MPMC 2016 Annual Discharge Plan

Submitted to:

Ministry of Environment
Environmental Protection Division
South Interior Region – Cariboo

and

Environment Canada

Prepared by:

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1.0 Introduction

In November 2015, Mount Polley Mining Corporation (MPMC) received an amendment to Permit 11678 issued by the British Columbia (BC) Ministry of Environment (MoE) under the BC *Environmental Management Act* (*EMA*). This amendment authorized the discharge of treated effluent from the Springer Pit and site runoff and seepage collection water management systems to Hazeltine Creek (from where it is conveyed to Quesnel Lake as furthered detailed herein).

This 2016 Annual Discharge Plan (the "Plan"), required under Section 1.3.4 of *EMA* Permit 11678, is required to outline the expected volume, timing, and quality of effluent released to Hazeltine Creek, and demonstrate how the British Columbia Water Quality Guidelines (WQGs) will be attained at the edge of the dilution zone in Quesnel Lake at all times.

Water discharge is also regulated by the Metal Mining Effluent Regulations (MMER) under the Federal *Fisheries Act*. This Plan has been developed for submission to the MoE and Environment Canada to satisfy the requirements of both *EMA* Permit 11678 and the MMER.

2.0 Discharge System

2.1 Discharge System Components

The discharge infrastructure, permitted under *EMA* Permit 11678, includes the following key components:

1. Springer Pit.
2. Mine contact water collection system.
3. Perimeter Embankment Till Borrow Pond.
4. Veolia Treatment system.
5. Pipeline into upper Hazeltine Creek.
6. Settling Pond at lower Hazeltine Creek.
7. Submerged diffusers in Quesnel Lake.

These works were completed in the fall of 2015. Construction details of the discharge system infrastructure and design are on record at the Mount Polley Mine.

2.2 Discharge System Locations

The Mount Polley Mine is located 56 kilometers northeast of Williams Lake, in central BC. Key discharge locations are as follows:

- Discharge to Hazeltine Creek at 5,819,888 N and 595,912 E.
- Discharge to Quesnel Lake through twin diffusers at 5,817,932 N and 601,747 E, and 5,817,935 N and 601,785 E.

3.0 Discharge Plan

3.1 Hydrology

The Mount Polley Mine area is drained by three (3) main watersheds: Hazeltine Creek at Quesnel Lake, Edney Creek at Quesnel Lake, and Morehead Lake. The Hazeltine Creek watershed includes Polley Lake and the upstream Frypan Lake, and conveys all water from Polley Lake, the east side of the Mount Polley Mine area, and the area surrounding the TSF.

MPMC has maintained a hydrological monitoring station on upper Hazeltine Creek that was originally installed by the Water Survey of Canada (08KH027). In general, the hydrology of Hazeltine Creek (and by extension, the Mount Polley Mine area), can be described as snowmelt driven, with the majority of annual runoff occurring during freshet. Recent hydrology and snowpack data for the past 12 months is included in Table 1.

Table 1: Recent hydrology and snowpack information (average data shown in brackets).

Month	Rainfall (mm)	Snowpack (SWE (mm) at month end)	Snowmelt (mm)	Evaporation (mm)
May-15	36.2 (53.5)	0	0	147.2
Jun-15	48.2 (78.2)	0	0	195
Jul-15	63.8 (58.9)	0	0	174.8
Aug-15	20.8 (52.2)	0	0	118.9
Sep-15	61.6 (48.2)	0	0	14.3
Oct-15	61.5 (58.2)	0	0	NC
Nov-15	16.8 (53.5)	23	0	6.7
Dec-15	0.0 (85.6)	100	0	5.2
Jan-16	31.5 (50.8)	167	1	7.6
Feb-16	26.4 (37.5)	219	54	18
Mar-16	17.2 (42.8)	50	170	45.2
Apr-16	33.9 (49.5)	0	50	95.8

SWE = Snow Water Equivalent

NC = Not Calculated (due to insufficient weather data)

3.2 Mine Water Balance

Currently (as of June 2016), mine contact water is pumped to the Springer Pit for temporary storage. Tailings and process water from the milling process also report by gravity from the Mill to the Springer Pit. Contact water from roads, haul roads, waste rock dumps and other mine areas north of Bootjack Creek either collects in sumps (NW PAG, 9K, Mine Drainage Creek, Mill Site, Wight Pit, Cariboo Pit) or flows directly to the Southeast Rock Dump Site (SERDS), West, or Long Ditches. The water that collects in the sumps is either pumped directly to the Springer Pit, or to the SERDS, West, or Long Ditches, which flow to the Central Collection Sump (CCS). Water in the TSF is currently pumped to the CCS. Water from the CCS is pumped to the Mill via the Booster Station to meet process requirements. Water from the Springer Pit is pumped via the Springer Pit Dewatering System to the Water Treatment Plant (WTP), and can also be used to supplement Mill process water requirements (via the Booster Station) if there is a shortfall in the available water from the CCS. All water in the CCS is used to meet Mill process requirements, or spills to the Perimeter Embankment Till Borrow Pond (PETBP). The Tailings Storage Facility (TSF) can be used as contingency storage for site contact water during high flow events when the CCS is unable to keep up with water transfer rates, and the PETBP is filling beyond target operational levels. The WTP can also source water from the PETBP, although this is less preferable under current conditions than sourcing water directly from the Springer Pit Dewatering system. Treated water from the WTP is discharged to Hazeltine Creek.

Outflow from Polley Lake is currently being regulated by a weir. The total live storage is approximately 4 Mm^3, and the main purpose of the weir is to temporarily store freshet runoff during April through June, and then release it in a controlled manner over the remainder of the year. This also enables MPMC to: (1) lessen peak flows to reduce the risk erosion and sedimentation that could occur in the riparian areas that are still undergoing rehabilitation if the mean annual flood channel is overtopped; (2) better manage the discharge of treated effluent through the diffuser during these months; and (3) control flow rates during periods of construction in Hazeltine Creek as part of habitat rehabilitation efforts.

3.3 Expected volume, timing and duration of effluent discharge

This section summarizes the expected volume, timing, and duration of effluent discharge to be released to Hazeltine Creek. This data has been derived from the site-wide water balance model (Golder 2015a), but includes actual flow data for January to April 2016. The future predictions from the water balance model take into account natural flows in Hazeltine Creek as well as flows released from the Polley Lake weir. Table 2 summarizes this information, and also provides the sources of mine-water and the percentage of each source in the total daily effluent discharge.

Table 2: Expected source, volume, timing and duration of effluent discharge in 2016.

Month	Average Daily Flow (m^3/day)	Discharge Days (days)	Flow from Springer Pit (%)	Flow from site runoff (%)	Average Polley Lake outflow (m3/day)
January	15,600[1]	31	N/A[3]	N/A[3]	13,800
February	12,700[1]	29	N/A[3]	N/A[3]	13,800
March	12,800[1]	31	N/A[3]	N/A[3]	18,100
April	13,200[1]	12[2]	54%	46%	0
May	25,600	31	67%	33%	0
June	25,700	30	66%	34%	0
July	24,800	31	68%	32%	18,100
August	25,900	31	72%	28%	18,100
September	24,600	30	68%	32%	22,500
October	17,500	31	55%	45%	28,500
November	15,200	30	46%	54%	31,100
December	25,900	31	73%	27%	13,800

[1] actual flow data from Water Treatment Plant (averaged daily flow derived from total monthly volume).

[2] no discharge on April 1, 2, 6-9 due to high flow in Hazeltine Creek, and on April 20-30 due to copper exceedance.

[3] Not Available: percentage source of mine-water discharge was not measured between January-March.

The maximum volume of daily effluent discharge is limited by *EMA* Permit 11678 to be 25,920 m^3. This is based on the maximum authorized discharge rate of 0.3 m^3/s (section 1.3.1 of *EMA* Permit 11678). However, as shown above, this volume will not always be attained due to limitations in the discharge system during times of high natural flow and the need to discharge flow from the Polley Lake outlet structure.

3.4 Management of suspended solids

Effluent discharge is being managed to minimize the deposition of suspended solids into Hazeltine Creek and Quesnel Lake through a number of methods. The primary method is through settling of suspended material in the Springer Pit, followed by active treatment at the Veolia Treatment Plant, a treatment system designed to remove suspended solids from influent water. Water is directly conveyed from the Springer Pit to the WTP (i.e. through continuous piping), mitigating the potential for influence of additional contact with open ditch and sump conveyance systems between the source water and the treatment system. Additionally, significant erosion control (e.g. armouring) work has been completed in areas of open ditch flow systems around the site identified as having high erosion potential to reduce the potential for an adverse effect on water quality. These aspects of the system minimize the amount of suspended solids being released to Hazeltine Creek and Quesnel Lake.

The secondary method of reducing suspended solid deposition (post effluent discharge to Hazeltine Creek) is through the existing sediment control measures that have been constructed, including the engineered rock channel foundation of Hazeltine Creek and the settling ponds in lower Hazeltine Creek. Further work is ongoing to reduce runoff from the floodplains of Hazeltine Creek by constructing armoured preferential flow-paths in areas where erosion has been observed during spring runoff.

3.5 Water Treatment

The main component of the treatment system is the Veolia Actiflo™ treatment plant, model ACP-650. The Actiflo™ clarifier system uses sand-ballasted settling to remove suspended solids present in the inflow water. The quality of influent and effluent water is monitored within the plant by a number of sensors, meters and controllers. Table 3 provides a summary of equipment in the treatment plant, including calibration and maintenance related to continuous measurements of flow, turbidity, specific conductance and temperature.

Table 3: Summary of equipment, maintenance and calibration for continuous site measurements.

Equipment Type and Location	Model Number	Calibration and Maintenance Requirements
Turbidity Meter: influent pipe	HACH SS6 Surface Scatter Turbidmeter	Scheduled, periodic maintenance requirements of the SS6 Turbidmeter are minimal. Standardization checks should be performed on a monthly basis. Calibration should be performed at least every four months by one of the methods provided in the Instrument Manual.
Electromagnetic Flowmeter: influent pipe	Siemens Sitrans F M MAG 5100 W	The device is maintenance-free, although a periodic inspection must be carried out to check: • Ambient conditions • Seal integrity of the process connections, cable entries, and cover screws • Reliability of power supply, lightning protection, and grounds

		If required, Siemens will recalibrate the sensor using one of the calibration methods included in the Operating Instruction Manual.
Turbidity Sensor: effluent pipe	HACH Solitax® model TS-LINE sc	There are no maintenance requirements for the sensor once installed. Calibration for turbidity uses Formazin or StabCal® standard. Calibration for total suspended solids (TSS) is based on gravimetric TSS analysis with a correction factor.
pH Sensor (includes temperature and conductivity): effluent pipe	HACH Ryton® Sensor model DPD1R1	Maintenance requirements for the pH Sensor include cleaning the sensor and inspecting the sensor for damage every 90 days. Instructions on how to clean the sensor are in the User Manual. Automatic calibration identifies the buffer table corresponding to the chosen buffer and automatically calibrates the probe after it stabilizes. Alternatively, a manual calibration is performed by placing the pH sensor in any buffer or sample with a known value and then entering that known value into the controller.
Flowmeter Signal Converter: main plant controls	Krohne IFC 010 Signal Converter	This is a signal converter and does not require any maintenance or calibration.
Universal Controller: main plant controls	HACH sc200™	This is a signal controller and does not require any maintenance or calibration.

The primary shutdown criterion for the WTP is based on measured TSS in the effluent. If TSS reaches 14.5 mg/L, discharge to the environment is ceased until the level of TSS drops to below this. This is monitored using the turbidity sensor and if that level is exceeded the WTP goes into a recirculation mode where water is diverted back into the PETBP. The secondary shutdown criterion is if water sampling indicates exceedance of any water quality parameters listed in Section 1.3.3 of *EMA* Permit 11678.

An additional shutdown criterion during freshet is if the natural flows in Hazeltine Creek exceed the design capacity of the diffuser (0.6 m^3/s). If this occurs, discharge from the WTP will immediately cease to prevent water overtopping the head pond and bypassing the diffusers into Quesnel Lake. Discharge from the WTP will only commence once the water level in the head pond recedes.

4.0 Protection of Receiving Environment

4.1 Background Water Quality

Background water quality at the point of discharge in Quesnel Lake is summarized below. The data summarized in Table 4 represents background water quality of Quesnel Lake in the West Basin, which was considered to represent the background level, as agreed with the MoE.

Table 4: Background water quality information for Quesnel Lake (West Basin, 2015 data)

Parameter	Units	Minimum	Mean	Maximum
pH (field)	pH units	7.3	7.6	8.7
Temperature (field)	°C	3.1	6.6	20
Conductivity (field)	µs/cm	59	128	202
Turbidity	NTU	0	1.5	48

Hardness (Dissolved)	mg/L	48	54	57
Total Dissolved Solids	mg/L	60	69	85
Total Suspended Solids	mg/L	<3	NC	12

NC = not calculated

4.2 Predicted Water Quality

A Technical Assessment Report (TAR) (Golder 2015b) was developed for the Mount Polley Mine, which included the following:

- Collection and storage of all site contact water in the Springer Pit;
- Mining of 4 million tonnes (Mt])of ore from the Cariboo pit;
- Storage of 4 Mt of tailings in Springer Pit;
- Discharge of up to 0.3 m^3/s of treated effluent to Quesnel Lake via Hazeltine Creek and two (2) twin diffusers installed below the thermocline in Quesnel Lake.

As part of the TAR, a water quality model was developed to predict the treated effluent chemistry of site discharge during operations and evaluate the influence of the discharge on Quesnel Lake (Golder 2015b). The model was developed using the GoldSim Contaminant Transport Module (GoldSim 2010). GoldSim is a graphical, object-oriented mathematical model where all input parameters and functions are defined by the user and are built as individual objects or elements linked together by mathematical expressions. The object-based nature of the model is designed to facilitate understanding of the various factors, which control an engineered or natural system and predict the future performance of the system.

In GoldSim, each flow that could influence water quality was itemized and assigned a chemical profile based on site water quality monitoring data. The model was designed to track the volume and the mass load in the discharge based on each water source (e.g., site runoff or pumped mine flows) contributing to the discharge. Based on the quantity of these two (2) parameters, the discharge water quality was calculated. A treatment efficiency was applied to the predicted discharge water qualities to evaluate the concentration of each parameter in the effluent to the Hazeltine channel.

The model was run stochastically using a Monte Carlo approach to bracket the range of effluent qualities that could occur. A probability distribution function was assigned to each source that could influence the discharge water quality and the model was run for 1000 realizations on a monthly timestep, allowing the model to generate 1000 unique values for each input. At each timestep, median and 95th percentile concentrations were calculated based on the 1000 simulated values. The maximum of the 95th percentile concentrations, accounting for treatment efficiency, were proposed as the effluent limits to be included in the amended application of *EMA* Permit 11678.

A hydrodynamic model was also developed for Quesnel Lake (Tetra Tech 2015) to evaluate the concentrations of modelled parameters at the edge of the initial dilution zone (IDZ). In the TAR, the predicted dilution factors in the mixing zone in Quesnel Lake were applied to the predicted 95th percentile effluent concentrations to predict the concentrations at the edge of the IDZ. The resultant concentrations at the edge of the IDZ formed the basis of the impact assessment in the TAR. The outcomes of this assessment indicated the following:

- The predicted effluent was not acutely toxic; and
- The predicted concentrations at the edge of the IDZ would not result in adverse effects to surface water quality.

On the above basis, the MoE approved the proposed effluent limits (e.g., predicted 95th percentile concentrations) included in the TAR.

Discharge of treated site contact water from the Mount Polley Mine began on December 1st, 2015, in accordance with the amended (November 29, 2015) *EMA* Permit 11678. Monitoring of the discharge and surface water quality has validated that the proposed effluent limits result in concentrations at the edge of the IDZ that are less than the BC WQGs. As part of the 2016 annual water management, it is expected that the BC WQGs will continue to be met at the edge of the IDZ in Quesnel Lake if MPMC continues to operate within their current *EMA* Permit 11678 limits.

4.3 Turbidity Target Levels

To meet the BC WQGs, turbidity at the edge of the IDZ must not exceed 5 NTU above the background on a 24-hour average basis, or 2 NTU above the background on a 30-day average basis.

MPMC has set target levels for turbidity based on these guidelines and measured site data. The background average for Quesnel Lake was set at 1.5 NTU (Golder 2015c), meaning the maximum at the point of discharge for a 24-hour period would be 6.5 NTU. Based on a minimum dilution factor of 54 (Golder 2015b) this means the maximum turbidity in the sediment pond in lower Hazeltine Creek would be 271 NTU.

Regular monitoring and comparison to these levels is performed by MPMC. Further details of planned monitoring are presented in the Comprehensive Environmental Monitoring Plan (CEMP; MPMC 2016).

5.0 Exceedances and Reporting

5.1 Ministry of Environment

If effluent quality guidelines in *EMA* Permit 11678 Section 1.3.3 are exceeded, discharge will be shut off, and will resume only when a subsequent re-test demonstrates that the effluent meets the requirements (as per Section 1.3.7 of *EMA* Permit 11678).

Any toxicity test failures, as described in *EMA* Permit 11678 Section 3.10, will be reported to the MoE Environmental Protection Director as required, and MPMC will makearrangements to complete a re-test, and subsequent actions occurring as per the Response Framework in MPMC’s CEMP.

MPMC will also notify the Director of any non-compliance and take appropriate remedial action. MPMC will provide written confirmation of all non-compliance events within 24 hours of the original notification, and follow up with a written report within 30 days, as described in Permit 11678 Section 3.11.

5.2 Environment Canada

As required under MMER Section 24 (1-2), the Inspector will be notified if effluent monitoring guidelines in MMER Schedule 4 are exceeded, if the effluent is outside the pH range of 6.5 to 9.5, or if the effluent is acutely lethal. A written report will follow within 30 days of the tests being completed.

If the effluent is determined to be acutely lethal, the effluent water quality samples will be characterized without delay and additional acute lethality sampling will be conducted as required under MMER Section 15.

If deposits outside of the normal course of events occur, acute lethality testing will be completed as required by MMER Section 14 (1). A written report meeting the requirements outlined in MMER Section 31 (2) will be submitted within 30 days, as required under Section 31 (2).

5.3 Local Communities

As required in the Communication Plan developed under Section 2.10 of *EMA* Permit 11678, MPMC must contact the Soda Creek Indian Band, the Williams Lake Indian Band, the Cariboo Regional District, and the Community of Likely if any event that requires reporting the MoE and/or Environment Canada occurs.

References

Golder Associates Ltd. (Golder) 2015a. Mount Polley Mine Phase 4 Water Management Plan (TSF 970 m Design). Report prepared for Mount Polley Mining Corporation, Likely, BC. November, 2015.

Golder. 2015b. Mount Polley Mine: Short Term Effluent Discharge. Technical Assessment Report of an Effluent Permit Amendment. Ref. No. 1411734-030-R-Rev0-12000. May 29, 2015.

Golder. 2015c. Post-Event Environmental Impact Assessment Report (PEEIAR). Report prepared for Mount Polley Mining Corporation, Likely, BC. June 5, 2015.

GoldSim 2010. GoldSim User Manual. GoldSim Consulting Group. Redmond, Washington. December 2010.

Mount Polley Mining Corporation (Mount Polley). 2016 Comprehensive Environmental Monitoring Plan. March 2016.

Tetra Tech EBA 2015. Dilution Modelling at Potential Outfalls in Quesnel Lake. File: 704-V13203212. Memo#005. May 29, 2015.