APPENDIX E

Proposed Water Treatment Plan for Operations Phase Water Management

TECHNICAL MEMORANDUM

DATE	17 October 2016	**REFERENCE No.**	1411734-163-TM-Rev0-16000
TO	Dale Reimer, General Manager Mount Polley Mining Company		
CC	Jerry Vandenberg and Michael Herrell		
FROM	Henlo du Preez, Michael Bratty, Allan Bronsro and Thalita da Silva Sympovsky	**EMAIL**	Henlo_DuPreez@golder.com; Michael_Bratty@golder.com; Allan_Bronsro@golder.com; Thalita_daSilvaSympovsky@golder.com

PROPOSED WATER TREATMENT PLAN FOR OPERATIONS PHASE WATER MANAGEMENT – MOUNT POLLEY MINE

1.0 INTRODUCTION

The Mount Polley Mine (Mine) is a copper-gold mine owned and operated by Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation. The Mine site is located 56 km northeast of Williams Lake, British Columbia. As authorized by the BC Ministry of Environment (MoE) in the amendment to *Environmental Management Act* (EMA) Permit 11678, the Mine presently treats and discharges Mine contact water in accordance with a short-term water management plan (Golder 2015). Despite this permitted water discharge, there remains surplus volume of Mine contact water in the Springer Pit, and a positive water balance is predicted for the remainder of operations; as a result, there is a need to develop a Long-Term Water Management Plan.

Authorization for discharge of treated effluent as part of the Long-Term Water Management Plan requires an amendment to EMA Permit 11678. To support this amendment, a technical assessment of the effluent discharge is required to identify whether receiving water uses are impaired. That assessment, contained in the Technical Assessment Report (TAR), will be used by the MoE in its permitting decisions and by MPMC in its due diligence to verify that it meets the requirements of the EMA and the Metal Mining Effluent Regulations.

This technical memorandum supports MPMC's TAR by documenting the development of the water treatment plan for excess Mine contact water. The objectives of the memorandum are as follows:

- to define the conceptual influent design basis used to identify and evaluate water treatment requirements; depending on the results from bench test work, which is currently being undertaken, the water treatment plan will optimize existing equipment to meet new treatment targets and constraints for operations
- to describe the performance of the existing water treatment plant (WTP)
- to provide a description of the proposed optimization to the treatment process, including how the optimized process compares to best available technology (BAT)
- to predict the treated effluent quality, based on source water quality and expected treatment performance

The first step to analyzing any water treatment process is to establish an influent design basis for the selection and sizing of treatment technology options. The conceptual design basis is discussed in Section 2.0.

2.0 CONCEPTUAL INFLUENT DESIGN BASIS

A conceptual influent design basis was developed to evaluate whether the existing Actiflo® treatment system has the capacity to meet treatment requirements and, if not, to identify candidate technologies and potential treatment options for the stream targeted for treatment. During operations, the site water to be treated comes from two main sources: the water stored in the Springer Pit and the site runoff that collects in the Perimeter Embankment Till Borrow Pond (PETBP). Depending on seasonal fluctuations and operational requirements, the Mine has the ability to convey water from either of these two sources to the Actiflo treatment plant. The projected future behaviour of this feed stream was analyzed using GoldSim models for the following aspects:

- flow rate (Golder 2016a and Section 2.1 below)
- water quality (Golder 2016b and Section 2.2 below)

The GoldSim models were used for stochastic analyses to quantify the site-wide water balance and water quality under different climate scenarios and with variable source water quality.

2.1 Flow to Water Treatment Facilities

Golder Associates Ltd. (Golder) prepared a stochastic site-wide water balance model to predict Mine site discharge during operations (Golder 2016a). During operations, prior to 4 May 2016, Mine contact water from the PETBP was pumped to the existing WTP at a controlled rate. A direct pipeline from the Springer Pit to the WTP was completed on 4 May 2016, to feed the WTP. The Actiflo system has a design flow rate of 0.23 m^3/s (20,000 m^3/d). The existing maximum authorized total discharge rate is 0.3 m^3/s. When feed water already meets EMA Permit 11678 water quality limits, feed water flows exceeding the design flow may be passed through the WTP in a passive treatment mode as determined by online instrumentation whereby reagents are not added and mechanical mixing is not active. However, to cover the range of feed water qualities that do not already meet EMA Permit 11678 limits, a rate of 0.23 m^3/s was selected for the influent WTP design flow.

2.2 Water Quality in Feed to Treatment Facilities

Water quality predictions are based on the site water quality model (Golder 2016b), which uses a stochastic set of inputs to predict feed water quality over the life of the Mine. The 95th percentile predicted feed water quality from Springer Pit and Perimeter Embankment Till Borrow Pond was screened against proposed Quesnel Lake water quality targets as described in the TAR. Based on assessment of the predicted water quality (Table 1), copper and selenium are the only parameters that are predicted to potentially exceed the water quality targets without additional treatment. Copper concentrations have exceeded the existing EMA Permit 11678 water quality limits, and additional treatment is being investigated.

The maximum of the 95th percentile modelled selenium concentration (87 µg/L) was marginally higher than the proposed effluent limit of 75 µg/L (refer to Section 6.3.2, Effluent Permit Limits of TAR). The modelled values, however, are conservative (refer to Appendix D of TAR); concentrations in the current discharge have remained closer to 30 µg/L, and median long-term predictions are also in this range. It is therefore considered possible, but unlikely, that selenium treatment will be required. If operational monitoring data indicate that selenium concentrations in the discharge trend towards the maximum value of the modelled 95th percentile concentration, additional mitigation, such as reducing selenium concentrations prior to discharge using pit lake treatment, would be implemented.

A monitoring program is currently in place to detect trends in water quality parameters. While the 95th percentile predictions provide a conservative design basis, additional treatment capacity may be required, depending on the ability to bypass water that meets the discharge targets in the future.

Table 1: Operations Treatment Screening

Parameter	Units	Proposed Effluent Discharge Limit	Springer Pit	Perimeter Embankment Till Borrow Pond
Total Metals				
Arsenic	mg/L	0.028	0.0033	0.014
Chromium	mg/L	0.004	0.0013	0.002
Copper	mg/L	0.033	**0.048**	**0.049**
Iron	mg/L	1	0.76	0.69
Lead	mg/L	0.00082	0.00024	0.00041
Molybdenum	mg/L	0.36	0.17	0.18
Nickel	mg/L	0.0051	0.002	0.0024
Selenium	mg/L	0.075	**0.087**	**0.079**
Zinc	mg/L	0.059	0.011	0.026

Note:

Maximum 95th percentile predicted concentrations presented for Springer Pit and Perimeter Embankment Till Borrow Pond

Feed water quality values that exceed target values are highlighted in red.

3.0 EXISTING TREATMENT

In this section, the existing water treatment equipment is described and its site performance is evaluated. Subsequent actions that are needed to meet the most recent operational requirements are listed.

3.1 Actiflo Treatment Plant

The existing WTP makes use of a high-rate ballasted flocculation system, patented under the Actiflo name by Veolia Water Solutions & Technologies, which is a coagulation/sedimentation process. As the nascent floc particles agglomerate around the sand particles, they grow larger and heavier and settle rapidly. This enhanced settling allows clarifier designs with high overflow rates, short retention times (typically 8 to 10 minutes), and orders of magnitude smaller footprint than conventional systems (e.g., settling ponds) of similar capacity. The Actiflo process has the advantage of being able to handle wide variations in hydraulics and solids loading rates.

The high-rate ballasted flocculation unit is illustrated in Figure 1. The system includes one injection tank, one maturation tank, a settling tank, a recirculation pump, and a hydrocyclone. A coagulation stage or reaction stage located upstream of the high-rate ballasted flocculation is required. Feed water enters the process in the coagulation/reaction tank. Here, a coagulant is added to destabilize suspended solids and colloidal matter or to react with dissolved metals in the influent stream. After initial mixing, the water passes into the injection tank, where polymer is added as a flocculation aid and microsand is injected to promote floc settling. The sand particles provide "seeding" zones where the floc particles grow in the next process step.

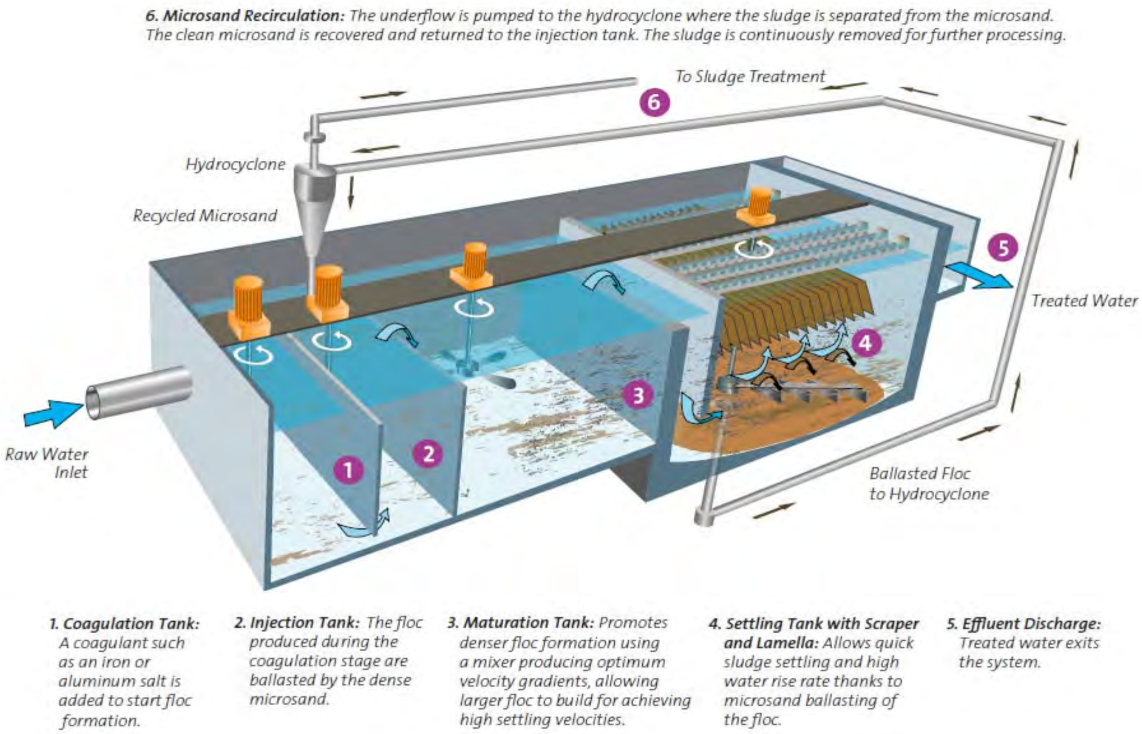

Figure 1: Schematic of the Actiflo Process

Source: Veolia (2016a).

The Actiflo process continues as water passes through an underflow passage from the injection tank into the maturation tank. In this tank, gentler mixing is used to encourage the formation of polymer bridges between the microsand and the suspended solids or metal hydroxides. The large specific surface area of microsand promotes polymer bridging and enmeshment of microsand and floc already in suspension. The fully formed ballasted flocs flow from the maturation tanks to the settling tank. In this tank, laminar conditions through the settling zone provide rapid and effective removal of the microsand/sludge flocs.

Clarified water exits the process via a series of collection troughs. The microsand/sludge flocs are collected at the bottom of the settling tank and pumped to a hydrocyclone for separation. Energy from pumping is converted to centrifugal forces within the body of the hydrocyclone, causing the sludge to separate from the higher density microsand (specific gravity of microsand = 2.65). After separation, the microsand is concentrated and discharged from the bottom of the hydrocyclone for reinjection into the injection tank for reuse. Sand lost from the system is typically less than 2 g/m^3 of treated water. The sludge is discharged from the top of the hydrocyclone because of its lighter density and may flow to a thickening tank or be discharged for final disposal.

Due to the large inventory of microsand in the system, the process can tolerate changing influent total suspended solids (TSS) and turbidity loadings much better than conventional clarifiers can. Settling rates on flocculated microsand are as fast as most conventional chemically assisted gravity settling processes. The process is not sensitive to temperature changes, unlike conventional clarifiers, and can be placed inside a building for freeze protection. Effluent TSS and turbidity levels achieved are consistently low, typically less than 10 mg/L for TSS, and turbidity ranges from 0.2 to 2 nephelometric turbidity units (NTU). The short (10-minute) hydraulic residence time in the clarifier enables the operator to quickly see the effects of process changes made to the system and enables system optimization and adjustments.

Because of the increased settling efficiency of the high-rate ballasted flocculation process, the footprint of this clarification unit is typically $1/20^{th}$ the footprint compared to that of a conventional clarifier sized to treat the same flow rate. This small footprint makes this process particularly well suited for industrial applications, especially in winter operations.

For more design information of the Actiflo plant (model ACP-650), including an equipment list, hydraulic profile, field installation drawings, bill of materials, estimated chemical consumption, and piping and instrumentation diagrams, refer to Attachment A.

3.2 Performance

Since the commissioning of the Actiflo plant in October 2015 and the start of discharge on 1 December 2015, MPMC has been monitoring its performance. TSS and copper removal in particular has not consistently met design criteria while also meeting the flow design criterion of 0.23 m^3/s. An overview of the plant performance, and strategies employed by MPMC to improve performance, are described in more detail in the sections below.

The improvements in the plant equipment and/or operational procedures are expected to allow the plant to consistently meet the discharge targets and constraints.

3.2.1 Total Suspended Solids Removal

The Actiflo plant is designed to reduce TSS concentrations from a maximum of 2,000 mg/L to below 15 mg/L. A TSS concentration of 1,000 mg/L in the Springer Pit was selected in the short-term technical assessment to define the water quality for the influent design basis. This value was chosen as a conservative basis because it was not known at the time whether tailings being deposited into the Springer Pit would become re-suspended. Analysis of TSS monitoring data for the Springer Pit (Golder 2016c,d) indicates that sufficient sedimentation takes place inside the pit so that the pit water at the location of the barge remains below the TSS discharge limit of 15 mg/L. TSS data from the PETBP (Golder 2016e) as measured at the inflow of the WTP show that the TSS concentration is variable and not consistently below 15 mg/L. Therefore, some TSS removal from the mixture of the Springer Pit and the PETBP water is required when the two sources are mixed.

Operational data show that spikes in the WTP outflow TSS exceeding the 15 mg/L limit have been observed. In general, the performance of the Actiflo system can be improved through equalization of the feed and optimization of reagent doses. An optimization program for the MPMC Actiflo plant is being implemented.

From the time that the Actiflo plant came into operation, the TSS concentration in the feed has varied between approximately 5 and 20 mg/L. For the remainder of operations, there could be a risk of higher TSS concentrations as the water level in the Springer Pit is drawn down, or when treatment is required for water from other sources with elevated TSS concentrations.

MPMC has undertaken the following actions to study and manage the sediment load being discharged:

- a formal post-commissioning audit completed by Veolia (2016b) to optimize the system, maximize plant throughput, explore the possibility of increasing throughput beyond design flow, and provide additional training to MPMC operators
- increased water quality monitoring of the Springer Pit water column, including vertical profiles of water quality, and grab samples at multiple depths for several constituents (Golder 2016d)
- installation of a direct pipeline from the Springer Pit to the WTP in the short term, to minimize sediment contamination prior to treatment during drawdown of the pit
- standardized in-house testing and calibration methods for turbidity and TSS to facilitate process optimization
- analysis of TSS and turbidity data from WTP influent and effluent (Golder 2016e) to demonstrate that average monthly and maximum TSS discharge targets of 15 mg/L and 30 mg/L, respectively, can consistently be achieved

3.2.2 Copper Inflow to Treatment

It is evident from Table 1 that at some times during Mine operations, the maximum 95th percentile total and dissolved copper concentrations are predicted to exceed the target values.

Although total copper concentrations in the treated effluent discharge met the existing effluent permit limit from the commencement of discharge in December 2015 until March 2016, a trend of increasing concentrations was observed that resulted in exceedances being recorded in April 2016 (MPMC 2016). An analysis of site sample results over the same period suggests that site runoff water was the main source of elevated copper related to the these exceedances, which was compounded by freshet conditions when the site runoff flow conveyed through the WTP increased. At that time, Springer Pit copper concentrations remained lower than the discharge concentration.

The operation of the direct pipeline from the Springer Pit to the WTP has reduced copper loading in the feed water, and it will be available until water is drawn down in Springer Pit. The total copper concentration within the Springer Pit is below the EMA Permit 11678 limit, but the concentrations are variable and may not consistently meet EMA Permit 11678 limits in the future (Golder 2016d).

Due to the variability in copper inflow levels, MPMC has initiated bench test work to evaluate copper removal methods using different reagents and dosages to support the optimization of the existing Actiflo water treatment plant. This will provide MPMC with the operational flexibility to have a copper removal strategy in place should it wish to treat water sources with higher copper concentrations, or should the copper concentration in the Springer Pit rise as the water level is drawn down.

4.0 PROCESS OPTIMIZATION

As described in the short-term water management plan (Golder 2015), a BAT assessment was conducted, which led to the installation of an Actiflo treatment plant (described in Section 3.1).

The criteria considered in establishing BAT are contained in Attachment B. In the context of an existing WTP, the BAT analysis is focused on the potential optimization to existing treatment process or equipment to achieve the project objectives during operations for the following reasons:

- suitability, simplicity, and robustness of the existing system for removal of all of the constituents of concern, including copper
- proven ability to meet the objectives, under similar circumstances at other mines in Canada
- economics and reduced environmental footprint of existing infrastructure
- minimizing lead time for implementation

Following the operational phase, other technologies may be considered.

It is proposed to retain the existing Actiflo system for the operations phase. The reasons described in the short-term water management plan (Golder 2015) for selecting an Actiflo system as BAT are still valid, and the predicted additional treatment requirements could be achieved through optimization of the Actiflo system.

Having considered the performance of the current Actiflo system (as described in Section 3.0), it is proposed to optimize the treatment system to promote copper removal.

4.1 Copper Removal Process

MPMC adopted a work plan to outline steps to develop and demonstrate a conceptual plan to optimize the existing water treatment plant. The work will evaluate the use of trimercaptotriazine (TMT) and higher dosages of polyaluminum chloride (PAC) to achieve copper removal to low levels.

TMT is a commercial chelating agent used to precipitate heavy metals such as cadmium, copper, and zinc to form low-solubility metal precipitates. PAC, which is already being used as a coagulant on the existing Actiflo plant, does not require pH correction after dosage, produces less sludge, and performs better in cold water.

MPMC has initiated a work plan to conduct trials in Golder's Vancouver water treatment laboratory, using representative samples collected on site. The chemistry of TMT is simple and robust: TMT is used to sequester copper (and other divalent cations), while coagulant addition produces an aluminum hydroxide precipitate that adsorbs the TMT-metal complex. Depending on the initial concentration, TMT has shown removal rates in excess of 80% for the precipitation of copper. Furthermore, in some cases, low effluent copper levels can be met with coagulant addition alone.

It is expected that the TMT and coagulant process can be carried out in conjunction with the current water treatment process and infrastructure, with minor or no equipment additions, for the removal of fine or colloidal sediments and other metals. The process can be inhibited by competing metals, oxidants, or chelating agents, so the reagent dosages vary with changing feed water quality. The TMT and coagulant reagents are shipped as a liquid and dosed into the head of the existing system using simple metering pumps and automation. A real-time control system, based on flow and inlet turbidity to set the reagent doses, is envisioned. The TMT process does not reduce the hydraulic capacity of the plant.

Golder's engineers have direct design and operations experience with a similar process using similar equipment (Actiflo) at the Minto Mine in the Yukon, where the process met effluent targets.

The by-product of the process is a water treatment sludge, largely made up of aluminum hydroxide. The trace metals are typically stable, and the sludge will be disposed by conventional means, such as in tailings. The planned work will further characterize the sludge and establish suitable disposal methods.

4.2 Treated Water Quality

By optimizing the Actiflo system to include copper removal through TMT and/or increase PAC coagulant dosing, the dissolved copper concentration is expected to be reduced by at least 80%, subject to confirmation by bench test work. While very effective for copper removal, TMT is also effective for removing other base metals and its dosage can be adjusted if required.

The optimized Actiflo system is expected to reduce the concentration of metals in the treated water to below the proposed treated water quality targets provided in Table 1. The Actiflo is not designed to remove selenium, but selenium concentration will be monitored during operations and if needed a treatment solution for selenium removal will be implemented.

5.0 CONCLUSIONS

The following conclusions can be drawn for the work conducted to identify an operations phase treatment strategy for MPMC:

- Based on the site-wide water balance model, a maximum discharge flow rate of 0.6 m^3/s would mitigate the risk of uncontrolled discharge at the 99.5% confidence level. The existing Actiflo system has a design flow rate of 0.23 m^3/s (20,000 m^3/d). The water balance model predicts that an operational treatment rate of 0.23 m^3/s would be sufficient to meet overall discharge requirements, although provisions have been put in place to operate at 0.3 m^3/s in passive mode when feed water quality meets permit limits. A portion of the site-wide flow may pass through the treatment system, in passive mode, if the water quality meets the discharge requirements.
- The projected water quality for the treated discharge stream indicates that additional copper removal may be required, in addition to the current requirement for TSS removal.
- It is unlikely that selenium treatment will be required during operations. Selenium concentration will continue to be monitored and if required, additional mitigation, such as reducing selenium concentrations prior to discharge using pit lake treatment, would be implemented.
- Considering the site requirements, the BAT for the operational phase is determined to be an optimized Actiflo process. Adding TMT and coagulants would be expected to bring the effluent into compliance with the discharge permit, subject to confirmatory bench testing work being undertaken by MPMC.
- The existing equipment may be adapted to use TMT and aluminum coagulants (or aluminum coagulants alone) to reduce the copper concentration to below the target values. The TMT and coagulant processes are robust, and proven at other sites in Canada. The processes are also effective for removal of other base metals, should the need arise.

6.0 CLOSURE

We trust the above meets your present requirements. If you have any questions or requirements, please contact the undersigned.

GOLDER ASSOCIATES LTD.

Henlo du Preez, BEng
Senior Water Treatment Specialist

Michael Bratty, MEng, PEng
Senior Water Treatment Engineer

Allan Bronsro, MCIP, Peng
Associate, Senior Water Resources Engineer

Thalita da Silva Sympovsky, M.Eng., P.Eng.
Environmental/Process Engineer

HDP/MB/AB/cf/ls/pn/kp

Attachments: Study Limitations
Attachment A: Actiflo Unit
Attachment B: BAT Criteria

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ATTACHMENT A
Actiflo Unit

SUMMARY OF ACP-650

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	MOUNT POLLEY
SUMMARY OF ACP-650	0	SUBMITTAL FOR INSTALLATION	G.D.W	G.P.	2015-09-02		
	1						
	2					REF. No.	5000281502 Rev. 0
	3						
DESSIN /DWG #	4					Date:	2015-09-02

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION			P&ID I.D./TAG	OBJECT ACCOUNT	SUBSIDIARY	FA/SA/FI SITE	P / N
				ACTIFLO UNIT - ACP-650							
				Application:							
				WasteWater Treatment Plant							
				Number of unit:							
				1 Actiflo (ACP)							
				Manufacturer:							
				Veolia Water							
				Actiflo Model							
				ACP-650							
				Equipement voltage							
				575V							
				ACTIFLO PROCESS							
					NOMINAL FLOW	**MAX. FLOW**					
				Capacity per unit	10,000 m³/d	20,000 m³/d					
				Rise rate	40 m/h	80 m/h					
				Retention time							
				Coagulation tank	2.3 mins	1.15 mins					
				Injection tank	2.3 mins	1.15 mins					
				Maturation tank	6.3 mins	3.15 mins					

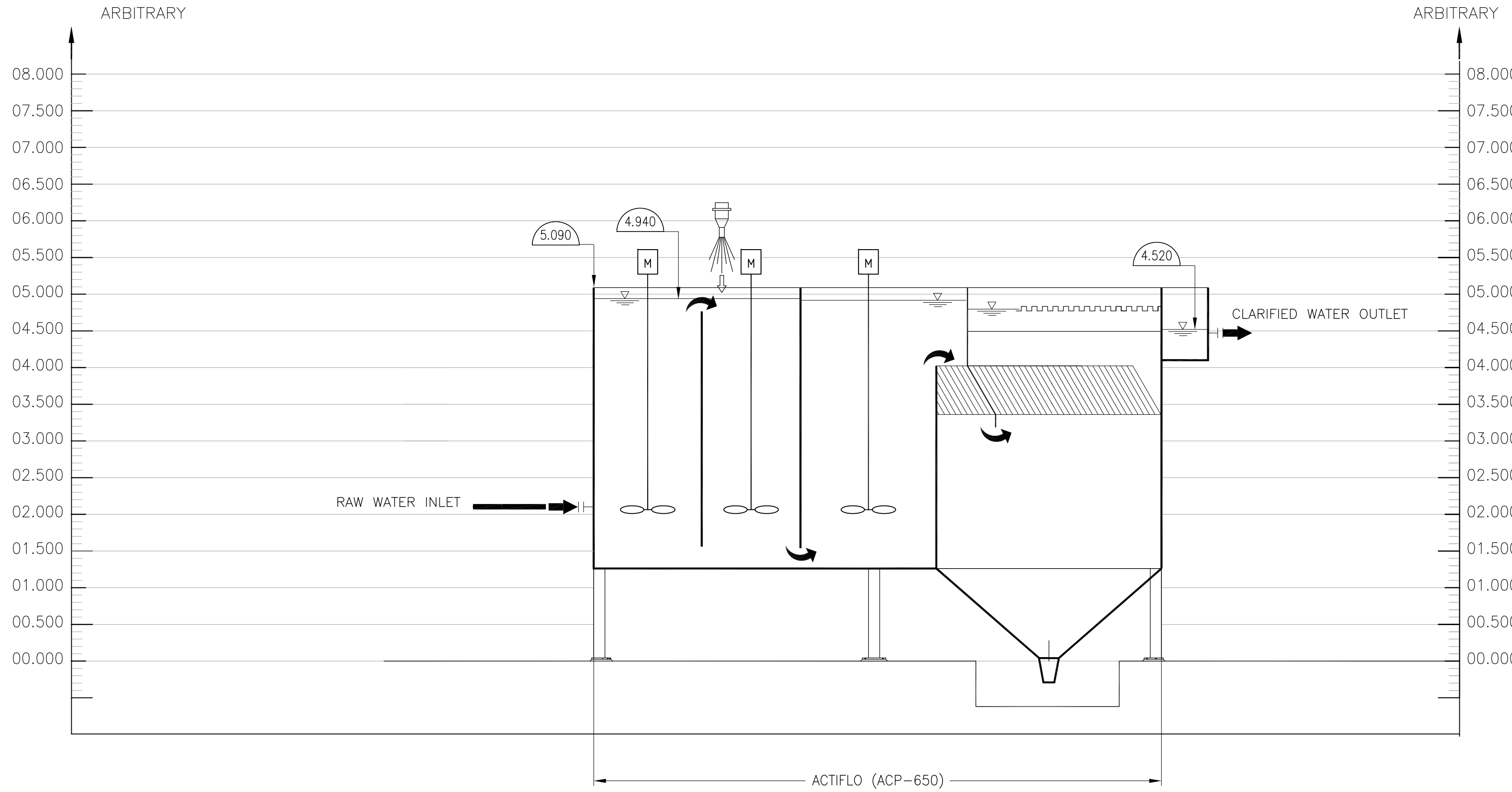
NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	MOUNT POLLEY
SUMMARY OF ACP-650	0	SUBMITTAL FOR INSTALLATION	G.D.W	G.P.	2015-09-02		
	1						
	2					REF. No.	5000281502 Rev. 0
	3						
DESSIN /DWG #	4					Date:	2015-09-02

REV.	ITEM		QTE/QTY. Unit.	Total	DESCRIPTION	P&ID I.D./TAG	OBJECT ACCOUNT	SUBSIDIARY	FA/SA/FI SITE	P / N
					SETTLING TANK					
					Height of lamella pack:					
					610 mm [24"] vertical					
					Type:					
					DH85					
					Angle:					
					60 degrees from horizontal					
					Collection troughs:					
					3 per Actiflo unit					
					RECIRCULATION SYSTEM					
					Quantity of complete recirculation line:					
					2 per Actiflo unit Note: each recirculation line has one hydrocyclone and one pump					
					Recirculation rate @ Max. flow:					
					One (1) pump running with 75 m^3/h (9% recirculation)					
					Two (2) pump running with 150 m^3/h (18% recirculation)					
					Sludge production flow @ Max. flow:					
					60 m^3/h @ one pump running					

End of the list

HYDRAULIC PROFILE



DESIGN FLOW:

Qmax = 20 000 m³/d

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DESIGNER	DATE
SID	2015-06-29
CHECKER	DATE
G.D.W.	2016-06-29
ENGINEER	DATE
G.P.	2016-06-29
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TITLE
TENDER AQUAMOVE
HYDRAULIC PROFILE

CLIENT
MT. POLLEY MINE

VEOLIA WATER Solutions & Technologies

John Meunier
4105 Sartelon Street,
Saint-Laurent, Qc, Canada H4S 2B3
Tel: (514) 334-7230 / Fax: (514) 334-5070

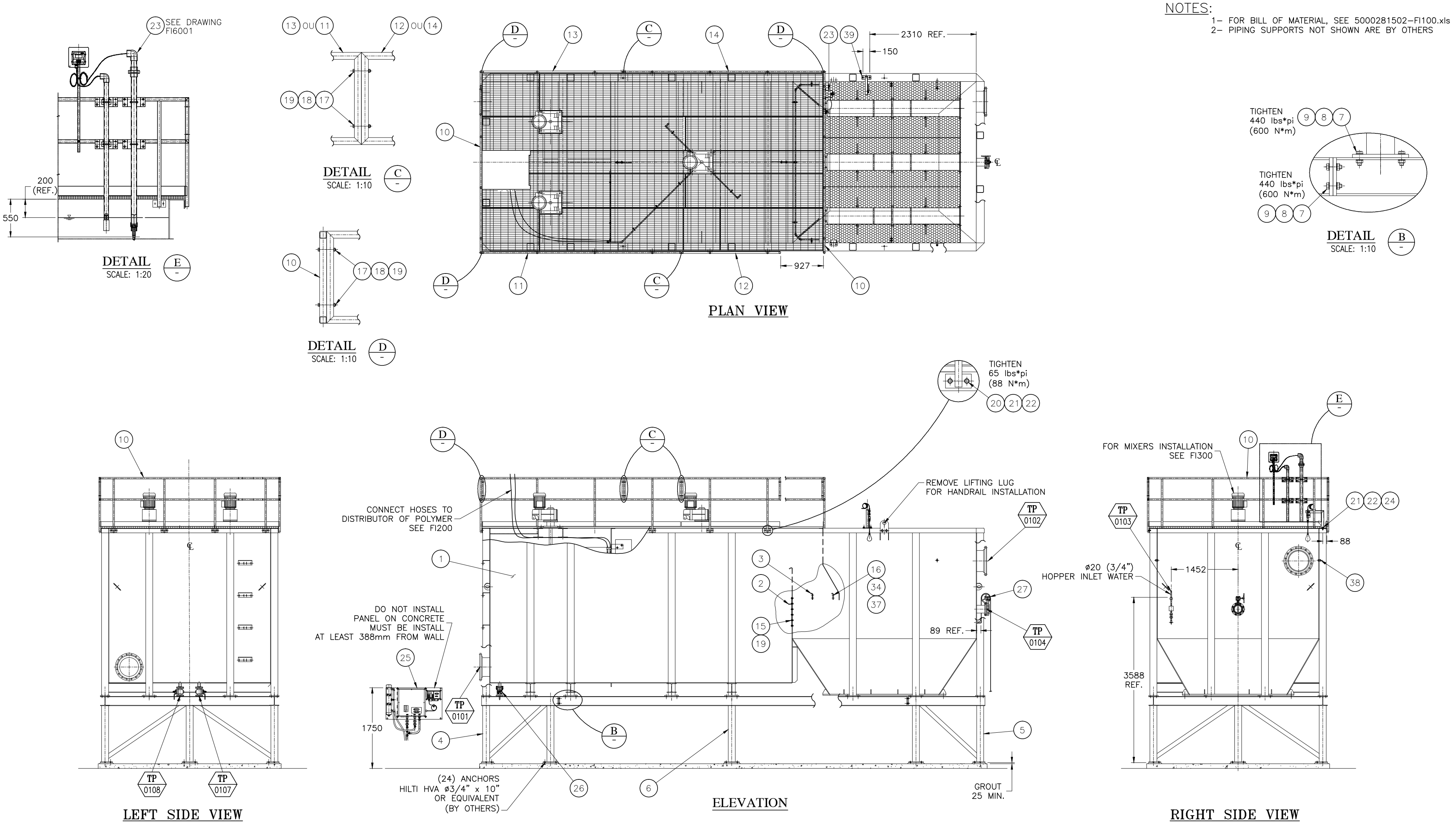
PROJECT	DRAWING	INTERNAL	SHEET	REV
5000281502	HY001		1 OF 1	2

STD: "D" 22x34 REF: BAR = 1" AT PLOT SCALE

FIELD INSTALLATION DRAWINGS & BOM

Sep 03, 2015 8:26:24 - W:\2015\5000281502 - Mount Polley (ST98793)\15- Dessins execution_Drawings\5- FI\5000281502-FI100ACP650_1.dwg - iddirsma

NOTES:
1- FOR BILL OF MATERIAL, SEE 5000281502-FI100.xls
2- PIPING SUPPORTS NOT SHOWN ARE BY OTHERS



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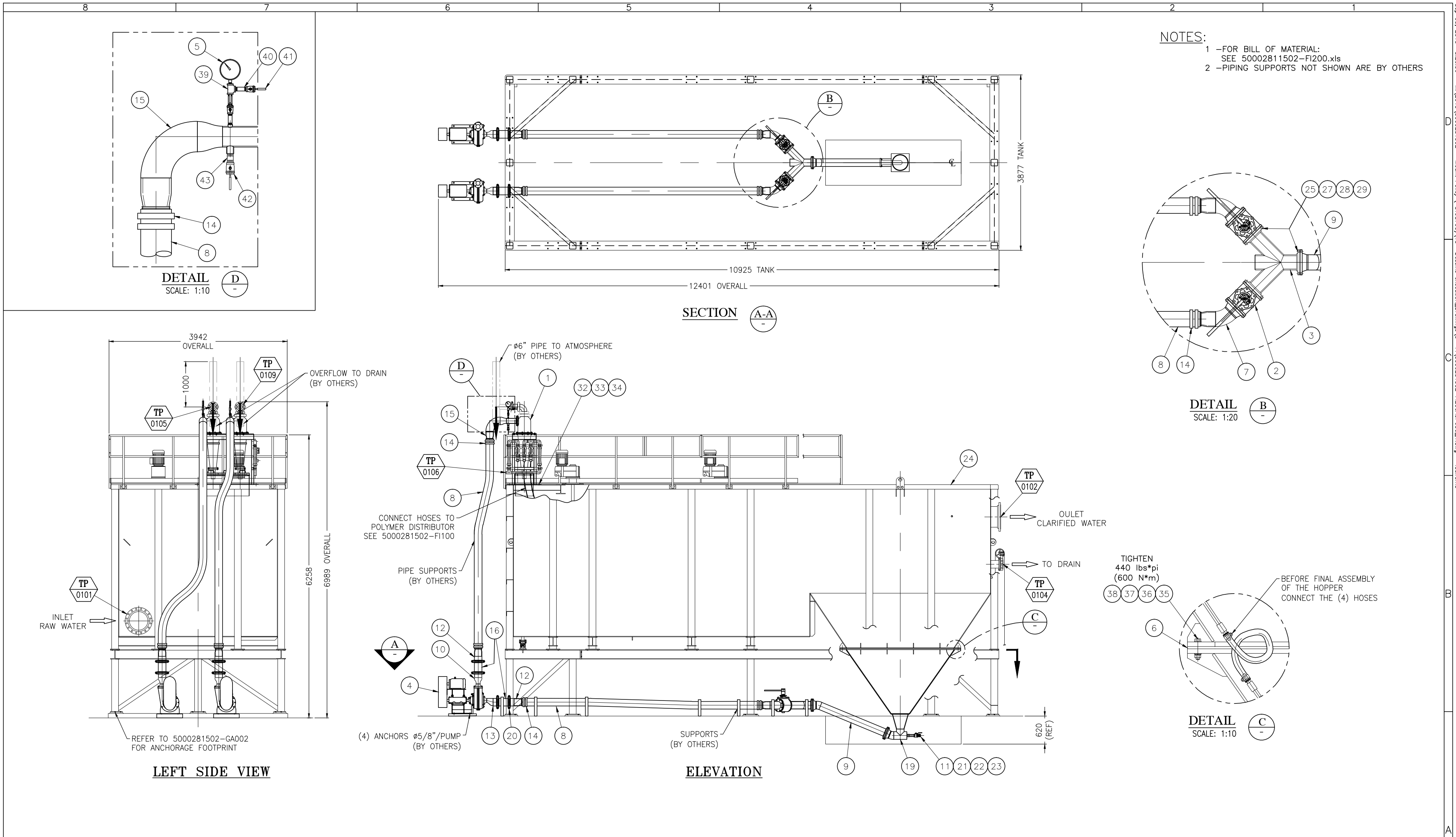
STD: "D" 22x34 | REF: 2003_X-308 | BAR = 1" AT PLOT SCALE

DESIGNER: Y.R.	DATE: 2015-08-13	TITLE: ACTIFLO ACP-650 ACTIFLO TANK ASSEMBLY FIELD INSTALLATION
CHECKER: S.M.	DATE: 2015-08-13	CLIENT: MOUNT POLLEY
ENGINEER: G.P.	DATE: 2015-08-13	VEOLIA
SCALE: 1:40		PROJECT DRAWING: 5000281502 – FI100

VEOLIA WATER TECHNOLOGIES CANADA INC. 4105 Sartelon, Saint-Laurent, Qc, Canada. Tel: (514) 334-7230

PROJECT DRAWING	INTERNAL	SHEET	REV
5000281502 – FI100	ACP650	1 OF 1	1



REV	DESCRIPTION	DATE	REV'D	CHK'D	APV'D	ECN
1	FOR INSTALLATION	2015-08-14	Y.R.	G.D.W	G.P.	N/A

STD: "D" 22x34 — REF: 2003_X-308 — BAR = 1" AT PLOT SCALE

CONFIDENTIALITY AND INTELLECTUAL PROPERTY NOTICE

DESIGNER	DATE
Y.R.	2015-08-13
CHECKER	DATE
G.D.W	2015-08-13
ENGINEER	DATE
G.P.	2015-08-13
SCALE:	1:40

TITLE: ACTIFLO ACP-650 RECIRCULATION LINE FIELD INSTALLATION

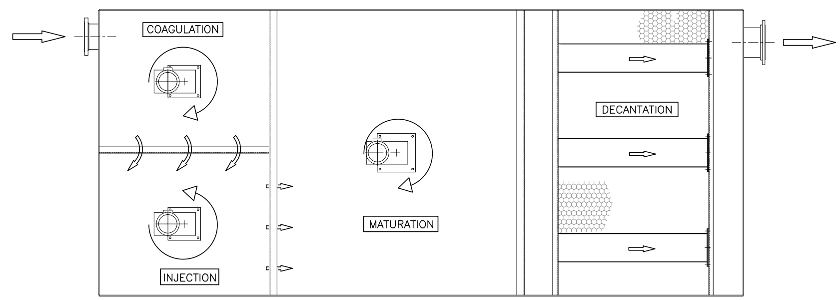
CLIENT: MOUNT POLLEY

VEOLIA

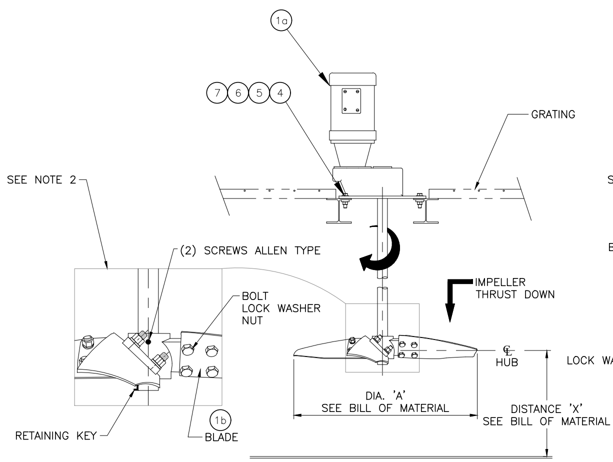
VEOLIA WATER TECHNOLOGIES CANADA INC.

PROJECT DRAWING	INTERNAL	SHEET	REV
5000281502 - FI200	ACP650	1 OF 1	1

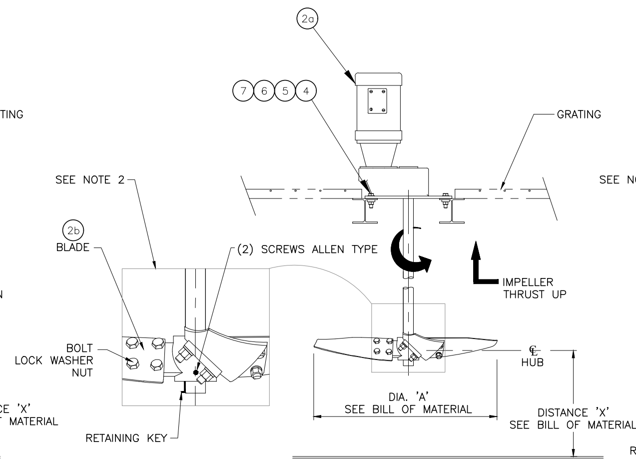
NOTES:
1- FOR BILL OF MATERIAL, SEE 5000281502-FI300.xls
2- HUB AND BLADES COULD BE SHIPPED LOOSE IF BLADE DIAMETER IS TO LARGE



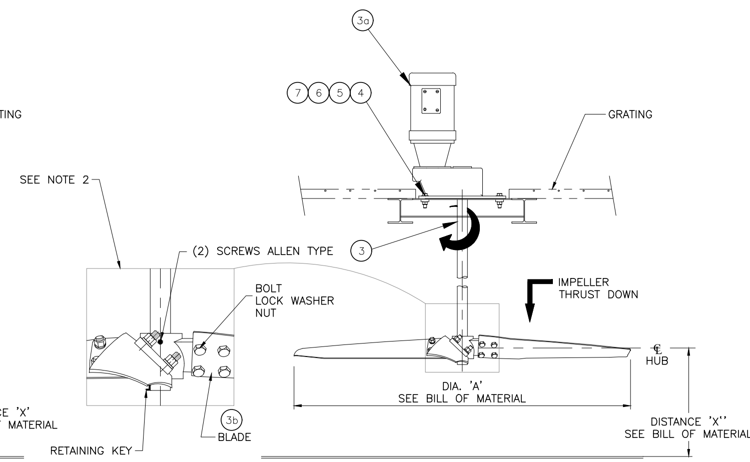
PLAN VIEW



COAGULATION TANK



INJECTION TANK



MATURATION TANK

REV	DESCRIPTION	DATE	REV'D	CHK'D	APV'D	ECN
1	FOR INSTALLATION	2015-08-14	Y.R.	S.M.	G.P.	N/A

STD: "D" 22x34 | REF: 2003_X-308 | BAR = 1" AT PLOT SCALE

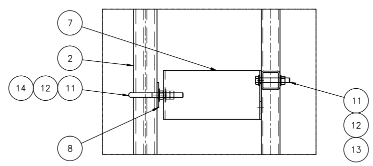
DESIGNER: Y.R.	DATE: 2015-08-13	TITLE: ACTIFLO ACP-650 MIXERS ASSEMBLY FIELD INSTALLATION
CHECKER: S.M.	DATE: 2015-08-13	CLIENT: MOUNT POLLEY
ENGINEER: G.P.	DATE: 2015-08-13	VEOLIA — VEOLIA WATER TECHNOLOGIES CANADA INC. 4105 Sartelon, Saint-Laurent, Qc, Canada, Tel: (514) 334-7230
SCALE: 1:40		PROJECT / DRAWING: 5000281502 – FI300 · INTERNAL: ACP650 · SHEET: 1 OF 1 · REV: 1

NOTES:

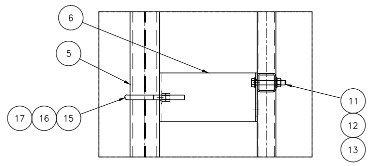
1- FOR PARTS LIST SEE BILL OF MATERIAL: 5000281502-FI6001.

2- FOR INSTALLATION POSITION SEE: 50002815021-FI100.

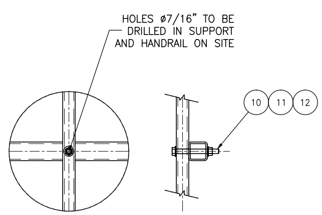
3- FOR INSTALLATION DETAILS SEE ALSO MANUFACTURER'S INSTRUCTIONS INCLUDED IN O&M MANUAL.



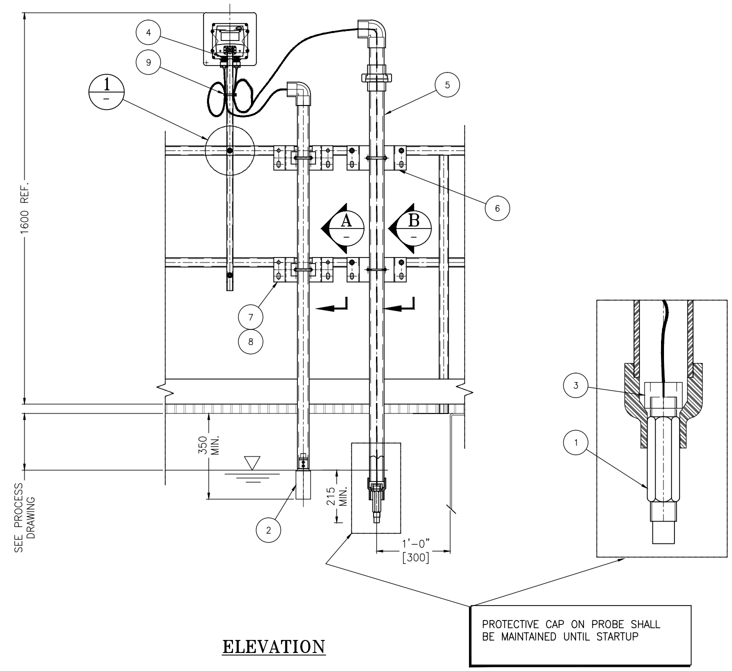
SECTION A
SCALE: 1:5



SECTION B
SCALE: 1:5



DETAIL 1
SCALE: 1:5



ELEVATION

REV	DESCRIPTION	DATE	REV'D	CHK'D	APV'D	ECN
1	FOR INSTALLATION	2015-08-20	F.C.	G.D.W.	G.P.	N/A

DESIGNER: O.F.	DATE: 2006-04-11	TITLE: pH PROBE MODEL "DPD1R1", TURBIDIMETER MODEL "SOLITAX" AND TRANSMITTER SC200, FIELD INSTALLATION ON HANDRAILS
CHECKER: C.T.	DATE: 2006-04-12	CLIENT: MOUNT POLLEY
ENGINEER: –	DATE: –	VEOLIA Water Solutions & Technologies CANADA Inc. 4105 Sartelon Street, Saint-Laurent, Qc, Canada H4S 2B3 Tel: (514) 334-7230 / Fax: (514) 334-5070
SCALE: 1:10		PROJECT / DRAWING: 5000281502 – FI6001; INTERNAL: CTR2100; SHEET: 1 OF 1; REV: 1

STD: "D" 22x34 | REF: | BAR = 1" AT PLOT SCALE

VEOLIA

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE		Rev.	DESCRIPTION	DATE	Rev	Ver/chk	Appr.	Affaire / Contract	MOUNT POLLEY
ACP-650 TANK ASSEMBLY		0							
		1	FOR INSTALLATION	2015-08-13	1	GP	PSM		
		2						REF. No.	5000281502 Rev. 1
		3							
DESSIN /DWG #	FI-100	4						Date:	2015-08-13

REV.	ITEM		QTE/QTY. Unit.	Total	DESCRIPTION	INV. /Plan Ref. Drawing	P&ID I.D./TAG	Commentaires / Comments
	5000281502-FI100-	1	1	1	ACP-650 TANK	STOCK		
	5000281502-FI100-	2	1	1	ACCESS DOOR	FA104		
	5000281502-FI100-	3	2	2	LAMELLA SUPPORT	FA116		
	5000281502-FI100-	4	1	1	BASE#1 (LEFT HAND), 725 kg (1595 lbs)	STOCK		
	5000281502-FI100-	5	1	1	BASE#2 (RIGHT HAND), 725 kg (1595 lbs)	STOCK		
	5000281502-FI100-	6	2	2	BASE#3, 450 kg (990 lbs)/UNIT	STOCK		
	5000281502-FI100-	7	80	80	BOLT HEX. 3/4"-UNC x 3" LG., GRADE 8, ZINC	FXSC_______		
	5000281502-FI100-	8	80	80	NUT HEX. 3/4"-UNC, GRADE 8, ZINC	FXNU_______		
	5000281502-FI100-	9	160	160	FLAT WASHER 3/4" NOM., GRADE 8, ZINC	FXWA_______		
	5000281502-FI100-	10	2	2	HANDRAILS, 66 kg (146 lbs)/UNIT	STOCK		
	5000281502-FI100-	11	1	1	HANDRAILS, 73 kg (161 lbs)	STOCK		
	5000281502-FI100-	12	1	1	HANDRAILS, 40,5 kg (89 lbs)	STOCK		
	5000281502-FI100-	13	1	1	HANDRAILS, 52 kg (114 lbs)	STOCK		
	5000281502-FI100-	14	1	1	HANDRAILS, 73 kg (161 lbs)	STOCK		
	5000281502-FI100-	15	22	22	HEX. BOLT HD 3/8"-16 UNC x 1 1/2", 304	FXSCYS200376		
	5000281502-FI100-	16	8	8	HEX. BOLT HD 5/8"-11 UNC x 2", 304	FXSCYY200493		
	5000281502-FI100-	17	10	10	BOLT 3/8"-UNC x 3-1/2" LG., SS 304	FXSCYS200385		
	5000281502-FI100-	18	18	18	NUT HEX. 3/8"-UNC, SS 304	FXNUYS200206		
	5000281502-FI100-	19	58	58	FLAT WASHER 3/8" NOM., SS 304	FXWAYS200666		
	5000281502-FI100-	20	36	36	BOLT HEX. 1/2"-UNC x 1-1/2" LG., SS 304, ASTM F593C	FXSCYV200426		
	5000281502-FI100-	21	38	38	NUT HEX. 1/2"-UNC, SS 304, ASTM F594C	FXNUYV200213		
	5000281502-FI100-	22	76	76	FLAT WASHER 1/2" NOM., SS 304	FXWAYV200670		
	5000281502-FI100-	23	1	1	TRANSMITTER AND TURBIDITY SENSOR/ PH SENSOR	FI6001		
	5000281502-FI100-	24	2	2	HEX. HEAD SCREW Ø1/2"-13UNC x 1 3/4" (304)	FXSCYV200428		
	5000281502-FI100-	25	1	1	RAW WATER TURBIDIMETER PANEL	STOCK		
	5000281502-FI100-	26	2	2	PLUG VALVE ø50	STOCK		
	5000281502-FI100-	27	1	1	BUTTERFLY VALVE ø150	STOCK		
	5000281502-FI100-	28			NOT USED	_		
	5000281502-FI100-	29			NOT USED	_		
	5000281502-FI100-	30			NOT USED	_		
	5000281502-FI100-	31			NOT USED	_		
	5000281502-FI100-	32	LOT	LOT	MICROSAND	ST-011		
	5000281502-FI100-	33	1	1	CONTROL PANEL (NOT SHOWN ON DRAWING)	AUTOMATION		
	5000281502-FI100-	34	8	8	HEX. NUT 5/8"-11 UNC, 304	FXNUYY200221		
	5000281502-FI100-	35			NOT USED	_		
	5000281502-FI100-	36			NOT USED	_		
	5000281502-FI100-	37	16	16	FLAT WASHER 5/8", 304	FXWAYY200674		
	5000281502-FI100-	38	1	1	PLUG Ø3/4" MNPT, #150 (304)	FPPLSS302202		
	5000281502-FI100-	39	1	1	LEVEL SWITCH	SA6001		

Fin de la liste / End of list

VEOLIA

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE		Rev.	DESCRIPTION	DATE	Rev	Ver/chk	Appr.	Affaire / Contract	MOUNT POLLEY
ACP-650 RECIRCULATION LINE		0							
		1	FOR INSTALLATION	2015-08-13	1	G.D.W.	G.P.		
		2						REF. No.	5000281502 Rev. 1
		3							
DESSIN /DWG #	FI-200	4						Date:	2015-08-13

REV.	ITEM		QTE/QTY. Unit.	Total	DESCRIPTION	INV. /Plan Ref. Drawing	P&ID I.D./TAG	Commentaires / Comments
	5000281502-FI-200	1	1	1	HYDROCYCLONES	SA-500		
	5000281502-FI-200	2	2	2	PLUG VALVE ø6", 304	ST-999-003		
	5000281502-FI-200	3	1	1	RECIRCULATION "Y" PIPE ø6"	FA102		
	5000281502-FI-200	4	2	2	RECIRCULATION PUMP	ST-999-001		
	5000281502-FI-200	5	2	2	PRESSURE GAUGE 0-60 PSI ASHCROFT	5IMPSGG300401		
	5000281502-FI-200	6	1	1	HOPPER GASKET	FA106		
	5000281502-FI-200	7	2	2	RECIRCULATION PIPE ø6"	FA102		
	5000281502-FI-200	8	1	1	FLEXIBLE TUBE Ø6" ID, Ø170mm OD, GREEN FDA,150PSI ALFAGOMMA 720LG-6 LG. APPROX.: 16,320 mm	FTTUCS305972		
	5000281502-FI-200	9	1	1	RECIRCULATION PIPE ø6"	FA102		
	5000281502-FI-200	10	2	2	CONCENTRIC REDUCER ø6" x ø3"	FA102		
	5000281502-FI-200	11	1	1	CAM LOCK MALE ø1 1/2" x FNPT, PART "A", 316	FPADSS314244		
	5000281502-FI-200	12	4	4	RECIRCULATION PIPE ø6"	FA102		
	5000281502-FI-200	13	2	2	ECCENTRIC REDUCER ø6" x ø3"	FA102		
	5000281502-FI-200	14	12	12	HOSE CLAMP W4, Ø162mm x Ø174mm (304)	FXCLZL306213		
	5000281502-FI-200	15	2	2	RECIRCULATION PIPE ø6"	FA102		
	5000281502-FI-200	16	4	4	RECIRCULATION PIPE ø6"	FA102		
	5000281502-FI-200	17			NOT USED	-		
	5000281502-FI-200	18			NOT USED	-		
	5000281502-FI-200	19	1	1	HOPPER DETAIL	FA105		
	5000281502-FI-200	20	8	8	RIGIDE COUPLING "GRUVLOCK" Ø6", SEAL EPDM (GALV.) STYLE-07	FPAD________		
	5000281502-FI-200	21	1	1	BALL VALVE Ø1 1/2" FNPT, "FULL PORT" (316) PMP	ST-999-004		
	5000281502-FI-200	22	1	1	NIPPLE ø1 1/2" x 4" LONG, MNPT, 304	FPNISS302200		
	5000281502-FI-200	23	1	1	NIPPLE ø1 1/2" x 2" LONG, MNPT, 304	FPNISS312727		
	5000281502-FI-200	24	1	1	TANK ASSEMBLY	FI100		
	5000281502-FI-200	25	5	5	GASKET FLANGE Ø6",FF, 1/8" TH (RED RUBBER)	SEGAFP200126		
	5000281502-FI-200	26			NOT USED	-		
	5000281502-FI-200	27	40	40	HEX. HD BOLT ø3/4"-10 UNC x 3 1/2", 304	FXSCZC200548		
	5000281502-FI-200	28	40	40	HEX. NUT ø3/4"-10 UNC, 304	FXNUZC200229		
	5000281502-FI-200	29	80	80	FLAT WASHER ø3/4", 304	FXWAZD200680		
	5000281502-FI-200	30			NOT USED	-		
	5000281502-FI-200	31			NOT USED	-		
	5000281502-FI-200	32	4	4	HEX. HD BOLT ø5/8"-11 UNC x 1 1/2", 304	FXSCYY200491		
	5000281502-FI-200	33	4	4	HEX. NUT ø5/8"-11 UNC, 304	FXNUYY200221		
	5000281502-FI-200	34	8	8	FLAT WASHER ø5/8", 304	FXWAYY301425		
	5000281502-FI-200	35	30	30	HEX. HD BOLT ø3/4"-10 UNC x 4", GRADE 8, ZINC	FXSC________		
	5000281502-FI-200	36	30	30	HEX. NUT ø3/4"-10 UNC, GRADE 8, ZINC	FXNU________		
	5000281502-FI-200	37	30	30	LOCK WASHER ø3/4", GRADE 8, ZINC	FXWA________		
	5000281502-FI-200	38	60	60	FLAT WASHER ø3/4", GRADE 8, ZINC	FXWA________		
	5000281502-FI-200	39	2	2	TEE ø1/2" FNPT, 304	FPTESS202724		
	5000281502-FI-200	40	6	6	NIPPLE 1/2 x 3", 304	FPNISS302608		
	5000281502-FI-200	41	4	4	BALL VALVE Ø1/2" FNPT, "FULL PORT" (BRASS)	VABLBR200260		
	5000281502-FI-200	42	2	2	BALL VALVE Ø1" FNPT, "FULL PORT" (BRASS)	VABLBR200262		
	5000281502-FI-200	43	2	2	NIPPLE 1 x 3", 304	FPNISS314056		
	5000281502-FI-200	44			NOT USED	-		

End of list

VEOLIA

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE		Rev.	DESCRIPTION	DATE	Rev	Ver/chk	Appr.	Affaire / Contract	MOUNT POLLEY
ACP-650 - MIXERS ASSEMBLY		0							
		1	FOR INSTALLATION	2015-08-13	0A	GP	PSM		
		2						REF. No.	5000281502 Rev. 1
		3							
DESSIN /DWG #	FI-300	4						Date:	2015-08-13

REV.	ITEM		QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	INV. /Plan Ref. Drawing	P&ID I.D./TAG	Commentaires / Comments
	5000281502-FI300-	1a	1	1	COAGULATION MIXER	STOCK		
					MODEL : "ENVIREQUIP" MODEL: MIX-TECH EVG 5-5			
					MODEL: MIX-TECH EVG 5-5			
					MTL : SS 304L			
					C/W 5 HP MOTOR, 575 Vac / 3 ph / 60 Hz, 1770 rpm, TEFC, HE			
					WEIGHT : 287 kg			
	5000281502-FI300-	1b	1	1	COAGULATION MIXER BLADES	STOCK		
	5000281502-FI300-	2a	1	1	INJECTION MIXER	STOCK		
					MODEL : "ENVIREQUIP" MODEL: MIX-TECH EVG 5-5			
					MODEL: MIX-TECH EVG 5-5			
					MTL : SS 304L			
					C/W 5 HP MOTOR, 575 Vac / 3 ph / 60 Hz, 1770 rpm, TEFC, HE			
					WEIGHT : 287 kg			
	5000281502-FI300-	2b	1	1	INJECTION MIXER BLADES	STOCK		
	5000281502-FI300-	3a	1	1	MAURATION MIXER	STOCK		
					MODEL : "ENVIREQUIP" MODEL: MIX-TECH EVG 5-5			
					MODEL: MIX-TECH EVG 5-3			
					MTL : SS 304L			
					C/W 3 HP MOTOR, 575 Vac / 3 ph / 60 Hz, 1770 rpm, TEFC, HE			
					WEIGHT : 393 kg			
	5000281502-FI300-	3b	1	1	MATURATION MIXER BLADES	STOCK		
	5000281502-FI300-	4	12	12	BOLT HEX. 7/8"-UNC x 2-1/2" LG., SS. 304	FXSCYI200316		
	5000281502-FI300-	5	12	12	NUT HEX. 7/8"-UNC, SS 304	FXNUYI200193		
	5000281502-FI300-	6	12	12	WASHER PLATE 7/8" NOM., SS 304	FXWAYI200658		
	5000281502-FI300-	7	12	12	SPRING WASHER 7/8" NOM., SS 304	FXWAYI200659		

Fin de la liste / End of list

VEOLIA

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE		Rev.	DESCRIPTION	DATE	Rev	Ver/chk	Appr.	Affaire / Contract	MOUNT POLLEY
CLARIFIIED WATER pH METER "DPD1R1", TURBIDIMETER "SOLITAX" & SC200 CONTROLLER FIELD INSTALLATION		1	FOR INSTALLATION	2015-08-20	F.C.	G.D.W.	G.P.		
		2							
		3						REF. No.	5000281502 Rev. 1
		4							
DESSIN /DWG #	FI6001	5						Date:	2015-07-16

REV.	ITEM		QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	INV. /Plan Ref. Drawing	P&ID I.D./TAG	Commentaires / Comments
	5000281502-FI6001-	1	1	1	pH PROBE "DPD1R1"	ST-004-2	AE 2-014	
	5000281502-FI6001-	2	1	1	CLARIFIED WATER TURBIDIMETER MODEL: "SOLITAX" C/A SC200 CONTROLLERASSEMBLY	SA6011	AIT 2-013 AIT 2-014 AE 2-013	
	5000281502-FI6001-	3	1	1	HALF COUPLING Ø1" FNPT, #150, 1 9/16" DE (304)	FPADSS312210		
	5000281502-FI6001-	4	2	2	CABLE CONNECTOR Ø1/2" CABLE Ø3/16" @ Ø5/8", IPEX (PVC)	CECKGU200251		
	5000281502-FI6001-	5	1	1	PIPE SUPPORT & GUIDE FOR pH PROBE 2" DIA. PVC x 1850mm LG.	FA151		
	5000281502-FI6001-	6	2	2	MOUNTING BRACKET 200mm LG.FOR pH PROBE SS304L FOR HANDRAIL INSTALLATION	FA6009		
	5000281502-FI6001-	7	2	2	MOUNTING BRACKET 200mm LG.FOR SOLITAX SS304L FOR HANDRAIL INSTALLATION	FA6012		
	5000281502-FI6001-	8	2	2	MOUNTING PLATE LG.FOR SOLITAX SS304L FOR HANDRAIL INSTALLATION	FA6013		
	5000281502-FI6001-	9	1	1	CABLE TIE 7" NYLON BLACK	FXTIYO200120		
	5000281502-FI6001-	10	2	2	HEX. HEAD SCREW Ø3/8"-16UNC x 3 1/2" (304)	FXSCYS200385		
	5000281502-FI6001-	11	28	28	FLAT WASHER Ø3/8", SAE TYPE N (304)	FXWAYS200666		
	5000281502-FI6001-	12	22	22	HEX.NUT Ø3/8"-16UNC (304)	FXNUYS200206		
	5000281502-FI6001-	13	8	8	HEX. HEAD SCREW Ø3/8"-16UNC x 2 1/2" (304)	FXSCYS200380		
	5000281502-FI6001-	14	2	2	U BOLT PIPE Ø1 1/2", ROD Ø3/8"-16UNC, EXTENDED (304)	FXUBZE200617		
	5000281502-FI6001-	15	2	2	U BOLT PIPE Ø2", ROD Ø1/4"-20UNC, EXTENDED (304)	FXUBZG200620		
	5000281502-FI6001-	16	8	8	HEX.NUT Ø1/4"-20UNC (304)	FXNUYP200199		
	5000281502-FI6001-	17	4	4	FLAT WASHER Ø1/4", SAE TYPE N (304)	FXWAYP200662		

Fin de la liste / End of list

ESTIMATED CHEMICALS CONSUMPTION

ESTIMATED CHEMICALS CONSUMPTION

Project:	**MOUNT POLLEY**
Poject No.	**5000281502**
Version:	**1**

Total Max. Flow:	**20 000**	m^3/d

Liquid Polyaluminum Chloride

	MIN.	**AVERAGE**	MAX.
Dosage (ul/L)	**100**	**150**	**250**
Volume per day (L /d)	2 000	**3 000**	5 000
Volume per hour (L /h) @	83	**125**	208
Alum volume per year (m^3/y)		**1095**	
Metering pump (1) maximum capacity			**220 L/h**
Metering pump (2) maximum capacity			**400 L/h**

Dry Polymer

Solution concentration: 0,20% @ nominal flow = 2 g/L

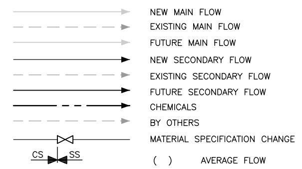
		MIN.	**AVERAGE**	MAX.
Dosage (mg/L or g/m^3)		1,00	**1,50**	3,00
Dry weight per day (kg/d)		20	**30**	60
Volume per day (L /d) @	0,20%	10 000	**15 000**	30 000
Volume per hour (L /h) @	0,20%	417	**625**	1 250
Dry polymer dosage per year (kg/y)		7 300	**10 950**	21 900
Metering pump maximum capacity				**1250 L/h**

Microsand

	MIN.	**AVERAGE**	MAX.
Losses (g/m^3)	1,00	**2,00**	3,00
Dry weight per day (kg/d)	20	**40**	60
Microsand per year (kg/yr)	7 300	**14 600**	21 900

Note:
. The data listed hereinabove is for information only and under no gurantee.
. The jar test should be used to determine the optimum dosing rate.

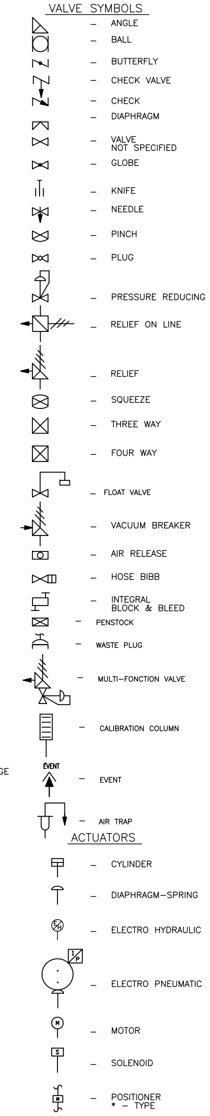
FLOWS AND LINES



ABBREVIATIONS

A TO C	–	AIR TO CLOSE
A TO O	–	AIR TO OPEN
AVG	–	AVERAGE
B/EL	–	BOTTOM ELEVATION
CL	–	CENTER LINE
CFM	–	CUBIC FEET PER MINUTE
CW	–	CITY WATER (POTABLE)
DIA	–	DIAMETER
DWG	–	DRAWING
EL	–	ELEVATION
F.C.	–	FAIL CLOSED
F.O.	–	FAIL OPEN
FRL	–	FILTER\REGULATOR\LUBRICATOR
GAL	–	GALLONS
GPD	–	GALLONS PER DAY
GPH	–	GALLONS PER HOUR
GPM	–	GALLONS PER MINUTE
HB	–	HOSE BIB
HG	–	INCHES OF MERCURY
HI	–	HIGH
HOA	–	HAND/OFF/AUTO
HP	–	HORSEPOWER
IA	–	INSTRUMENT AIR
ID	–	INSIDE DIAMETER
INV	–	INVERT
LO	–	LOW
MH	–	MANHOLE
MW	–	MANWAY
N.C.	–	NORMALLY CLOSED
N.O.	–	NORMALLY OPEN
OAL	–	OVERALL LENGTH
O.D.	–	OUTSIDE DIAMETER
OF	–	OVERFLOW
PA	–	PLANT AIR
PSIG	–	POUNDS PER SQUARE INCH – GAUGE
PW	–	PLANT WATER
RED	–	REDUCER
RPM	–	REVOLUTIONS PER MINUTE
SCFM	–	STANDARD CUBIC FEET PER MINUTE
SCH	-	SCHEDULE
SG	-	SPECIFIC GRAVITY
SP	-	SETPOINT
SSH	-	STRAIGHT SIDE HEIGHT
STD	-	STANDARD
SW	-	SEAL WATER
SWD	-	SIDE WATER DEPTH
TDH	-	TOTAL DYNAMIC HEAD(FT OF FLUID)
T/EL	-	TOP ELEVATION
TYP	-	TYPICAL
VAC	-	VACUUM
VSD	-	VARIABLE SPEED DRIVE
WC	-	WATER COLUMN
WD	-	WATER DEPTH
WL	-	WATER LEVEL
WV	-	WORKING VOLUME (DOES NOT INCLUDE FREEBOARD OR HEEL)

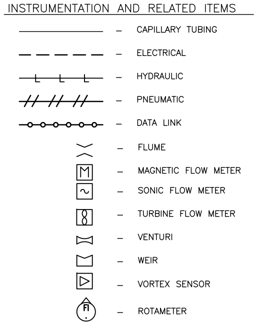
VALVE SYMBOLS



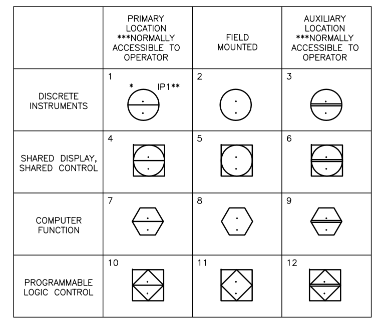
PIPING AND TUBING MATERIALS

ABS	-	ACRYLONTRILE BUTADIENE STYRENE TRUSS PIPE
ALM	-	ALUMINUM PIPE OR TUBING
ARP	-	ALUMINUM REINFORCED PLASTIC PIPE
BL	-	BLACK IRON PIPE
BPT	-	BRAIDED PLASTIC TUBING–PVC
CI	-	CAST IRON PIPE
CISP	-	CAST IRON SOIL PIPE
CMCP	-	CORRUGATED METAL CULVERT PIPE
CMH	-	CHEMICAL HOSE
CMP	-	CORRUGATED METAL PIPE
COP	-	COPPER PIPE
CPVC	-	CHLORINATED POLYVINYL CHLORIDE PIPE
CS	-	CARBON STEEL PIPE
DI	-	DUCTILE CAST IRON PIPE
ERP	-	EPOXY RESIN PIPE
FRP	-	FIBERGLASS REINFORCED PLASTIC PIPE
GS	-	GALVANIZED STEEL PIPE
HOSE	-	FLEXIBLE HOSE
HSI	-	HIGH SILICON IRON PIPE
KLS	-	PVDF LINED STEEL PIPE (KYNAR ® LINED TYPICAL)
KYN	-	PVDF (KYNAR ® TYPICAL)
MI	-	CARBON STEEL PIPE W/MALLEABLE IRON FITTINGS
NEO	-	NEOPRENE HOSE
NI	-	NICKEL ALLOY PIPE
NLS	-	NEOPRENE LINED STEEL PIPE
PEP	-	POLYETHYLENE PIPE
PETB	-	POLYETHYLENE TUBING
PLS	-	POLYPROPYLENE LINED STEEL PIPE
POP	-	POLYPROPYLENE PIPE
PRP	-	PHENOLIC RESIN PIPE
PVC	-	POLYVINYL CHLORIDE PIPE
PVC HOSE	-	POLYVINYL CHLORIDE HOSE
PVDF	-	POLYVINYLIDENE FLUORIDE PIPE
RBR	-	RUBBER HOSE
RCCP	-	REINFORCED CONCRETE CULVERT PIPE
RCP	-	REINFORCED CONCRETE PIPE
SAR	-	SARAN TUBING
SLH	-	SLUDGE HOSE
SLS	-	SARAN LINED STEEL PIPE
SS	-	STAINLESS STEEL PIPE OR TUBING
TEF	-	TEFLON TUBING
TI	-	TITANIUM ALLOY PIPE
TLS	-	TEFLON LINED STEEL PIPE
TYB	-	TYGON ® TUBING–BRAIDED
TYG	-	TYGON ® TUBING–UNBRAIDED

INSTRUMENTATION AND RELATED ITEMS



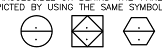
INSTRUMENT SYMBOLS



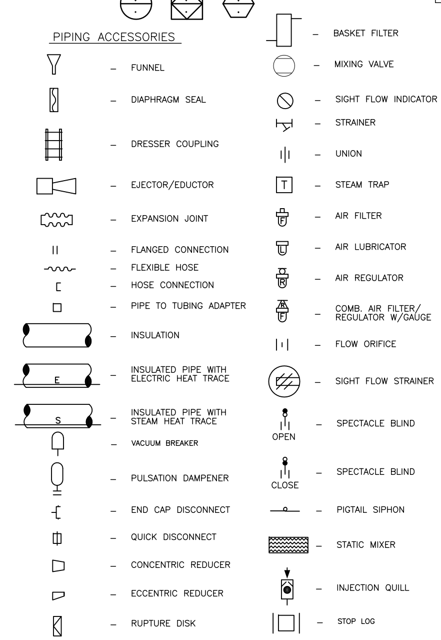
* SYMBOL SIZE MAY VARY ACCORDING TO THE USER'S NEEDS AND THE TYPE OF DOCUMENT. A SUGGESTED SQUARE AND CIRCLE SIZE FOR LARGE DIAGRAMS IS SHOWN ABOVE. CONSISTENCY IS RECOMMENDED.

** ABBREVIATIONS OF THE USER'S CHOICE SUCH AS IP1 (INSTRUMENT PANEL #1), IC2 (INSTRUMENT CONSOLE #2), CC3 (COMPUTER CONSOLE #3), ETC., MAY BE USED WHEN IT IS NECESSARY TO SPECIFY INSTRUMENT OR FUNCTION LOCATION.

*** NORMALLY INACCESSIBLE OR BEHIND–THE–PANEL DEVICES OR FUNCTIONS MAY BE DEPICTED BY USING THE SAME SYMBOL BUT WITH DASHED HORIZONTAL BARS, I.E.



PIPING ACCESSORIES



ISA INSTRUMENT IDENTIFICATION TABLE

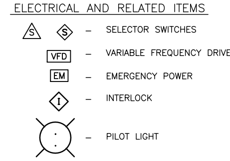
	FIRST LETTER		SUCCEEDING LETTERS	
	PROCESS VARIABLE	MODIFIER (IF NEEDED)	READOUT OR COMPUTER FUNCTION	MODIFIER (IF NEEDED)
A	ANALYSIS		ALARM	
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE
C	USER'S CHOICE		CONTROL	
D	USER'S CHOICE	DIFFERENTIAL		
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)	
F	FLOW RATE	RATIO (FRACTION)		
G	USER'S CHOICE		GLASS, VIEWING DEVICE	
H	HAND			HIGH
I	CURRENT (ELECTRICAL)		INDICATE	
J	POWER	SCAN		
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE	CONTROL STATION	
L	LEVEL		LIGHT	LOW
M	USER'S CHOICE	MOMENTARY		MIDDLE, INTERMEDIATE
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE (RESTRICTION)	
P	PRESSURE, VACUUM		POINT (TEST CONNECTION)	
Q	QUANTITY	INTEGRATE, TOTALIZE		
R	RADIATION		RECORD	
S	SPEED, FREQUENCY	SAFETY	SWITCH	
T	TEMPERATURE		TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECH. ANALYSIS		VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL	
X	UNCLASSIFIED	X–AXIS	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESENCE	Y–AXIS	RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z–AXIS	DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

LEGEND BASED ON ISA STANDARD S 5.1

INSTRUMENT TAG NUMBERS

TIC 103 – INSTRUMENTATION IDENTIFICATION OR TAG NUMBER
103 – LOOP NUMBER
TIC – FUNCTIONAL IDENTIFICATION
NOTE: HYPHENS ARE OPTIONAL AS SEPARATORS

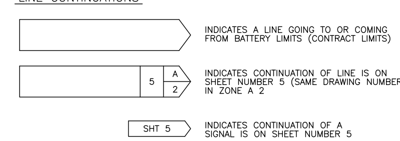
ELECTRICAL AND RELATED ITEMS



LINE NUMBER IDENTIFICATION

1"–P–110–CS–I
- INSULATION
- MATERIAL CLASS
- LINE NUMBER
- FLUID SERVICE DESIGNATION
- LINE SIZE

LINE CONTINUATIONS



EQUIPMENT TAG NUMBERS

MXXXX	AGITATORS, AERATORS
BXXXX	AIR HANDLING–BLOWERS, COMPRESSORS, DRYERS
RXXXX	CLARIFIERS, THICKENERS, SEPARATORS
FXXXX	FILTERS–VACUUM, PRESSURE, CENTRIFUGES
PXXXX	PUMPS
TXXXX	TANKS
EXXXX	HEAT EXCHANGER
IXXXXX	SOFTENERS, DEMINERALIZERS
ROXXXX	REVERSE OSMOSIS UNITS
SGXXXX	STEAM GENERATORS

VALVE & ACCESSORY TAG

VXXXX	VALVE
EJXXXX	EXPANSION JOINT
HXXXX	HOSE
FXXXX	FILTER
SXXXX	STRAINER
SBXXXX	SPECTACLE BLIND
STXXXX	STEAM TRAP

REV	DESCRIPTION	DATE	REV'D	CHK'D	APV'D	ECN
2	FOR INSTALLATION	2015–09–02	SID	G.D.W.	G.P.	N/A
01	FOR APPROVAL	2015–08–03	Y.R.	G.D.W.	G.P.	N/A

DESIGNER: Y.R.	DATE: 2015–07–29
CHECKER: G.D.W.	DATE: 2015–07–29
ENGINEER: G.P.	DATE: 2015–07–29
SCALE: P.A.E.	

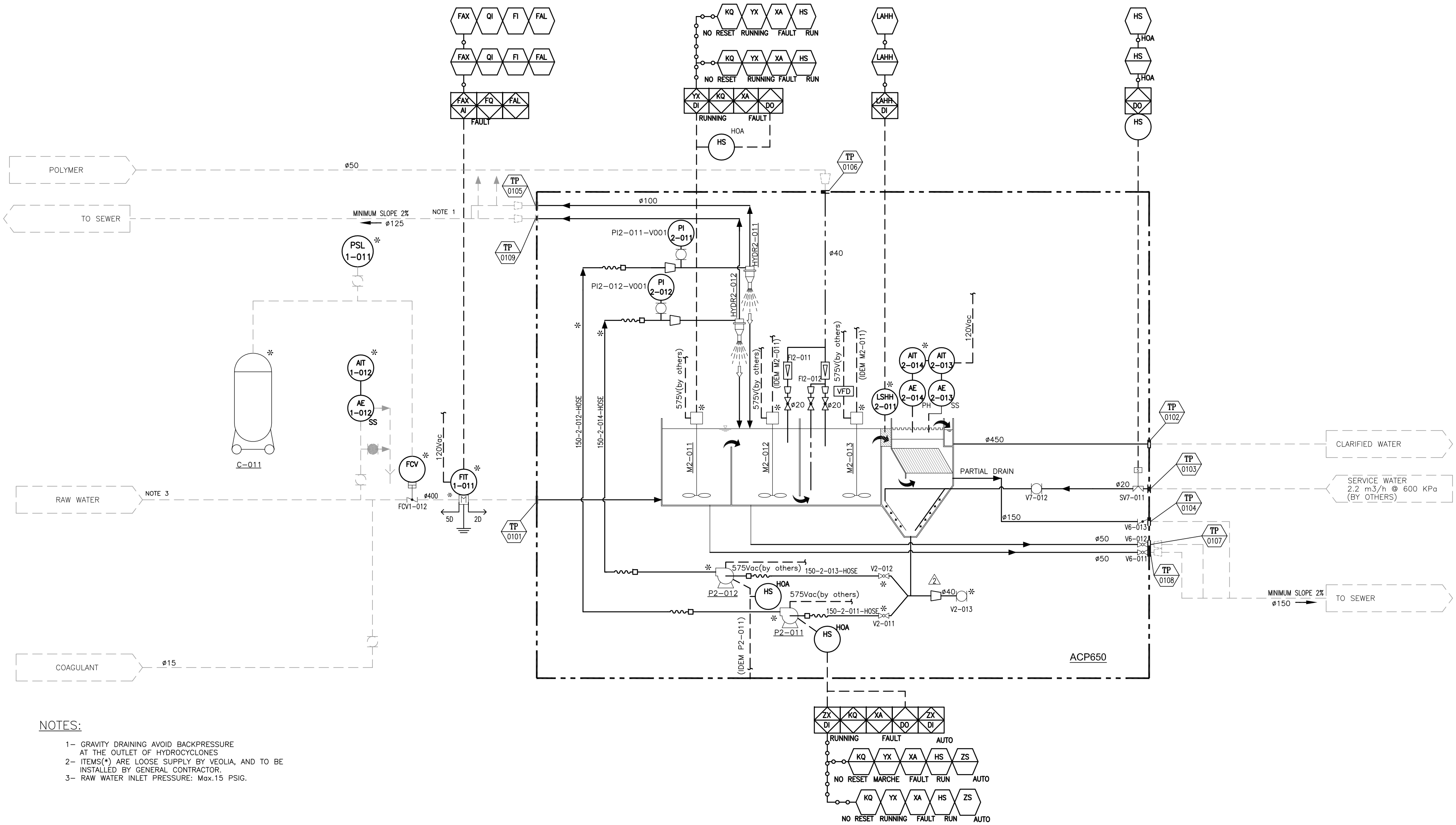
TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
WATER TREATMENT SYSTEM
LEGEND

CLIENT: MOUNT POLLEY

VEOLIA
VEOLIA WATER TECHNOLOGIES CANADA INC. 4105 Sartelon, Saint-Laurent, Qc, Canada, Tel.(514) 334-7230

PROJECT DRAWING	INTERNAL	SHEET	REV
5000281502 – PI000	PCH0000	1 OF 1	2

STD: "D" 22x34 REF: ED09–PI003 BAR = 1" AT PLOT SCALE



NOTES:

1– GRAVITY DRAINING AVOID BACKPRESSURE AT THE OUTLET OF HYDROCYCLONES
2– ITEMS(*) ARE LOOSE SUPPLY BY VEOLIA, AND TO BE INSTALLED BY GENERAL CONTRACTOR.
3– RAW WATER INLET PRESSURE: Max.15 PSIG.

C–011
COMPRESSOR
5.4 SCFM(9.2m3/h) @90 PSI
AIT TANK: 56.8 L
15 A; 120V/60Hz; 1750 RMP

M2–011
MIXER
COAGULATION TANK
MOTOR 5 HP
575V/3Ph/60Hz

M2–012
MIXER
INJECTION TANK
MOTOR 5 HP
575V/3Ph/60Hz

M2–013
MIXER
MATURATION TANK
MOTOR 3 HP
575V/3Ph/60Hz

P2–011/P2–012
RECIRCULATION PUMP
DEBIT: 75 m³/h
MOTOR 20 HP
575V/3Ph/60Hz

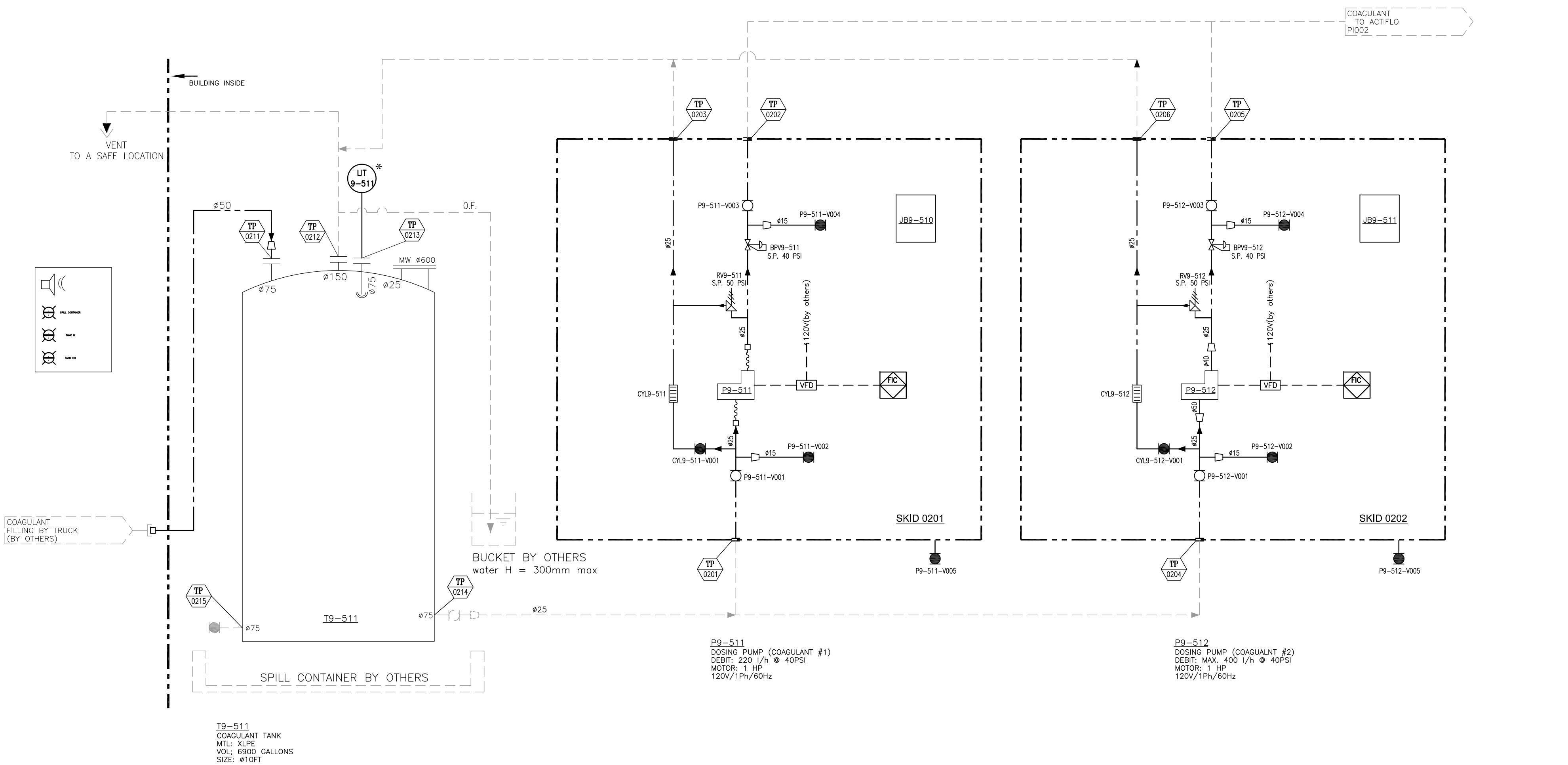
*	SUPPLIED BY JMI
(heavy line)	SUPPLIED BY JMI
(line)	SUPPLIED BY JMI
(line)	CHEMICALS SUPPLIED BY JMI
(dashed line)	BY OTHERS OR EXISTANT
(heavy line)	SKID LIMITS
(hatched line)	PNEUMATIC
(dashed line)	ELECTRICITY OR CONTROL
(linked circles)	DATA LINK
(pipe with E)	HEAT TRACED PIPING WITH INSULATION
AI	SCADA (OPTIONAL)
(hexagon)	LOCAL HMI
(boxed)	ON LOCAL PLC

DI,DO,AI,AO : PLC I/O

REV	DESCRIPTION	DATE	REV'D	CHK'D	APV'D	ECN
2	FOR INSTALLATION	2015-09-02	SID	G.D.W.	G.P.	N/A
1	FOR APPROVAL	2015-08-07	Y.R.	G.D.W.	G.P.	N/A

DESIGNER: Y.R.	DATE: 2015-07-29	TITLE: PROCESS AND INSTRUMENTATION DIAGRAM WATER TREATMENT SYSTEM ACTIFLO (ACP650)
CHECKER: G.D.W.	DATE: 2015-07-29	CLIENT: MOUNT POLLEY
ENGINEER: G.P.	DATE: 2015-07-29	VEOLIA — VEOLIA WATER TECHNOLOGIES CANADA INC. 4105 Sartelon, Saint-Laurent, Qc, Canada, Tel:(514) 334-7230
SCALE: P.A.E.		PROJECT: 5000281502 – DRAWING: PI001 — INTERNAL: PCH0000 — SHEET: 1 OF 1 — REV: 2

STD: "D" 22x34 — REF: ED09–PI003 — BAR = 1" AT PLOT SCALE



* SUPPLIED BY JMI
SUPPLIED BY JMI
SUPPLIED BY JMI
CHEMICALS SUPPLIED BY JMI
BY OTHERS OR EXISTANT
SKID LIMITS

PNEUMATIC
ELECTRICITY OR CONTROL
DATA LINK
HEAT TRACED PIPING WITH INSULATION

SCADA (OPTIONAL)
LOCAL HMI
ON LOCAL PLC
DI,DO,AI,AO : PLC I/O

REV	DESCRIPTION	DATE	REV'D	CHK'D	APV'D	ECN
2	FOR INSTALLATION	2015–09–02	SID	G.D.W.	G.P.	N/A
1	FOR APPROVAL	2015–08–07	Y.R.	G.D.W.	G.P.	N/A

DESIGNER	Y.R.	DATE 2015–07–29
CHECKER	G.D.W.	DATE 2015–07–29
ENGINEER	G.P.	DATE 2015–07–29
SCALE:	P.A.E.	

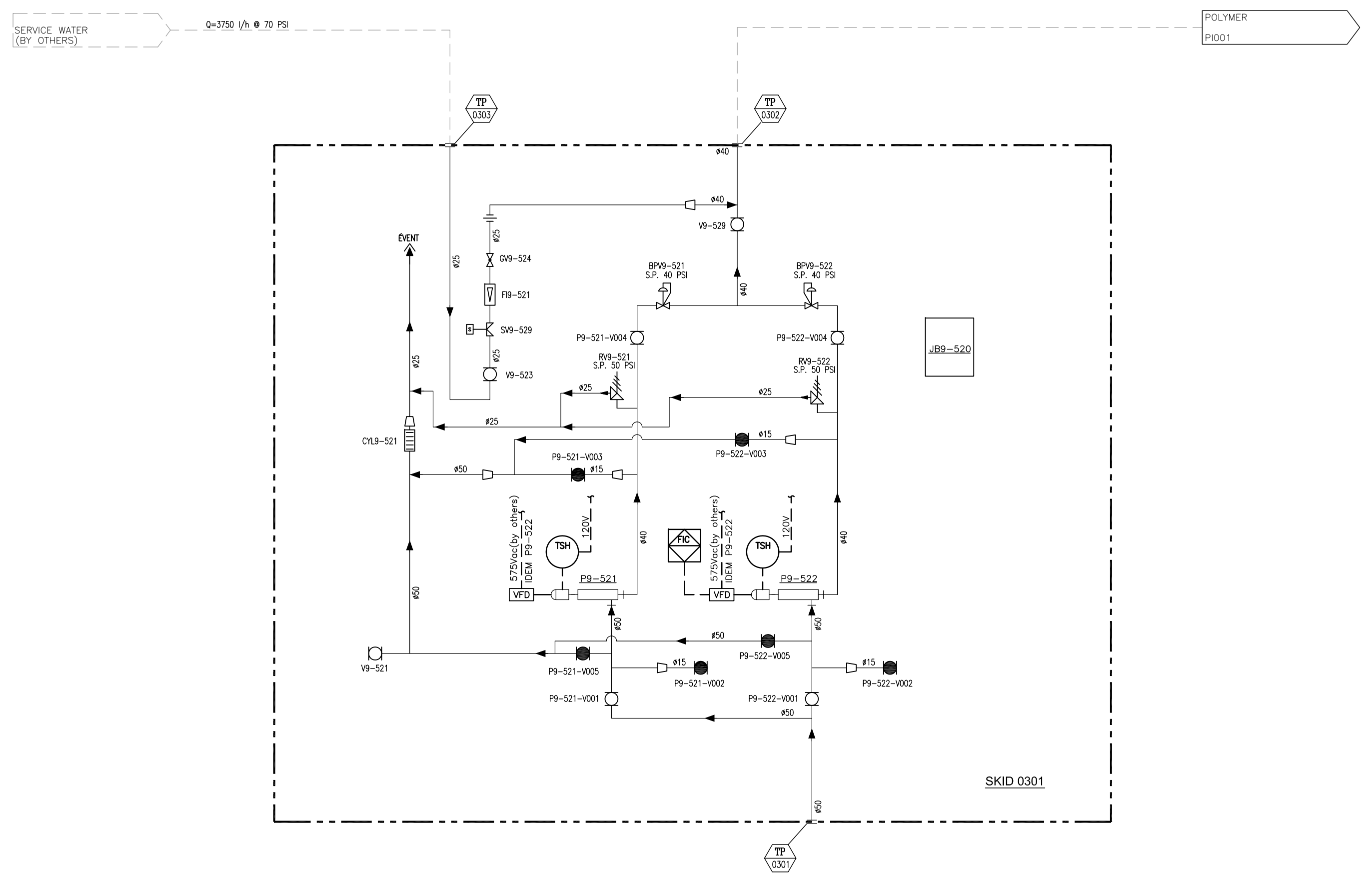
TITLE
PROCESS AND INSTRUMENTATION DIAGRAM
WATER TREATMENT SYSTEM
COAGULANT #1 AND COAGULANT #2

CLIENT
MOUNT POLLEY

VEOLIA
VEOLIA WATER TECHNOLOGIES CANADA INC. 4105 Sartelon, Saint-Laurent, Qc, Canada, Tel.(514) 334-7230

PROJECT DRAWING	INTERNAL	SHEET	REV
5000281502 – PI002	PCH0000	1 OF 1	2

STD: "D" 22x34
REF: ED09–PI003
BAR = 1" AT PLOT SCALE



P9-521
DOSING PUMP
MAX. FLOWRATE: 1294 l/h
MOTOR: 1 HP
575V/3Ph/60Hz

P9-522
DOSING PUMP
MAX. FLOWRATE: 1294 l/h
MOTOR: 1 HP
575V/3Ph/60Hz

✻ SUPPLIED BY JMI
SUPPLIED BY JMI
SUPPLIED BY JMI
CHEMICALS SUPPLIED BY JMI
BY OTHERS OR EXISTANT
SKID LIMITS

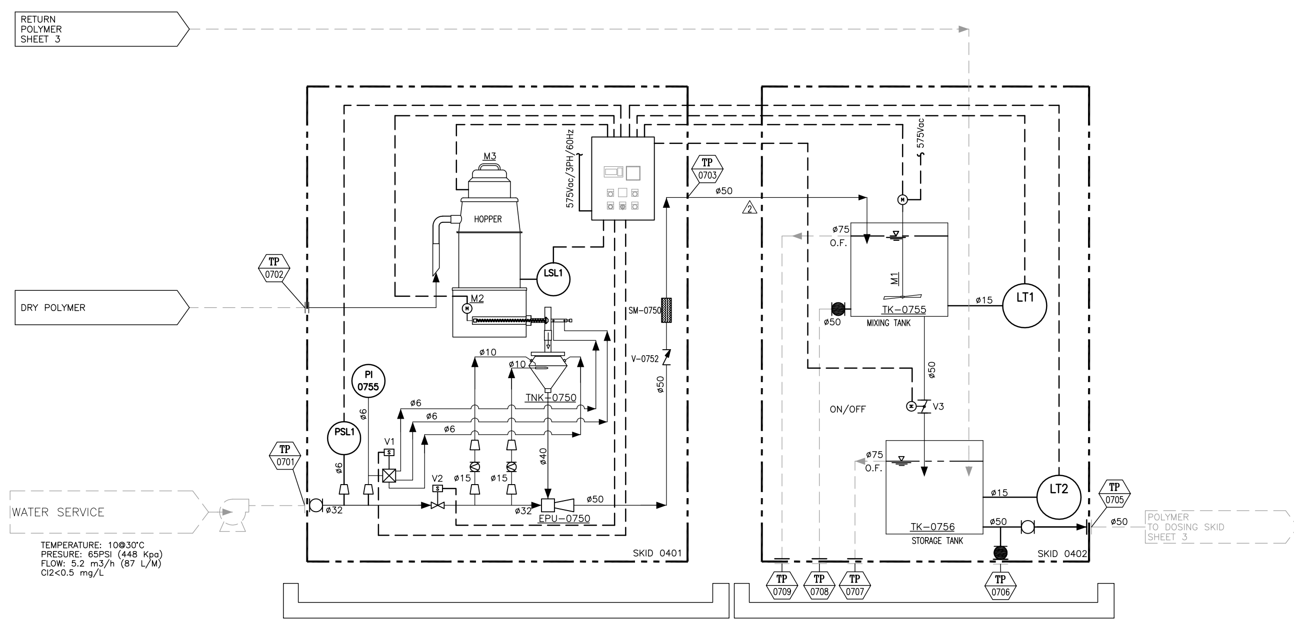
PNEUMATIC
ELECTRICITY OR CONTROL
DATA LINK
HEAT TRACED PIPING WITH INSULATION

SCADA (OPTIONAL)
LOCAL HMI
ON LOCAL PLC
DI,DO,AI,AO : PLC I/O

REV	DESCRIPTION	DATE	REV'D	CHK'D	APV'D	ECN
2	FOR INSTALLATION	2015-09-02	SID	G.D.W.	G.P.	N/A
1	FOR APPROVAL	2015-08-07	Y.R.	G.D.W.	G.P.	N/A

DESIGNER: Y.R.	DATE: 2015-07-29	TITLE: PROCESS AND INSTRUMENTATION DIAGRAM WATER TREATMENT SYSTEM POLYMER
CHECKER: G.D.W.	DATE: 2015-07-29	CLIENT: MOUNT POLLEY
ENGINEER: G.P.	DATE: 2015-07-29	VEOLIA — VEOLIA WATER TECHNOLOGIES CANADA INC. 4105 Sartelon, Saint-Laurent, Qc, Canada, Tel:(514) 334-7230
SCALE: P.A.E.		PROJECT DRAWING: 5000281502 – PI003 / INTERNAL: PCH0000 / SHEET: 1 OF 1 / REV: 2

STD: "D" 22x34 — REF: ED09-PI003 — BAR = 1" AT PLOT SCALE



M3
VACUUM CONVEYOR
#642A 16585
120V/9.2Amp

M2
FEEDER SCREW&BLENDING DRIVE
POWER Req.: 0.5HP
VOLTAGE: 575V/3Ph/60Hz

TNK–0755
MIXING TANK
VOLUME: 2500L

TNK–0756
STORAGE TANK
VOLUME: 2500L

MXR–0755
POLYMER MIXER MOTOR
MODEL:EVG1–2.0
POWER Req.: 2.0HP
VOLTAGE: 575V/3Ph/60Hz

* SUPPLIED BY JMI
SUPPLIED BY JMI
SUPPLIED BY JMI
CHEMICALS SUPPLIED BY JMI
BY OTHERS OR EXISTANT
SKID LIMITS

PNEUMATIC
ELECTRICITY OR CONTROL
DATA LINK
HEAT TRACED PIPING WITH INSULATION

SCADA (OPTIONAL)
LOCAL HMI
ON LOCAL PLC
DI,DO,AI,AO : PLC I/O

REV	DESCRIPTION	DATE	REV'D	CHK'D	APV'D	ECN
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1	FOR APPROVAL	2015–08–11	Y.R.	G.D.W.	G.P.	N/A

DESIGNER: Y.R.	DATE: 2015–07–29	TITLE: PROCESS AND INSTRUMENTATION DIAGRAM DRY POLYMER PREPARATION SYSTEM HYDRAPOL 2500L
CHECKER: G.D.W.	DATE: 2015–07–29	CLIENT: MOUNT POLLEY
ENGINEER: G.P.	DATE: 2015–07–29	VEOLIA
SCALE: P.A.E.		

VEOLIA WATER TECHNOLOGIES CANADA INC. 4105 Sartelon, Saint-Laurent, Qc, Canada, Tel: (514) 334-7230

PROJECT DRAWING	INTERNAL	SHEET	REV
5000281502 – PI004	PCH0000	1 OF 1	2

STD: "D" 22x34
REF: 5000214065–PI002
BAR = 1" AT PLOT SCALE

ATTACHMENT B
BAT Criteria

1.0 BEST AVAILABLE TECHNOLOGY

Mount Polley Mining Corporation (MPMC) will base the operational water treatment plan on best available technologies economically achievable (BATEA), in a similar manner as was done for the Short-Term Technical Assessment Report (Golder 2015). The difference between best available technology (BAT) and BATEA is that BATEA includes proposed treatment improvements that could be used to augment the BAT to yield better treated water quality.

In the context of an existing water treatment plant, the BATEA analysis is focused on the modifications to existing equipment to achieve the project objectives.

1.1 Definition and Regulatory Context

The regulatory context for defining BAT effluent regulations to achieve a discharge water quality that is not deleterious is provided by the Metal Mining Effluent Regulation (MMER), registered in June 2002 pursuant to the *Fisheries Act*. The MMER prescribes authorized concentration limits for substances in mine effluents that discharge to waters frequented by fish. The regulated parameters are arsenic, copper, cyanide, lead, nickel, zinc, total suspended solids (TSS), Radium 226, and pH.

The BC Ministry of Environment (MoE) also provides guidance for the preparation of the TAR and specifically refers to the application of the concept of an initial dilution zone (IDZ) in surface waters. The guidance document states:

> *The IDZ is the initial portion of a larger mixing zone applied to a specific effluent discharge. The concept recognizes the role of dilution in mitigating the effects of effluents and that there is an accepted area of higher concentrations of contaminants prior to where full mixing occurs. [The Ministry of Environment]'s Best Achievable Technology (BAT) policy puts requirements on dischargers for treating effluents to a high standard and does not rely on dilution alone to mitigate potential impacts. IDZs are typically only allowed when BAT has been applied.* (MoE 2014)

1.2 A Review of BAT for Mines in Canada and an Assessment of BATEA

The following discussion requires clarification of the terms BAT and BATEA. BAT in the context of this document, and the permit application it supports, is intended to be the best technology that MPMC can practicably achieve within the constraints of the current realities at the site. BATEA is used to align the work reported here with BAT for the wider mining industry in Canada. A recent study (Pouw et al. 2015) did just that and the term BATEA was introduced to include proposed treatment improvements that could be used to augment the current BAT to yield better treated water quality. What is considered BAT for the MPMC operations phase water treatment plan as opposed to BATEA for the entire industry in the long term may therefore not be the same.

Pouw et al. report that Environment Canada is undertaking a review of the MMER within a context of a multi-stakeholder consultation process to obtain feedback on proposed changes through a series of meetings and workshops. Hatch was commissioned by the Mine Environment Neutral Drainage (MEND) Program, on behalf of regulatory and industry stakeholders, to complete a study of water management and treatment practices at mining operations in Canada and to identify BATEA for the augmentation of mining effluent treatment (Hatch 2014).

The following table excerpt reproduced from Pouw et al. (2015) summarizes the proposed BATEA for the base metal sub-sector of the mining industry and provides the model effluent treatment flowsheet, proposed BATEA, and the effluent quality achieved by the industry subsector as measured through case study data from 31 treatment operations surveyed (Table 1). The model effluent treatment flowsheet referred to here is in essence the current industry best practice treatment process for (in this case) the base metal mining sector in Canada. The term flowsheet is used to collectively refer to the combination of treatment steps that make up the water treatment process (also called the block flow diagram).

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

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

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

Source: Pouw et al, 2015.

1.3 Process Outline for Defining BAT

The following process describes how BAT was defined for the short-term water treatment plan for the Mount Polley Mine site.

Step 1: Identify Potential Technologies or Options

In this step, the potential technologies or options that could be implemented were identified. Categories of potential technologies considered were:

- water diversion practices
- water treatment processes
- waste handling options (water treatment sludge)
- energy-efficient equipment and processes
- engineering practices

The focus was on proven technologies because of the need to continue with the existing active water treatment and not to disrupt discharge.

Step 2: Eliminate Technically Infeasible Options

From the list of potential technologies, those that do not meet the definition of BAT were identified and eliminated. Technologies were eliminated if they were found to be technically infeasible based on physical, chemical, or engineering principles, or where technical difficulties would prevent the successful use of the technology option at the Mount Polley Mine.

Step 3: Consider the Reliability of Each Option

Each technically feasible option was ranked in terms of the probability that the technology will operate according to its specifications. Reliability was based on on-site performance, published performance data, and case studies, as well as Golder's in-house expertise.

Step 4: Rank Technically Feasible Options by Control Effectiveness

The efficiency of removal of TSS and metals for each of the technically feasible options from Step 2 was evaluated. This removal efficiency was then used to rank the options, along with the comparative technologies at other mine sites, by referring to cases studies and published reports, as well as discussions with and submissions from technology vendors.

Step 5: Consider the Cost-Effectiveness of Each Option

The cost-effectiveness of each option was determined by conducting rough cost estimates based on capacity factored methods, parametric models, and analogous operations at other mining sites around the world. This was done as a Class-5 cost estimate as defined by the Association for the Advancement of Cost Engineering.

Step 6: Select BAT

The removal efficiency, reliability, and cost-effectiveness rankings from Steps 3, 4, and 5, respectively, were used to make a recommendation on which option is BAT.

REFERENCES

Golder (Golder Associates Ltd.). 2015. Technical Assessment Report in Support of an Effluent Permit Amendment prepared for MPMC. Golder Doc. No. 1411734-030-R-Rev0-12000. May 29, 2015.

Hatch. 2014. Study to Identify BATEA for the Management and Control of Effluent Quality from Mines. Available at mend-nedem.org/wp-content/uploads/MEND_3.50.1_BATEA.pdf

Pouw K, Campbell K, Babel L. 2015. *Best Available Technologies Economically Achievable (BATEA) to Manage Effluent from Mines in Canada.* The 10th International Conference on Acid Rock Drainage and the International Mine Water Association's Annual Meeting, ICARD-IMWA 2015. Santiago, Chile.

o:\final\2014\1421\1411734\1411734-163-tm-rev0-16000\attachments\attachment b\attachment b - rev 0 - bat criteria.docx