Mclean, Keegan MTIC:EX

From: Luke Moger <lmoger@mountpolley.com>
Sent: Tuesday, July 29, 2014 11:27 AM
To: Howe, Diane J MEM:EX; Demchuk, Tania MEM:EX
Subject: FW: Application to treat and discharge water
Attachments: 0 - Discharge of Treated Water to Polley Lake (MEM) - 2014 07 29 (Cover Letter).pdf; 1 - Discharge of Treated Water to Polley Lake (MEM) - 2014 07 29.pdf; A - Full Size Figures.pdf; B - Consultation Report Final.pdf; C1 - 516217 Cover Letter.pdf; C2 - 516217 Licence of Occupation.pdf; C3 - 516217 Management Plan.pdf; D0 - H2O Innovation Proposal P-13078 - Mount Polley.pdf; D1 - Appendix 2 - Preliminary Membrane Projection.pdf; D2 - Appendix 2a - Preliminary Membrane Projection.pdf; E1 - Single Line Diagram (Newalta) - 2014 06 27.pdf; E2 - Load List (Newalta) - 2014 06 27.pdf

Hi Diane and Tania;

Apologies – the first e-mail bounced due to a filter, and so I have had to attach all of the appendices individually.

Kindest Regards

Luke Moger, PMP
Project Engineer, Mining Operations
Mount Polley Mining Corporation

Tel: +1 (250) 790-2215 ext. 2113
Fax: +1 (250) 790-2613
Email: LMoger@MountPolley.com

From: Luke Moger
Sent: July-29-14 11:09 AM
To: Howe, Diane J MEM:EX
Cc: 'Demchuk, Tania MEM:EX'; Colleen Hughes; Art Frye
Subject: RE: Application to treat and discharge water

Hi Diane;

Please find attached an electronic copy of the MEM component of the permit amendment application for the construction of the Water Treatment Plant at Mount Polley Mine.

Tania - please let me know how many hard copies you would like and to what address and I can package and send them off this week.

Kindest Regards,

Luke Moger, PMP
Project Engineer, Mining Operations
Mount Polley Mining Corporation

Tel: +1 (250) 790-2215 ext. 2113
Fax: +1 (250) 790-2613
Email: LMoger@MountPolley.com

From: Demchuk, Tania MEM:EX [mailto:Tania.Demchuk@gov.bc.ca]
Sent: July-09-14 2:10 PM
To: Colleen Hughes; Howe, Diane J MEM:EX
Cc: Luke Moger
Subject: RE: Application to treat and discharge water

Hi Colleen,

Thank-you for the notice of the MOE permit amendment application.

Luke: Please ensure MEM receives a hard-copy of the Mines Act permit amendment application.

Give me a call or email if you have any questions.

Thanks,
Tania

From: Colleen Hughes [mailto:chughes@mountpolley.com]
Sent: Wednesday, July 9, 2014 1:47 PM
To: Howe, Diane J MEM:EX
Cc: Demchuk, Tania MEM:EX; Luke Moger
Subject: Application to treat and discharge water

Good Afternoon Diane

I have attached to this email a letter notifying Ministry of Energy and Mines of a departure from our current M200 approval. Luke Moger will be providing further details to MEM regarding the pipeline and treatment plant.

Regards,

Colleen Hughes, EP
Environmental Coordinator
Mount Polley Mining Corporation
PO Box 12
Likely, BC V0L 1N0
250-790-2617
chughes@mountpolley.com

Mclean, Keegan MTIC:EX

From: McConnachie, Jennifer MEM:EX
Sent: Friday, March 7, 2014 11:49 AM
To: Howe, Diane J MEM:EX; Demchuk, Tania MEM:EX
Subject: FW: Polley Influent Parameters Exceeding Canadian/BC Water Quality Criteria

Diane,
Another email that you may want to review re: Mount Polley.

Jen

From: Bings, Dan P ENV:EX
Sent: Wednesday, January 22, 2014 12:36 PM
To: McConnachie, Jennifer MEM:EX
Cc: Hill, Douglas J FLNR:EX; Demchuk, Tania MEM:EX; Kerley, Jason F FLNR:EX
Subject: Polley Influent Parameters Exceeding Canadian/BC Water Quality Criteria

Hi Jen, respecting your query as to which analytes in the source water exceeded water quality objectives, I've revised the first trial results spreadsheet (attached) to red flag the influent parameters which exceed guidelines. They are summarized as follows:

Exceeding acute or chronic aquatic life criteria were:

1. Copper
2. Iron
3. Selenium
4. Zinc
5. Nitrate
6. Nitrite
7. Sulphate
8. Phosphorous

Exceeding drinking water criteria were:

1. Total dissolved solids (aesthetic)
2. Manganese (aesthetic)
3. Selenium
4. Sulphate (aesthetic)

The first pilot was effective in meeting all the preceding objectives with the exception of some nitrate and all nitrite results (aquatic life). The second pilot will incorporate an undisclosed pre-treatment intended to meet the nitrogen objectives. As well, MPMC has sent a bulk sample to another technology provider for bench testing as a contingency should the second pilot not be successful in meeting the nitrogen objectives.

Dan Bings
Environmental Protection Officer
Ministry of Environment
Cariboo Region
PH: (250) 398-4897 FX: (250) 398-4214

BC Pollution Free

Mount Polley Water and Load Balance

Prepared for

Mount Polley Mining Corporation

Prepared by

SRK Consulting (Canada) Inc.
1CM017.002
December 2013

Mount Polley Water and Load Balance

December 2013

Prepared for

Mount Polley Mining Corporation
PO Box 12
Likely, BC V0L 1N0
Canada

Tel: +1 250 790 2215
Web: www.imperialmetals.com

Prepared by

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Tel: +1 604 681 4196
Web: www.srk.com

Project No: 1CM017.002

File Name: Mount Polley Water Management Assessment_1CM017002FINAL_20131205_SRJ_TRS_SB

srk consulting

Executive Summary

Mount Polley Mining Corporation (MPMC) retained SRK Consulting (Canada) Inc. (SRK) to prepare a screening level water and load balance for the Mount Polley Mine. This report describes the development and results of the screening level water and load balance model. This model will be used to develop and assess short term (next two years) and long term (beyond two years) water management options for the Mount Polley mine.

The Mount Polley mine discharge is regulated by *Environmental Management Act* Permit 11678 issued in June 2013 by the BC Ministry of Environment. The permit includes limits to water quality and annual discharge volumes. The permit limits the discharge volume to 1.4 Mm³ annually. Receiving water quality objectives also limit the constituent loadings that can be released to Hazeltine Creek, which is dependent on the real-time dilution capacity of Hazeltine Creek.

A screening level water balance model based on annual precipitation, evaporation and runoff was prepared for the Mount Polley Mine site. The water balance model quantifies and forecasts the annual net input of water to the Tailings Management Facility (TMF). Results of the model indicate that the annual site-wide free water volume generated over the last year is approximately 0.8 Mm³. Runoff from progressively larger areas has been diverted to the TMF since it re-opened in 2005, and will increase over next few years as runoff from the northwest portion of the site is diverted to the TMF. The annual site-wide free water volume generated on site is expected to increase to 1.7 Mm³ of water under average hydrologic conditions, or 3.2 Mm³ of water under a wet hydrologic year with similar precipitation as measured in 2008 (621 mm), because of the expanded footprint.

There are no specific sources that contribute a disproportionate quantity of constituent loadings to the TMF. Rather, waste rock areas, tailings and developed mine areas in general appear to contribute loadings at similar rates. Increases in selenium, molybdenum, nitrate and sulphate have been trending up since the mine operation resumed in 2005. These increases are expected to continue until solubility limits are reached or when mine development and ore processing end.

Copper and uranium concentrations in the TMF do not increase because they precipitate in the milling process. When processing stops after closure, it is possible that the concentrations will increase in the TMF.

In order to discharge 1.4 Mm³ of water during an average precipitation year, treatment will be required for selenium and molybdenum and likely for sulphate and nitrate in the future.

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1 Introduction

1.1 Background

In June 2013, the BC Ministry of Environment issued an Amended *Environmental Management Act* Permit 11678 to the Mount Polley Mining Corporation (MPMC), which specifies effluent limits and conditions for the Mount Polley Mine. Several of the limits that regulate the release of mine water from site significantly restrict the volume of mine water that can be released to the receiving environment (Hazeltine Creek). The discharge restrictions create challenges because the volume of free mine water that has accumulated on site is stressing the available storage capacity within the tailings management facility (TMF). Expanding the TMF is challenging due to geotechnical considerations.

In September 2013, MPMC retained SRK Consulting (Canada) Inc. (SRK) to prepare a screening level water and load balance for the Mount Polley Mine. SRK visited the site on September 9 and 10, 2013, reviewed available data, and prepared a memo documenting the initial findings (SRK 2013). This report describes the development and results of the screening level water and load balance model. This model will be used to develop and assess short term (next two years) and long term (beyond two years) water management options at Mount Polley.

MPMC short term water management objective is to discharge 6 Mm^3 over the next two years. The long term water management objective for the site is to retain enough water volume in the tailings management facility (TMF) to support one year of processing and discharge any site water in excess of this amount.

1.2 Report Scope

The scope of this study is to complete the following tasks:

- Prepare a screening level water and load balance for the mine site based on the existing site water balance provided by MPMC. This model uses annual precipitation and evaporation values to estimate the change in water storage in the TMF on an annual basis, based on the contributing catchments and milling rates.
- Review the water quality data across the site in order to understand the loading sources and general trends within the TMF.
- Estimate discharge constraints.
- Prepare preliminary design criteria for developing water management options to meet water management objectives

Section 2 of this report provides a summary of information that was used for the water management assessment. The site water balance and water balance model is discussed in Section 3. Section 4 assesses water quality and the load balance model for the site. Constraints taken into consideration are discussed in Section 5. Conclusions and recommendations are provided in Sections 6 and 7, respectively.

2 Supporting Information

2.1 *Environmental Management Act* Permit 11678

The *Environmental Management Act* Permit 11678, was amended in June 2013 for MPMC. The permit conditions constrain the volume and quality of the discharge from the site.

The volume of water discharged from the mine site is constrained by two criteria:

1. The total volume of effluent discharged each day must not exceed 35% of flow in Hazeltine Creek for the same day as measured at nearby monitoring station W7.
2. The maximum annual volume of water discharged from the mine site must not exceed 1.4 Mm^3 per year.

The permit also states the released water must be dam filtered. However, water can be discharged, if meeting effluent criteria, from any source, given notification of the Ministry.

Water quality limitations are summarized in Table 1. The water quality limits do not apply at the "end-of-pipe" but to the water quality at Station W7 downstream of the discharge to Hazeltine Creek.

Table 1: Water Quality Limitations as stated in PE 11678 (BC MOE 2013)

Parameter- water sample	**Units**	**30-day Mean**
Nitrate	mg/l	3
Total Copper	mg/l	0.007
Total Molybdenum	mg/l	0.05
Total Selenium	mg/l	0.002
Parameter –water sample	**Units**	**Maximum**
Sulphate	mg/l	309
Parameter –water sample	**Units**	**Annual Mean**
Total Cadmium	mg/l	0.000025
Parameter – sediment sample	**Units**	**Mean**
Total Selenium	µg /g dw	2
Parameter – Fish Muscle Rainbow Trout	**Units**	**Mean**
Total Selenium	µg /g wet wt	1
Parameter – creek substrate	**Units**	**Maximum**
Chlorophyll a	mg/m2	100
TSS	mg/l	25

Source: \\VAN-SVR0\Projects\01_SITES\Mt_Polley\1CM017.002_Water and Load Balance Model\!020_Project_Data\010_SRK\Soren's Working Files\ Discharge Strategy WQ 2013 (MTD Only) for Discharge Plan_Rev9_SB.xlsm

Note: Annual mean based on samples taken during the discharge period of April to October

2.2 Hydrology

Monthly precipitation and evaporation records from 1998 to 2013 were provided by MPMC. Additional annual precipitation data from the nearby meteorological station at Spokin Lake (Environment Canada, 2013a) were also used.

Hazeltine Creek is the receiving water and has a catchment area of approximately 27.6 km² and an average elevation of 980 masl (KP, 2009). Knight Piésold Consulting (KP) prepared a hydrograph of monthly average flows for Hazeltine Creek in 2009 using data recorded on site and a regional analysis of nearby gauging stations. MPMC measured flow in the creek from 2010 to 2013 and updated the hydrograph.

A nearby gauging station, Borland Creek below Valley Creek (Environment Canada, 2013b), is similar to those in Hazeltine Creek. The catchment area is 113 km² and the average elevation is 993 masl. Data from this location was used to estimate the peak flow hydrographs for Hazeltine Creek.

2.3 Catchment Delineation

Most catchments at the mine have been delineated by MPMC. MPMC also provided contour information, existing site mapping and infrastructure layout.

2.4 Water Quality Data

Historical water quality data were used to develop the load balance model. Water quality monitoring stations are listed in Table 2 and shown on Figure 1.

Table 2: Water Quality Sampling Locations

Station ID	Description and Location
LDa	Long Ditch pipeline, south of the confluence with south east rock dump seepage (SERDS) ditch
E1	Tailings Management Facility
E10	Wight Pit
E8	Cariboo Pit
JCP	Joe's Creek Pipeline
BP	Boundary Pit
E11	Springer Pit
E7	Perimeter Pond
E5 / MTD	Main Embankment Drain
W7	Hazeltine Creek, downstream of the confluence with the mine discharge

Source: \\VAN-SVR0\Projects\01_SITES\Mt_Polley\1CM017.002_Water and Load Balance Model\!020_Project_Data\010_SRK\Soren's Working Files\ 2013 Compiled Effluent_WQ Data__REV05_SRJ_LCC.xlsm

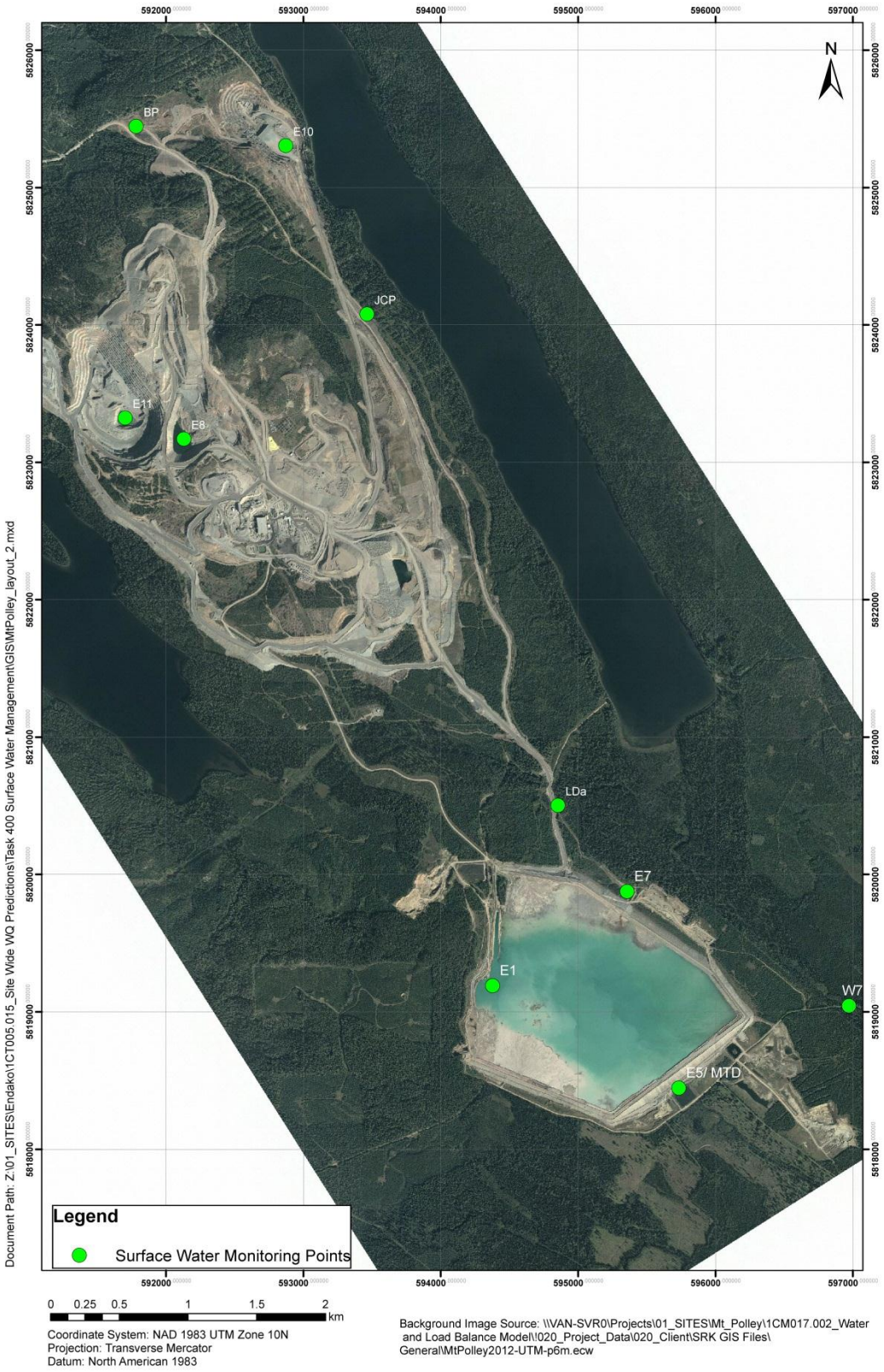


Figure 1: Water Quality Monitoring Locations

Water quality samples for total and dissolved metals, nutrients, anions, TSS and physical parameters were collected between December 2008 and April 2013.

2.5 Existing Site Water Balance

MPMC prepared a monthly site water balance from May 2012 to June 2013. This water balance estimates the change in storage within the mine water management structures, most notably the TMF, and compares predicted to measured values. Monthly mill throughput, TSF bathymetric surveys, and physical characteristics of the tailings were incorporated into the annual water balance by SRK (Table 3).

Table 3: MPMC Site Water Balance Values

Term	Quantity
Hydrology between May 2012 and April 2013	
Total Precipitation	690 mm
Open Water Evaporation	480 mm
Tailings Characteristics	
Dry Bulk Density	1.4 kg/m³
Specific Gravity	2.65
Moisture Content by Volume	47 %
Volumes	
Change in Storage in TMF between May 2012 and April 2013	7,616,770 m³
Mill Throughput from May 2012 to April 2013	3,028,658 tonnes
Change in storage in Springer and Cariboo pits between May 2012 and April 2013	(502,598) m³

Source: \\VAN-SVR0\Projects\01_SITES\Mt_Polley\1CM017.002_Water and Load Balance Model\!020_Project_Data\010_SRK\water balance\Site Water Balance 2013_SB_r9.xlsx

MPMC also provided SRK with the estimated annual volume of free water within the TMF (from bathymetric surveys) and Cariboo pit, based on survey, pit modelling and pumping data from 2004 to 2013. This data was later used to verify the revised water balance.

Historical milling rates (Imperial Metals Corporation, 2010) were used to calculate the annual volume of water required for subaqueous deposition of tailings in the TMF from 2007 until 2012.

3 Site Water Balance Model

3.1 Model Description

A screening level water balance model based on annual precipitation, evaporation and runoff was prepared for the Mount Polley Mine site. The water balance model quantifies and forecasts the annual net input of water to the TMF. Figure 2 shows the site water balance conceptual model.

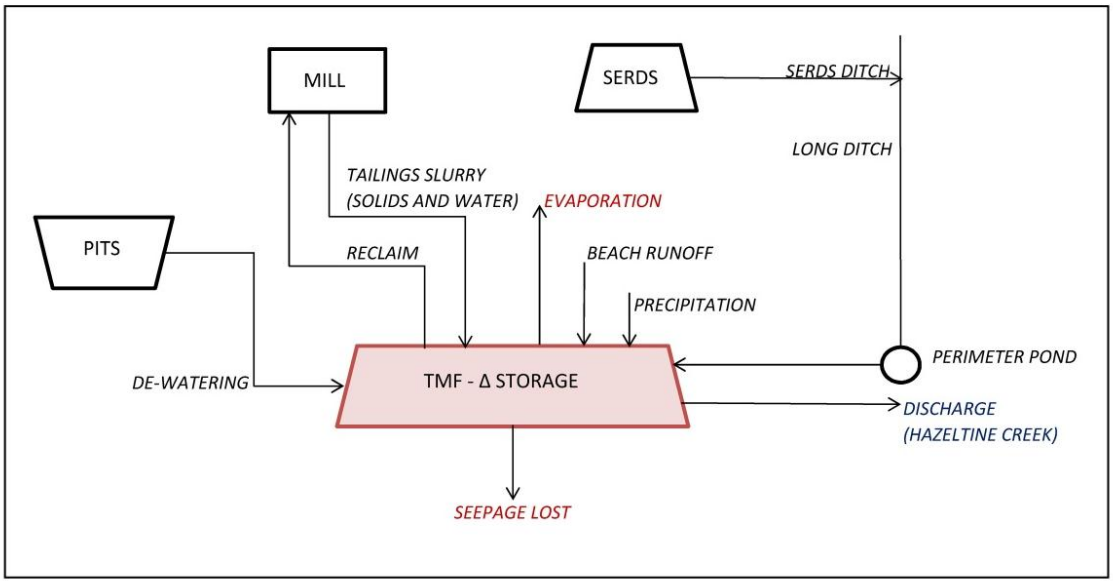
Inputs to the TMF include:

- Tailings slurry from the mill (solids and water),
- Direct precipitation and runoff to the TMF,
- Runoff from developed mine areas,
- Seepage from TMF perimeter drains, and
- Pit de-watering.

Outputs from the TMF include:

- Reclaim water to the mill,
- Evaporation, and
- Seepage losses.

The catchment areas were divided into tailings area and mine area. The tailings area includes the TMF beach and pond. These areas are used to estimate evaporation and direct precipitation to the TMF. The mine area includes all other site catchments that convey water to the TMF (e.g., seepage collection, runoff, or pit water).



Source: \\VAN-SVR0\Projects\01_SITES\Mt_Polley\1CM017.002_Water and Load Balance Model\!020_Project_Data\010_SRK\water balance\Site Water Balance 2013_SB_r9.xlsx

Figure 2: Schematic of Scoping-level Site Water Balance for the TMF

3.2 Model Inputs

3.2.1 Tailings and Reclaim Water

The projected mill throughput is assumed to be 8 million tonnes of ore per year between May 2012 and April 2013. Historical mill rates were used in the verification of the site-wide runoff coefficient.

3.2.2 Precipitation, Evaporation

Direct precipitation and evaporation have been measured monthly. However, the precipitation record was not consistent when compared to the record from Spokin Lake. Several of the years of data contained gaps in the monthly record. In order to produce comparable water volumes to those measured on site, the Spokin Lake precipitation record was used in the verification of the site wide runoff coefficient. The evaporation record was more consistent, and was therefore used in the water balance.

3.2.3 Storage Capacity of Open Pits

Another unknown in this analysis is how much water was pumped from the pits to the TMF in years past and how much will be pumped in future years. For the purpose of this analysis, it is assumed that the pits will not be used for the long-term storage of mine water.

Groundwater flows into the pits is not included in this analysis, since these flows are assumed to be minor in comparison to the runoff volumes.

It is important to note that the current volume of water in the Cariboo Pit is included in the annual site-wide water volume calculated in the water balance.

3.2.4 Runoff

Insufficient data were available to estimate runoff coefficients for individual sub-catchments. A site-wide runoff coefficient was estimated from available data and is used to predict the effect of direct precipitation across the entire mine site.

The site-wide runoff coefficient is defined by Equation 1:

$$\textit{Site Wide Runoff Coefficient} = \frac{\textit{Net Annual Runoff Collected } (mm)}{\textit{Total Annual Precipitation } (mm)} \quad \text{(Equation 1)}$$

The site wide runoff coefficient was used to calibrate the model.

3.3 Model Calibration, Verification and Predictions

Three periods of mine operations were evaluated: operations in 2005 (Figure 3), operations in 2013 (Figure 4) and operations in 2016 (Figure 5). The mine footprint is divided into two areas: the tailings and the mine. The tailings area remains constant and the mine area increases over the three operation periods (Table 4). More runoff from mine areas (contact water) is intercepted by collection ditches (*i.e.,* Long Ditch, SERDS Ditch and the proposed West Ditch) and conveyed to the TMF.

Table 4: TMF and Mine Areas for each Operation Period

Catchment Sub-Section	Type of Area	2005 (m^2)	2013 (m^2)	2016 (m^2)
Tailings Area	Direct Precipitation	1,700,000	1,700,000	1,700,000
	Runoff	635,000	635,000	635,000
Mine Area	Runoff	3,350,000	6,590,000	8,070,000

\\VAN-SVR0\Projects\01_SITES\Mt_Polley\1CM017.002_Water and Load Balance Model\!020_Project_Data\010_SRK\water balance\Site Water Balance 2013_SB_r9.xlsx

3.3.1 Model Calibration

The water balance model was calibrated by varying the site wide runoff coefficient. Table 5 shows the data used to estimate the runoff coefficient. The change in the TMF water volume and other data (Sections 2.5 and 3) between May 2012 and April 2013 were used to estimate the site-wide runoff coefficient.

Table 5: TMF Water Balance May 2012 to April 2013

Variable	Value	Unit	Data Source
Site-Wide Inventory Increase (Water + Solids)	7,114,172	m^3	MPMC
Increase in Total Tailings Solids Inventory	3,028,658	m^3	Calculated
Change in Water Inventory	**4,085,515**	m^3	Calculated
Direct TMF Inputs			
Direct Precipitation + Beach Runoff	1,566,989	m^3	MPMC
Direct TMF Outputs			
Evaporation (direct and beach)	(1,054,919)	m^3	MPMC
TSF Seepage	(70,080)	m^3	MPMC
Net TMF Direct Inputs	441,991	m^3	
Net TMF Water Inventory Increase	3,643,524	m^3	
Catchment Area Upstream of TMF	6,590,590	m^2	SRK
Yield Upstream of TMF	552.84	mm	Calculated
Annual Precip (May 2012 - April 2013)	692.30	mm	MPMC
Annual Evap (May 2012 - April 2013)	479.50	mm	MPMC
Site-Wide Runoff Coefficient	**0.80**	**-**	Calculated

Source: \\VAN-SVR0\Projects\01_SITES\Mt_Polley\1CM017.002_Water and Load Balance Model\!020_Project_Data\010_SRK\water balance\Site Water Balance 2013_SB_r9.xlsx

The site-wide runoff coefficient was estimated to be approximately 0.80. This value is the fraction of precipitation that eventually accumulates in the TMF.

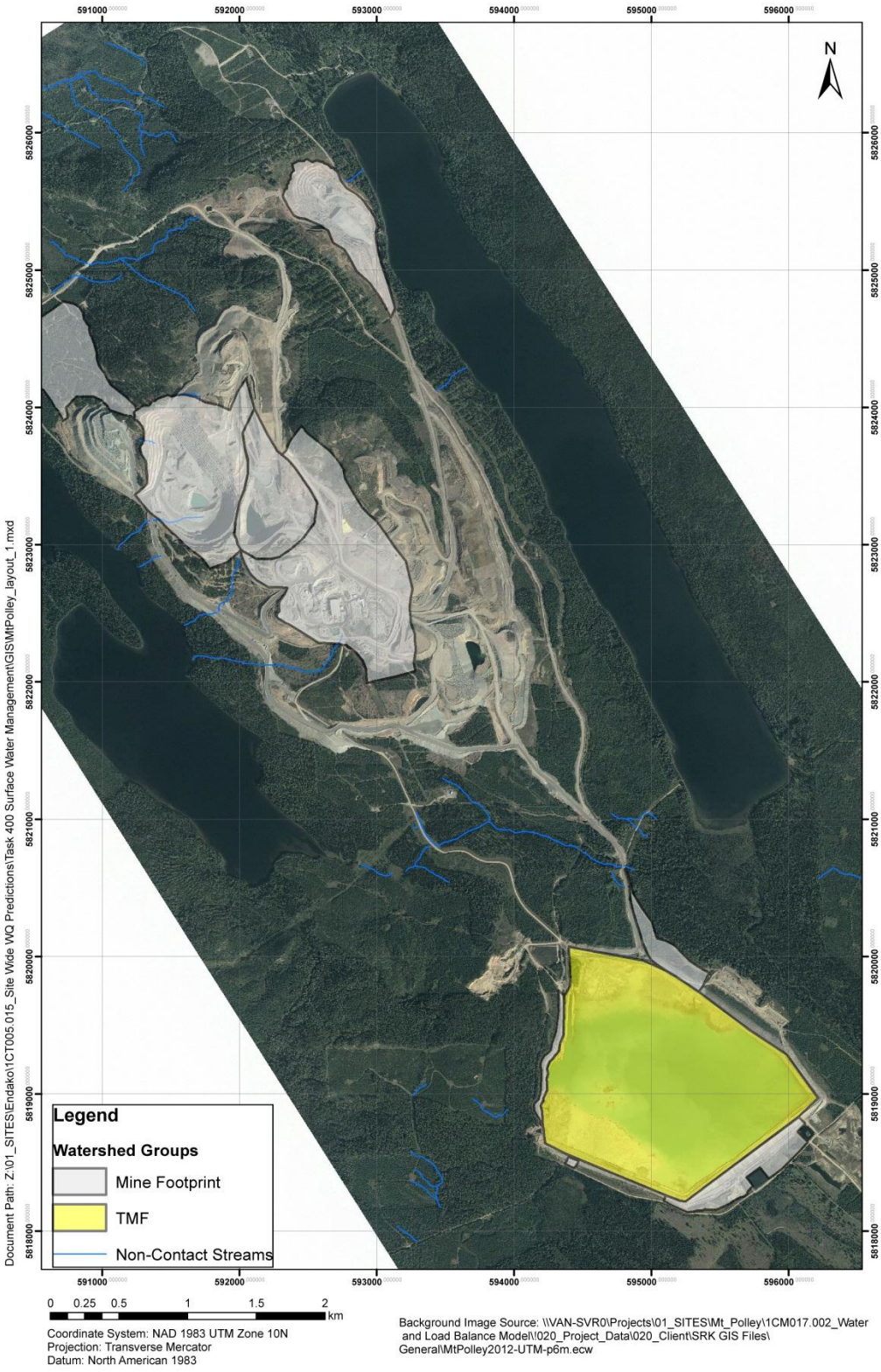


Figure 3: 2005 Mine Footprint

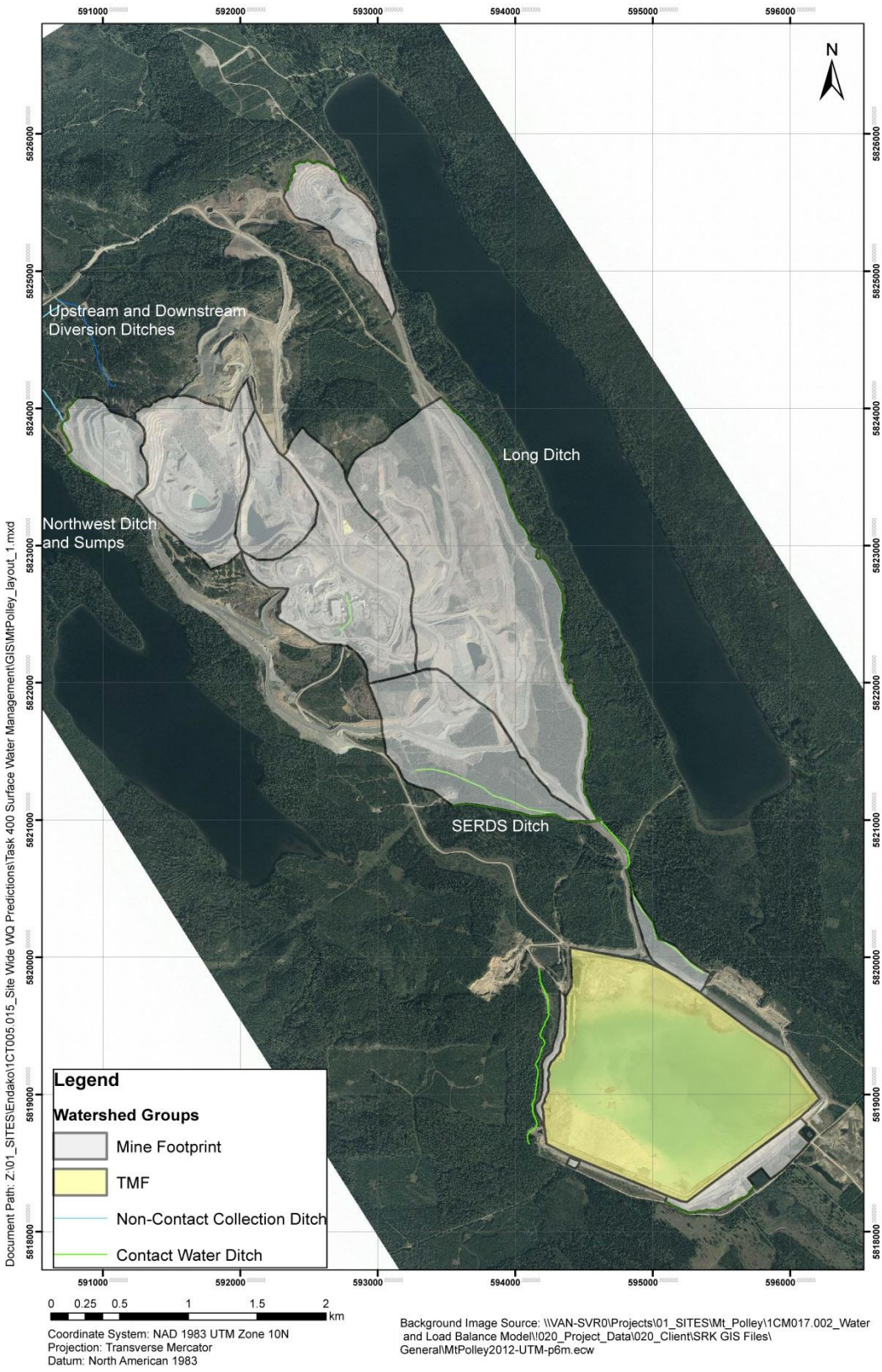


Figure 4: 2013 Mine Footprint

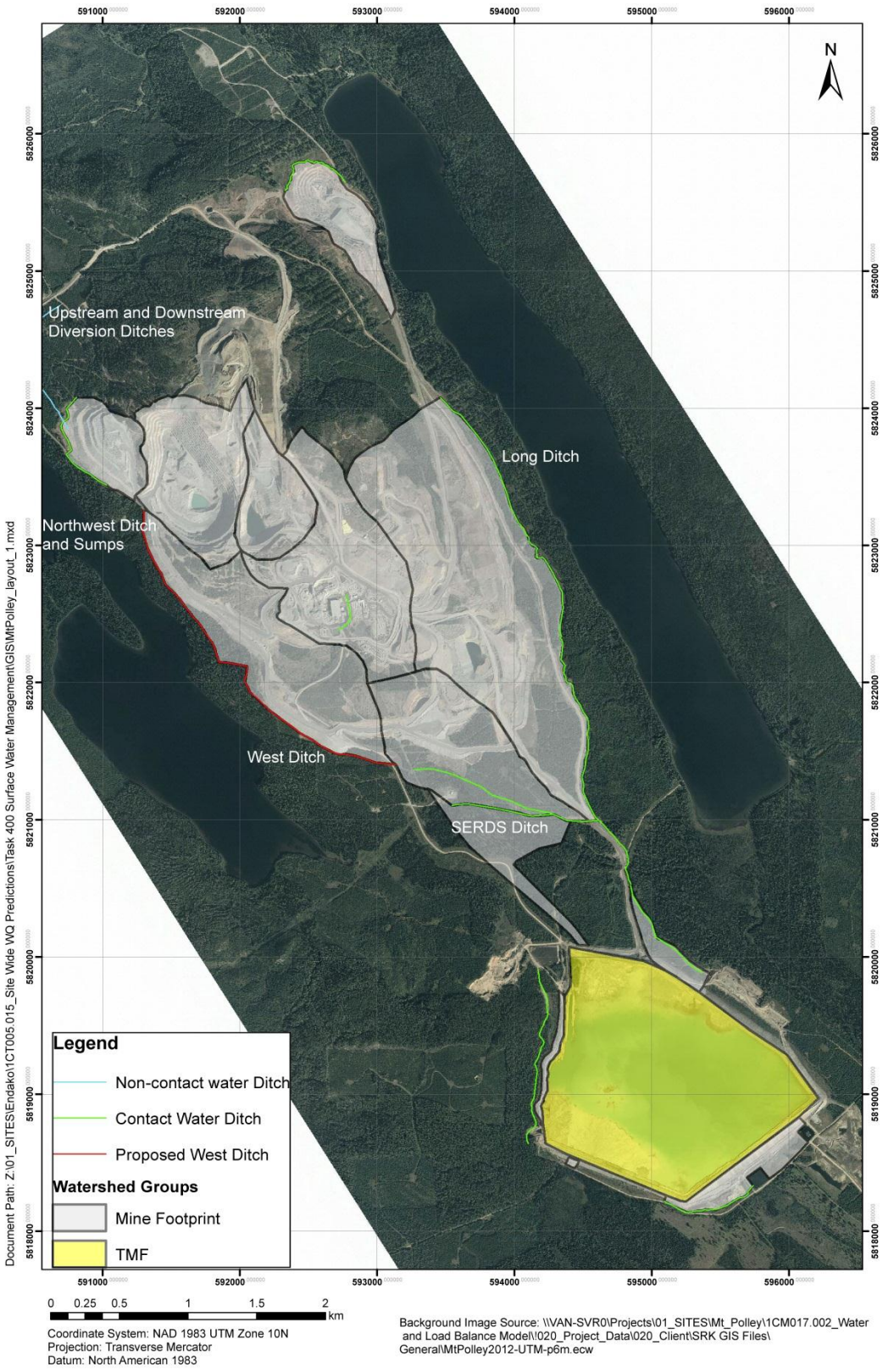


Figure 5: 2016 Mine Footprint

3.3.2 Model Verification

The site-wide runoff coefficient, which was calculated to be 0.80, was verified by estimating the water volume in the TMF from 2005 to 2012 using recorded precipitation from Spokin Lake, MPMC evaporation records and milling rates. It was assumed that all mine-related runoff from the site was collected in the TMF, which includes water from the pits.

The initial volume of water in the TMF at the end of 2004 provided by MPMC was approximately 5,000,000 Mm^3. A significant loss of water from the TMF of approximately 1.8 Mm^3 was observed in August 2008 from the data provided by MPMC. This reduction in TMF volume is included in the water balance to match the observed water volumes.

Table 6 summarizes inputs and predictions for model verification, including site water volumes provided by MPMC, predicted annual water volumes, and cumulative water volumes.

Table 6: Estimated Annual Site Wide Water Volumes based on Historical Precipitation

	2005	2006	2007	2008	2009	2010	2011	2012	2013[2]
Annual Precipitation (mm/year)	609	468	536	621	532	404	625	565	380
Change in Annual Site-Wide Free Water Volume (Mm^3/year)	(0.8)	0.3	(0.1)	1.7	(0.2)	(0.6)	2.3	1.2	0.8
Calculated Site-Wide Free Water Volume (Mm^3)	4.3	4.5	4.4	4.4[1]	4.2	3.7	6.0	7.2	8.1
MPMC Estimated Site Free Water Volume (Mm^3)	5.1	5.5	5.4	3.8	3.3	2.5	3.9	5.7	8.0

Source: \\VAN-SVR0\Projects\01_SITES\Mt_Polley\1CM017.002_Water and Load Balance Model\!020_Project_Data\010_SRK\water balance\Site Water Balance 2013_SB_r9.xlsx

Notes:
1. A reduction of 1.8 Mm^3 was added in 2008 to match the change in volume in the TMF presented by MPMC.
2. Based on 2013 data until end of June

The model verification indicated that the site-wide runoff coefficient should be adjusted to 0.78, which produced reasonable site-wide free water volume estimates that are comparable to those measured by MPMC.

It is important to note that, from 2005 to 2013, the mine has not been able to discharge water from the TMF, and therefore the accumulated water volume the TMF is the sum of the annual site-wide free water volumes during this period.

3.3.3 Model Predictions

The site water balance model was used to predict the annual volume of site-wide water as mining impacted area increases (Table 4). Two scenarios were evaluated. The first scenario assumes average precipitation. The second scenario assumes annual precipitation is the same as in 2008. Table 7 summarizes the annual water volumes for each scenario.

Table 7: Projected Annual Site-Wide Free Water Volumes, Post-Mine Expansion

	Scenario 1: Avg. Precipitation	Scenario 2: 2008 Precipitation
Annual Precipitation (mm)	630	808
Annual Water Volume (Mm^3)	1.7	3.2

Source: \\VAN-SVR0\Projects\01_SITES\Mt_Polley\1CM017.002_Water and Load Balance Model\!020_Project_Data\010_SRK\water balance\Site Water Balance 2013_SB_r9.xlsx

These results support the finding that the discharge volume limit or storage capacity must increase to manage free water retained in the TMF. After the mine expands with the West Ditch and the new haul road and waste dumps to the south (Scenario 2), the annual volume of free/excess water is expected to be even greater.

3.4 Hazeltine Creek Hydrology and Permitted Discharge

3.4.1 Hazeltine Creek Hydrology

The average monthly flow rates in Hazeltine Creek were estimated by KP and improved by MPMC with recorded flow data (Table 8). The majority of the annual flow within Hazeltine Creek occurs in the months of April, May, June and July (approximately 82% of total annual flow). Considering this trend, it is recommended that the 1.4 Mm^3 should be discharged over these four months, instead of the full permitted season (April to October) in order to minimize operational costs of discharging.

Table 8: Monthly Flows for Hazeltine Creek

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Flow (m^3/s)	0.05	0.05	0.07	0.74	0.65	0.20	0.10	0.03	0.02	0.02	0.08	0.05
% Flow Distribution	2%	2%	3%	35%	32%	10%	5%	2%	1%	1%	4%	2%

3.4.2 Hazeltine Creek Flow Variability and Permitted Discharge

A screening level frequency analysis was prepared for Hazeltine Creek to estimate return periods for annual flow. Flow in Hazeltine Creek affects the volume that can be discharged from the TMF. The discharge flow to Hazeltine Creek cannot exceed 35% of the flow in Hazeltine Creek at the time of discharge. Integrating the flow over the annual hydrograph will produce the total annual volume. The purpose of this analysis is to evaluate how inter-annual variation in Hazeltine Creek flow could affect the TMF discharge rate.

Nearby Environment Canada station Borland Creek below Valley Creek was used because its catchment has a similar average elevation andcatchment area, and has 24 years of complete data (KP, 2009). Eight of the 24 years of data were incomplete or incorrect when compared to the rest of the data set, and were removed from the analysis. A frequency analysis was performed in REGBAY software, using the annual runoff for each of the remaining 16 years of data. REGBAY calculates the various return period annual runoff values by comparing the regression index of different statistical distributions. The distribution with the best fit to the Borland Creek runoff

values was the Log Pearson distribution. The annual runoff values are summarized in Table 9. The annual runoff for each return period was then converted into a percentage of the average runoff, which are also shown in Table 9.

Table 9: Frequency Analysis for Annual Runoff

		Dry				Wet				
Return Period	Average (KP/MPMC)	100	20	10	5	2	5	10	20	100
Annual Runoff (mm)	97.9	34.6	44.49	51.2	61.3	88.8	133.5	168.0	204.8	303.3
% of Average Annual Runoff	100%	35%	45%	52%	63%	91%	136%	172%	209%	310%
Allowable Discharge Volume (Mm^3) based on 35% of Hazeltine Creek	2.3	0.8	1.0	1.2	1.4	2.0	3.0	3.9	4.7	7.0

Percentages of average annual runoff demonstrate inter-annual variability in Hazeltine Creek flow. The allowable discharge volume for each return period is the maximum amount of water that can be discharged annually to Hazeltine Creek from the mine, over the four month discharge period.

The results in Table 9 show that discharge of 1.4 Mm^3 is not possible in years that are drier than the 1 in 5 dry year, because the discharge volume exceeds 35% of the annual volume of Hazeltine Creek.

3.4.3 Discharge from the Main Toe Drain

The discharge permit states that the discharge water must be dam filtered or only water collected in the Main Toe Drain (MTD). Flow was measured in the MTD infrequently (only two measurements, both during the month of August 2013). Therefore, monthly volumes that report to the MTD cannot be estimated. It is recommended that a flow meter with a totalizer be installed on the pump-back line(s) from the MTD.

4 Water Quality and Load Balance

4.1 Water Quality Review

Site water quality data were reviewed to assess the effect of mine water and tailings slurry on TMF water quality. Figure 1 shows the locations of sampling stations reviewed.

Figure 6 through Figure 9 show historical concentrations of nitrate, molybdenum, selenium and sulphate for mine water across the Mount Polley mine site, in the TMF and in the MTD. In solution, these parameters are highly soluble anions (i.e., NO_3^-, MoO_4^{2-}, SeO_4^{2-}, SO_4^{2-}).

Nitrate is from residual ammonium nitrate fuel oil (ANFO) explosives. Nitrate is also a nutrient and is assimilated by algae and microorganisms. At Mount Polley, the rate of nitrate increase is roughly proportional to the rate of development since 2005. Annual nitrate loading to the TMF each year exceeds the natural degradation rate. Assuming that the ANFO loss rate on site

remains as is, the nitrate concentration in the TMF should increase at roughly the same rate as it has since 2005 as long as mine development continues. After closure, the nitrate concentrations are expected to gradually decrease.

Molybdenum, selenium and sulphate concentrations in the TMF have increased over time similar to nitrate. The concentrations of these parameters are expected to continue to increase over the short to medium term of the mine's development. The concentrations of molybdenum, selenium and sulphate in mine water and in the TMF water are similar, which suggests that mine water runoff (pit water, waste rock runoff, etc.) and tailings slurry contribute loadings equally to the TMF. Because loadings originate all over the mine site it is not possible to reduce loadings by targeting a few sources.

Figure 12 and Figure 13 show concentrations of total and dissolved copper at the site. Concentrations of dissolved copper generally are lower in the TMF than in the mine water on site. The lower concentrations in the TMF likely result from increasing the pH in the mill circuit. The increased pH causes copper and other metals such as zinc, nickel, cadmium and lead to precipitate as metal hydroxides. The mill therefore effectively functions as a water treatment plant for metal removal. However, concentrations of dissolved metals are likely to increase during closure when the mill no longer operates.

Figure 13 shows historical concentrations of cadmium. Cadmium concentrations were below the analytical detection limit in most samples collected and the detection limits in many cases are much greater than the downstream standard. It is possible that this can be remedied by requesting that the external laboratory use a lower analytical detection limit, but it is also possible that the samples contain other parameters (such as molybdenum) in concentrations that interfere with the ability to measure low cadmium.

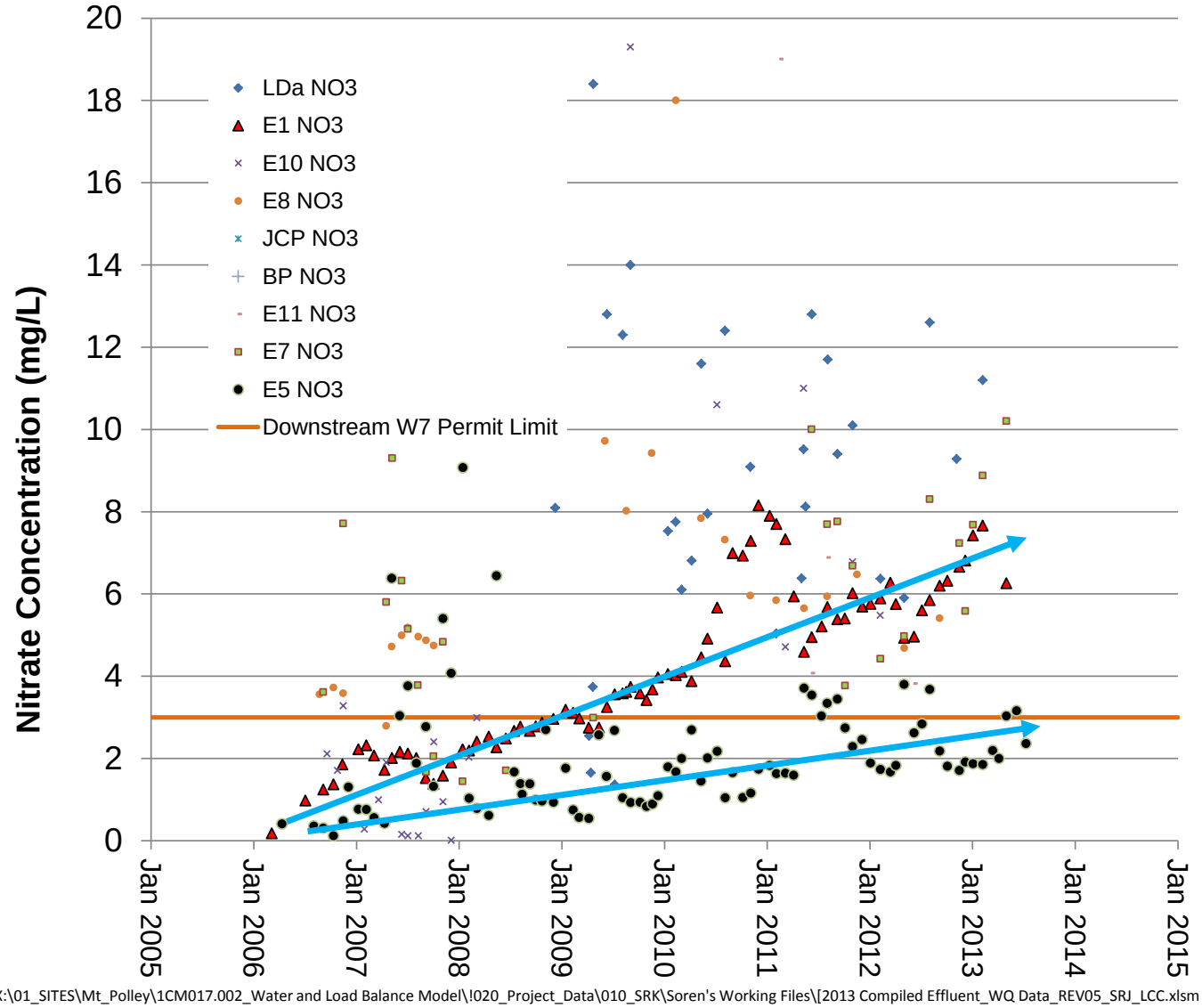


Figure 6: Nitrate Concentrations in Mount Polley Mine Water

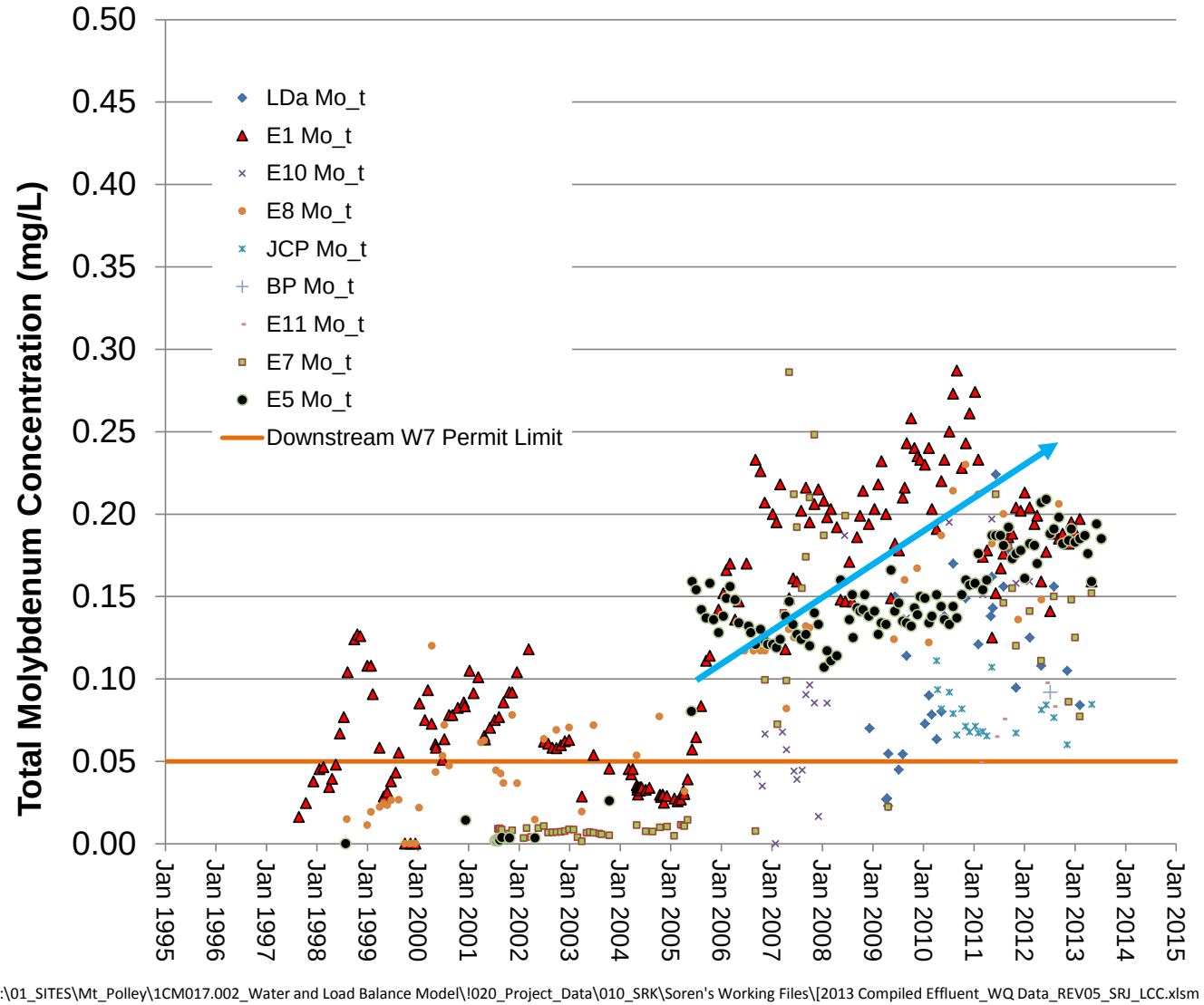


Figure 7: Total Molybdenum Concentrations in Mount Polley Mine Water

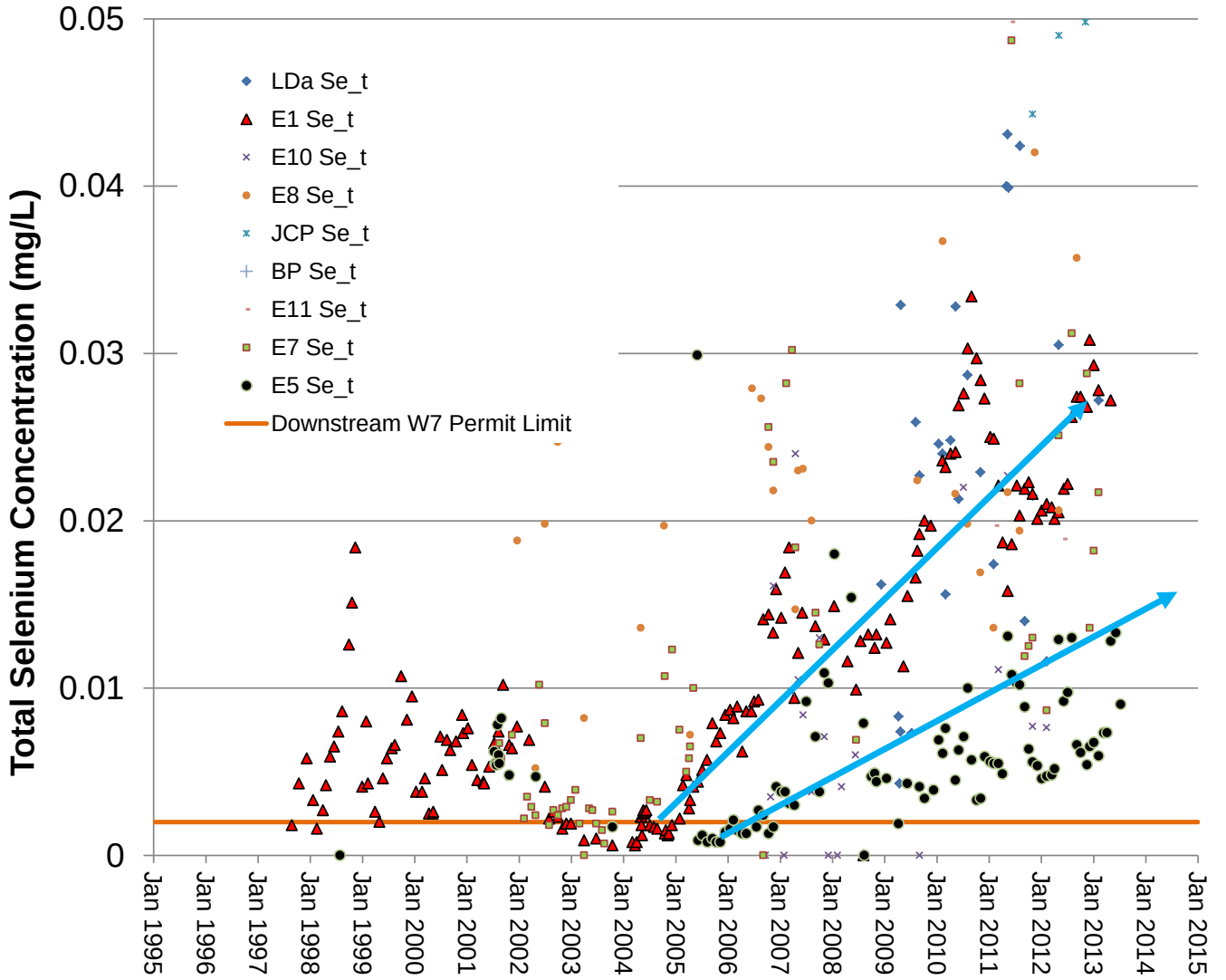


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Figure 8: Total Selenium Concentrations in Mount Polley Mine Water

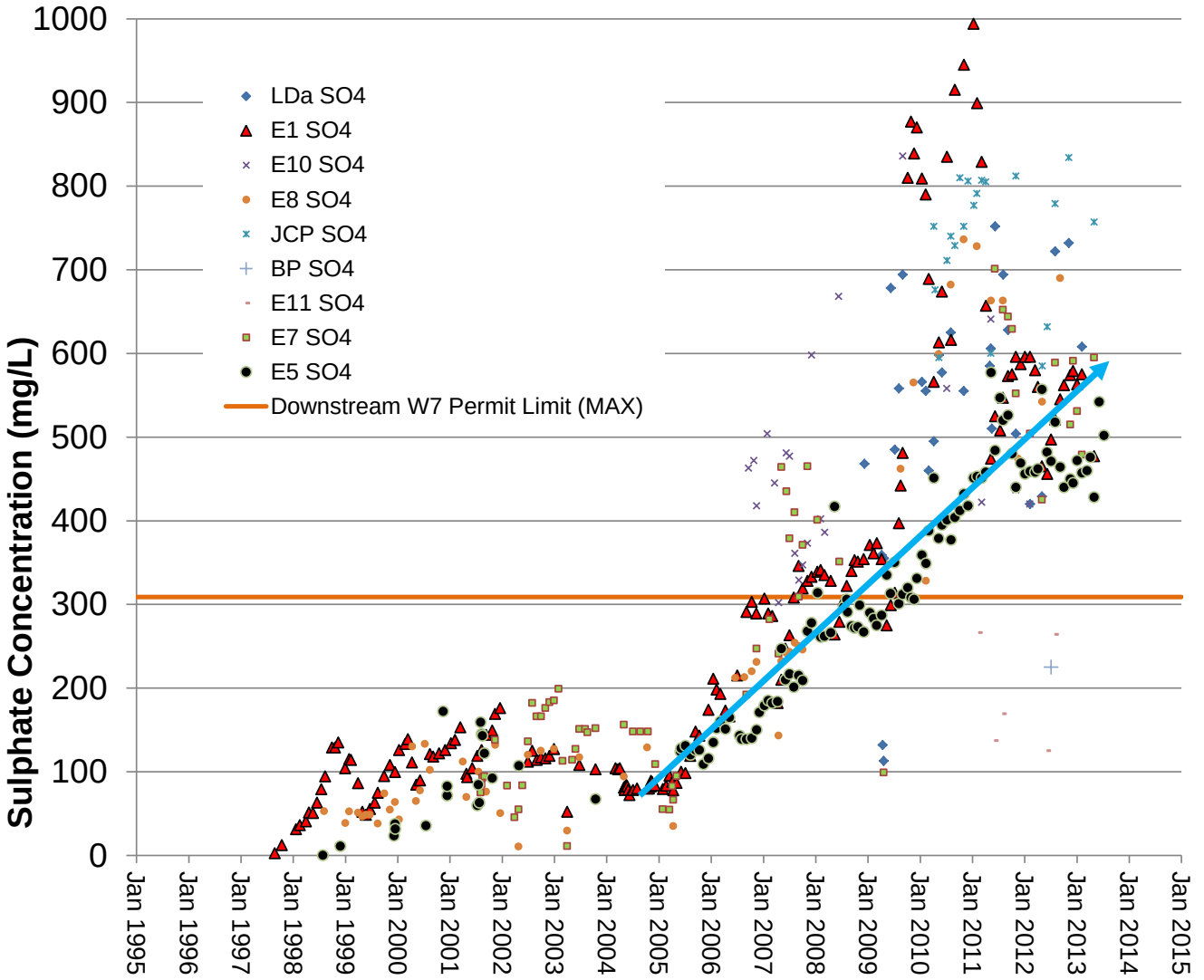

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Figure 9 Sulphate Concentrations in Mount Polley Mine Water

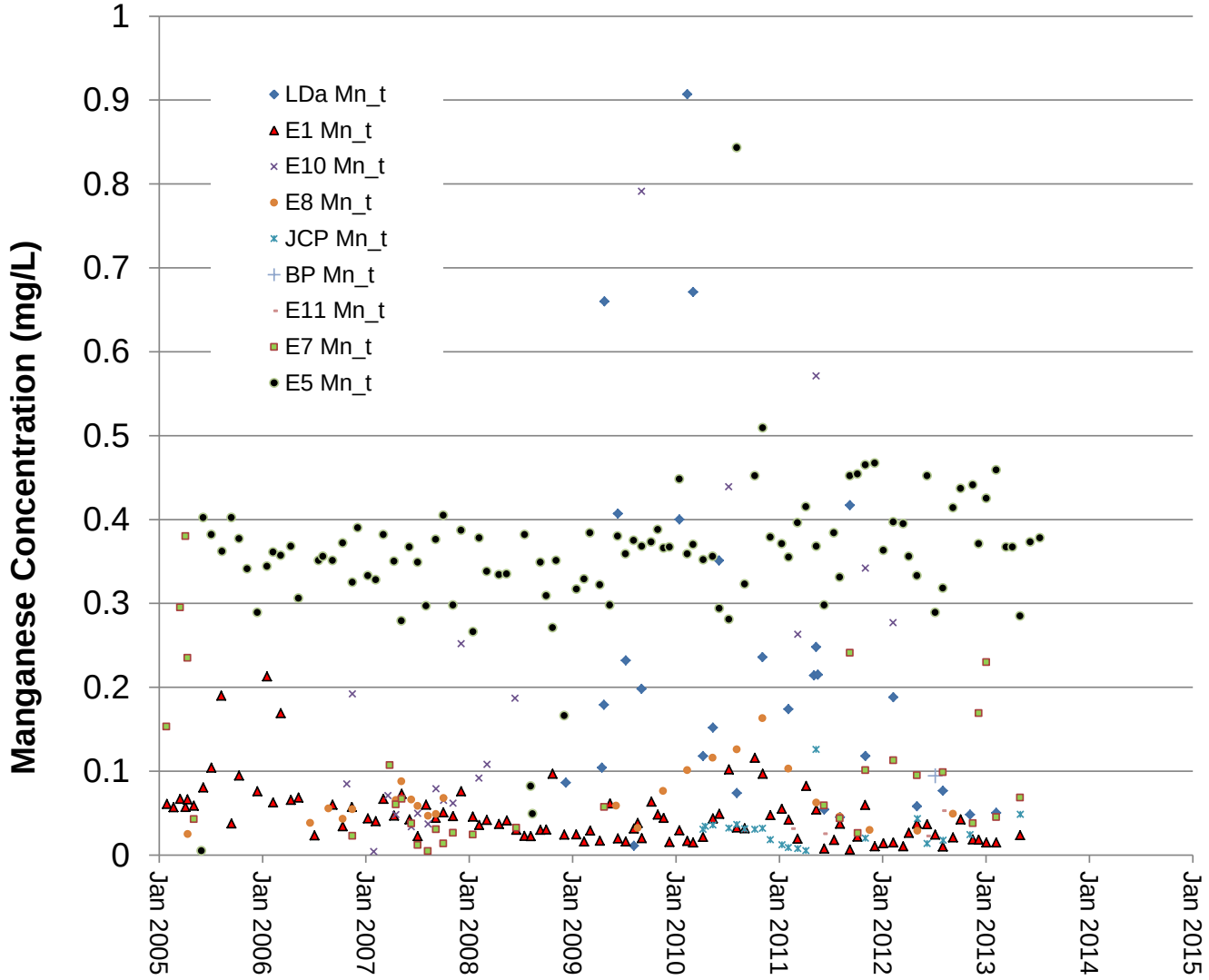

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Figure 10: Manganese Concentrations in Mount Polley Mine Water

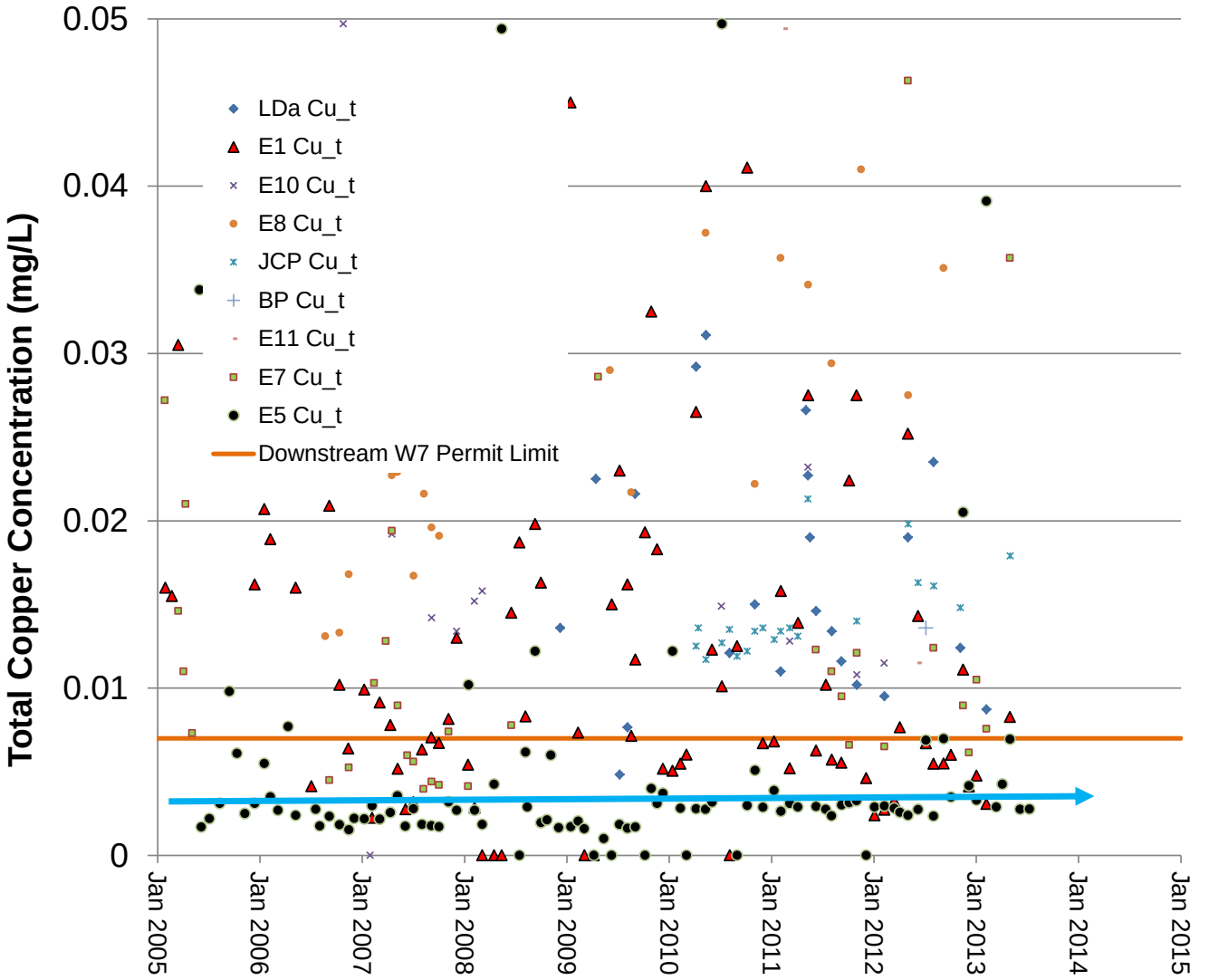

Figure 11: Total Copper Concentrations in Mount Polley Mine Water

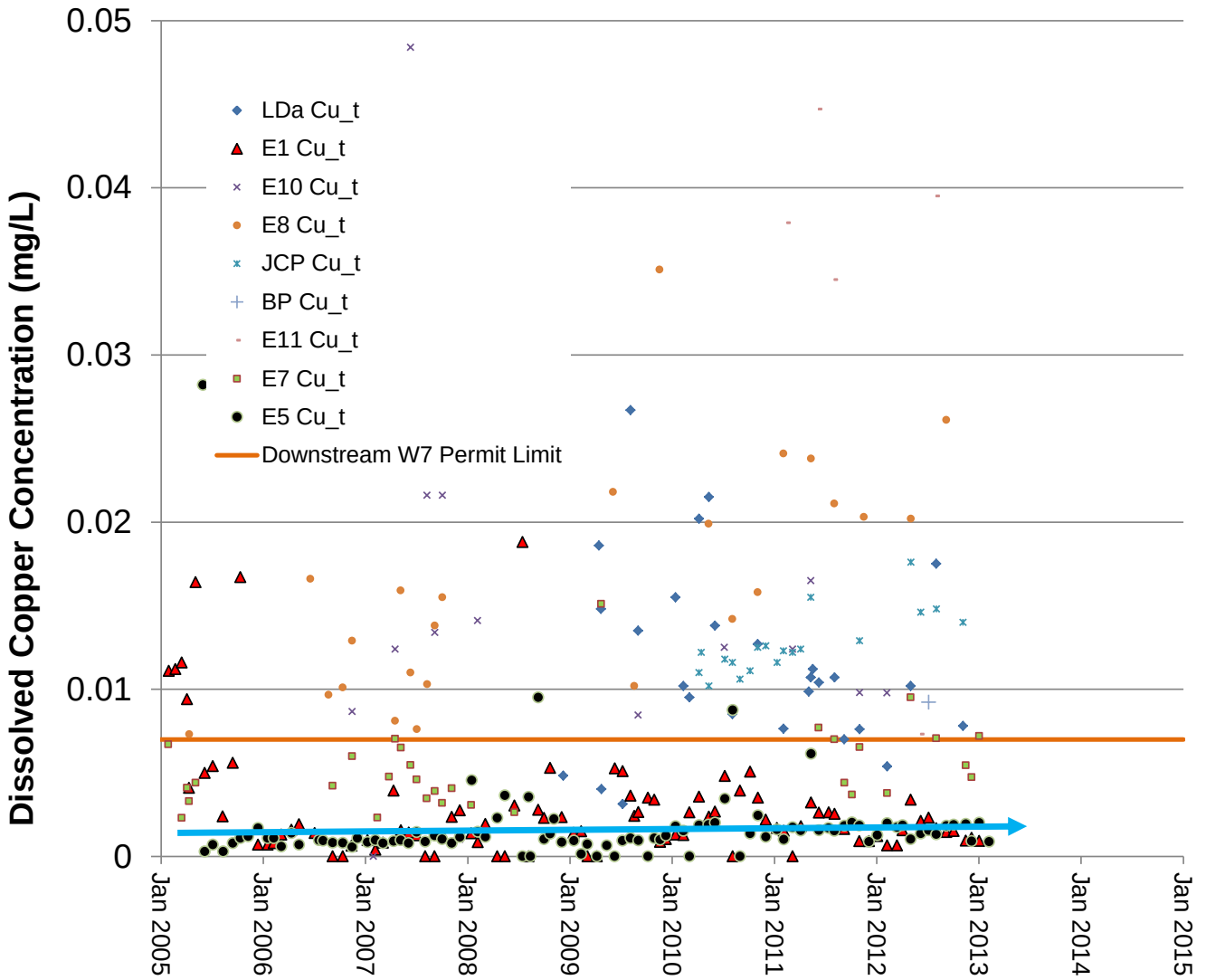

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Figure 12: Dissolved Copper Concentrations in Mount Polley Mine Water

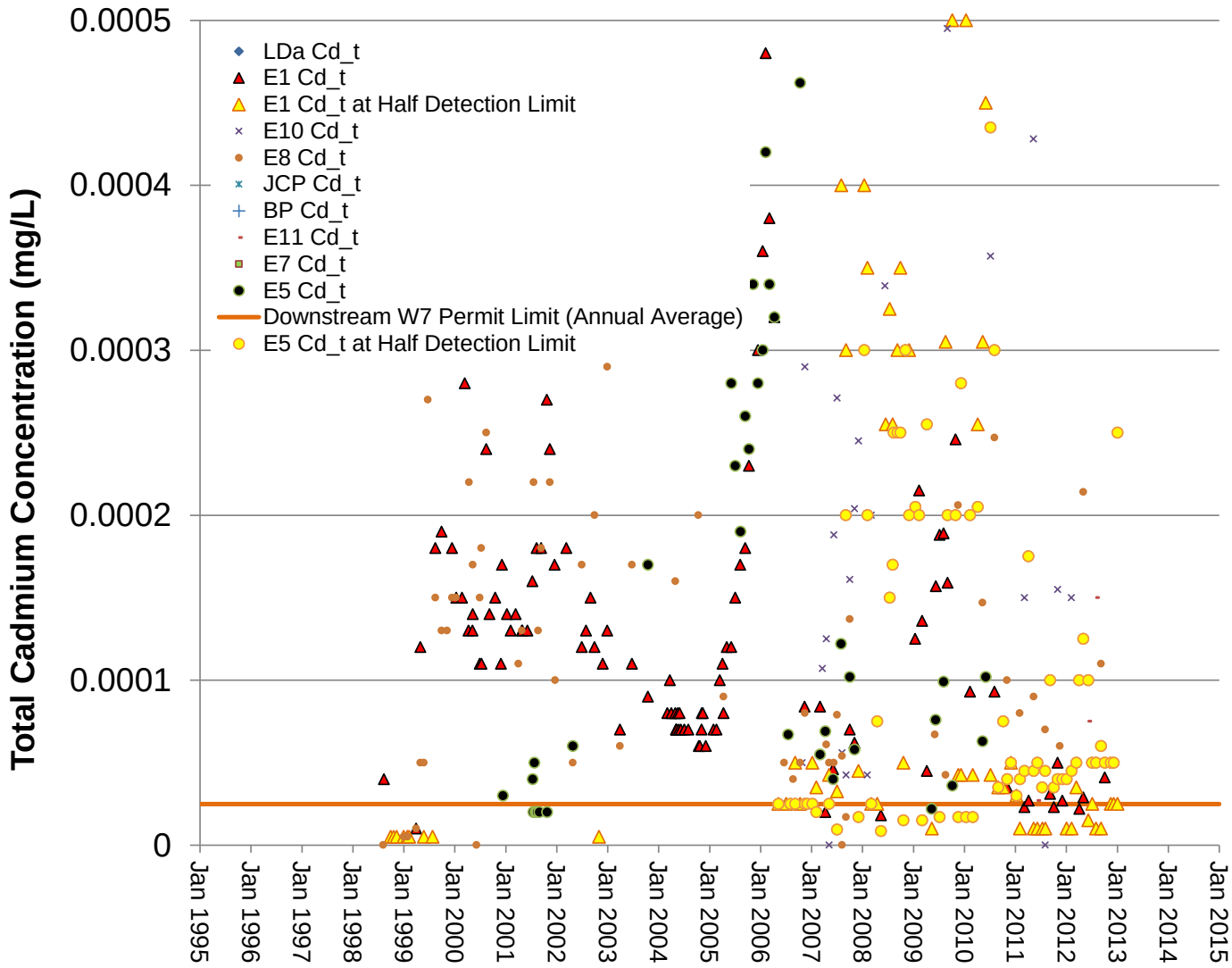

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Figure 13: Total Cadmium Concentrations in Mount Polley Mine Water

5 Discharge Constraints

5.1 Hazeltine Creek Water Quality

A mass balance was used to estimate monthly allowable discharge rates, from the MTD or TMF into Hazeltine Creek using the following equation:

$$Discharge\ Flow\ \left(\frac{m^3}{s}\right) = \frac{\left(Backgr.Conc\left(\frac{mg}{L}\right) - Permit\ Conc\left(\frac{mg}{L}\right)\right) Upstream\ flow\left(\frac{m3}{s}\right)}{Permit\ Conc\left(\frac{mg}{L}\right) - Effluent\ Conc.\left(\frac{mg}{L}\right)} \quad \text{(Equation 2)}$$

Current concentrations of nitrate, copper, molybdenum, selenium and sulphate from the TMF, MTD and Hazeltine Creek and monthly average flows were used in the mass balance (Table 10).

Table 10: Constituent concentrations used to estimate discharge limits. Units are mg/L

Location	Nitrate	Total Copper	Total Molybdenum	Total Selenium	Sulphate
Hazeltine Creek	0.0014	0.0029	0.0018	0.00058	24
MTD	1.09	0.0038	0.179	0.016	455
TMF	6.2	0.009	0.179	0.03	539

Source: Z:\01_SITES\Mt_Polley\1CM017.002_Water and Load Balance Model\!020_Project_Data\010_SRK\Soren's Working Files\Discharge Strategy WQ 2013 (MTD Only) for Discharge Plan_Rev9_SB.xlsm

Table 11 presents the maximum allowable annual discharge volumes from the TMF and MTD based on the current concentrations of nitrate, copper, molybdenum, selenium and sulphate within Hazeltine Creek. These estimates are based on average Hazeltine Creek hydrologic conditions, and assume that discharge only occurs between April and July.

Table 11: Maximum Discharge of Untreated Water from the TMF or MTD during an average runoff year in Hazeltine Creek.

Parameter	Max Untreated Discharge From:	
	TMF (Mm^3/year)	MTD (Mm^3/year)
Nitrate	4.2	Not limited
Total Copper	6.6	Not limited
Total Molybdenum	0.7	1.7
Total Selenium	0.2	0.4
Sulphate	5.5	2.4

Source: \\VAN-SVR0\Projects\01_SITES\Mt_Polley\1CM017.002_Water and Load Balance Model\!020_Project_Data\010_SRK\Soren's Working Files\ Discharge Strategy WQ 2013 (MTD Only) for Discharge Plan_Rev9_SB.xlsm

Note: Red shading indicates constituents already exceed discharge loading limit.

Selenium and molybdenum are currently the only two parameters that limit the allowable discharge of untreated water from the TMF (Table 11). Nitrate, total copper and sulphate concentrations do not restrain the TMF discharge volume below the annual volume limit. Selenium limits the discharge volume from the MTD. Nitrate and copper concentrations within the MTD are currently below the permitted discharge limit in the MTD. Under current conditions, the available volume of water discharged from either the TMF or MTD is much less than the maximum amount permitted, due to quality constraints.

The current sediment selenium concentrations in Hazeltine Creek exceed the permit limit (2 mg/kg). SRK understands that MPMC can discharge water on the condition that sediment concentrations are monitored, and remain below 5 mg/kg.

5.2 Discharging Treated Water from the TMF

5.2.1 Approach and Assumptions

The current discharge load of selenium and molybdenum must be reduced to discharge the maximum permitted volume (1.4 Mm^3) to Hazeltine Creek. Treatment will reduce the load of these constituents. In the future, nitrate and/or sulphate treatment may also be needed. Treatment targets for selenium, molybdenum, nitrate and sulphate (in mg/L) were estimated for discharging from 1.4 Mm^3 to 4.0 Mm^3 of treated water annually. This assumes the current permit limits in Hazeltine Creek (W7) would remain in effect and TMF water is treated.

TMF concentrations of selenium, molybdenum, nitrate-N and sulphate between May 2012 and May 2013 were averaged. As a contingency, average concentrations and hydrologic inputs were increased by 25%.

5.2.2 Results

The treatment targets for selenium, molybdenum, sulphate, and nitrate were calculated. Table 12 presents the water treatment target concentration ranges on an average annual basis, as well as the current TMF concentrations and the limit for each parameter set in the discharge permit. Two treatment and discharge options were evaluated. For Option 1 treatment rate would be constant. For Option 2 the treatment rate would vary to match the hydrograph of Hazeltine Creek to take advantage of the maximum dilution capacity in Hazeltine Creek.

Table 12 shows the target concentration for the annual discharge volumes for each treatment option. The target concentrations decrease with increasing discharge volumes because the dilution capacity in Hazeltine Creek remains constant.

Table 12: Water Treatment Target Ranges for TMF water

Condition	Annual Discharge Volume (Mm^3)	Target Effluent Concentration from TMF (mg/l)			
		Selenium	Molybdenum	Sulphate	Nitrate
TMF Current Concentration	-	0.03	0.2	539	6.2
W7 Permit Concentration	-	0.002	0.05	309	3
Option 1 **Water Treatment at Constant Rate**	1.4	0.003	0.08	473	5
	2	0.0026	0.07	424	4
	3	0.0024	0.06	386	4
	4	0.0023	0.06	366	4
Option 2 **Water Treatment Variable According to Hydrograph**	1.4	0.005	0.17	1028	11
	2	0.004	0.13	813	8
	3	0.004	0.12	731	7
	4	0.004	0.12	731	7

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6 Conclusions

Mount Polley Mine Corporation requested SRK prepare a screening level site wide water and load balance to assess the discharge requirements from the TMF against the permit requirements specified in Permit 11678. This analysis included an annual water balance around the TMF, a hydrologic analysis on the variability of flow within Hazeltine Creek, an assessment of the water quality across the site, and an estimation of allowable discharge volumes as well as treatment requirements.

The following conclusions were made based on this analysis:

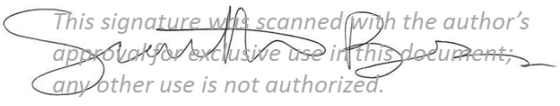
- With the expected increase in total mine catchment area, the 1.4 Mm^3 will be exceeded on an average basis (1.7 $Mm^{3)}$ in an average precipitation year and 3.2 Mm^3 in a year with 808 mm precipitation).
- The 35% maximum discharge criteria becomes limiting during to a 1 in 5 dry year or drier years.
- There are no “hot spot” loading sources that contribute a disproportionate amount of constituent loadings to the TMF.
- Increases in selenium, molybdenum, nitrate and sulphate have been trending up since the mine operation resumed in 2005. These increases are expected to continue until their solubility limits are reached or until the end of the milling and mining process.
- Some metals, including copper and uranium, show no change in concentrations in the TMF due to precipitation in the milling process. After closure of the mine, when the milling process is no longer operational, it is possible that the concentrations will increase in the TMF.
- In order to achieve the desired 1.4 Mm^3 of annual mine water discharge, treatment will be required to reduce the concentrations of selenium and molybdenum and likely for sulphate and nitrate depending on the water treatment capacity.

7 Recommendations

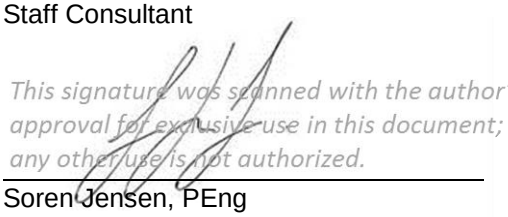
Based on the site wide water balance and water quality review SRK recommends the following:

- Develop a strategy for obtaining permission to increase the volume of allowable discharge from site.
- Implement flow monitoring for the MTD flow.
- Request that the external laboratory use a lower analytical detection limit for cadmium.
- Evaluate short- and long-term water treatment options.

This report, *"Mount Polley Water Management Assessment - DRAFT"*, was prepared by

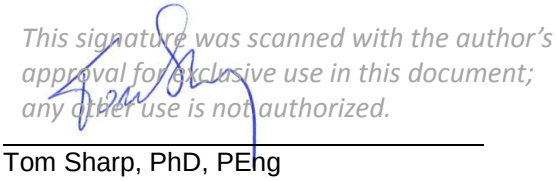


Samantha Barnes, EIT
Staff Consultant



Soren Jensen, PEng
Senior Consultant

and reviewed by



Tom Sharp, PhD, PEng
Principal Consultant

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

8 References

British Columbia Ministry of Environment [BC MOE]. 2013. Amended Permit 11678. Issued to Mount Polley Mining Corp. Authorization No.: 11678. June 2013.

Environment Canada [EC]. 2013a. Spokin Lake

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SRK Consulting (Canada) Inc., 2013. Water Management Strategy, Mount Polley Mine – DRAFT. Prepared for Mount Polley Mining Corporation. Project No.: September 23, 2013.

Mount Polley Mining Corporation

January 15, 2014

Project Description for the treatment and discharge of mine-influenced water to Polley Lake

Information provided by Mount Polley to Ministries of Energy and Mines and Environment for the initiation of First Nations Consultations.

1. Proponent Information

The Mount Polley Mining Corporation, a division of Imperial Metals Corporation, owns and operates the Mount Polley copper-gold mine located 56 kilometres north-east of Williams Lake, British Columbia. The mine operated from August 1997 to September 2001, was placed into care and maintenance from September 2001 to March 2005, and was re-opened in March 2005. Currently the mine life is expected to extend to 2026. Since March 2005, mining has been active in six open pits. Mount Polley Mine also includes a crusher and mill (concentrator), a Tailings Storage Facility, seepage collection ponds, a surface water collection system, and access roads.

The representative managing the project for the purpose of this application is Colleen Hughes, Environmental Coordinator, and she can be reached at the contact information below:

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Environmental Coordinator, Mount Polley Mining Corporation
PO Box 12
Likely, BC V0L 1N0
(250) 790-2617
chughes@mountpolley.com

2. Background

On November 26, 2013 Mount Polley issued notification of intent to apply for an amendment to permit 11678 to allow for the discharge 3,000,000 cubic meters ($3Mm^3$) per year of treated water to Polley Lake. Previous to the official notification, this topic was discussed at a Mount Polley Public Liaison Committee meeting in Big Lake on November 6, 2013 and with First Nations (Soda Creek Indian Band and Williams Lake Indian Band) at Implementation Committee Meetings on October 24, 2013, and again on November 28, 2013.

Mount Polley mill tailings and site runoff water are collected in the environmentally-secure Tailings Storage Facility. The supernatant from the Tailings Storage Facility is re-cycled through the mill process. Mount Polley mine operates with an annual water surplus, and currently has 6.5 Mm^3 of water stored in the Tailings Storage Facility. Given that the Tailings Storage Facility

provides the only available water storage on site, geotechnical review of the structure to store this and future projected annual surplus was modelled through a third-party engineering firm (BGC Engineering). Resulting analysis showed that the Tailings Storage Facility is not a suitable long-term solution for the storage of surplus mine-influenced water on site; in fact, there exists a three (3) year timeframe during which storage will become geo-technically problematic. Additionally, it is the opinion of Mount Polley staff and third party consultants that the volume of water removed from the surrounding watersheds would be best served by being returned to the environment (at a suitable quality). In addressing these issues, the water management strategy at Mount Polley has been classed into two time-frames: short-term (3-5 years) and long-term (life of mine). The proposed water treatment facility relates to the short-term time-frame, during which, long-term strategies will be further researched and evaluated.

Due to prior projection of the accumulation of this water within the Tailings Storage Facility, MPMC applied and received approval (under the British Columbia *Environmental Management Act*) for the discharge of dam-filtered Tailings Storage Facility supernatant to Hazeltine Creek. This discharge permit for the Hazeltine Creek system currently limits permitted releases due to effluent water quality and quantity parameters, as well as creek flow limitations. Even if discharging at the maximum allowable rate, would not satisfy current site requirements.

In 2013, a third-party consultant (SRK Consulting) was retained to review short-term water management strategies available at Mount Polley. After confirming the surplus water accumulation projected by Mount Polley and the projected water chemistry, SRK recommended reverse osmosis as a treatment method to meet the BC water quality objectives for aquatic life.

In order to help determine the most suitable treatment technology for use at Mount Polley, BI Purewater from Richmond BC was retained to operate a pilot water treatment plant on site from December 9, 2014 to December 19, 2014. The pilot system treated approximately 20 gallons per minute (gpm) of surface run-off water from the Perimeter Seepage Collection Pond, which collects flow from the Southeast Rock Dump Site Ditch and Long Ditch (Figure 1).

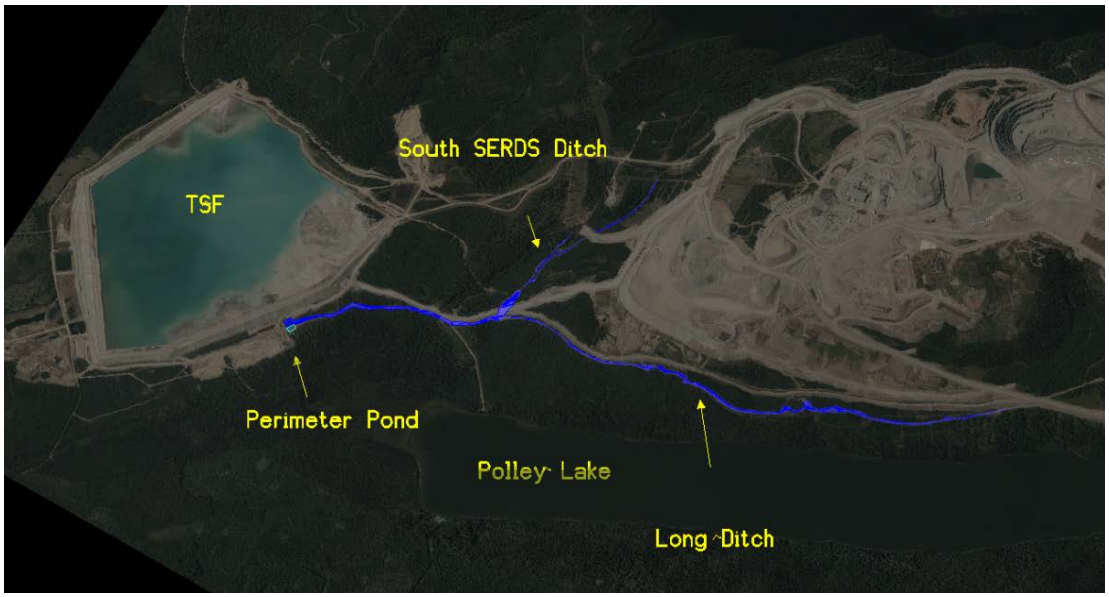

Figure 1: Source Water for Pilot Plant

Results from this pilot trial have been compiled and submitted to the Ministry of Environment (MOE) for review. These results show that the treatment system used was very effective in removing the contaminants of concern and all of the results met the BC and Canadian Drinking Water Objectives.

3. Project Overview

Design and Construction

The Water Treatment Facility will be located adjacent to the Perimeter Seepage Pond. The design will be determined upon final review of the pilot treatment plant results and the proposals for construction from third party organizations. Construction will commence in the spring of 2014 with completion expected late spring or early summer. Construction will be completed by mine personnel in conjunction with third party contractors, and operation will be conducted by contractors initially, but may transition into Mount Polley operation.

Construction is anticipated to last 2-3 months, and will involve completion of the treatment plant in parallel with supporting components including power, the pipeline to Polley Lake, monitoring equipment, and communications systems.

Treated water from the Water Treatment Facility will be conveyed via pipeline to Polley Lake where it will connect with an existing pipe that was installed in the lake in 2001. The water will then discharge into the lake through a diffuser system (to be designed by KP).

General layout of the Water Treatment Facility and corresponding system is as included in Figure 2.

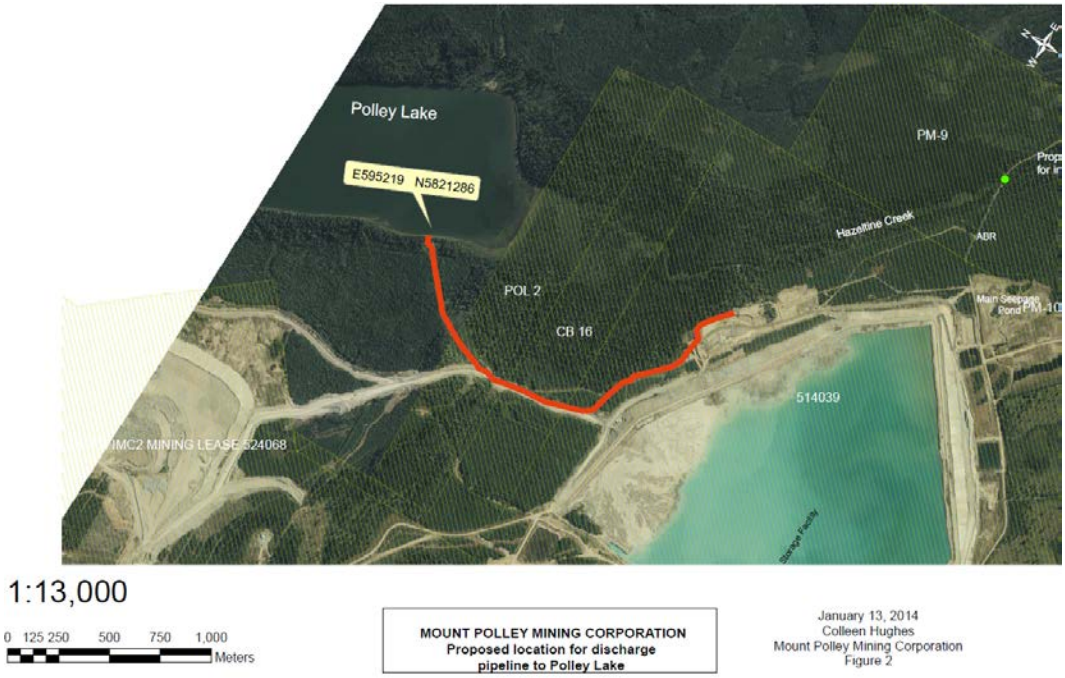

Figure 2: General Layout of Water Treatment Facility

The project is projected to have a life cycle of 3-5 years in full-scale operation, the results of which, combined with ongoing long-term water management strategy development, will dictate the use of this facility past this time. At the time that the plant is no longer deemed necessary, then it will be decommissioned appropriately.

Environmental, economic, social, heritage, and health effects

Environmental effects from the treatment of water are not expected. The area where the plant will be located has adequate drainage and is ditched to a contained till borrow pit which will collect any overflow or leakage of untreated water. All by-products from the treatment process are scheduled to be stored in the Tailings Storage Facility.

Impacts from the proposed discharge to Polley Lake will likely be similar to those reviewed in the Technical Assessment for the discharge to Hazeltine, published in 2009. A third party review of this document was conducted by Brian Olding and Associates in 2011 and submitted as part of the permit application for discharge to Hazeltine Creek. Potential biological impacts to Polley Lake are currently being reviewed by Pierre Stecko of Minnow Environmental Inc. These findings will be presented to MOE upon receipt by Mount Polley. Impacts from the treated water are not expected, as the water will be treated to below the BC water quality objectives for all contaminants of concern.

Hydrological impacts are not expected. The addition of water to Polley Lake should provide an ameliorating effect on the watershed, as the existing run-off collection system currently removes water from the lake system. An updated report on hydrologic effects to Hazeltine Creek is being completed by Knight Piésold (KP). Previous information from KP, published in the Technical Assessment, suggests that Hazeltine Creek would benefit from increased flows, as

historically a 14 km^2 portion of the Bootjack Creek watershed flowed into Hazeltine Creek, but this area was diverted into the Morehead Creek watershed in approximately 1913. This reduction in watershed area equates to about 30% of the catchment area above the confluence of Bootjack and Hazeltine Creeks. In the TA, KP recommends a maximum effluent discharge of 0.21 m^3/s, suggesting that Hazeltine Creek will support an additional discharge of 0.1 m^3/s from the Water Treatment Facility.

Impacts on First Nations interests are not expected, and project updates have been regularly presented through the Implementation Committee (tri-party meetings including MPMC, Soda Creek Indian Band and Williams Lake Indian Band). Impacts on public interest are also not expected, and project updates have been presented through the Public Liaison Committee Meeting as well as a Public Meeting. As outlined above, the discharged water will be treated to meet the BC water quality objectives for both acute and chronic (30 day) guidelines and the volume of water returned to the watershed will not exceed the maximum as recommended by KP.

Land Use Setting

All infrastructures for the Water Treatment Facility will be within the already disturbed area beside the Perimeter Seepage Collection Pond. This pond and a large portion of the proposed pipeline to Polley Lake are on Mount Polley mining claims (Figure 2). An application for land tenure for the additional section of pipeline not covered by these claims (northern portion towards Polley Lake) has been made through Front Counter BC.

Mclean, Keegan MTIC:EX

From: Bings, Dan P ENV:EX
Sent: Thursday, January 16, 2014 10:40 AM
To: Hill, Douglas J FLNR:EX; Kerley, Jason F FLNR:EX
Cc: McConnachie, Jennifer MEM:EX; Demchuk, Tania MEM:EX
Subject: MPMC water treatment Project Description & supporting reports
Attachments: TSF Interim Dam Design Path Forward - BGC - 2013 11 27.pdf; Mount Polley Water and Load Balance (SRK) - 2013 12 05.pdf; MPMC Information for Consultation.pdf

Supporting reports referenced in the project description, also attached and titled "MPMC Information for Consultation".

Dan Bings
Environmental Protection Officer
Ministry of Environment
Cariboo Region
PH: (250) 398-4897 FX: (250) 398-4214

BC Pollution Free

From: Luke Moger [mailto:lmoger@mountpolley.com]
Sent: Wednesday, January 15, 2014 5:55 PM
To: Bings, Dan P ENV:EX
Cc: Colleen Hughes
Subject: RE: Information for Consultation

Hi Dan;

Please find attached a copy of the BGC (most recent) and SRK reports – if you should have any questions, please let me know.

Kindest Regards,

Luke Moger
Project Engineer, Mining Operations
Mount Polley Mining Corporation

Tel: +1 (250) 790-2215 ext. 2113
Fax: +1 (250) 790-2613
Email: LMoger@MountPolley.com

From: Colleen Hughes
Sent: Wednesday, January 15, 2014 11:46 AM
To: Luke Moger
Subject: FW: Information for Consultation

Hi Luke

Would you be able to provide this information to MOE?

Thank you
Colleen

From: Bings, Dan P ENV:EX [mailto:Dan.Bings@gov.bc.ca]
Sent: Wednesday, January 15, 2014 11:10 AM
To: Colleen Hughes
Subject: RE: Information for Consultation

Can you fire off a digital copy of the BGC water balance report and the SRK treatment technology recommendation report? We may need it in our back pocket if asked to justify the discharge and/or the method of treatment. D

From: Colleen Hughes [mailto:chughes@mountpolley.com]
Sent: Wednesday, January 15, 2014 10:42 AM
To: Bings, Dan P ENV:EX
Subject: Information for Consultation

Hi Dan

Here is the final document. I should have the application for the pipeline complete today but will have to wait a week for a cheques to be processed.

Thanks
Colleen

From: Bings, Dan P ENV:EX [mailto:Dan.Bings@gov.bc.ca]
Sent: Tuesday, January 14, 2014 4:35 PM
To: Colleen Hughes
Subject: RE: MOE_MEM First Nations Consultations Activities_CH_KM2

lol...oddly enough, it didn't even register on me!

From: Colleen Hughes [mailto:chughes@mountpolley.com]
Sent: Tuesday, January 14, 2014 4:34 PM
To: Bings, Dan P ENV:EX
Subject: RE: MOE_MEM First Nations Consultations Activities_CH_KM2

You didn't like my WTF did you? ☺

From: Bings, Dan P ENV:EX [mailto:Dan.Bings@gov.bc.ca]
Sent: Tuesday, January 14, 2014 4:33 PM
To: Colleen Hughes
Subject: RE: MOE_MEM First Nations Consultations Activities_CH_KM2

The only thing I'd change would be to qualify that the treatment objective is both acute and chronic (30 day) guidelines. It might not also hurt to mention that the permeate also meets drinking water objectives.

Otherwise, given the limited re-use of the acronyms in the document and given the target audience, it might be an idea to do away with the handful of acronyms and use the full terms.

Dan

From: Colleen Hughes [mailto:chughes@mountpolley.com]
Sent: Tuesday, January 14, 2014 4:10 PM
To: Bings, Dan P ENV:EX
Subject: MOE_MEM First Nations Consultations Activities_CH_KM2

Hi Dan

Here is the document we have put together for MOE to use for consultation. Please have a look and let me know if you would like to see any changes.

Colleen

Mclean, Keegan MTIC:EX

From: McConnachie, Jennifer MEM:EX
Sent: Friday, March 7, 2014 11:22 AM
To: Howe, Diane J MEM:EX; Demchuk, Tania MEM:EX
Subject: RE: Mine permit amendment-Water Treatment Application

Hi Diane,

We have approved a pilot treatment plant and are awaiting an application for full scale treatment. I've attached some emails that will hopefully give a bigger picture for you. Here's an excerpt of one of the email strings.

Hi Luke,

In anticipation of forthcoming permit amendment applications, we are hoping you can provide us a synopsis of expected timelines to assist in our review and consultation planning process. Please provide the approximate timelines for information requirements summarized below (as well as any additional information you feel may be useful). We likely have some of this information, but believe it is useful to have it all in one place. Note that in the interest of expediting permitting processes for both the *Environmental Management Act* and *Mines Act* amendments, MEM and MOE have been in touch and we encourage you to communicate with both ministries jointly going forward. For the requested information here, I will ensure it gets to all those involved once I receive it from you.

1. Water Treatment Plant
    a. EMA discharge TAR and EA documents **[End of January/Beginning of February]**
        Work is currently underway with Minnow Environmental (Pierre Stecko) and Knight Piésold (Greg Smyth)
    b. Mines Act information requirements **[End of February/Beginning of March]**
        Contingent on the results of the second pilot plant for plant configurations
    c. Potential Water Act (Section 9) authorization for changes to the Polley Lake extraction infrastructure to facilitate discharge **[Mid-February]**

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    a. 5 Year Mine Plan and Reclamation Program **[End of February – Pending Status of Mine Plan (To Be Submitted At Latest With the Mine Plan)]**
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        i. Status of required WQ modeling and Waste Rock management items?
        WQ modeling has been completed by SRK [Tom Sharp]
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    b. Details of Mine Plan changes - what activities are required for mine life extension that are not already permitted? **[End of March]**
        New Pit Designs
        Expanded SERDS
        Updated PAG Schedule

3. Co-mingling tailings and waste rock trial project **[Mid-February]**

a. Information requested by MEM during preliminary review
   Work is currently underway with SRK (Steve Day)
   i. Geotechnical
   ii. Geochemical/monitoring

4. Intermediate Dam Design (during Water Treatment Phase) **[End of April]**
   A dam design package based on the short-term water management strategy will be produced once adequate modelling assumptions can be projected

It may also be useful for you to provide a summary of First Nations consultation that may have already taken place for any or all of these items.

First Nations Consultation has been completed on the pilot plant and discharge through the Implementation Committee (IC), and the outlined discharge parameters (3,000,000m^3/year, BCWQG, 12-month discharge) have been proposed, with positive response. The mine reclamation planning is constantly in discussion as part of the environmental component of the IC, as are the details of the upcoming mine permit (they are aware of the ~2023 revised mine life as well as the general pit outlay and the waste requirements). Full informational packages were circulated regarding co-mingling of tailings and waste, and a presentation was also completed by MPMC at the IC. First Nations are also aware of the geotechnical and storage conditions of the existing tailings storage facility (i.e. they know that a new design corresponding with the extended mine life is in the works), but formal details are yet to be refined or presented.

Thanks in advance,

Jennifer McConnachie, MSc, PAg
Inspector of Mines (Reclamation)
Ministry of Energy and Mines
Phone: 250.565.4422
Cell: 250.640.0717

From: Howe, Diane J MEM:EX
Sent: Friday, March 7, 2014 11:15 AM
To: Demchuk, Tania MEM:EX; McConnachie, Jennifer MEM:EX
Subject: FW: Mine permit amendment-Water Treatment Application

FYI:

Boy I am totally out to lunch on this one. I know we are still working on the Co mingling amendment one, did we receive an application for a water treatment plant on site? .

Regards, Diane

Diane Howe
Deputy Chief Inspector, Reclamation and Permitting
Ministry of Energy and Mines
Victoria, BC
(250) 952-0183

<< OLE Object: Picture (Device Independent Bitmap) >>

_____

From: Kerley, Jason F FLNR:EX
Sent: Friday, March 7, 2014 10:46 AM
To: Hoffman, Al MEM:EX; Nicol, Jane FLNR:EX; Metcalfe, Shelley ENV:EX; Howe, Diane J MEM:EX
Cc: Hill, Douglas J FLNR:EX; Osmachenko, Linda FLNR:EX
Subject: Mine permit ammendment-Water Treatment Application

Consultation for this application is complete. Attached is the consultation summary for your records.

<< File: mpmc_water_treatment_consult_summary_7Mar14.pdf >>

Jason Kerley, R.P.F.
Senior Advisor, First Nations Relations
Cariboo Region
(250) 398-4249
jason.kerley@gov.bc.ca

Mclean, Keegan MTIC:EX

From: Demchuk, Tania MEM:EX
Sent: Monday, January 13, 2014 4:12 PM
To: 'Luke Moger'; McConnachie, Jennifer MEM:EX; Bings, Dan P ENV:EX
Cc: 'Art Frye'; 'Ryan Brown'; 'Colleen Hughes'
Subject: RE: Upcoming/In Progress permit amendment applications

Hi Luke,

Okay, thanks for that clarification. As we approach the submission date, we would likely find it useful for you to check in (email/phone) to let us know what the planned approach will be. Our preferred approach is to keep everything together to the extent possible.

Cheers,
Tania

From: Luke Moger [mailto:lmoger@mountpolley.com]
Sent: Monday, January 13, 2014 4:07 PM
To: Demchuk, Tania MEM:EX; McConnachie, Jennifer MEM:EX; Bings, Dan P ENV:EX
Cc: Art Frye; Ryan Brown; Colleen Hughes
Subject: RE: Upcoming/In Progress permit amendment applications

Hi Tania;

Happy New Year as well!

Yes, our intention is to submit them together, but if there is a non-reclamation and closure item delaying the Mine Plan Permit Application Package, then I was thinking that we may be able to submit the 5-Year Reclamation and Closure Plan a bit earlier to help with the review process timing; understanding that obviously the two are required to be read in conjunction to evaluate, but thinking it may just help to get them "in the queue" to check for overall completeness and appropriateness.

Kindest Regards,

Luke Moger
Project Engineer, Mining Operations
Mount Polley Mining Corporation

Tel: +1 (250) 790-2215 ext. 2113
Fax: +1 (250) 790-2613
Email: LMoger@MountPolley.com

From: Demchuk, Tania MEM:EX [mailto:Tania.Demchuk@gov.bc.ca]
Sent: Monday, January 13, 2014 3:48 PM
To: Luke Moger; McConnachie, Jennifer MEM:EX; Bings, Dan P ENV:EX
Cc: Art Frye; Ryan Brown; Colleen Hughes
Subject: RE: Upcoming/In Progress permit amendment applications

Hi Luke,

Thanks for that update on timelines.

One clarification, under the Mine Plan update is it correct that you will wait to submit both of those items in one report at the end of March?

Thanks, and happy new year!
Tania

From: Luke Moger [mailto:lmoger@mountpolley.com]
Sent: Monday, January 13, 2014 2:09 PM
To: McConnachie, Jennifer MEM:EX; Demchuk, Tania MEM:EX; Bings, Dan P ENV:EX
Cc: Art Frye; Ryan Brown; Colleen Hughes
Subject: RE: Upcoming/In Progress permit amendment applications

Hi Jennifer;

Apologies for the delay - as per our correspondence last week, I think we have all the information to put together some realistic timelines to address your e-mail (please see in red below).

As a general update, we are looking at a second round of piloting, which has set back our schedule a bit. Consultation has been ongoing, and we have held our regular Implementation Committee Meetings, a Public Liaison Meeting in Big Lake and a Public Meeting in Likely. The general tone of these meetings has been positive, and we are currently awaiting comment in order to identify any next steps required in this regard.

The short-term water management strategy (current discharge application) development is a leading or parallel event to many of the items as listed below, and so completion of them hinges on parts of the final solution being formalized.

If there is anything that you require further information or clarification on, please don't hesitate to contact me.

Kindest Regards,

Luke Moger
Project Engineer, Mining Operations
Mount Polley Mining Corporation

Tel: +1 (250) 790-2215 ext. 2113
Fax: +1 (250) 790-2613
Email: LMoger@MountPolley.com

From: McConnachie, Jennifer MEM:EX [mailto:Jennifer.McConnachie@gov.bc.ca]
Sent: Monday, December 16, 2013 1:09 PM
To: Luke Moger; Demchuk, Tania MEM:EX
Cc: Art Frye; Ryan Brown; Colleen Hughes
Subject: Upcoming/In Progress permit amendment applications

Hi Luke,

In anticipation of forthcoming permit amendment applications, we are hoping you can provide us a synopsis of expected timelines to assist in our review and consultation planning process. Please provide the approximate timelines for information requirements summarized below (as well as any additional information you feel may be useful). We likely have some of this information, but believe it is useful to have it all in one place. Note that in the interest of expediting permitting processes for both the *Environmental Management Act* and *Mines Act* amendments, MEM and

MOE have been in touch and we encourage you to communicate with both ministries jointly going forward. For the requested information here, I will ensure it gets to all those involved once I receive it from you.

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        A dam design package based on the short-term water management strategy will be produced once adequate modelling assumptions can be projected

It may also be useful for you to provide a summary of First Nations consultation that may have already taken place for any or all of these items.

First Nations Consultation has been completed on the pilot plant and discharge through the Implementation Committee (IC), and the outlined discharge parameters (3,000,000m^3/year, BCWQG, 12-month discharge) have been proposed, with positive response. The mine reclamation planning is constantly in discussion as part of the environmental component of the IC, as are the details of the upcoming mine permit (they are aware of the ~2023 revised mine life as well as the general pit outlay and the waste requirements). Full informational packages were circulated regarding co-mingling of tailings and waste, and a presentation was also completed by MPMC at the IC. First Nations are also aware of the geotechnical and storage conditions of the existing tailings storage facility (i.e. they know that a new design corresponding with the extended mine life is in the works), but formal details are yet to be refined or presented.

Thanks in advance,

Jennifer McConnachie, MSc, PAg
Inspector of Mines (Reclamation)

Ministry of Energy and Mines
Phone: 250.565.4422
Cell: 250.640.0717

From: Luke Moger [mailto:lmoger@mountpolley.com]
Sent: Wednesday, October 16, 2013 4:14 PM
To: McConnachie, Jennifer MEM:EX; Demchuk, Tania MEM:EX
Cc: Art Frye; Ryan Brown; Colleen Hughes
Subject: 5-Year Reclamation and Closure Component (MPMC Anticipated 2013 Mine Permit Amendment Application)

Hi Jennifer and Tania;

Thank you both for making the time to connect today. As per our conversation, we are just sorting through our permitting, "to-do" list on site, and wanted to make sure that we are on the same page internally (and also with the various governing bodies). Please find below a summary of our conversation, and let me know if there is anything that I have misinterpreted.

1) Mount Polley is still planning on submitting an M-200 Mine Permit Amendment Application to extend the mine life
    a. This is anticipated to be submitted in late November/early December of 2013
2) Mount Polley has identified water management (net surplus) on site as a major component of mine life extension
    a. There exists a two-three year time frame in which tailings storage facility constraints dictate the existing on-site surplus needs to be reduced
    b. There is a life-of-mine requirement to deal with this surplus on an annual basis moving forwards
    c. Work on modelling of site chemistry (flow and loading) is currently underway (SRK)
    d. Water management strategy evaluation (short and long term) is currently under way
3) It is required that along with the M-200 Mine Permit Amendment Application, a full update to the 5-year Reclamation and Closure Plan is submitted
    a. The short-term water management strategy/implementation plan must be well developed if planned for execution within the next one-three years
    b. The long-term water management strategy has to be presented, but will not require the same amount of detail

It was recommended that once work on the 5-year Reclamation and Closure Plan has been completed to an appropriate extent, discussion be conducted to receive guidance/feedback prior to formal submission as part of the M-200 Mine Permit Amendment Application; this has been tentatively scheduled for mid-November.

Thanks again for making the time to field my questions, and we look forward to discussing again soon.

Kindest Regards,

Luke

Luke Moger
Project Engineer, Mine Operations
Mount Polley Mining Corporation
PO Box 12
Likely BC V0L 1N0
Canada

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BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
Suite 800 - 1045 Howe Street, Vancouver, BC Canada V6Z 2A9
Telephone (604) 684-5900 Fax (604) 684-5909

BGC Project Memorandum

To:	**Mount Polley Mining Corporation**	**Doc. No.:**	**1197001.13.004**
Attention:	**MPMC – Mr. Luke Moger**	**cc:**	
From:	**Daryl Dufault, Todd Martin**	**Date:**	**November 27, 2013**
Subject:	**Mount Polley Tailings Storage Facility Interim Dam Design Proposed Path Forward – DRAFT, Revision #1**		
Project No.:	**1197001.04**		

This draft memorandum updates and supersedes an earlier version dated November 6, 2013. Section 3.0 Recommended Next Steps, has been updated to include the telephone discussion between Mr. Luke Moger of the Mount Polley Mining Corporation (MPMC), and Messrs. D. Dufault and T. Martin of BGC Engineering (BGC) held on November 21, 2013. It has also been updated to reflect comments on the first draft provided by Mr. Moger.

1.0 INTRODUCTION

A telephone conference between Mr. Luke Moger of the Mount Polley Mining Corporation (MPMC), and Messrs. D. Dufault and T. Martin of BGC Engineering (BGC) was held on October 22, 2013, to discuss comments generated from the MPMC review of the BGC memorandum #1197.13.003 Mount Polley Tailings Storage Facility Stability Modeling. The main objective of the BGC memo #1197001.03 was to identify the potential extent of downstream stripping required to support future dam raises. MPMC comments were mostly editorial and the memo was updated and reissued in final form on October 22, 2013.

During the teleconference the topic of surplus pond volume estimates was revisited and a list of pond volumes (based on bathymetric surveys carried out typically once or twice per year) was provided by MPMC. Mr. Moger clarified that the tailings storage facility (TSF) pond volume increase from May 2012 to May 2013 initially provided by MPMC was over conservative, as it was based not on the difference between pond soundings on those dates, but instead on projections. A comparison of pond soundings between August 2012 and August 2013 indicated the increased in pond volume was in the order of 1.4 Mm3/year. A plot of pond volume versus time for the period of 2007 through 2013 (August), based on pond sounding data provided by MPMC, is shown in Figure 1. The plot also shows the cumulative volume of

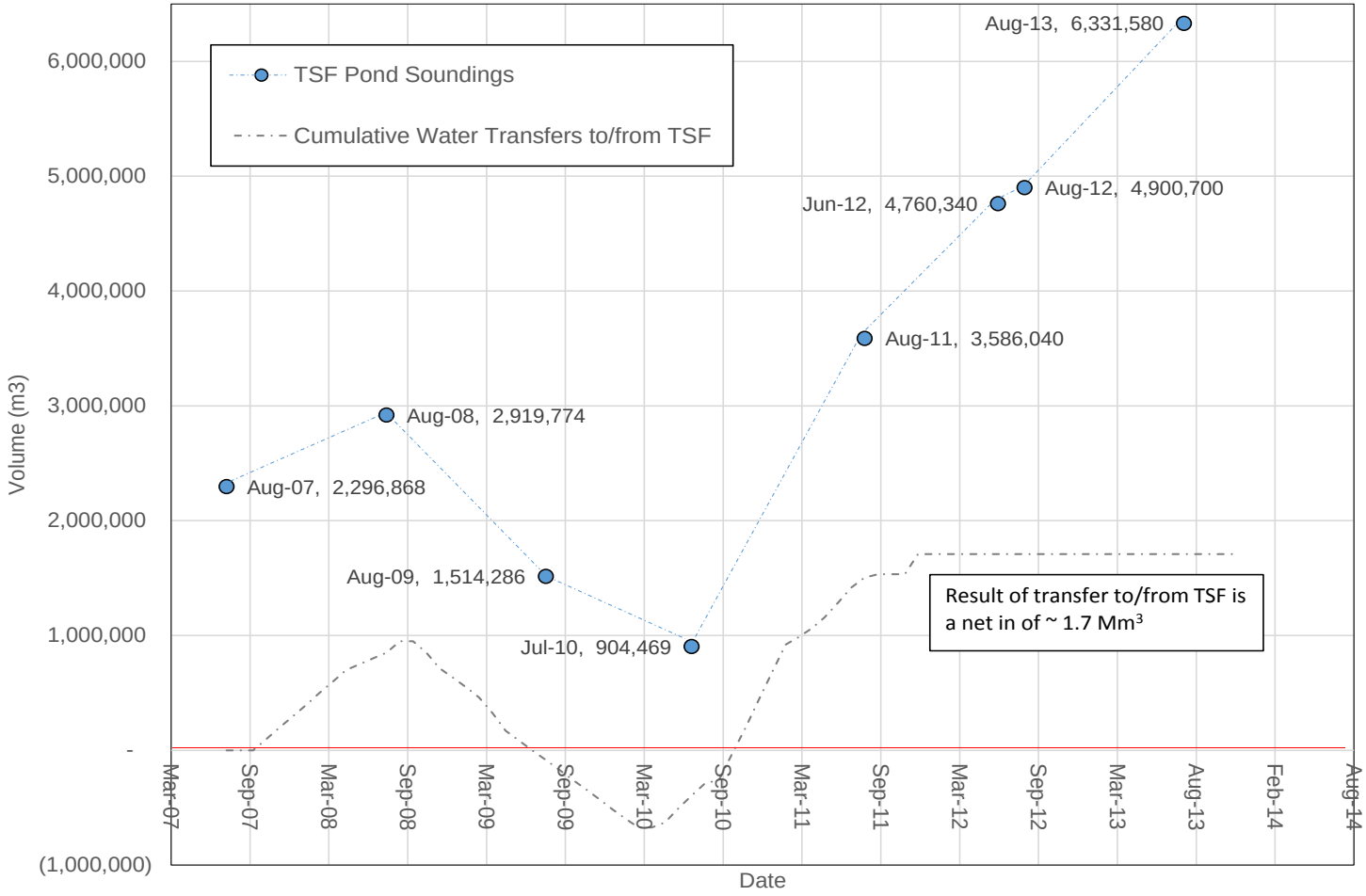
water transferred between the Cariboo Pit and the TSF (negative values indicating net water transferred out of the TSF).

BGC Memo #1197.13.003 also highlighted three key discussion points regarding the management of mine site impacted waters that require addressing before planning for substantial additional dam raising to accommodate the planned mine life extension can be carried out.

The key discussion points were as follows:

1. MPMC is to develop a predictive monthly water balance model that identifies and projects the inflows and outflows from the tailings impoundment.
2. A clear definition of the plan to resolve the water balance issue is required, such that the volume of free water in the TSF can be reduced and wide above-water tailings beaches can be established and maintained against the dam. This is a necessary pre-cursor to the additional raising required to accommodate the mine life extension.
3. Until a comprehensive and calibrated water balance is developed and vetted, a specific interim crest elevation for the next construction phase cannot be provided. The target crest elevation for the next stage of raising must accommodate the projected tailings production, flood storage and freeboard requirements, and the water pond volume. The water pond volume to be assumed is largely dependent on the additional accumulation of surplus water in the TSF. That projected surplus is to be derived from the water balance model.

Figure 1 TSF Pond Volumes 2007-2013



2.0 BACKGROUND INFORMATION

This section remains unchanged for the most part from the October 22, 2013 BGC memorandum and is included for completeness.

The Mount Polley Mine has been operating since 1996 and in the past two years has been operating with a significant excess of mine contact water stored in the TSF. Earlier in 2013, MPMC retained BGC to undertake a design for raising of the TSF embankment (made up of the Perimeter, Main and South dams) to a crest elevation of about 1,000 m, which would accommodate a planned extension of the mine life. The currently permitted TSF embankment crest elevation is El. 970 m. The embankment is planned to be raised above this permitted elevation in 2014 to accommodate ongoing tailings and water storage requirements.

BGC personnel visited the site June 10 and 11, 2013, to initiate the design assignment for the dam crest raise to El. 1,000 m. Subsequent to that site visit, and the on-site discussions with MPMC personnel, BGC issued the following memorandum:

> *#1197001.13.001 Mount Polley Mine Site Visit – Trip summary and path forward (18 June 2013) outlining the findings of the site visit, the importance of reducing the pond volume and developing a comprehensive, reliable water balance.*

A key conclusion provided within that memorandum was that there is currently a surplus of water in the TSF and the water balance is such that surplus water will continue to accumulate, as the TSF is in effect the site water management pond. From August 2012 to August 2013, for example, the water volume[1] in the TSF (as estimated by bathymetric survey) increased by about 1.4 million m^3. If not dealt with, this ongoing accumulation will preclude raising the embankment as planned to accommodate the mine life extension, as the accumulating surplus will:

- *Displace tailings storage capacity*
- *Prevent the formation and development of wide, above-water, beaches, a necessary element of the dam design, to separate the dam from the reclaim water pond*

BGC recommended, in the above-referenced memorandum, that priority be placed on developing a working water balance, understanding the sources contributing to the surplus, and devising strategies and timelines to eliminate that surplus. It is important to note that elimination of the surplus means achieving both of the following objectives:

[1] In BGC document #1197001.13.001 the TSF excess water accumulation between May 2012 and May 2013 was reported as 3.2 Mm^3 (as provided by MPMC). It has since been clarified that that estimate was based on projections not bathymetric surveys. Moving forward the pond volumes based on bathymetric surveys will be used.

- *Prevention of further water accumulation on an annual basis and, of equal importance*
- *Gradual reduction of the volume of water in the pond to increase tailings storage capacity and facilitate the development of wide, above water, tailings beaches against the dam*

The establishment and maintenance of wide, above-water, tailings beaches represents a fundamental design component of the dam. Given the current water balance circumstances, BGC recommended that an interim raise design be evaluated which would provide sufficient tailings, water (including the accumulating surplus), and flood storage/freeboard capacity in the short-term until the water surplus is eliminated, the volume of water in the TSF decreased, and above-water beaches are established and maintained.

A key question unanswered when the above-referenced memorandum was issued was how long it would take to resolve the water surplus situation, and thus, the extent of the "interim" embankment raising that would be required to provide for mine production and tailings storage through to that time.

In a telephone conference between Mr. Luke Moger of MPMC, and Messrs. D. Dufault and T. Martin of BGC held on July 2, 2013, this question was discussed. BGC pointed out that, in the absence of wide, above-water, tailings beaches separating the till core of the embankment from the reclaim water pond, from a geotechnical perspective, the dam was being operated more as a water-retaining dam than a tailings dam. As such, the question of how long the dam could continue to be operated in this manner could be assessed on the basis of generally-accepted design practice relating the core width of water-retaining earthfill dams to the hydraulic head acting across the core. MPMC authorized BGC to proceed with this assessment, which was documented in the following BGC memorandum:

> *#1197001.13.002 Mount Polley Mine – Revised Target Crest Elevation Assessment (25 July 2013)*

The assessment indicated that, under the current water surplus conditions, once the embankment crest reaches the currently permitted crest El. 970 m, the core width to hydraulic head ratio will already be at the generally accepted lower limit of design practice for water-retaining dams. As the water level increases, the core width to hydraulic head ratio will be less than the accepted limit in 2014, demonstrating the urgency with which the water balance surplus needs to be eliminated.

Still left unanswered at the current time is when the water balance surplus will be eliminated. As a consequence, also left unanswered is the scope of the interim raise required. Dam crest raising above crest El. 970 m will require an extension of the downstream rockfill shell of the dam. An extension of the downstream shell may also be required to achieve minimum required factor of safety criteria. As discussed in the aforementioned August 7 teleconference, prior to the contractor working on the 2013 embankment raise leaving site in the fall, MPMC would like

to have an indication of the potential downstream shell extensions that would be required for a range of interim crest raise elevations. It was therefore agreed that BGC would undertake stability analyses to determine the downstream shell configurations for the various interim crest elevations evaluated, with the elevations intermediate between the permitted crest elevation of 970 m, and the originally targeted crest elevation of 1,000 m to accommodate the proposed mine life extension.

3.0 RECOMMENDED NEXT STEPS

The key discussion points presented in Section 1.0 are restated below with MPMC updates in italics and BGC comments underlined and in italics (**updates in bold font**):

1. MPMC is to develop a predictive monthly water balance model that identifies and projects the inflows and outflows from the tailings impoundment. *MPMC has developed a predictive monthly water balance model that identifies and project the inflows and outflows from the tailings impoundment. BGC has carried out an initial review of the water balance and although it appears to capture the mine site inputs and outputs it does not include the typical design storm events or wet/dry year scenarios required for dam staging.*
2. Resolution of the water balance issue, such that the volume of free water in the TSF can be reduced and wide above-water tailings beaches can be established and maintained against the dam, is required before the TSF expansion design can proceed. *The MPMC internal review showed that water treatment designed to create an effluent stream that satisfies the current discharge criteria in combination with an amendment to the current discharge permit provides the best opportunity for reducing the TSF excess water situation and moving forward allows for ongoing maintenance of the pond water volume.*
    - **a.** The necessary treatment options have not been identified at this time and this component of the plan will be supported and investigated a member of the Imperial Metals support team (Paul Sterling has been assigned to this task). **Reverse osmosis appears to be the favored treatment methodology. MPMC is currently in discussion with vendors for water treatment systems. Discharge is proposed to be into Polley Lake, beginning as early as spring 2014. The target quality of the discharge is to meet or exceed the B.C. fresh water quality guidelines.**
    - b. The work to develop the proposed amendment to the discharge permit will be led by MPMC, **which has been in regular contact with the B.C. Ministry of Energy and Mines and the B.C. Ministry of Environment pertaining to its plans. It is understood that both ministries are supportive of MPMC's plans.**
    - c. Originally, MPMC is anticipated that a total annual discharge volume of 2 Mm^3 would suffice to prevent continued accumulation of surplus water in the TSF, and

to gradually draw down the surplus that will have accumulated prior to the initiation of this discharge. **The discharge volume target has since been increased to 3 Mm^3/yr (email communication L.Moger November 14, 2013, and confirmed during the November 21, 2013 teleconference). MPMC is planning on this higher rate of discharge in order to provide for more flexibility (e.g. in wetter than average years) and to draw down the accumulated surplus more rapidly.**

d. MPMC is planning on feeding the water treatment plant from the perimeter pond, which receives drainage from the TSF drains, and receives runoff from the majority of the site. Given that it is primarily site runoff that will be feeding the water treatment plant, there will be some seasonality to it (i.e. not as reliable and steady a supply as if the water were being drawn from the TSF). So it may be necessary to also feed the water treatment plant from the TSF to achieve the desired annual treatment and discharge volumes. This will emerge from water balance simulations once the water treatment schedule has been incorporated and the water balance model vetted.

3. Until a comprehensive and calibrated water balance is developed and vetted, a specific interim crest elevation for the next construction phase cannot be provided. *Some work remains to convert the water balance into a better suited planning tool. BGC is committed to assisting MPMC to complete this task and proposes enlisting the assistance of Dr. Peter McCreath of Clearwater Consultants Ltd. A comprehensive vetting of the water balance is also required to confirm the adequacy of the target 2 Mm^3* ***(now 3 Mm^3)*** *annual discharge volume for MPMC's planning purposes.* **MPMC would like BGC to hold all work until such time as the permitting discussions are advanced with the respective regulatory bodies to provide confidence that the proposed discharge plan will be approved, and can then be incorporated into the water balance model by MPMC.**

This memorandum documents the details of the October 22, 2013 and November 21, 2013 teleconferences and the proposed path forward to support the upcoming interim design raise of the Mount Polley TSF.

Moving forward BGC recommends the following:

- MPMC is to develop a best estimate of timing and rate of water treatment and discharge. This estimate shall include assumptions of seasonality (i.e. are discharges required to coincide with the freshet) and incorporate discharges into the MPMC water balance. **As discussed above, MPMC is currently anticipating initiation of water treatment and discharge as early as the spring of 2014.**
- The updated water balance would then be used to project TSF pond level versus time going forward. Treatment discharge scenarios should include wet and dry hydrologic scenarios, up to and including 1 in 200 year return period wet and dry years. Although such extreme return period years would not be used for design purposes, it is important

to evaluate the impacts of such events and develop contingency plans to deal with them. The present MPMC water balance model appears to utilize wet and dry years based on the site record alone; true hydrologic scenarios will require a broader review of site and regional climate history (BGC has requested the full climate data set but has yet to receive it). The water balance needs to also consider what would happen if the proposed discharge scenario is delayed a year or two or if the treatment proposed is less efficient that designed (there are many variations of treatment implementation and efficiency that can be considered; the level of confidence in the treatment scenarios and timing needs to be identified by MPMC).

- BGC to complete a detailed review of the Mt. Polley water balance model. BGC proposes to enlist Peter McCreath of Clearwater Consultants, or similar, to assist with the review (Dr. McCreath has not been contacted at this time and his availability would have to be confirmed). **As indicated above, this review will wait until MPMC has confirmed the water treatment schedule, and incorporated that schedule within the water balance model.**

After MPMC produces the projected TSF pond volumes and all agree that the water balance predicted volumes appear reasonable, BGC will add these to the tailings production schedule, and the storage-elevation curve, to develop a dam crest raising schedule. From the new crest raising schedule, BGC can then discuss and agree with Mt. Polley on the appropriate target crest elevation for this next “interim” crest raise permitting stage. It should be recognized that the design and construction of a water treatment plant and associated permit amendments may have long timelines and to allow for this work to progress in a timely manner the above referenced path forward should be considered high priority, to be undertaken immediately.

4.0 CLOSURE

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Yours sincerely,

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