relevant information.

After reviewing the May 2012 draft permit the permittee again requested that the targets for cadmium, selenium and sulphate be increased as originally proposed and cited a number of studies calling the current guidelines into question (July 13, 2012). CS reviewed the memo and noted that there was no new information to change her assessment. However, cadmium, selenium and sulphate are currently under review by staff with the Water Protection and Sustainability Branch. To ensure that all current research has been considered, a third party review by Watershed Science Staff was requested by the Environmental Quality Section (letter dated July 19, 2012).

On August 14, 2012 Colleen Hughes, with Mount Polley Mine, confirmed that the permittee would like to proceed with the issuance of the draft permit. They also stated that they would like MOE proceed with the review of the letter submitted July 13, 2012 regarding the BCWQG levels for Cadmium, Selenium and Sulphate.

### Nitrate

Nitrate in the effluent ranges from 1.8 to 7.8 mg/l in the tailings impoundment and seepage ponds, which exceed the BCWQG limit of 3 mg/l. This limit is based on the reproductive success of the Pacific Tree Frog which is found throughout central and southern BC (Water Quality Guideline for Nitrogen (Nitrate, Nitrite, and Ammonia –

September 2009). Therefore, the BCWQG is relevant to this area and has been included as a target for Hazeltine Creek.

#### Total Cadmium

An annual mean of 0.025µg/l was recommended for total cadmium based on values from Hazeltine Creek. The BCWQ working guideline maximum for total cadmium is a calculated value of 0.025µg/l at 73 mg/l hardness. The concentration of cadmium in Hazeltine Creek fluctuates sporadically throughout the year. The data set is limited due to high method detection limits (MDL) resulting in many non-detectable results. Of 208 data points only 48 were above the MDL. The samples used in the calculation had a MDL between 0.01 µg/l and 0.05 µg/l (e-mail CS, May 22, 2012). The mean value recommended was based on using the below MDL results as equal to the MDL. An annual mean was selected to set a realistic target based on the receiving environment levels. To ensure this is not an issue in the future, a MDL of 0.01 µg/l is required in table 3 of the draft permit. Should additional samples with lower detection limits show lower total cadmium levels this target should be revisited. Mean levels of cadmium in the effluent from the tailings impoundment are 0.2µg/l, in the perimeter seepage pond and in the main seepage pond 0.045 µg/l. This data set also has many values below the MDL. The target should be easily met with dilution for the seepage pond water. Further results above the MDL will provide increase certainty of the values of Cadmium in the effluent and the creek.

#### Total Copper

CS noted that the proposed site-specific objectives proposed for total copper are acceptable for setting permit limits. Total copper is based on the lowest water effects ratio of 2.4 that results from copper binding with high dissolved organic carbon in Hazeltine Creek. A target for copper of 0.007mg/l was recommended.

#### Total Molybdenum

The proposed limit for molybdenum is based on the BCWQG for livestock drinking water which is 0.08 mg/l. There are cattle in the area which are subject to molybdenosis. The technical assessment report for the BCWQG recommends that the limit for wildlife be the same as for livestock. The summary table in the guideline shows the level for wildlife as 0.05 mg/l. However, this accounts for exposure through both irrigation and drinking water, which is not applicable at Mount Polley, and should not be used. The limit for the protection of aquatic life is much higher at 1 mg/l. The levels of molybdenum in the tailings impoundment effluent and seepage ponds in the 2011 annual report have means between 0.057 and 0.12mg/l. Thus dilution is needed to meet the receiving water targets.

#### Total Selenium

Water samples for total selenium are based on the BCWQG. The values of total selenium in Hazeltine Creek are quite low; however, the values in the biota have demonstrates an increasing trend. There is no direct relationship between the levels of selenium in the water and sediment and what is found in the plants and animals in the same creek, so the cause of increasing trends is not clear. The targets used for the water column are from the BCWQG.

Given the environmental fate of selenium, a holistic environmental approach of testing all levels in the food web has been recommended by Ministry staff and Brian Olding, in order to better understand the mechanism of transfer and accumulation of selenium in Hazeltine Creek. This is why the limits for selenium in sediment and muscle tissue have been included as targets along with the water sample. Mount Polley is undertaking an extensive monitoring program for selenium in water, sediment and biota.

### Sulphate

The BCWQG for sulphate is a maximum of 100 mg/l. This parameter is currently under review by the provincial government and may require updating should a new limit be adopted. Sulphate in the effluent is in the range of 400-800 mg/l and if dilution in the initial dilution zone is not adequate then treatment may be required. Sulphate has a negative effect on the development of early life stages in fish. To ensure these effects are not taking place, chronic embryo to alevin bioassay has also been included in the permit.

### Chlorophyll a

Chlorophyll a has been included as a surrogate for phosphorus in the targets for Hazeltine Creek based on the BCWQG of 100 mg/m<sup>2</sup> of chlorophyll a. Phosphorus is higher in the effluent than the creek and phosphorus is the limiting nutrient in Hazeltine Creek for most of the growing season.

Other parameters of interest:

- Dissolved Aluminium has not been included in the targets because for approximately half of the year, it is higher in the creek than in the effluent. The BCWQG have a 30-mean of 0.05mg/l, which is exceeded in the creek at high flows. During periods of high flow the effluent discharge will lower the overall concentration of aluminium in the creek. The mean aluminium concentration for the tailings impoundment and sediment ponds are 0.06 and 0.01mg/l respectively. The discharge to the creek is a maximum of 35% of creek flow which should provide adequate dilution so as not to exceed the BCWQG. Dissolved aluminium has not been included as a target for Hazeltine Creek because it is not a concern for the reasons stated above. However, CS reports that daphnia and invertebrates are sensitive to dissolved aluminium so increases above natural variability for those months that have lower concentrations should be avoided. Therefore, the draft includes a chronic test for daphnia and to closely monitor dissolved aluminium upstream and downstream of the discharge to ensure no negative effects on the receiving environment. CS also raised the concern that the mine may use alum as a flocculent in the settling pond which could increase the amount of dissolved aluminium. This concern is addressed by a clause requiring the permittee notify the Director of any process modifications that may adversely affect the quality and/or quality of the discharge (clause 2.3).
- Dissolved and total iron levels are also much lower in the effluent than what is found in the creek, so targets have not been included for these parameters.

- Temperature is not included as a target at W7 because it fluctuates considerably during the year from various sources to this small stream. The draft permit requires that temperature be continuously monitored to identify if there is any trends (clause 3.1).

### Audit

An Audit clause has been added to review the data for the Hazeltine Creek discharge and address concerns raised regarding objectivity in review of data. The clause reads as follows: 'Monitoring data for Hazeltine Creek and the authorized discharge to Hazeltine Creek and the analysis of that data as presented in the annual report must be reviewed and audited by a third party qualified professional. Furthermore, the findings of the audit must be appended to the annual report. The audit of this data and analysis must consider: data quality and completeness, the QA Manual for the monitoring program, the provincial water quality policies and guidance documents, and standard operating procedures and data handling protocols in place for Mount Polley Mine.'

### Security

It is possible that the mine may need to treat the effluent prior to discharge, in the future, should concentrations in the tailings impoundment rise. The likelihood of water treatment has been discussed with Diane Howe, Deputy Chief Inspector, and Reclamation and Permitting with the Ministry of Energy, Mines and Natural Gas (e-mail dated October 2, 2012). She indicated that security aspects for water treatment would be reviewed during their 5 year mine plan and reclamation program update or when and if the company applies for another expansion amendment. Security can also be reviewed upon request, if EPD suspects the discharges are compromising the environment.

Clause 2.7 of the permit, 'Posting of Security', has remained unchanged except for updating the ministry name. The clause requires the Permittee to hold a security with the Ministry of Energy, Mines and Natural Gas under the *Mines Act* for the Mine Plan and Reclamation Program. At this time, security is not considered necessary because effluent treatment is not required. However, should the mine request discharge of effluent with higher concentrations of parameters of concern, treatment may be necessary. This would then trigger consideration of security during the next mine review or mine expansion application.

## ***Permit Updates and General Permit Clauses***

### *Discharge to Tailings Impoundment*

The maximum elevation for the tailings impoundment at 1000m elevation has been added under clause 1.1.6 of the draft permit. The elevation value was taken from the latest approved design raise (960.5m) of the tailings impoundment under *Mines Act* Permit M-200, August 15, 2011. Capping the elevation will ensure that any impacts from future dam raises will require an amendment of the *Environmental Management Act* Permit so that possible environmental impacts related to increased head pressure which may result in increased seepage rates are considered by EPD.

A discharge period was added for the tailings impoundment supernatant section 1.1.2 of the draft permit 'The authorized discharge period is continuous'. This was a previous oversight.

Supernatant to Cariboo Pit Removed

Clause 1.2 for tailings impoundment supernatant to the Cariboo Pit has been removed. The mine manages water onsite by pumping water into unused pits and this will now be covered off in a general clause under Surface Runoff and Mine Drainage Control that will allow greater flexibility to move water onsite and require records of volumes transferred.

Edney Creek Discharge Removed

Clause 1.3 of the permit which authorizes a discharge of 2,000 m<sup>3</sup>/day from the main embankment seepage pond to Edney Creek has been removed from the permit. This discharge was approved for the mine closure from 2002-2005 and is no longer necessary at this time.

Discharge of groundwater to Polley Lake Removed

Clause 1.4 for the discharge of clean groundwater upgradient of the Wight Pit to Polley Lake has been removed. This is not 'mine water' as it has not been in contact with site operations and is not on site where it could be contaminated. This will be covered off in a general clause under Surface Runoff and Mine Drainage Control that will require non-contact water to be diverted.

Flow Measurement for southeast sediment control pond Removed

Clause 3.3 Removed the clause for monitoring flow into the southeast sediment control pond has been removed as this sediment pond no longer exists.

Environmental Emergency Response Plan

This clause will replace the spill contingency plan. It is now broader and will deal with all environmental emergencies and must include a notification protocol for advising the Soda Creek Indian Band and the Williams Lake Indian Band of significant events at the mine site. Clause 2.5 of the draft permit.

Communication Plan

A clause requiring a communication plan to be developed by the permittee in consultation with the Williams Lake and Soda Creek Indian Bands has been added to the draft permit. Clause 2.6 of the draft permit.

### Surface and Groundwater Monitoring Plan

This clause replaces the tables in the previous permit for sampling location, frequency and parameters. The plan must be developed by a qualified professional and submitted for approval by the Director. The Director may amend the plan and a few requirements have been listed. This will allow for greater flexibility for site monitoring activities while enabling oversight from EPD. Clause 3.1 of the draft permit.

### Biological Monitoring and Lake Sampling Program

This new clause in clause 3.2 of the draft permit specifies that a biological monitoring program must be developed and submitted for approval by the Director. The plan must include but not be limited to the mine site, Hazeltine Creek, Edney Creek, Bootjack Lake and Polley Lake.

The program must include documentation of wildlife occurrence and an annual photo survey of Hazeltine Creek at pre-selected observation sites to document any visible changes to creek habitat. The program must also include monitoring for selenium in biota

### Sampling and Analysis Procedures

This clause has been updated to include the reference for the acute and chronic toxicity tests and now also includes a table of MDL's which will greatly improve the data for interpretation of cadmium and other parameters. Clause 3.7 of the draft permit.

### Reporting

This clause now also includes a requirement for groundwater to be included in the quarterly and annual reports and for interpretation of trends to be included at least every five years. Clause 3.9 of the draft permit.

### Toxicity Failure Reporting

This clause has been included in the draft permit for all bioassay toxicity tests. It defines what a failure is for both acute and chronic bioassays. If a sample fails the test, the permittee must immediately report the failure to this office and investigate the cause. The permittee must make immediate arrangement to retest and the Director may require additional toxicity testing. Section 3.11 of the draft permit.

Non-compliance Reporting and Exceedances

A clause for non-compliance and exceedance reporting has been added which will quickly draw attention to problems for a timely response from EPD and will increase efficiency of reviewing data. Section 3.12 of the draft permit.

- **Recommendations**

It is recommended that the Director grant the attached permit as drafted.



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