DESIGN REPORT FOR EFFLUENT WATER TREATMENT PLANT, PUMPING STATIONS, PIPELINES & ASSOCIATED BERM, AND DIFFUSER

Meliadine Gold Project, NU

ISSUED FOR USE
FILE: 28920

AEM DOCUMENT NUMBER: 6515-E-132-005-132-REP-009

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (***the project***). The mine is located approximately 25 km north from Rankin Inlet, and 80 km southwest from Chesterfield Inlet in the Kivalliq Region of Nunavut. A Type "A" Water Licence (No. 2AM-MEL1631) was awarded to Agnico Eagle for the development of the project.

Agnico Eagle retained Tetra Tech to conduct a detailed design of the water management infrastructures for the project. Several infrastructures such as water retention dikes, berms, culverts, channels, collection ponds, pumping stations and water treatment plants are required to manage water during pre-production, operation, and interim mine closure.

More precisely, the water management infrastructures designated by effluent water treatment plant, pumping stations, pipelines, as well as effluent water outfall system (including the diffuser) into Meliadine Lake are required to be constructed and installed.

This report presents the site conditions, design basis and considerations, engineering analyses, construction drawings, and specifications for the detail design of those infrastructures.

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ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
ABA	Acid Base Accounting
ARD	Acid Rock Drainage
CCME	Canadian Council for Ministers of the Environment
CP	Collection Pond
DEIS	Draft Environmental Impact Statement
DTSF	Dry stack Tailings Storage Facility
FEIS	Final Environmental Impact Statement
FS	Feasibility Study
ft	Feet
HC	Health Canada
HTC	Humidity Test Cell
IDF	Inflow Design Flood
kg	Kilograms
km	Kilometres
lbs	Pounds
m	Meters
mm	Millimeters
mg/L	Milligrams per Liter
ML	Metal Leaching
MMER	Metal Mining Effluent Regulations
Mt	Million Tonnes
NAG	Non-Acid Generating
OP	Ore Stockpile
SFE	Shake Flask Extraction
TDS	Total Dissolved Solids
TSF	Tailings Storage Facility
TSS	Total Suspended Solids
usgpm	US Gallons per minute
USGS	United States Geologic Survey
WRSF	Waste Rock Storage Facility
WTP	Water Treatment Plant

1.0 INTRODUCTION

1.1 Site Location and Access

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Project (the Project), a gold mine located approximately 25 km north from Rankin Inlet, Nunavut. Situated on the western shore of Hudson Bay, the Project site is located on a peninsula between the east, south, and west basins of Meliadine Lake (63°1'23.8'' N, 92°13'6.42"W) on Inuit Owned Land. A general location plan for the project is shown in Figure 1.1.

The area is accessible from the all-weather gravel road linking the existing exploration camp with Rankin Inlet.

1.2 Existing and Future Site Facilities

Current facilities at the Meliadine Project site include the exploration camp located on the shore of Meliadine Lake, approximately 3.5 km south-east of the future accommodations. The self-contained exploration camp consists of four wings of new trailers that can accommodate up to 200 people and includes kitchen facilities, complete with diesel generators. Power for the exploration camp is currently provided by diesel generators. Potable water for the exploration camp is pumped from Meliadine Lake.

The current project focuses on the development of the Tiriganiaq gold deposit which will be mined using conventional open-pit and underground mining operations. Proposed site facilities include: plant site and accommodation complex buildings for 520 people, a mill, power plant, maintenance facilities, tank farm for fuel storage, ore stockpiles, waste rock storage facilities, a dry stack tailings storage facility, and water management systems including collection ponds, water retention dikes, water diversion berms, channels, culverts, a freshwater treatment plant, an effluent water treatment plant (EWTP), a sewage treatment plant and many pipelines.

In April 2016, the Nunavut Water Board (NWB) has issued Type "A" Water License No. 2AM-MEL1631 (Water Licence "A") to Agnico Eagle Mines Limited (Agnico Eagle) for the Meliadine Gold Project site authorizing the use of water and the disposal of waste required by mining and milling and associated uses.

Figure 1.1 shows the location of the future EWTP including the pipeline between the Collection Pond 1 (CP1) pumping station and the EWTP, then to the final discharge through a diffuser.

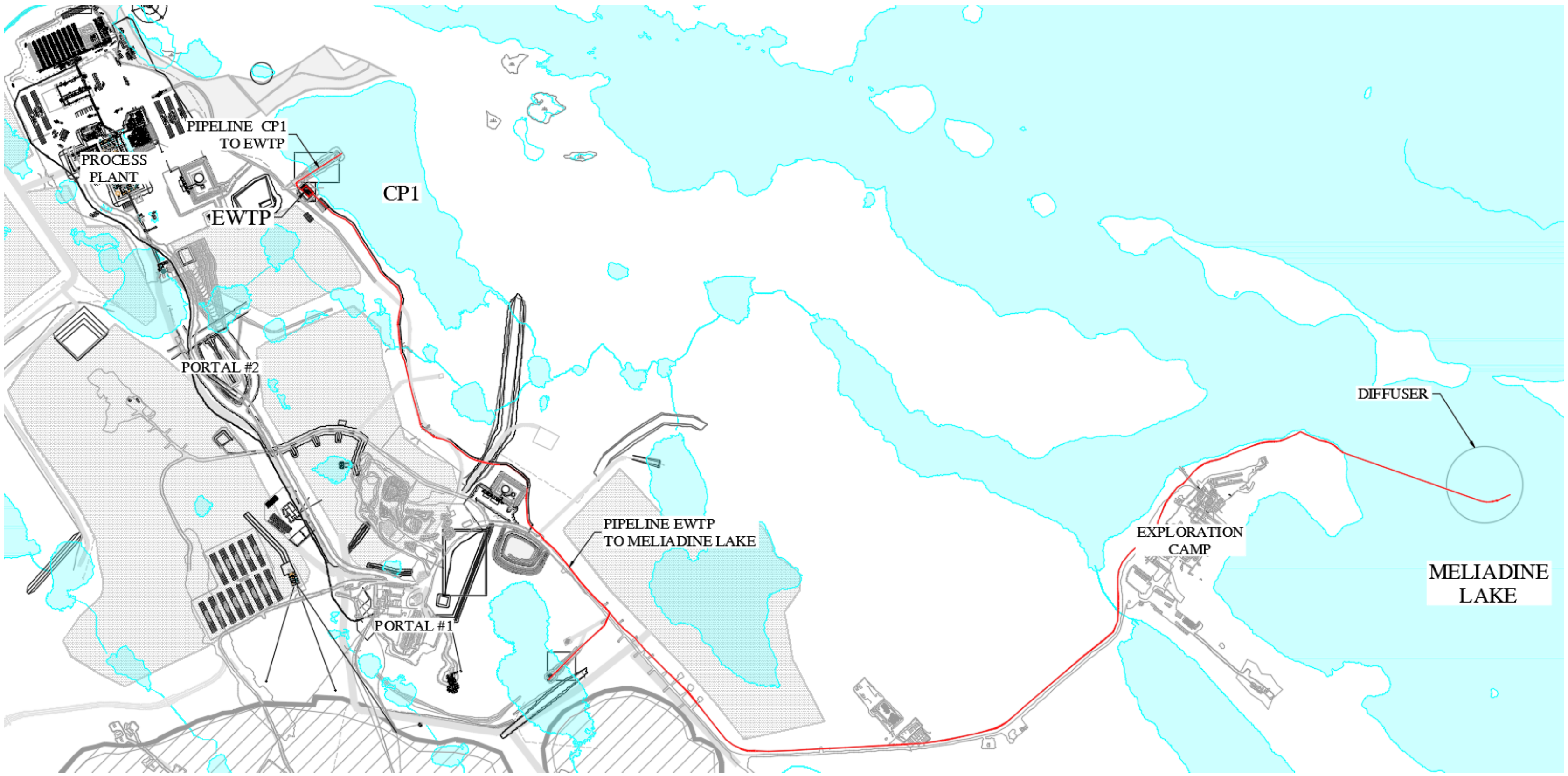


Figure 1.1 – Location of Meliadine EWTP and pipeline to final discharge

1.3 Purpose of the Document

This report includes the final design and construction drawings for the EWTP, CP1 and CP5 pumping stations and associated pipelines, as well as the diffuser that will release the final effluent from the EWTP into Meliadine Lake, as specified under Water License “A” No.2AM-MEL1631 Part D, Item 1.

The water treated at the EWTP will be sourced from CP1. The effluent water from the EWTP will be pumped through a pipeline connecting the diffuser on the pipeline end in Meliadine Lake. This report also details the environmental conditions characterizing Meliadine Lake where the diffuser will be installed, the associated numerical modelling work undertaken to design the diffuser and assess the concentrations of the released effluent at the end of the mixing zone in Meliadine Lake.

1.4 Scope of Work

Tetra Tech was retained by Agnico Eagle to design the pumping stations, pipelines, and effluent water outfall to Meliadine Lake. AEM was in charge of the EWTP design. This report describes the EWTP, CP1 and CP5 pumping stations, pipelines and the diffuser design. Construction drawings of the listed infrastructures are presented in Appendix A of this report.

2.0 DESIGN METHODOLOGY

2.1 Water management strategy

During mine construction and operation, contact water originating from affected areas on surface will be intercepted, diverted and collected within the various collection ponds. The collected water at the mine site will be eventually pumped and stored in CP1, where the contact water will be treated by the EWTP prior to discharge to the receiving environment, or used as make-up water at the mill.

As part of the Water Management Program, pipelines are required to transfer water during the operation months, from spring freshet to October. Contact water of CP5 will be pumped to CP1. Waters directed to CP1 will be treated in the EWTP to an approved quality level prior to being discharged in the Meliadine Lake sub-basin through a diffuser system.

The pond is emptied every fall in order to collect all water at next year freshet. The water management philosophy has been previously described and approved by the NWB.

Permitted effluent discharge in a water body has the requirement for the effluent to assimilate within the water body within a certain distance downstream of the discharge. This distance is called the edge of the mixing zone and is 100 m. The diffuser system has for purpose to enhance the near-field mixing, i.e. increase the dilutions, of the released effluent in this receiving water body. A diffuser system is composed of a pipe with several ports of significant reduced diameter compared to the main pipe, resulting in high discharge velocities creating entrainment of water in the near-field receiving water body, hence increasing mixing. By the time the mixed effluent reaches the edge of the mixing zone, concentrations of the various effluent constituents have to be less than the guidelines described in the Water Licence “A”.

2.2 Methodology

A stochastic tool was first used to test various diffuser configurations under a representative range of environmental conditions and select the optimal configuration. A three-dimensional hydrodynamic model was implemented to obtain three-dimensional currents in Meliadine Lake over the open water period from June to October. The stochastic tool uses the three-dimensional currents as inputs into the US EPA Visual Plume model. About 1,000 independent simulations were conducted for each diffuser configuration to assess its performances under a wide range of current speeds and directions, representative of the June-October period near the proposed diffuser location. Each simulation provided dilutions achieved either at the edge of the mixing zone or when the plume surfaces, the smaller of the two distances. These 1,000 simulations per configuration allowed to reliably test several diffuser configurations and select the optimal configuration for dilution.

Once an optimal configuration was selected, the three-dimensional hydrodynamic model was used with an embedded version of the US EPA Visual Plume Model, to assess the potential for conventional constituents to build-up over time. Although dilutions may be acceptable over the first year or so of operation, it has been speculated that a continuous discharge over subsequent years may result in accumulation of the conventional constituent. The Water Management Plan for the Water License “A” application (Agnico Eagle, 2015a, 2017) stated a total of 8 years (Year 1 to Year 8) of mill operations. There were four pre-production years (Year -4 to Year -1) and three post-production (interim closure) years (Year 9 to 11) for water treatment requirements in the Water Management Plan. However, no water discharge through the diffuser occurred during Year -4 (2016). Hence, the actual pre-production period will be three years (Year -3 to Year -1). As a result, a multi-year simulation covering a total of 14 years of discharge through the diffuser (Year -3 to Year 11) was set up to assess conventional constituent build-up in the lake by the end of Year 2030, assuming for modelling purpose a diffuser discharge start date of June 2017.

Data inputs, including lake bathymetry, wind conditions and characteristics of the effluent, are presented in Section 3. Section 7 describes the results: the selected optimized diffuser characteristics, followed by the results of the stochastic modelling and the 3-D modelling of conventional constituent build-up to support the final design. Three scenarios were investigated:

- Scenario 1 (Base Case) looked at the accumulation of conventional constituent concentration over time in the base case, i.e. mean (normal) precipitations years;
- Scenario 2 (Wet Year Case) investigated the accumulation of conventional constituent if one or two years were to be a wet precipitation year;
- Scenario 3 (Sensitivity Case) assessed the impact of a greater pumped discharged rate in the base case, i.e. mean precipitations years.

3.0 GENERAL SITE CONDITIONS AND OTHER DATA INPUT FOR DESIGN

3.1 Model Domain

The model domain encompasses an entire sub-basin of Meliadine Lake, so that the development of currents could be established. This area has limited connectivity with the main lake, with one open boundary located on the northwest side of the sub-basin (92.2 W, 63.04 N), where water can be exchanged with the rest of the Meliadine Lake system. Bathymetry data was only available for a small area surrounding the proposed diffuser location. To assess the potential for conventional constituent build-up in the Meliadine Lake sub-basin, the bathymetric survey contours were extrapolated, based on professional judgement, to obtain bathymetry over the entire sub-basin in which the outfall is located. This domain, in terms of bathymetry, is shown in Figure 3.1. The black circle represents the location of the diffuser. The total volume of water in this domain is approximately 57 Mm^3.

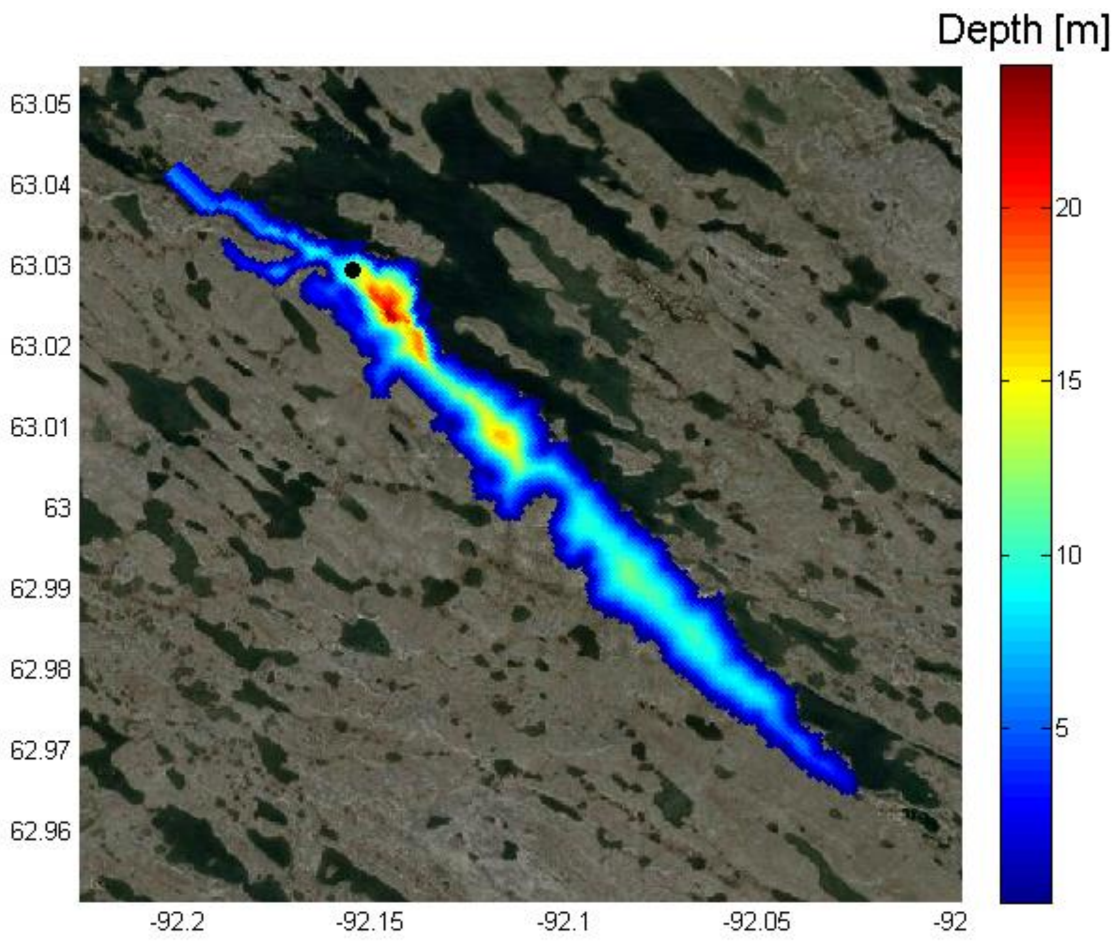


Figure 3.1: Meliadine Lake Model Domain

Runoff water into the Meliadine Lake sub-basin is significant during the summer period due to snowmelt and light precipitation. Runoff water was incorporated in the model as a river flowing into the southern end of Meliadine Lake sub-basin, providing clean freshwater to the system. The river is located at (92.1 W, 63.01 N). Flow rates from the river, as a surrogate for runoff, were determined following the method described below.

Meliadine Lake has two outlets named Meliadine Lake Main Outlet and West Outlet. These are located far away from the Meliadine Lake sub-basin that is shown on Figure 3.1. Note that they do not appear on Figure 3.1 since they are not part of the Meliadine Lake sub-basin. Mean daily discharges were presented in the Appendices of the Aquatics baseline Synthesis report 1994-2009 (Golder, 2012) and are summarized in Table 3.1. Due to the availability of environmental data, year 1997 was selected when analyzing river flow rates.

Table 3.1: Volume Discharged at Meliadine Lake Outlets

	Monthly Volume Discharged (m^3)					
	May 1997	**June 1997**	**July 1997**	**August 1997**	**September 1997**	**October 1997**
Main Outlet	51,840	5,176,224	12,650,688	3,889,814	1,378,685	0
West Outlet	0	1,302,048	2,263,594	79,056	1,123	0

Estimation of net runoff into the Meliadine Lake sub-basin was based on the volume discharged through the two outlets of Meliadine Lake. It was estimated that the Meliadine Lake sub-basin has an area approximately 1/8 of the entire Meliadine Lake. Monthly discharges at the two outlets were summed up and divided by a factor of 8 to obtain monthly runoff inputs into the Meliadine Lake sub-basin. However, hydrological year 1997 was acknowledged to be a year with precipitation that was significantly below average. The month of June in particular presented flow rates about 25% that of June in other years, reflecting the smaller-than-usual snowfall that occurred over the winter 1996-1997 and the low rainfall of June 1997. As a result, the river flow rate corresponding to June was augmented by a factor of 4, approximately representing an additional 1 m^3/s flow rate for the entire month of June. Table 3.2 shows flow rates representing runoff in the model. Only June to October was considered since they encompass the period of discharge. On a yearly basis, almost 6 Mm^3 of water enters Meliadine Lake sub-basin as runoff, representing about 10% of the sub-basin total water volume, and therefore corresponding to a nominal residence time of 10 years. An additional amount ranging between approximately 0.5 Mm^3 and 0.8 Mm^3 enters the Meliadine Lake sub-basin as effluent.

Table 3.2: Runoff Flow Rates into Meliadine Lake Sub-Basin

	Volume Released (m^3/s)				
	June	**July**	**August**	**September**	**October**
Runoff into Meliadine Lake sub-basin	1.312	0.696	0.185	0.067	0

The open boundary located on the north-west side of the model (92.2 W, 63.04 N) allows water to be exchanged between the Meliadine Lake sub-basin and the rest of the lake. A slope in the water surface due to inflow at the south, wind-driven surface currents pushed towards the north-northwest and return flow at depth during periods of northerly winds will contribute to the outflow. This outflow carries diluted conventional constituent water out of the Meliadine Lake sub-basin, when such water has reached the northwestern open boundary. When inflow occurs, due to northwest winds, the water entering the Meliadine Lake sub-basin system is assumed to be free of conventional constituents, a reasonable assumption given the large volume of Meliadine Lake. Due to the open north-west boundary, the water level stays near a constant level, with the exception of daily episodic wind events, which would lead to a slope in the water surface. As a result, between approximately 6.5 Mm^3 and 6.8 Mm^3 of water exits the Meliadine Lake sub-basin on a yearly basis through the northwest opening, representing approximately the volume of runoff water and the volume of water contained in the effluent being discharged.

3.2 Environmental Data

3.2.1 Winds

Based on availability of data from the Rankin Inlet Airport (Environment Canada station), the calendar year 2014 was selected as the basis for the wind and meteorological data required to drive the three-dimensional circulation model. Figure 3.2 shows the wind rose constructed from this year of data. Wind speed is reported in m/s.

The predominant wind direction is from the northwest (winds blowing towards the southeast) with speed reaching 15 to 20 m/s. Most of the time, wind speed is less than 10 m/s. Note that directions in this wind rose are the opposite of conventional wind roses, in that the direction shown is the direction toward which the wind is blowing. The non-conventional direction format was selected in order to reinforce the strong correlation between winds and currents, as will be seen in the section 7.

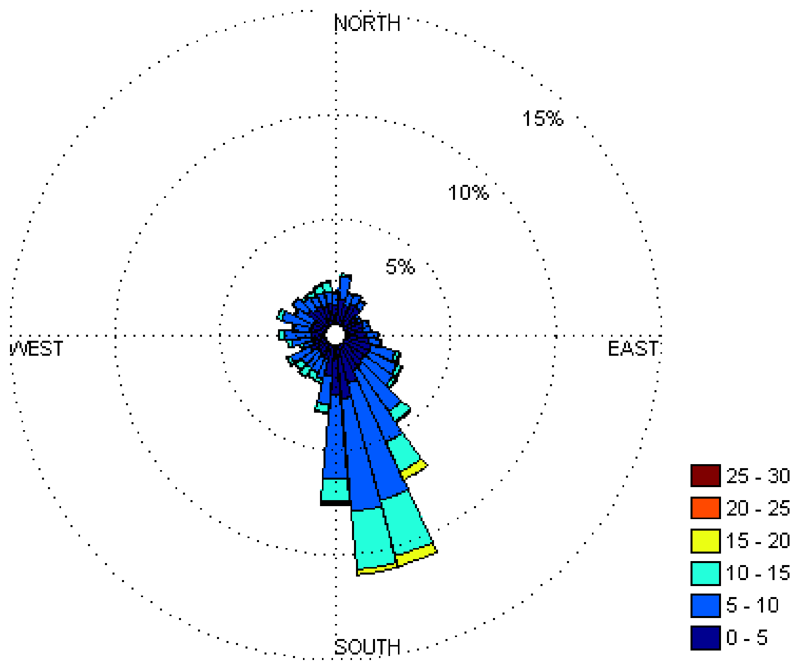


Figure 3.2: Wind Rose (Rankin Inlet Airport – Year 2014) [in m/s]

3.2.2 Currents

Currents were simulated over year 2014 (June to October) and currents over the entire water column were extracted at the diffuser location for the stochastic simulations. A time-series of currents averaged over the entire water column was constructed and is presented as a current rose in Figure 3.3. The unit is m/s, and the direction shown is the direction to which the current is headed.

The current rose shows two predominant directions: currents predominantly head towards either the north or also towards the southeast. Maximum observed currents reach approximately 0.1 m/s and are heading southeast, which is in agreement with the wind speed and direction at site, shown in Figure 3.2. It should also be noted that there are significant instances of currents heading towards the north, reflecting calm periods of weak winds, in which a return flow dominates. The Meliadine Lake sub-basin has modest stratification, mainly due to wind mixing overcoming warming of the top part of the water column by summer heating and its shallow depth.

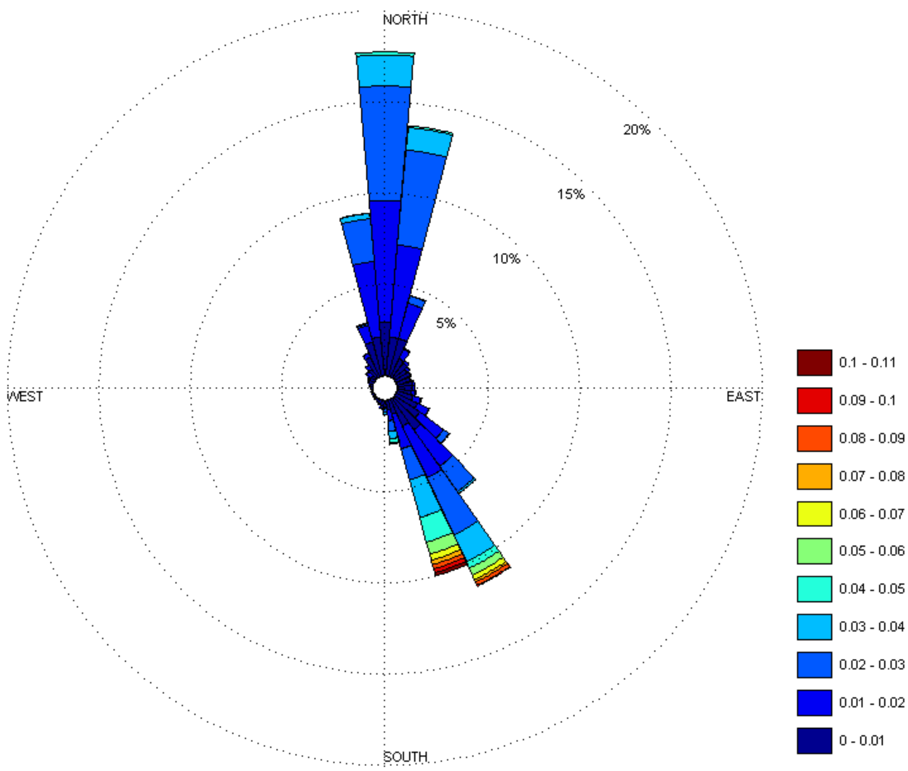


Figure 3.3: Current Rose at Proposed Diffuser Location [in m/s]

3.3 Characteristics of the Effluent

Water quality predictions for the effluent have been developed based on runoff water in the open pits and contact water from the mine site main infrastructures including waste rock, tailings and overburden material. Water will be collected in containment ponds, ultimately pumped into the final water collection pond (CP1), where water will be reused by the process plant (when feasible) and the excess water will be treated for Total Suspended Solids (TSS) by the EWTP prior to its discharge through the diffuser into Meliadine Lake. TSS levels in the treated water will be reduced to a maximum concentration of 15 mg/L for discharge (as per Water Licence “A”).

Water Licence “A” provides upper bounds of end-of-pipe concentrations for various conventional constituents, not to be exceeded since they are regulated values. These end-of-pipe effluent concentration predictions were based on the Metal Mining Effluent Regulation (MMER).

Constituent concentrations used in this present modelling study were based on the Meliadine Lake outfall diffuser end-of-pipe prediction monthly mean conventional constituent concentrations weighted by the monthly effluent flow rate, described in Section 3.4. The Water Management Plan (Agnico Eagle, 2015b) presents the monthly constituent concentrations. The presence of 15 mg/L TSS is predicted to increase total constituent concentrations to greater levels than dissolved concentrations in CP1. The effect of TSS addition on total constituent concentrations was assessed in Golder’s Report (Golder, 2015), in which an average value for each constituent corresponding to 15 mg/L TSS was calculated.

Table 3.3 shows the effluent characteristics corresponding to Water Licence “A”, and the predicted Meliadine Lake Outfall Diffuser end-of-pipe values. Total conventional constituent concentrations (dissolved + 15 mg/L TSS) [C] were used in this study and were calculated with the following equation:

$$[\mathrm{C}] = \frac{\sum_{\mathrm{m}}(\mathrm{V_m}.[\mathrm{C}]_{\mathrm{m}})}{\sum_{\mathrm{m}} \mathrm{V_m}}$$

With:

- Vm the volume of effluent discharged over the month, m – presented in Section 3.4. Unit in m^3/s.
- [C]m the concentration of conventional constituent averaged over the month, Unit in mg/L

All Meliadine Lake outfall diffuser end-of-pipe monthly average concentration predictions meet the requirements set by the Water License “A”, and were provided as “CP1 water quality” in the Water Management Plan.

Table 3.3: Effluent Characteristics

	Water License "A"		Meliadine Lake Median Background Concentration [mg/L]	Meliadine Lake Outfall Diffuser End of Pipe Prediction Monthly Average Concentrations	
	Maximum End-of-Pipe Average Concentration [mg/L]	Maximum End-of-Pipe Concentration of Any Grab Sample [mg/L]		Dissolved Conventional Constituent Concentration [mg/L]	Total Used in the Model (Dissolved + 15 mg/L TSS) [mg/L]*
Conventional Constituents					
Total Dissolved Solids	1400	1400	35.0	204	204
Total Suspended Solids	15	30	1.5		15
pH	6 to 9.5	6 to 9.5	7.4		
Major Ions					
Chloride			6.4	20	20
Fluoride			0.03	0.0002	0.0002
Sodium			3.2	5.3	5.6
Sulphate			2.9	35.9	35.9
Nutrients					
Total Ammonia as Nitrogen	14	18	0.025	4.6	4.6
Nitrate Ion	-	-	0.11	5.8	5.8
Phosphorus (total)	2	4	0.0055	0.4	0.4
Cyanides					
Total cyanide	0.5	1.0	0.00100	0.005	0.005
Free cyanide	-	-			
Metals					
Aluminum	2	3	0.0025	0.09	1.20
Antimony			0.0001	0.0029	0.0029
Arsenic	0.3	0.6	0.0003	0.101	0.191
Barium			0.0071	0.012	0.021
Cadmium			0.00003	0.000005	0.000012
Chromium			0.0002	0.00001	0.0030
Copper	0.2	0.4	0.00111	0.0011	0.0037
Iron			0.0235	0.01	1.70
Lead	0.2	0.4	0.00003	0.0011	0.0049
Manganese			0.00283	0.12	0.13
Mercury			0.00001	0	0.0000015

Molybdenum			0.00011	0.005	0.005
Nickel	0.5	1	0.0006	0.0023	0.0032
Selenium			0.00005	0.00037	0.00039
Silver			0.00005	0.00005*	0.00006*
Thallium			0.00002	3.4E-07	0.000006
Uranium			0.00003	0.0004	0.0004
Zinc	0.4	0.8	0.0015	0.009	0.010

* Monthly data was not available, the average concentration provided by Water Quality prediction Table D.2 (Golder, 2015) was used.

3.4 Effluent Flow Rates

The pump sending the effluent to the Meliadine Lake diffuser is understood to discharge at a design rate of 11,688 m^3/day. For the purpose of the simulations, it has been assumed that the pump will not operate continuously. It was assumed that once the pump is activated, it would stay active i.e. pumping, for at least three consecutive days. The amount of effluent flow released over each month and over each year was based on the overall water balance for the project, which were conducted in support of the Water Licence “A” application. Base case precipitation year, corresponding to mean precipitation year, as well as wet precipitation year were described in the water balance. Both were considered in the subsequent modelling analysis.

Since the effluent contains a large fraction of collected surface runoff, most of the effluent will be released during the beginning of the summer period (mid-June and July) reflecting snow melt and rain. The schedule for effluent released each month was based on:

- Monthly amount to be released;
- Precipitation pattern (year 2014 used due to availability of the data); and
- Pump operating for at least three consecutive days. The pumping rate is 11,688 m^3/day.

Table 3.4 shows the estimated monthly volumes of effluent released through the diffuser for the base case simulation under mean precipitation years.

Table 3.4: Estimated Monthly Effluent Released for Simulated Base Case (Mean Precipitation Years)

Year	Effluent Released Over the Course of the Month [m^3]				
	June	July	August	September	October
Year -3: 2017	175,320	233,760	70,128	70,128	23,376
Year -2: 2018	175,320	163,632	81,816	70,128	23,376
Year -1: 2019	175,320	151,944	93,504	58,440	23,376
Year 1: 2020	175,320	268,824	116,880	93,504	35,064
Year 2: 2021	175,320	303,888	105,192	93,504	35,064
Year 3: 2022	175,320	292,200	105,192	163,632	70,128
Year 4: 2023	175,320	350,640	128,568	105,192	35,064
Year 5: 2024	175,320	350,640	128,568	93,504	35,064
Year 6: 2025	175,320	350,640	128,568	93,504	35,064
Year 7: 2026	175,320	350,640	128,568	93,504	35,064
Year 8: 2027	175,320	280,512	105,192	81,816	35,064
Year 9: 2028	175,320	292,200	116,880	93,504	35,064
Year 10: 2029	175,320	292,200	116,880	93,504	35,064
Year 11: 2030	175,320	280,512	116,880	93,504	35,064

Two assumed wet precipitation years, Year 2 and Year 7, are presented in Table 3.5 with other mean precipitation years. Each wet precipitation year corresponds to a return period of 100 years. Table 3.5 shows the estimated monthly volumes of effluent released for the wet year case simulation.

Table 3.5: Estimated Monthly Effluent Released for Simulated Wet Year Case (Mean Precipitation Years with Two 1/100 Wet Precipitation Years)

Year	Effluent Released Over the Course of the Month [m^3]				
	June	July	August	September	October
Year -3: 2017	175,320	233,760	70,128	70,128	23,376
Year -2: 2018	175,320	163,632	81,816	70,128	23,376
Year -1: 2019	175,320	151,944	93,504	58,440	23,376
Year 1: 2020	175,320	268,824	116,880	93,504	35,064
Year 2: 2021 Wet Year	175,320	362,328	362,328	315,576	81,816
Year 3: 2022	175,320	292,200	105,192	163,632	70,128
Year 4: 2023	175,320	350,640	128,568	105,192	35,064
Year 5: 2024	175,320	350,640	128,568	93,504	35,064
Year 6: 2025	175,320	350,640	128,568	93,504	35,064
Year 7: 2026 Wet Year	175,320	350,640	350,640	350,640	175,320
Year 8: 2027	175,320	280,512	105,192	81,816	35,064
Year 9: 2028	175,320	292,200	116,880	93,504	35,064
Year 10: 2029	175,320	292,200	116,880	93,504	35,064
Year 11: 2030	175,320	280,512	116,880	93,504	35,064

4.0 DESIGN OF THE EFFLUENT WATER TREATMENT PLANT (EWTP)

4.1 Process summary

The purpose of the EWTP (ACP-700R) is to remove TSS from the influent water pumped from CP1. The equipment has an operational range of 6,250 to 28,000 m^3/d. It is expected that the EWTP will be in use only during the open water season, approximately four (4) months in the year (June to October).

The first treatment component consists of one Actiflo® clarifier with two (2) recirculation lines and two (2) hydrocyclones. The Actiflo® can be operated with one (1) or two (2) lines, depending on the influent flow rate and TSS content. The hydrocyclone overflow is sent to the Multiflo for sludge thickening which overflows by gravity into a break tank and then pumped into the raw water Actiflo® inlet pipe for recirculation. The principal purpose of the Multiflo is to decrease the amount of water sent to the mill, since the total water content volume within the sludge cannot be managed at the mill. This unit does not contribute to the efficiency of the system to reduce dissolved chemical parameters within the water effluent. The Actiflo® overflow is designed to meet the Type A License final effluent discharge criteria for TSS concentrations. The final effluent is monitored for pH, turbidity and flow rate, which are monitored continuously.

The Multiflo will be installed in 2018, prior to the start-up of the mill.

The EWTP general flow diagram is illustrated in Figure 4.1. The following sub-sections describe the EWTP components.

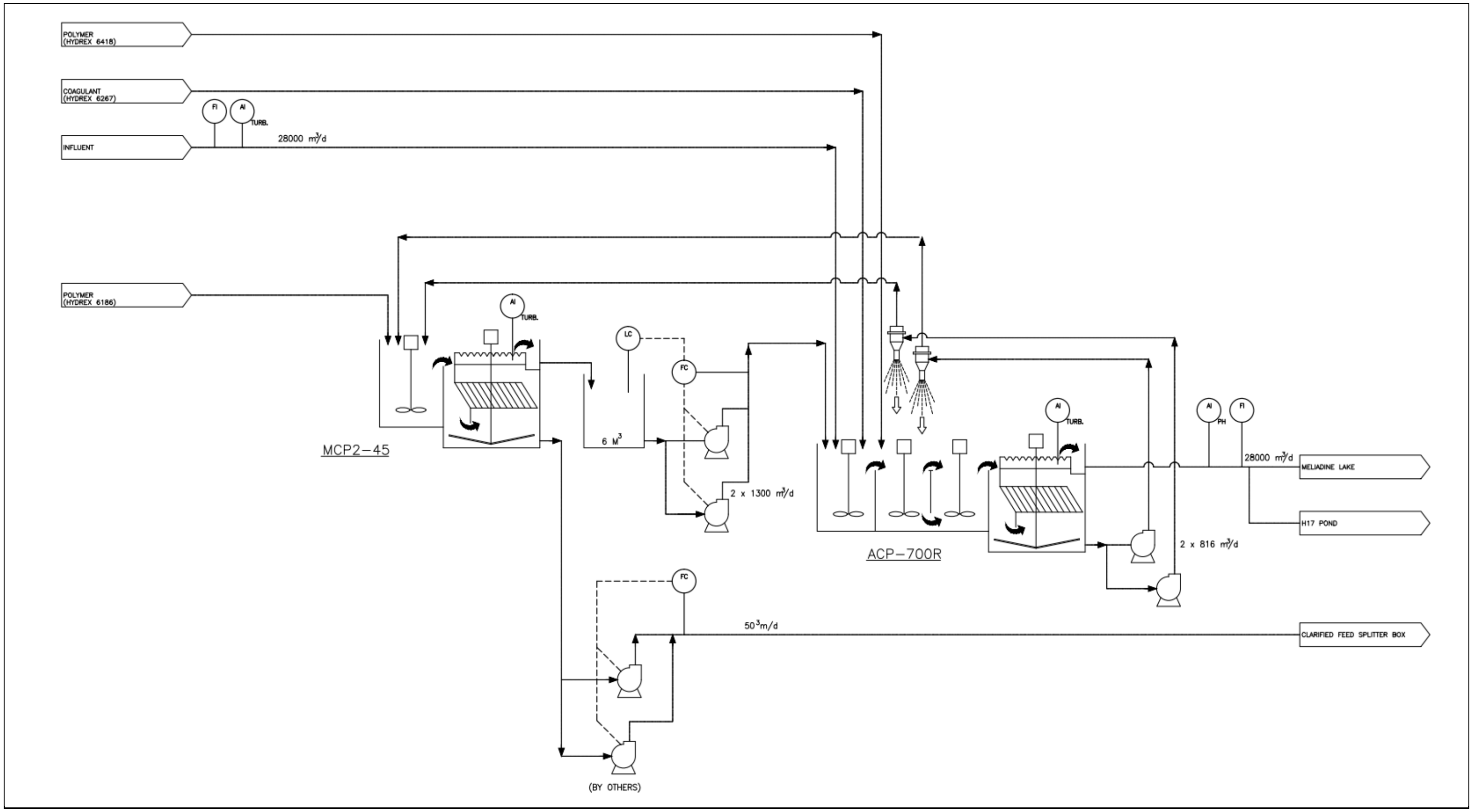


Figure 4.1 – Meliadine EWTP Overall Process Flow Diagram

4.2 Actiflo®

The Actiflo® clarifier uses sand ballasted settling, a high rate coagulation/flocculation/sedimentation process. In the coagulation basin, TSS are destabilised under the action of the coagulant and start to form small aggregates (also called flocs). The coagulant is a trivalent soluble metal compound, usually consisting of iron or aluminium, which will cause coagulation when it reaches a certain concentration. Once the coagulant has performed the destabilising effect, it will precipitate as a metal hydroxide and will participate in the formation of the aggregates. Water then flows into a second tank called the injection tank. There, micro-sand and polymer are added; the polymer acts as a flocculant aid, binding the destabilised solids together with the micro-sand particles by forming polymer bridges. The micro-sand provides a large contact area for floc attachment and acts as ballast, thereby accelerating the settling of the flocs. From the injection tank, water flows into the maturation tank where flocs formed in the previous stage agglomerate and grow into high density flocs known as micro-sand ballasted flocs. Water then overflows to the settling section of the tank, and with the help of the lamella system, a solid-liquid separation is achieved resulting in clarified water exiting from the system via a collection trough or weirs. The clarified water is monitored for pH, turbidity and flow rate prior to final discharge. The flow rate signal is also connected to a flow totalizer.

The flocs settle in a portion of the system where they are collected by a rake mechanism. A portion of the unit's design raw water flow is continuously withdrawn from the clarifier and pumped to a hydrocyclone system which separates the micro-sand from the sludge. The recovered micro-sand is reused in the process even though a small quantity of the micro-sand is not recovered by the hydrocyclones and remains within the sludge discharged to CP1. The lost micro-sand needs to be replaced periodically by adding more to the process. After micro-sand separation, the sludge is sent to the Multiflo clarifier, from which the supernatant water is recirculated to the head of the Actiflo® unit. This step results in the densification of the sludge, which is then sent to the mill where the water is recovered and the solids are blended with the filtered tailings.

During the first season of water treatment, the mill will not be in operation and the sludge from the Actiflo® will be managed differently. During this first year, the Multiflo unit is not required as sufficient capacity exists within CP1 to manage the water contained within the sludge. As such, the sludge from the overflow of the hydrocyclone will be returned to CP1 where the coagulated solids will settle in the pond. Any solids that do not settle will be returned to the treatment system and will not be discharged into the environment. The amount of solids flushed to CP1 (estimated at 1%) within the sludge is determined to be sufficiently low and will not lead to a significant solids or sediment accumulation in CP1, prior to commissioning of the Multiflo.

4.3 Multiflo

The Multiflo will be installed and operational in 2018, prior to the mill start-up.

The sludge extracted from the Actiflo® is transferred to the Multiflo to increase the sludge solid content to 5-8% w/w solids. The Multiflo is a compact clarification system using a flocculation reactor and enhanced lamella settling. The sludge enters the first tank section called the flocculation tank, where an anionic polymer is added. The polymer then binds the suspended solids by forming polymer bridges and the flocs agglomerate and grow into high-density flocs and settle quickly at the bottom of the unit. In the settling zone, the efficiency of this process is further increased by the use of the lamella tubes. The sludge is collected at the bottom of the settling tank, under the lamella tubes. The sludge produced will be pumped to the mill, while the supernatant water will flow to a transfer tank and pumped to the Actiflo®.

4.4 Service Water System

The service water system consists of two (2) multimedia filters, two (2) heaters, one (1) filtered water tank and four (4) service water pumps. Service water is used in the preparation of dry chemicals and for polymer makeup systems. Coagulant and polymer require filtered heated water.

4.5 Reagents

Two (2) types of polymers as well as a coagulant are used to treat the water that flows through the Actiflo® and each are supplied by a dosing system that is adjusted according to the influent flow rate. One cationic and one anionic polymers are used. Treated water from the Actiflo® is used for the mixing of the reagents.

4.6 Controls

The Actiflo® Feed Pump is equipped with a variable frequency drive (VFD) that allows the flow to be modulated. A controller uses the raw water flow meter's (65FIT6930001) signal and adjusts the frequency of the pump to obtain the flow specified by the Operator in order to maintain a constant flow rate to the system.

The raw water TSS analyzer is used to monitor the raw water quality. An alarm is triggered when a high-high turbidity is reached and if only one recirculation pump is running.

The effluent water TSS concentration and pH values are monitored continuously with in-line instrumentation. If effluent concentrations reach a set point indicating that final effluent discharge criteria may be exceeded, an alarm is sent to the Operator, who will manage the system to meet effluent criteria. A second alarm is sent to the Operator if effluent concentrations reach a second set point that is just below the final effluent discharge criteria. This will trigger the two (2) outflow valves to automatically divert the final effluent to CP1, preventing discharge to the environment.

Addition of the two (2) required reagents is proportional to the influent water flow. Since this flow is maintained constantly by a control loop, no manual adjustment is required. If the Operator has to modify the influent water flow, adjustment of the reagent dosing system will be required to maintain the target dosage rate. The reagent dosing systems are equipped with pumps that maintain a constant flow rate when running at a constant frequency. The flow can be modified by changing the electric motor frequency.

The reagent dosing system is equipped with valves and graduated cylinders allowing the Operator to measure the addition rate of the reagent using a stop watch. The Operator will determine the required flow of a specific reagent by a formula based on influent flow rate. Based on this calculation, a manual adjustment to the reagent pump will be done in order to obtain the required dosage. Initially, the formula will be based on laboratory testing and will be adjusted accordingly to the treatment plant performance.

5.0 DESIGN OF THE PUMPING STATION

5.1 General

Contact water collection ponds (CP) will be used to capture and store the contact water during the Meliadine mine operation. To empty the CP, permanent pumping stations will be installed and operated every year, during the mine development, from spring freshet to October.

For 2017, two permanent pumping stations will be installed. The water from CP5 will be pumped to CP1 and the water from CP1 will be pumped through the EWTP to Meliadine Lake. The pumping stations will be installed over underground sumps located within the pond jetties.

The pumping stations are designed to control the water level in the collection ponds and to empty them at the end of the season.

The water level in the ponds will be regulated with an ultrasonic level transmitter located in the pumping stations sump. When the water reaches the set high level, the pumps will start pumping the water until a set low level is reached.

The submersible pumps will be installed below the lakebed elevation, on the bottom of the sumps, in order to collect the maximum water.

5.2 Pump narrative

The amount of water to pump will increase over the years and more pumps will be added to meet the pumping requirement. The following tables present the expected pumping stations configuration until the end of the project:

CP1 to EWTP

	Years -3 to -1 (2017 to 2019)	Years 1 (2020)	Years 2 to 3 (2021 to 2022)	Years 4 (2023)	Years 5 to 6 (2024 to 2025)	Years 7 (2026)	Years 8 (2027)
Maximum flowrate (m^3/day)	14,880	14,880	14,880	20,640	20,640	35,040	35,040
Number of pumps	1	1	1	1	1	2	2

CP5 to CP1

	Years -3 to -1 (2017 to 2019)	Years 1 (2020)	Years 2 to 3 (2021 to 2022)	Years 4 (2023)	Years 5 to 6 (2024 to 2025)	Years 7 (2026)	Years 8 (2027)
Maximum flowrate (m^3/day)	19,205	19,205	30,935	30,935	32,775	32,775	32,775
Number of pumps	1	1	2	2	2	2	2

5.3 Pumping station enclosure

All mechanical and electrical pumping station equipment will be housed in a heated and insulated enclosure. Electrical equipment (e.g. control panel, junction boxes, VFD/soft starters, etc.) will be separated from the mechanical equipment (e.g. pumps, isolation valves, piping, piping accessories, etc.) by a wall and each room will have its own access door.

The enclosure has been designed following the site information and design coefficients (temperature, wind load, snow load, etc.) from the Agnico Eagle general guidelines to resist to the Nunavut climatic conditions. The enclosure will be installed on a leveled coarse compacted gravel surface. All surfaces will be painted in accordance with Agnico Eagle requirements to ensure good corrosion resistance over the years of operation.

5.4 Sumps and suction lines

Each pumping station will be installed over a sump which is connected to the pond with two environmental hazard free high density polyethylene (HDPE) pipes. As the water level in the collection pond rises, the HDPE pipes fill the sumps with water. Both sumps have been designed with two suction lines at different elevations. Every year, at the beginning of the freshet, the top water layer will flow through the upper suction line until the bottom line water will thaw. The bottom line diameter will be larger than the top one which will reduce water velocity at the bottom sump inlet.

The sumps are made from fusion welded HDPE and were pneumatically tested after fabrication to insure tightness. Before winter season, the two knife gate valves installed on the suction lines used to fill the sump with water, will be closed to isolate the sump. Once isolated, the sump will be drained and the submersible pumps will be pulled out from the sumps and stored during the winter season.

5.5 Submersible pumps

Each pumping station is equipped with two (2) identical Flygt submersible pumps used to pump the water from sump to an HDPE pipeline connected to the pumping station manifold.

The selected pumps are high flow low head type, each one is capable of pumping approximately 20,000 m^3/day.

Shut-off pressure is 65 psig for CP1 and 30 psig for CP5.

5.6 Piping

Piping manifold inside the pumping station will be made of steel with Victaulic connections for easy dismantlement during maintenance operations.

All piping was hydrostatically tested at the manufacturing facility to insure tightness.

5.7 Controls

The pumping stations have been designed to provide easy operation and maintenance. The equipment will be locally controlled at the pumping station and remotely controlled from a control room. The complete functional description is provided in Appendix B.

When the pumps are shut-down, the electrically operated valve, installed on the four inch drain line, will open to allow the water between the manifold and the first high point on the HDPE pipelines to flow back into the sump.

6.0 DESIGN OF THE HDPE PIPELINES

6.1 General

The pumping stations at CP1, CP5 and the EWTP transfer water through a total of 5.3 km of sections of 400 mm (Ø16 inch) and a section of 500 mm (Ø20 inch) HDPE pipes. The treated water from the EWTP will be pumped to a diffuser located in the Meliadine Lake. Sections of the pipelines are insulated when required. Here is a summary of the three (3) pipelines.

Description	Length (m)	Diameter (mm)
CP1 to EWTP	154.8	400
EWTP to Meliadine Lake	4,340.6	400
CP5 to CP1	832.3	500

The pipelines will be butt welded using a fusion welding machine. There will be a flange connection at every 76 m (250 feet) for easy manipulation during installation. The pipeline spools will be transported, handled and assembled on roads or pads using mobile equipment such as forklifts, front-end loaders or boom trucks. The routing of the pipelines has been designed in such a way to limit the need of installation equipment to run over the tundra and to stay off a distance of 31 m from water bodies.

No archeological sites have been located in any areas along the pipelines routing.

6.2 Above-ground pipelines

6.2.1 CP5 to CP1

The pipeline centerline routing is straight but the pipeline is designed to snake along its general path. This is required to give free movement of the pipelines under the Nunavut high outdoor temperature range and to limit the induced thermal expansion stress. Each earthen berms have a span of approximately 30 m from each other along the reference centerline of the pipelines and the contractor will follow an installation temperature chart to set the right snaking loop.

Except on pumping stations jetties, the pipelines lie directly on the tundra where sharp stones will be removed before installation to reduce the risks of tears and premature wear. Since the pipelines will be water tights, no hazards or disturbances are expected after installation. A hydrostatic test will be performed to confirm it.

The routing is also designed to maintain a minimum distance of 31 m from any water body.

CP5 to CP1 pipeline discharge on the shore of CP1 will lie on rip rap to avoid shore erosion. See Section 8.2.1 for more details.

6.2.2 CP1 to EWTP

Same designs as for the CP5 to CP1 pipeline, but of a shorter length, the pipeline will snake between each earthen berms. The contractor shall follow the temperature chart when installing the pipeline on the ground.

6.2.3 EWTP to Meliadine Lake

The first 180 m from the EWTP will be anchored at every 20 m, which will narrow the pipeline snaking foot print.

The second section (180 m to 900 m) of the pipeline reaching the dyke D-CP1 will be exposed to flooding every year at freshet. For this reason, the pipeline will be anchored with concrete blocks lying underwater and chains retaining the pipeline from deriving too far from its design centerline routing. This design will allow the pipeline to float on the water, minimizing stress loads on the material. Once water is pumped out of CP1, the pipeline will eventually reach its relative designed position on the ground and will remain there until the next flooding. All retaining accessories are galvanized to provide protection against rust over the operation years.

Each of the submersible anchors consists of a pair of 1500 kg (3306 lbs) concrete blocks. The pipeline will be maintained in place with a chain linking both blocks to the pipe attachment point. An anchor point is required every 38 m (125 ft) to maintain the pipeline in position. The anchors are sized to resist a maximum wind load corresponding to a 1/100 year event as well as all lake waves and gravity loads.

The section of the pipeline between D-CP1 and Meliadine Lake is the same as described in Section 6.2.1. The pipeline routing will always be 31m away from water bodies at the exception of a section along the exploration camp where the area is too narrow and therefore runs at a distance less than 31m.

6.2.4 Sub-marine pipeline

The section of the pipeline between the shore of Meliadine Lake and the diffuser is designed to be submerged at all time.

On-shore installation is preferred as sub-marine environment disturbances will be avoided, limiting sub-marine work and marine equipment. A construction pad, with a ramp, will be built on the water outfall shore, within 31m from the edge of waterbody (without entering the limit of the high water mark), to provide a flat area where material can be stored before being assembled and where heavy equipment can move, thus limiting at its minimum the disturbance of the land around the construction area. See section 8 of this report for details about the construction pad.

The preferred method for the installation of the sub-marine pipeline is named Float-and-Sink. The HDPE spools will be fusion jointed on the construction pad in a continuous process. The concrete ballasts will be assembled on the pipeline as it goes into the water but the pipeline will remain empty and will float on the surface of the water. Once a ballast will be attached to the pipeline, the assembly will be loaded on a wheeled bogey and rails will smoothly drive the pipeline in the water. The pipeline will float as it is approximately 7 times lighter than water; the bogey is then removed and installed back on the next ballast. To maintain the pipeline on the lakebed, a ballast is required every 4.5 m (15 ft). A tug boat will pull the pipeline using a pulling head in the Meliadine Lake.

When the pipeline will be completed and in position, it will be sunk by slowly filling it up with fresh water to avoid air entrapment. As the pipeline sinks, it will be carefully installed in the intended location on the bed lake. If required, a geotextile will be installed underneath the pipelines in order to reduce friction during pipelines thermal expansion/contraction and motion. Devices such as de-icer bubblers may be added, if required, to protect the entrance of the pipeline into Meliadine Lake from ice damages.

6.3 Material

All material considered in the design of the pipelines are health, safety and environmental hazard free. The material selection was also based on the chemical and mechanical properties which comply with the process conditions and the specific climate of Nunavut such as corrosion resistance or minimum operation temperature.

6.3.1 Pipelines

All pipelines and flanges are made of high quality Sclairpipe HDPE DR17 PE4710. Black HDPE was chosen for its high sunlight Ultraviolet resistance, supported by technical literature stating a life expectancy of 50-100 years of successful service. The complete Sclairpipe datasheet is available in Appendix C of this document.

A 50 mm (2 inch) thick factory applied waterproof rigid polyurethane foam was applied over some section lengths. The complete Urecon's product solution is available in Appendix D of this document. The sections of pipelines requiring insulation are those where gravitational draining is not possible due to the pipeline's profile shape. This insulation will reduce heat transfer and therefore reduce the possibility of water freezing and piping collapse under freezing temperature shutdown.

Both HDPE pipeline and polyurethane isolation are health, safety and environmental (HSE) hazard free. The isolation jacket shows the same characteristics as the pipe and is also HSE friendly.

6.3.2 Heat tracing and insulation

In order to protect the pipeline from freezing under cold temperature, a 50 mm thick factory applied rigid polyurethane foam was applied over a length of 50 m with heat-tracing cable. The waterproof polyurethane insulation is health, safety and environmental hazard free. The outer insulation jacket will have the same characteristics as the pipe and is also HSE friendly. The complete manufacturer product solution (Urecon pre-insulated pipe) is included in Appendix D of this document.

6.3.3 Flanges, valves and accessories

All pipelines flanges (stub-ends) are made of the same material as the pipelines, with a pressure rating class 150 lbs and comply with ANSI B16.5 dimensions for perfect mating and minimizing risks of leaks. Flanges and fittings for vents and drains are all made of stainless steel for good corrosion resistance.

Aboveground flanges backing rings are made of ductile iron and all hardware is made of stainless steel for strength and corrosion resistance. Submerged hardware in Meliadine Lake is all stainless steel made with magnesium sacrificial anodes to enhance corrosion protection in fresh water.

Valves are made of stainless steel or ductile iron with EPDM rubber or Teflon seals, depending of the design requirements.

6.3.4 Earthen berms, thrust blocks and ballast

Earthen berms are used to anchor the pipelines in flooding free areas. The berms are made of overburden.

In order to anchor the pipelines in place when earthen anchor berms cannot be used, concrete blocks and ballasts of different shapes are used for land and sub-marine service. The factory-made concrete ballasts are deemed to have no environmental effects. Openings are lined with rubber to protect the pipelines from scratches and maintain its integrity over a long period of operation.

6.3.5 Expansion joints

Expansion joints are required at every tie-in to a building. They are designed to absorb axial, radial, angular movements and lateral deflection of the pipelines in the pumping stations to reduce induced stress. Selected expansion joints are designed with a twin-sphere body, allowing higher movement, providing good flexibility to absorb and thus maintaining the integrity of the pipelines and the pumping stations.

6.3.6 Culvert sleeves

As the pipelines are running over a long distance, it may cross haul or access road along its path. Galvanized corrugated sleeves are used across the roads to support the weight of vehicles and backfill, and to maintain the integrity of the pipelines.

6.4 Equipment

6.4.1 Flowmeter

Magnetic flowmeters are installed on the two major pipelines as following:

Description	Number of flowmeters
CP5 to CP1	2
EWTP to Meliadine Lake	1
CP1 to EWTP	0

All flowmeters are connected to a PLC where data is logged. This equipment will be used to monitor the quantity of water transferred between CP5 and CP1 ponds and the water discharged into the environment. The flowmeters are also intended to be used as a real-time leak detector system. An alarm is set to inform the Control room when the flow reading of a pipeline has a difference greater than 10%. The goal of this system is to mitigate its minimum risks of environmental contamination.

The flowmeters of pipeline CP5 to CP1 are located as follow: one is installed near the discharge of CP5 pumping station and connected to its PLC. The second one is located on the top of D-CP1 at approximately 760 m (2,493 ft) away from the pumping station and it will be connected to the PLC in the electrical room of the evaporators into the P-Area.

The flowmeter of pipeline EWTP to Meliadine Lake is located on the construction pad (see Section 6.2.4) before the water outfalls to the diffuser. This flowmeter is Wi-Fi connected to the Exploration Camp nearby. Another flowmeter is required at the EWTP to complete the leak protection system but is not part of this package.

No flowmeters are deemed required on the CP1 to EWTP pipeline as the water transfer is already monitored by the EWTP to Meliadine Lake flowmeters. In case of leaks, as the pipeline runs along CP1, water will flow back into the pond.

All flowmeters are skid mounted and are rated for outdoor use in Nunavut.

6.4.2 Drains

Drains assemblies are provided to every pipeline lower points where it is not technically possible to drain gravitationally during shutdown operations. The water will be pumped and discharged where it safe of the environment.

6.4.3 Air/vacuum valve

An air/vacuum valve is located at every highest points of the EWTP to Meliadine Lake pipeline. This valve is required to exhaust air when filling and admit air while draining. This is an important equipment to protect the integrity of the pipeline and avoid risks of collapse in case of water column separation at shutdown.

No air/vacuum valves are needed on the CP5 to CP1 and CP1 to EWTP as the pipelines are able to safely sustain the possible vacuum stresses and air pockets at high points will be removed with the flow velocity.

7.0 DESIGN OF DIFFUSER AND MODELLING RESULTS

A description of the selected diffuser is presented below, followed by the results of the modelling analysis supporting the design. A stochastic analysis was first conducted to assess the optimal diffuser configuration though the simulation of over 1,000 simulations corresponding to a wide range of Meliadine Lake simulated currents. A three-dimensional modelling analysis was then conducted to assess the potential for the conventional constituent concentration to build-up over time.

The Water Management Plan (for the Water License "A" application) (Agnico Eagle, 2015a, 2017) stated a total of 8 years (Year 1 to Year 8) of mill operations. There were four pre-production years (Year -4 to Year -1) and three post-production (interim closure) years (Year 9 to 11) for water treatment requirements in the Water Management Plan. However, no water discharge through the diffuser occurred during Year -4 (2016). Hence, the actual pre-production period will be three years (Year -3 to Year -1). As a result, a three-dimensional multi-year simulation covering a total of 14 years of discharge through the diffuser (Year -3 to Year 11) was set up to assess conventional constituent build-up in the lake by the end of Year 2030, assuming for modelling purpose a diffuser discharge start date of June 2017. Three scenarios were investigated:

- Scenario 1 (Base Case) looked at the accumulation of conventional constituents over time for mean (normal) precipitations years. Estimated monthly volumes of discharged water, as shown in Table 3.4, with a discharge rate of 11,688 m³/day were used in the modelling;
- Scenario 2 (Wet Year Case) investigated the accumulation of conventional constituents if one or two years were to be a wet precipitation year. Estimated monthly volumes of discharged water, as shown in Table 3.5, with a discharge rate of 11,688 m³/day were used in the modelling;
- Scenario 3 (Sensitivity Case) assessed the impact of a greater pumped discharged rate for mean precipitations years. The estimated monthly volumes of discharged water were the same as Scenario 1 but the assumed daily discharge rate increased from 11,688 m³/day to 20,120 m³/day. Hence the discharge occurred over a shorter period of time.

Monthly average concentrations for each constituent in the outfall stream were used to assess the build-up of conventional constituents in the Meliadine Lake sub-basin. Total conventional constituent concentrations were used (instead of just dissolved concentrations), which include both dissolved and particulate forms carried in the estimated TSS of 15 mg/L. Conventional constituent concentrations build up until reaching an equilibrium, which occurs after Year 7 of the mine operation, corresponding to Year 2026. The effluent density has no impact on the dilutions at 100 m and beyond over a multi-year period. Conventional constituent concentration is fairly uniform over the entire sub-basin and the minimal stratification results in similar concentration over the water column.

The selected diffuser achieved dilutions that fall within the Site Specific Water Quality Objectives (SSWQO) and the Canadian Council of Ministers of the Environment guidelines (CCME) guidelines for all of the constituents. Thus, the proposed diffuser will meet water quality guidelines and objectives. In all three scenarios described in this report, water quality guidelines and objectives are met.

7.1 Diffuser Optimization - Stochastic Modelling

The US EPA Visual Plume model was used to assess dilutions in the near-field. Environmental conditions, i.e. currents at various depths, were provided by the 3-D hydrodynamic model H3D. Between mid-June and mid-October, approximate time period of effluent discharge in the Meliadine Lake sub-basin, one independent simulation was started every 3 hours, representing about 1,000 simulations in total, for a specific diffuser configuration. Scenarios corresponding to a buoyant plume (effluent is warmer than lake) and a non-buoyant plume (effluent is cooler than lake) were conducted.

This stochastic tool allowed to assess various diffuser configurations and to select the optimal diffuser configuration are presented in Section 7.2.

7.2 Diffuser Configuration

The optimized diffuser has the following design details:

- Diffuser connecting with the outfall through a Tee connection (diffuser oriented NE-SW);
- Coordinates of the Tee: 6,898,150 N / 542,756 E;
- Length of diffuser: 30 m;
- Diameter of the diffuser: 400 mm OD / 355 mm ID;
- Diffuser depth: about 14.6 m (from the Meliadine Lake water surface);
- Number of ports: 10 ports;
- Port diameter: 51 mm;
- Port spacing: 3 m;
- Tideflex valve mounted on top of diffuser pipe on each port to eliminate fish access;
- Vertical angle of valve: 45 degrees, pointing toward the southeast;
- Port height from lake bed: 1 m, corresponding to the approximate effluent exit height from the lakebed.

7.3 Diffuser Performances over Time - Results of the 3D Hydrodynamic Modelling

The three-dimensional (3D) hydrodynamic modelling combines both the 3D hydrodynamic model H3D coupled with the US EPA Visual Plumes model. Visual Plumes simulated the behavior of the plume in the near field and passed conventional constituent concentration to the 3D H3D model, which then advects conventional constituents in the far field. A passive scalar with a concentration of 1 was released, following the effluent flow rate schedule described in Section 3. Open boundary on the northwest side of the domain allowed freshwater with no conventional constituent to enter the domain when currents would be oriented in the southeast direction.

Three scenarios were investigated to assess the conventional constituent concentration potential build-up over the 14 year simulated period. All three scenarios have the same diffuser design presented in Section 7.2.

- Scenario 1 (Base Case) looked at the accumulation of conventional constituent concentration over time for the base case simulation for mean (normal) precipitation years. Estimated monthly volumes of discharged water with a discharge rate of 11,688 m^3/day were used for the modelling.
- Scenario 2 (Wet Year Case) investigated the accumulation of conventional constituent if one or two years were to be a wet precipitation year. Estimated monthly volumes of discharged water with a discharge rate of 11,688 m^3/day were used in the modelling.
- Scenario 3 (Sensitivity Case) assessed the impact of a greater pumped discharged rate for the mean precipitations years. The estimated monthly volumes of discharged water were the same as Scenario 1 but the assumed discharged rate increased from 11,688 m^3/day to 20,120 m^3/day.

7.3.1 Scenario 1: Simulation of Base Case (Mean Precipitation Years)

A 14-year simulation period (three years of pre-production, eight years of operation and three years of post-production) was conducted to assess the potential build-up of conventional constituent in the Meliadine Lake sub-basin corresponding to a base case simulation for mean precipitation years.

The multi-year simulation has showed that conventional constituent accumulated in Meliadine Lake sub-basin. By the end of Year 11, concentrations of the marker scalar, which entered at a concentration of 1 (unit-less), varied between 0.03 and 0.04 at the edge of the mixing zone, corresponding to a dilution of about 23:1 to 32:1. Maximum concentration was reached in Year 8 with a value of 0.042, i.e. 23:1 dilution.

The blue dots shown in Figure 7.1 represent the volume of effluent released over the course of each year through the Meliadine Lake's diffuser. The orange line shows the volume of effluent present in Meliadine Lake, i.e. within the model's domain shown on Figure 3.1. One can observe the orange curve, i.e. volume of effluent in the Meliadine Lake sub-basin, plateauing after Year 7 (2026), meaning that the system reached an equilibrium: the volume of effluent, with elevated constituent concentrations entering the lake via the diffuser is balanced by the modeled river inflows and by the exit of water carrying conventional constituents through the northern end of the modelled part of Meliadine Lake into the main body of Meliadine Lake.

As shown previously in Table 3.3, the end-of-pipe effluent concentration predictions were based on the Metal Mining Effluent Regulation (MMER) and presented in the Water License "A". The subsequent discharge of the effluent in the Meliadine Lake sub-basin has to meet regulatory guidelines at the end of the mixing zone. The Canadian Council of Ministers of the Environment guidelines (CCME) and the Site Specific Water Quality Objectives (SSWQO) guidelines were considered applicable for discharge to Meliadine Lake sub-basin. CCME guidelines provide an upper bound for concentrations of various constituents in the environment to protect aquatic life. The SSWQO values replace the CCME criteria values for the parameters Al, As, F, Fe and are applicable to Meliadine Lake because species used to develop them are representative of similar northern settings (Environment and Climate Change Canada, 2015). Values for the SSWQO are available in the Water Management Plan (Agnico Eagle, 2015a, 2017).

Concentrations for each constituent of the effluent were calculated at the end of the mixing zone so that it could be compared with the SSWQO and CCME guidelines. Table 7.1 presents the comparison. The calculation of the conventional constituent concentration takes into account the median background concentration in Meliadine Lake and is based on the Meliadine Lake Outfall Diffuser end-of-pipe predictions described in Table 3.3.

Most conventional constituents are present in Meliadine Lake at concentrations less than CCME guidelines. Arsenic is slightly greater than the CCME guideline; however a SSWQO has been developed specifically for Arsenic for the Meliadine Project. The Arsenic concentration in the lake after a 14-year discharge simulation is less than the SSWQO guideline by a factor of 3. Hence, regulatory guidelines are met for Arsenic.

In summary, water quality guidelines are met with the proposed diffuser system, even when including the effects of conventional constituent build-up due to low flushing rates in the receiving environment.

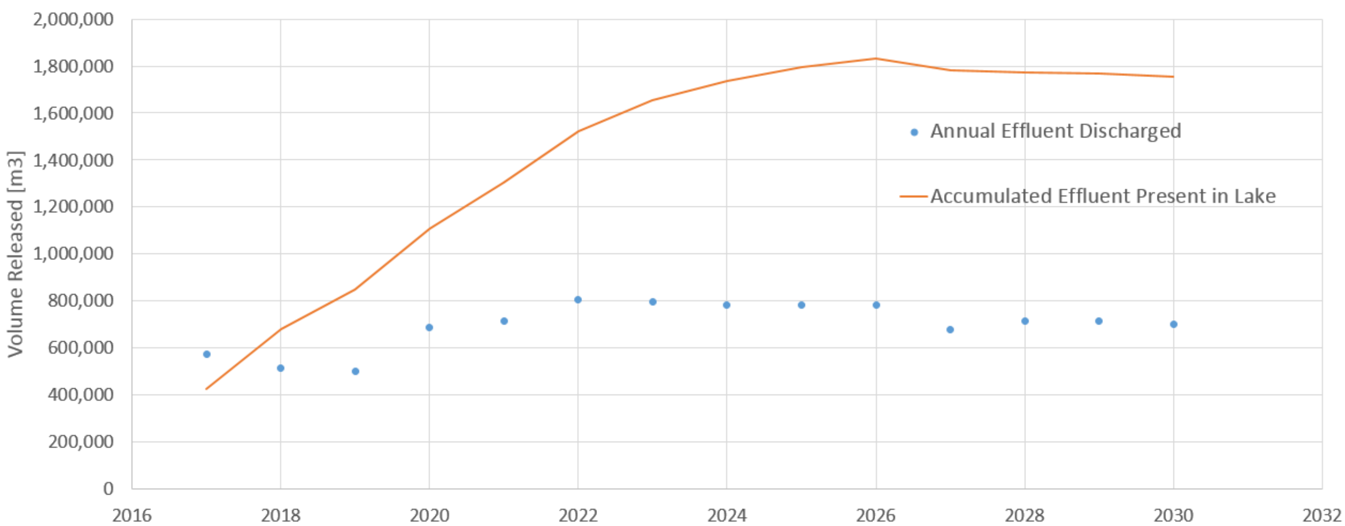


Figure 7.1: Volume of Effluent in the Model Domain

Table 7.1: Simulated Conventional Constituent Levels – Base Case (Mean Precipitation Years)

			Monthly Average Constituent Concentration	
	CCME Guidelines [mg/L]	SSWQO Guidelines [mg/L]	Base Case Scenario - Concentration Lower Bound [mg/L] - (corresponding to Dilution of 32:1, i.e. scalar concentration of 0.03)	Base Case Scenario - Concentration Upper Bound [mg/L] – (corresponding to Dilution of 23:1, i.e. scalar concentration of 0.042)
Conventional Constituents				
Total Dissolved Solids	-		39.9	41.8
Total Suspended Solids	8		1.9	2.0
pH	-			
Major Ions				
Chloride	120		6.8	6.9
Fluoride	0.12	2.8	0.03	0.03
Sodium	-		3.3	3.3
Sulphate	-		3.9	4.2
Nutrients				
Total Ammonia as Nitrogen	3.33		0.16	0.21
Nitrate Ion	13		0.28	0.34
Phosphorus (total)	0.03		0.02	0.02
Cyanides				
Total cyanide	-		0.0011	0.0012
Free cyanide	0.005		-	-
Metals				
Aluminum	0.1		0.03729	0.05065
Antimony	-		0.00018	0.00021
Arsenic	0.005	0.025	0.00585	0.00799
Barium	-		0.00750	0.00766
Cadmium	0.00005		0.00003	0.00003
Chromium	0.0089		0.00028	0.00031
Copper	0.002		0.00119	0.00121
Iron	0.3	1.06	0.07233	0.09107
Lead	0.001		0.00017	0.00023
Manganese	-		0.00653	0.00796
Mercury	0.000026		0.00001	0.00001
Molybdenum	0.073		0.00026	0.00031

			Monthly Average Constituent Concentration	
	CCME Guidelines [mg/L]	**SSWQO Guidelines [mg/L]**	**Base Case Scenario - Concentration Lower Bound [mg/L] - (corresponding to Dilution of 32:1, i.e. scalar concentration of 0.03)**	**Base Case Scenario - Concentration Upper Bound [mg/L] – (corresponding to Dilution of 23:1, i.e. scalar concentration of 0.042)**
Nickel	0.025		0.00068	0.00070
Selenium	0.001		0.00006	0.00006
Silver	0.00025		0.00005	0.00005
Thallium	0.0008		0.00002	0.00002
Uranium	0.015		0.00004	0.00005
Zinc	0.03		0.00175	0.00184

7.3.2 Scenario 2: Simulation of Wet Year Case (Mean and Two Wet Precipitation Years)

As described in Section 3.4, a wet year with a return period of 100 years will bring significantly more effluent water, and potentially more conventional constituents to the system. This section investigates the impact of one or two wet precipitation years on conventional constituent concentrations at the end of the mixing zone.

In this scenario, Year 7 (i.e. 2026) was simulated as a wet year. Pumping characteristics are the same during a wet precipitation year and a base case precipitation year, i.e. 11,688 m^3/day; however the duration of the release is higher during a wet year resulting in higher loadings to the system. As a result, almost twice the amount of conventional constituents were delivered to the Meliadine Lake sub-basin compared to the loading in a base case precipitation year. The wet year simulation showed that Years 7 (2026) and 8 (2017) are the years with the greatest concentrations of conventional constituent in the Meliadine Lake sub-basin. Concentrations of the marker scalar, which entered at a concentration of 1 (unit-less), vary between 0.04 and 0.05 at the edge of the mixing zone. A maximum value of 0.05 was reached over the course of Years 7 and 8, representing a dilution of 19:1. Such dilution is slightly lower than the ones obtained for the base case. Table 7.2 compares this dilution with CCME and SSWQO guidelines.

A second sub-scenario was developed, combined two wet years over the 14 year simulation period. Year 2 and Year 7 were assumed to be wet years since they are considered to be critical years for water quality purposes. As a result, the conventional constituent end-of-pipe loading in each year of Year 2 and Year 7 is almost twice the loading in the mean precipitation year for the base case, i.e. mean precipitation year. The joint probability for the occurrence of two wet years over a 14 year timeframe is extremely low (0.9%). Concentrations of the marker scalar, which entered at a concentration of 1 (unit-less), vary between 0.040 and 0.051 at the edge of the mixing zone on years 7 to 9. A maximum concentration value of 0.051 was reached over the course of Years 7 and 8, representing a dilution of 19:1, slightly lower than the dilutions obtained for the base case. Table 7.2 compares this dilution with CCME and SSWQO guidelines.

Figures 8.2 and 8.3 indicate the volume of effluent in the model domain for one wet year and two wet years, respectively. Despite the spike in the volume of conventional constituents present in the Meliadine Lake, water quality guidelines are met with the proposed diffuser system, even when including the effects of conventional constituent build-up due to low flushing rates in the receiving environment, as shown in Table 7.2. As shown in Table 7.2, the scenario with one wet year and the scenario with two wet years result in almost identical values for all conventional constituents of concern, with slightly greater values for the scenario with two wet years.

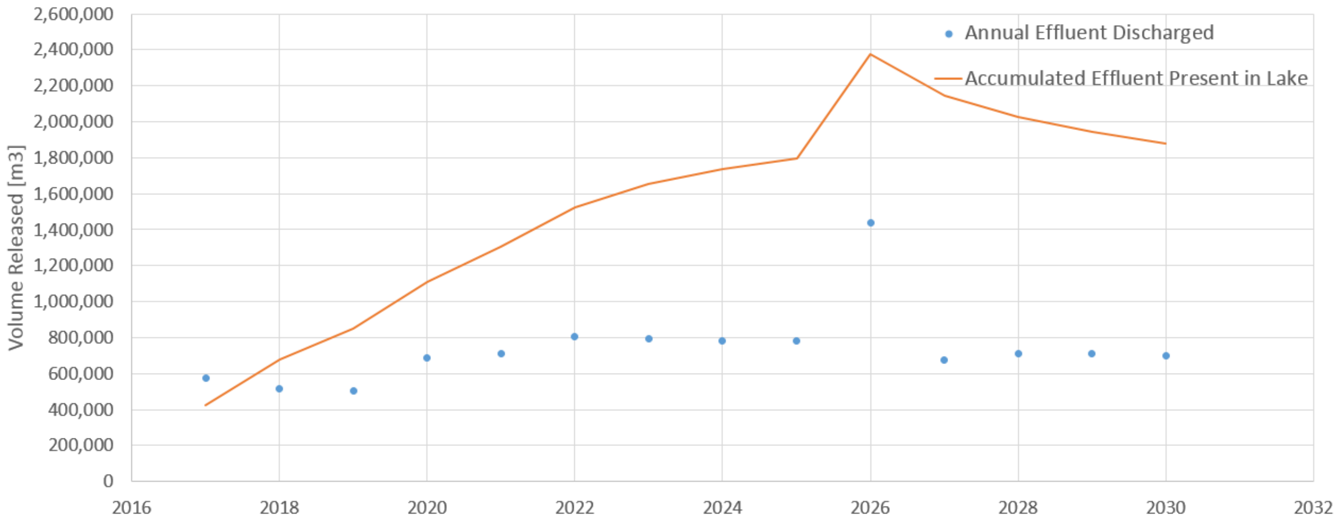


Figure 7.2: Volume of Effluent in the Model Domain – Year 7 Simulated as a Wet Year

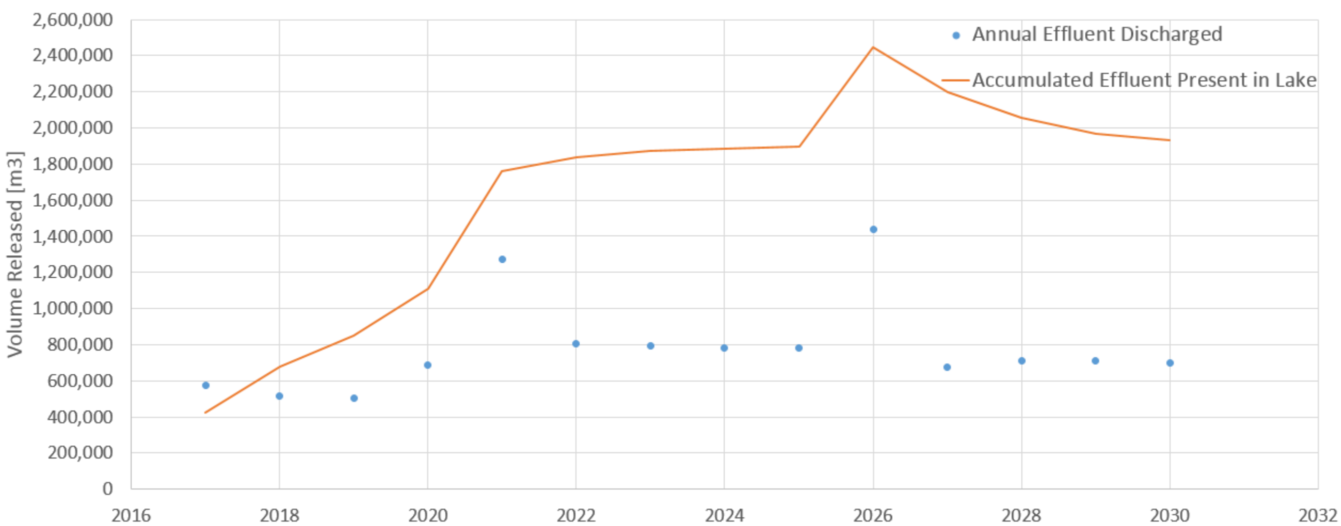


Figure 7.3: Volume of Effluent in the Model Domain – Years 2 and 7 Simulated as Wet Years

Table 7.2: Simulated Conventional Constituent Levels – Wet Year Cases

			Monthly Average Constituent Concentration		
			Wet Precipitation Year Scenario		Base Case Scenario
	CCME Guidelines [mg/L]	SSWQO Guidelines [mg/L]	Results for Two Wet Years (Years 2 and 7) – Dilution of 19:1 (scalar concentration of 0.051)	Results for One Wet Year (Year 7) – Dilution of 19:1 (scalar concentration of 0.050)	Dilution of 23:1 (scalar concentration of 0.042)
Conventional Constituents					
Total Dissolved Solids	-		43.2	43.0	41.8
Total Suspended Solids	8		2.2	2.1	2.0
pH	-				
Major Ions					
Chloride	120		7.1	7.0	6.9
Fluoride	0.12	2.8	0.03	0.03	0.03
Sodium	-		3.3	3.3	3.3
Sulphate	-		4.5	4.5	4.2
Nutrients					
Total Ammonia as Nitrogen	3.33		0.25	0.24	0.21
Nitrate Ion	13		0.39	0.38	0.34
Phosphorus (total)	0.03		0.02	0.02	0.02
Cyanides					
Total cyanide	-		0.0012	0.0012	0.0012
Free cyanide	0.005		-	-	-
Metals					
Aluminum	0.1		0.06068	0.05938	0.05065
Antimony	-		0.00024	0.00023	0.00021
Arsenic	0.005	0.025	0.00959	0.00938	0.00799
Barium	-		0.00778	0.00776	0.00766
Cadmium	0.00005		0.00003	0.00003	0.00003
Chromium	0.0089		0.00034	0.00033	0.00031
Copper	0.002		0.00124	0.00123	0.00121
Iron	0.3	1.06	0.10516	0.10333	0.09107
Lead	0.001		0.00027	0.00026	0.00023
Manganese	-		0.00902	0.00889	0.00796
Mercury	0.000026		0.00001	0.00001	0.00001

Molybdenum	0.073		0.00035	0.00035	0.00031
Nickel	0.025		0.00073	0.00072	0.00070
Selenium	0.001		0.00007	0.00007	0.00006
Silver	0.00025		0.00005	0.00005	0.00005
Thallium	0.0008		0.00002	0.00002	0.00002
Uranium	0.015		0.00005	0.00005	0.00005
Zinc	0.03		0.00191	0.00190	0.00184

7.3.3 Scenario 3: Simulation of a Greater Discharge Flow Rate (Sensitivity Case)

A sensitivity analysis was conducted to determine the impact of a greater pumping flow rate on the system.

The estimated monthly effluent volumes for the base case (mean precipitation years), were considered. The conventional constituent loading was kept constant, and the duration of the release was shortened. In other words, the same volume of conventional constituents was discharged compared to the base case precipitation year scenario, but the timeframe over which constituents were discharged was shorted.

The overall amount of effluent discharged on a monthly basis is based on the base case scenario, presented in Table 3.4. However the assumed daily discharge for this sensitivity analysis was 20,120 m³/day, instead of an 11,688 m³/day for the base case. The assumed constraint of having the pump operating for at least three days in a row was kept.

Concentrations of the marker scalar, which entered at a concentration of 1 (unit-less), vary between 0.04 and 0.05 at the edge of the mixing zone. A maximum concentration value of 0.046 was reached over the course of Years 7 and 8, representing a dilution of 21:1. Figure 7.4 indicates the volume of effluent in the model domain, with a stabilization after Year 8 (2027). Table 7.3 summarizes the conventional constituent level. Water quality guidelines are met, even though the pump capacity was increased from 11,688 m³/day to 20,120 m³/day. Results show slightly greater concentrations compared to the base case scenario; the maximum concentration is almost 10% greater than the base case.

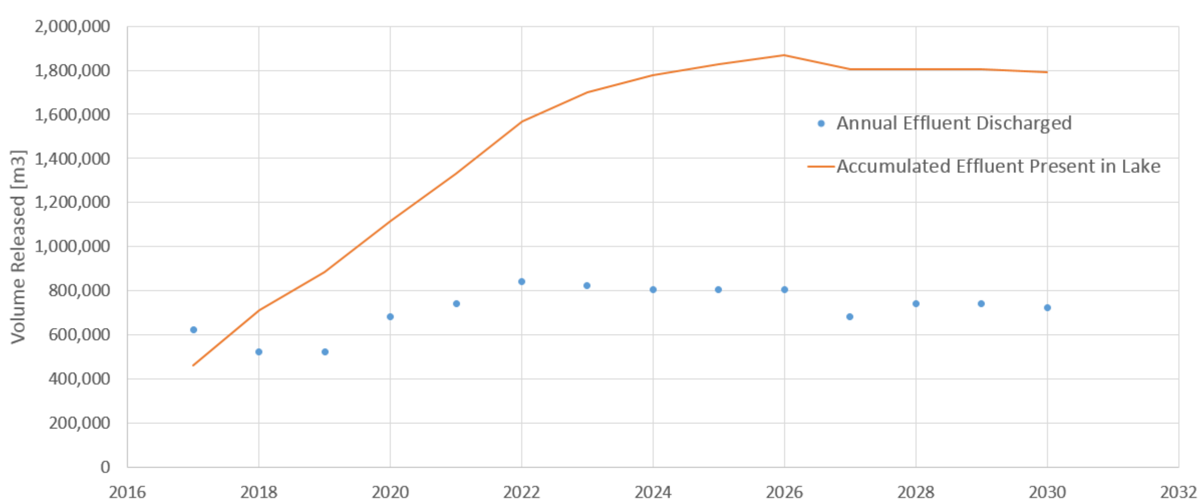


Figure 7.4: Volume of Effluent in the Model Domain – Greater Pumping Capacity

Table 7.3: Simulated Conventional constituent Levels – 20,120 m^3/day Discharge Rate (Sensitivity Case)

Monthly Average				
	CCME Guidelines [mg/L]	**SSWQO Guidelines [mg/L]**	**Greater Pumping Capacity Scenario (Sensitivity Case) Dilution of 21:1 (scalar concentration of 0.046)**	**Base Case Scenario – Dilution of 23:1 (scalar concentration of 0.042)**
Conventional Constituents				
Total Dissolved Solids	-		42.5	41.8
Total Suspended Solids	8		2.1	2.0
pH	-			
Major Ions				
Chloride	120		7.0	6.9
Fluoride	0.12	2.8	0.03	0.03
Sodium	-		3.3	3.3
Sulphate	-		4.4	4.2
Nutrients				
Total Ammonia as Nitrogen	3.33		0.23	0.21
Nitrate Ion	13		0.36	0.34
Phosphorus (total)	0.03		0.02	0.02
Cyanides				
Total cyanide	-		0.0012	0.0012
Free cyanide	0.005		-	-
Metals				
Aluminum	0.1		0.05547	0.05065
Antimony	-		0.00022	0.00021
Arsenic	0.005	0.025	0.00876	0.00799
Barium	-		0.00772	0.00766
Cadmium	0.00005		0.00003	0.00003
Chromium	0.0089		0.00032	0.00031
Copper	0.002		0.00122	0.00121
Iron	0.3	1.06	0.09784	0.09107
Lead	0.001		0.00025	0.00023
Manganese	-		0.00847	0.00796
Mercury	0.000026		0.00001	0.00001
Molybdenum	0.073		0.00033	0.00031
Nickel	0.025		0.00072	0.00070
Selenium	0.001		0.00007	0.00006
Silver	0.00025		0.00005	0.00005
Thallium	0.0008		0.00002	0.00002
Uranium	0.015		0.00005	0.00005
Zinc	0.03		0.00188	0.00184

8.0 CONSTRUCTION

8.1 General

8.1.1 Construction pad (on Meliadine Lake shore)

To minimize land disturbance during construction, a construction pad will be built close to the Meliadine Lake shore. This area will further be used as an operation and maintenance pad for the pipeline and diffuser. The main purpose of the pad is to define a limited area of work for shore activities, reducing the risks for environmental or health and safety issues. This pad will therefore be located within 31m of the Meliadine Lake shore, refer to drawing 65-417-230-223 in Appendix A. The location of the pad and its proximity to the edge of the water will allow safe access to the lake and installation of the submerged section of pipeline as well as the diffuser.

Drawing 65-695-265-221 in Appendix A shows an overview of the diffuser system: the diffuser with a Tee connection with the outfall pipe. Both diffuser arms have a length of 13.8 m, not including the flange connection of the Tee. Three ballast blocks will be installed on the diffuser pipe with the same ballast design as for the main outfall pipe. The diffuser will be made of HDPE PE 4710 with a DR 17 corresponding to a wall thickness of 22.5 mm. All metal connections and items will be 316 SS, and sacrificial anodes will be installed for corrosion protection.

In Appendix A, a shop drawing shows a schematic of the Tideflex valve that will be mounted onto each of the 10 diffuser ports. The valve will provide adequate protection against biofouling inside the pipe during the October-June period of inactivity. The valve will have a vertical angle of 45º. Appendix E shows two brochures from Red Valve Tideflex Company highlighting various use of the Tideflex valve.

No archaeological sites have been found near the construction site.

8.2 Material Specifications

8.2.1 Rip-rap

Rip-rap will be used as an erosion-protection or filling material for road crossing culvert as well as the pipeline discharge into CP1 (from CP5 and oil separator). The particle size specifications for the graded rip-rap materials are presented in the table below. The material shall be free of roots, organics, and other deleterious material. Processing may be required to achieve the specified gradation. The material can be processed from hard, durable, non-acid-generating rock.

Rip-rap Types for Various Earth Structures	Minimum Particle Size (mm)	Median Particle Size (D50) * (mm)	Maximum Particle Size (mm)	Approximate total QTY (m^3)
Rip-rap (300-500)	300	400	500	1500

8.2.2 Geotextile

Nonwoven geotextile will be installed in the lakebed underneath the pipeline entrance in the Meliadine Lake if required to reduce friction. The geotextile used for construction will be nonwoven, needle-punched.

8.3 Construction Quality Control/Assurance and Survey

A quality control/assurance program will be required during construction of each of the infrastructure components to ensure that construction-sensitive features of the design are achieved.

Upon the completion of the construction activities, an as-built construction report will be prepared and submitted to the regulators within 90 days after construction is completed. The construction report should provide all relevant supporting documentation.

Surveying will be carried out by Agnico Eagle to document the as-built conditions of excavations and fills including different material boundaries and facilitate the preparation of the as-built report.

8.4 Testing and Inspection

Prior to start up, the full length of above-ground pipelines will be tested for leaks at fusion weld and flange joints. If leaks are found, the joint will be re-welded or re-torqued and the hydrostatic test must be redone from the beginning.

All tests will be done according to ASTM F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings, ASTM F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping System Using Hydrostatic Pressure and the Plastic Pipe Institute Technical Note 38.

After start up, an annual inspection, performed by AEM personal, will be done to ensure pipeline integrity.

9.0 CLOSURE

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

Respectfully submitted,
Tetra Tech and Agnico Eagle team

EWTP

Prepared by:

Blandine Arseneault

Signature numérique de Blandine Arseneault
DN : cn=Blandine Arseneault
Date : 2017.06.22 12:45:52 -04'00'

Blandine Arseneault
Project Environment Lead

Reviewed by:

Pierre-Alexandre Bosse

Signature numérique de Pierre-Alexandre Bosse
DN : cn=Pierre-Alexandre Bosse
Date : 2017.06.22 11:52:49 -04'00'

Pierre-Alexandre Bossé
Project Process Lead

PERMIT TO PRACTICE
TETRA TECH INDUSTRIES, INC.
O/A TETRA TECH
Signature
Date 06.22.2017
PERMIT NUMBER: P 1029
NT/NU Association of Professional Engineers and Geoscientists

PUMPING STATIONS AND PIPELINE

Prepared by:

REGISTERED PROFESSIONAL ENGINEER
O. BEAUCHEMIN-THERIAULT
LICENSEE
NT/NU
Issue for use
22-06-2017

INGÉNIEUR
Orphé Beauchemin Thé…
144389
QUÉBEC
Issue for use
22-06-2017

Orphé Beauchemin, P. Eng.
Mechanical Engineer
(Nunavut #L3473 / OIQ #144389)

Reviewed by:

Benoit Tremblay, P. Eng.
Project Manager
(OIQ #132674)

2017.06.22 13:19:01 -05'00'

DIFFUSER

Prepared by:

Aurelien Hospital
22-06-2017

Aurelien Hospital, M.Eng., M.Sc.
Hydrotechnical Engineer and Marine Scientist

Reviewed by:

PROFESSIONAL
PROVINCE
J. A. STRONACH
BRITISH COLUMBIA
ENGINEER
June 22, 2017

Jim Stronach, Ph.D., P.Eng.
Senior Oceanographer
(APEGBC #17153)

TETRA TECH

10.0 REFERENCES

Agnico Eagle, 2015a. Meliadine Gold Project Water Management Plan. April 2015, Version 1, 6513-MPS-11.

Agnico Eagle, 2017. Meliadine Gold Project Water Management Plan. March 2017, Version 3, 6513-MPS-11.

Agnico Eagle, 2015b. Attachment C - Predictive Water Quality Modelling Results, Golder Doc# 498-1405283 Ver0, part of "Water Management Plan", Report# 6513-MPS-11 Version 1, April 2015.

Environment and Climate Change Canada, Intervention to the Nunavut Water Board – Respecting the Meliadine Gold Project – Phase 1 Type "A" Water Licence Application, Appendix A EC-04, ECCC File 6100 000 012/015, December 2015.

Golder Associates, SD 7-1 Aquatics Baseline Synthesis Report, 1994 to 2009 – Meliadine Gold Project, Nunavut, Report # 327-1013730076 Ver.0, October 2012.

Golder Associates, Effect of TSS Addition on Total Constituent Concentrations, Attachment D Table D.2 of "Mine Site Water Quality Predictions Meliadine Gold Project, Nunavut Report", Doc 498-1405283 Ver 0, April 2015.

APPENDIX A
DRAWINGS

Figure 1 EWTP Drawings

- 65-693-205-200 Rev. 1
- 65-693-205-201 Rev. 0
- 65-693-205-202 Rev. 0
- 65-693-205-203 Rev. 0
- 65-693-210-200 Rev. 4
- 65-693-210-201 Rev. 4
- 65-693-210-202 Rev. 4
- 65-693-210-203 Rev. 2
- 65-693-210-204 Rev. 2

Figure 2 Pumping Stations Drawings

- 6515-S-265-094-210-GAD-0010_Sub004
- 6515-S-265-094-210-GAD-0016_Sub004
- 6515-S-265-094-210-GAD-0017_Sub004

Figure 3 Pipeline Drawings

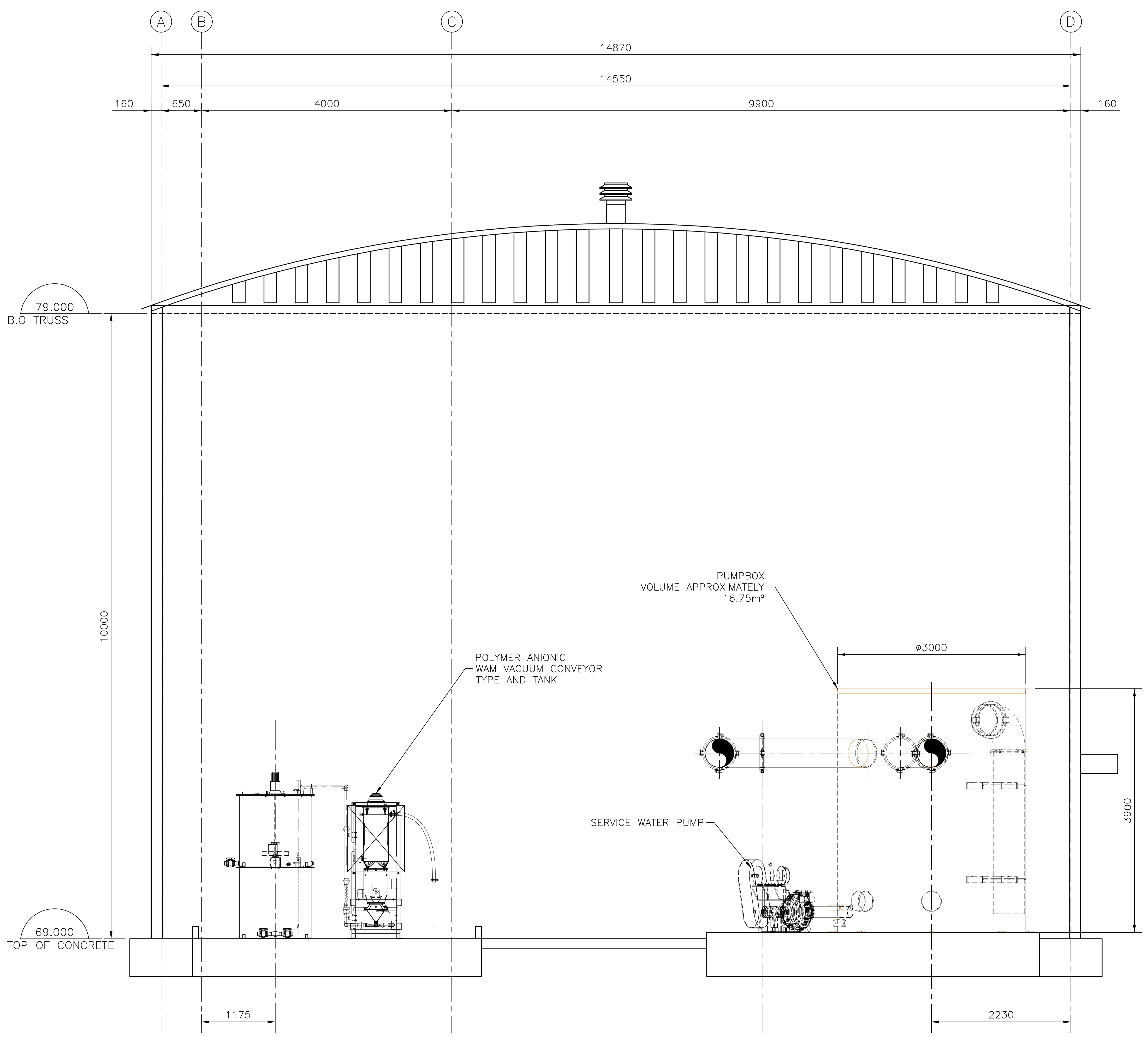
- 65-695-270-200 Rev. 2, Sheet 1/1
- 65-695-270-205 Rev. 2, Sheet 6/8
- 65-695-270-205 Rev. 2, Sheet 7/8
- 65-695-270-206 Rev. 2, Sheet 3/3
- 65-417-230-223 Rev. 0

Figure 4 Diffuser Drawings

- 65-695-265-221 Rev. 0
- TTS-41794

NO. DESSIN DRAWING NO. 65-693-210-204_R2

FORMAT ARCHD



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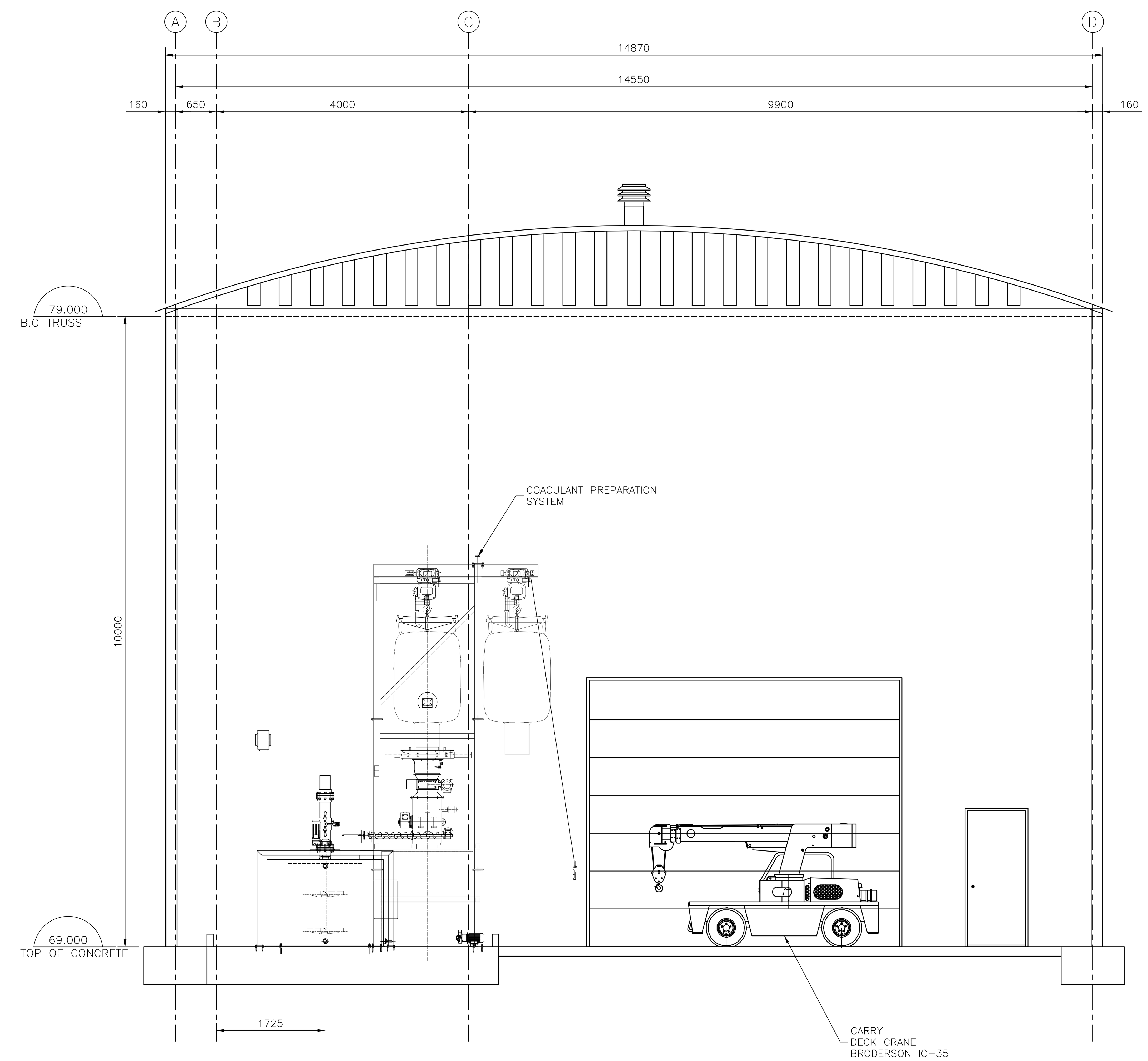

SECTION F
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POUR CONSTRUCTION
FOR CONSTRUCTION
AGNICO EAGLE
DATE : 2017-06-21

PLAN CLÉ
KEY PLAN

WSP
1075, 3e AVENUE EST
VAL-D'OR (QUÉBEC) CANADA J9P 0J7
TÉL. : 819 825-4274 | TÉLÉC. : 819 824-1514 | WWW.WSPGROUP.COM
Ref. 151-06440-10

NOTES GÉNÉRALES / GENERAL NOTES

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG
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AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
2	2017-06-21	GENERAL REVISION FOR HONCO BUILDING	V.T.	B.F.	
1	2017-04-28	BUILDING REVISION	V.T	B.F.	
0	2017-03-24	ISSUED FOR CONSTRUCTION	I.G.	B.F.	
A	2017-03-03	ISSUED FOR APPROVAL	V.T.	B.F.	

REVISIONS

TITRE / TITLE
AGNICO EAGLE – MELIADINE DIVISION
693 – FINAL WATER TREATMENT PLANT
210– GENERAL ARRANGEMENT
SECTIONS E AND F

DESSINÉ PAR DRAWN BY	STEVEN PERRON	DATE 2017-02-23
VERIFIÉ PAR CHECKED BY	STEVEN PERRON	2017-03-03
APPROUVÉ PAR APPROVED BY	BERTRAND FORTIN, ing.	2017-03-03
ÉCHELLE SCALE	INDICATED	DATE 2017-02-23

NO. DESSIN DRAWING NO. 65-693-210-204

NO. PROJET PROJECT NO.	REVISION	FEUILLE / SHT
6515	2	1 / 1

AE-CART-ARCH D

P:_15X-XXXX-XX\151-06440-10\01-COMM\Envoyé_AEM\WSP-AEM-151-06440-10-1361 (Gen Arr final water treatment plant Rev)\65-693-210-204_R2.dwg-2017-06-21 11:16:40

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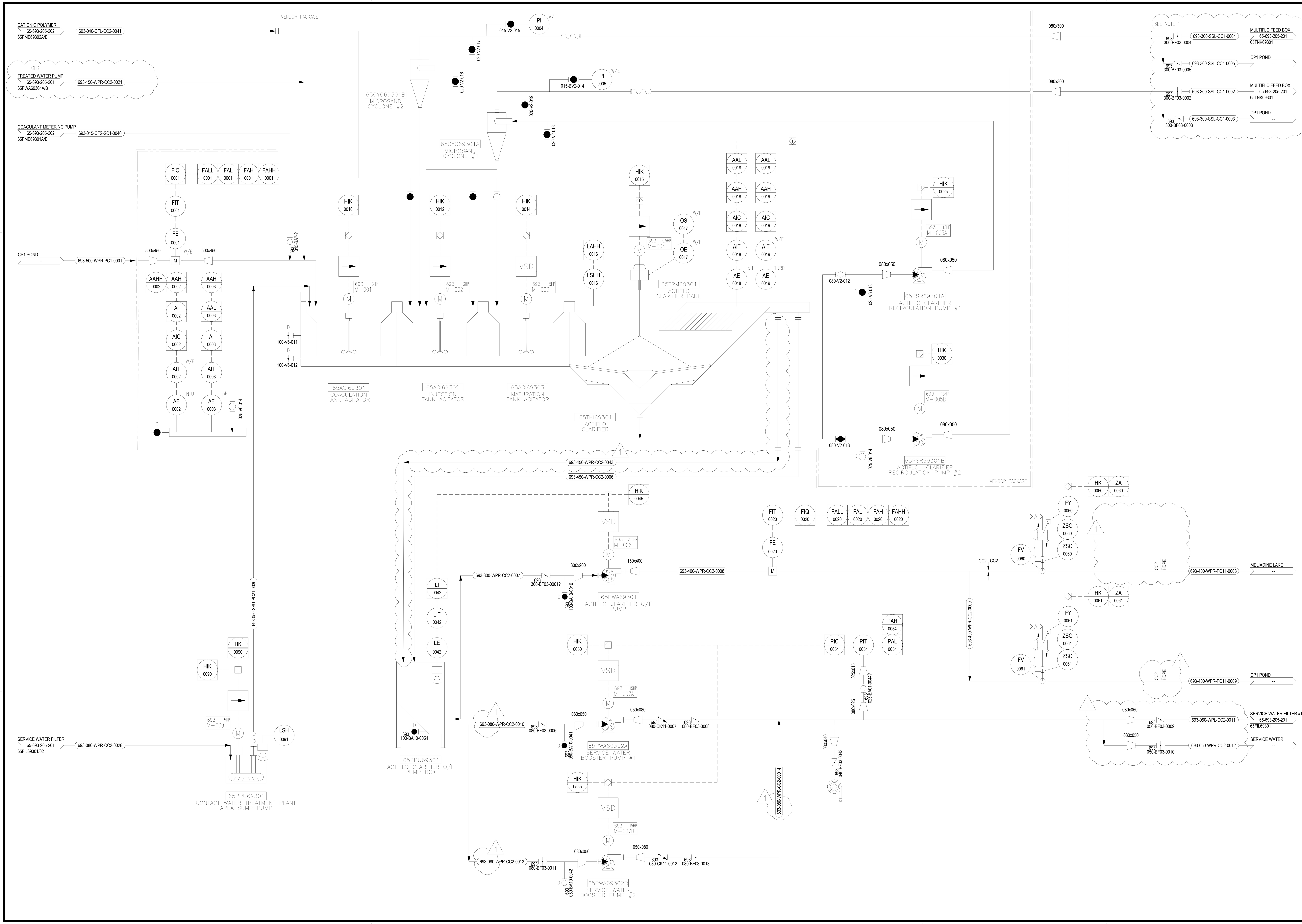
DRAWING NO. 65-693-205-200



PLAN CLÉ
KEY PLAN

WSP
1075, 3e AVENUE EST
VAL-D'OR (QUÉBEC) CANADA J9P 0J7
TÉL. : 819 825-4274 | TÉLÉC. : 819 824-1514 | WWW.WSPGROUP.COM
Ref. 151-06440-10

NOTES GÉNÉRALES / GENERAL NOTES

NOTE 1

- SENT TO CP1 FOR THE FIRST YEARS OF OPERATION.

POUR CONSTRUCTION
FOR CONSTRUCTION
AGNICO EAGLE
DATE : 2017-06-21

BASIC ENGINEERING FINAL APPROVAL PROCESS

NAME	TITLE	APPROVAL SIGNATURE	DATE
P-A BOSSÉ	PROJECT COORDINATOR		
MARTIN GAUMONT	MELIADINE PROCESS PLANT SUPERINTENDANT		
DANIEL SÉGUIN	ENGINEERING MANAGER MELIADINE		

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG
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AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
1	2017-06-21	GENERAL REVISION	E.B.	B.F.	
0	2017-06-02	ISSUED FOR CONSTRUCTION	E.B.	B.F.	

REVISIONS

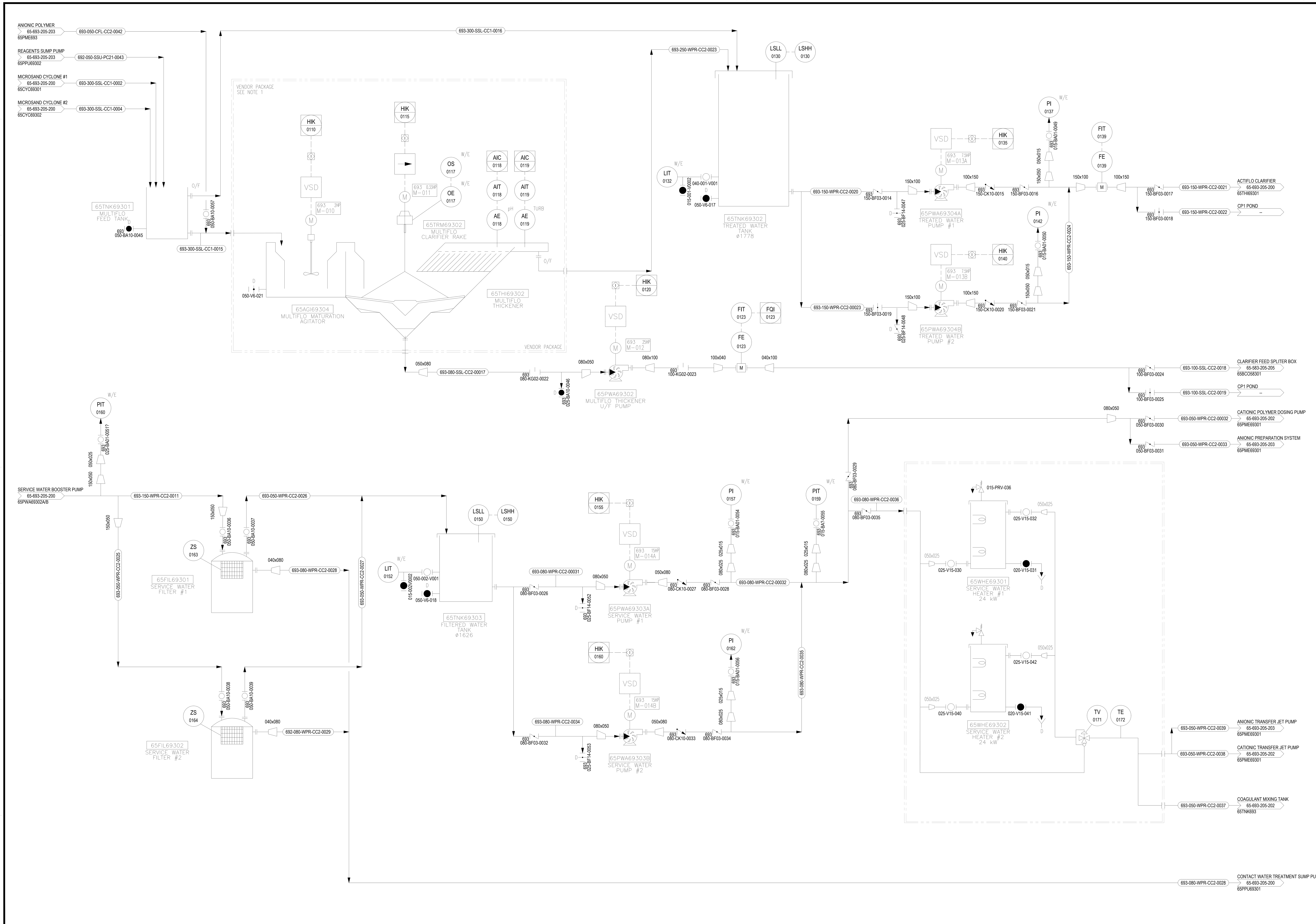
TITRE / TITLE
AGNICO EAGLE – MELIADINE DIVISION
693–FINAL WATER TREATMENT PLANT
205–P&ID
ACTIFLO CLARIFIER

DESSINÉ PAR / DRAWN BY	ERIC BOISSONNEAULT	DATE 2015-08-05
VERIFIÉ PAR / CHECKED BY	LUC SÉNÉCAL, P. Eng.	2017-06-21
APPROUVÉ PAR / APPROVED BY	BERTRAND FORTIN, P. Eng.	2017-06-021
ÉCHELLE / SCALE N/A	DATE 2015-08-05	

NO. DESSIN
DRAWING NO. 65-693-205-200

NO. PROJET / PROJECT NO.	REVISION	FEUILLE / SHT
6515	1	1 / 1

NO. DESSIN
DRAWING NO. 65-693-205-201



WSP
1075, 3e AVENUE EST
VAL-D'OR (QUÉBEC) CANADA J9P 0J7
TÉL. : 819 825-4274 | TÉLÉC. : 819 824-1514 | WWW.WSPGROUP.COM
Ref. 151-06440-10

NOTES GÉNÉRALES / GENERAL NOTES

NOTE 1

– NOT OPERATING BEFORE 2019

POUR CONSTRUCTION
FOR CONSTRUCTION
AGNICO EAGLE
DATE : 2017-06-02

BASIC ENGINEERING FINAL APPROVAL PROCESS

NAME	TITLE	APPROVAL SIGNATURE	DATE
P-A BOSSÉ	PROJECT COORDINATOR		
MARTIN GAUMONT	MELIADINE PROCESS PLANT SUPERINTENDANT		
DANIEL SÉGUIN	ENGINEERING MANAGER MELIADINE		

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG
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AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
0	2017-06-02	ISSUED FOR CONSTRUCTION	E.B.	B.F.	

REVISIONS

TITRE / TITLE
AGNICO EAGLE – MELIADINE DIVISION
693-FINAL WATER TREATMENT PLANT
205-P&ID
MULTIFLO CLARIFIER

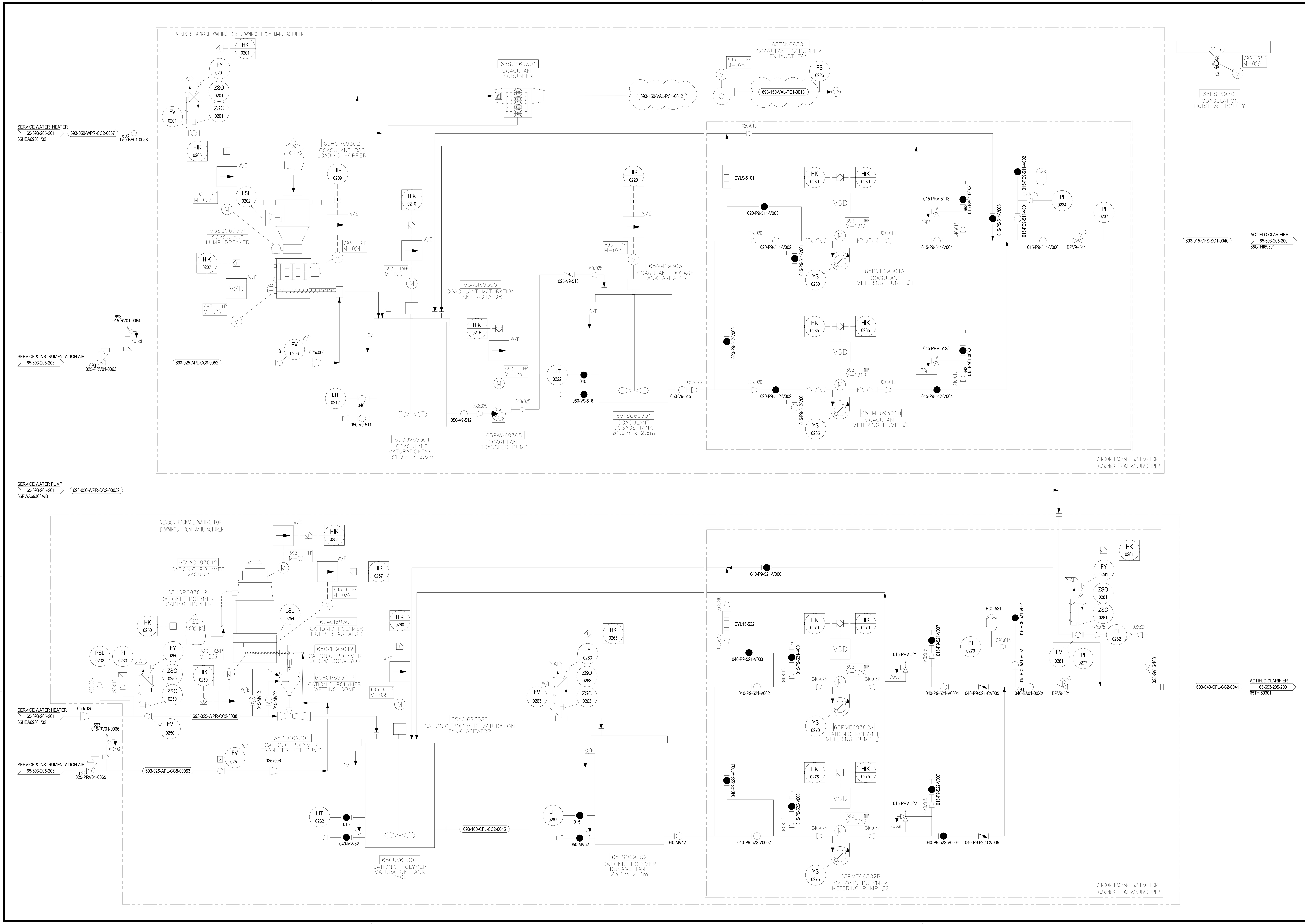
DESSINÉ PAR / DRAWN BY	ERIC BOISSONNEAULT	DATE 2015-08-05
VERIFIÉ PAR / CHECKED BY	LUC SÉNÉCAL, P. Eng.	2017-06-02
APPROUVÉ PAR / APPROVED BY	BERTRAND FORTIN, P. Eng.	2017-06-02
ÉCHELLE / SCALE N/A	DATE 2015-08-05	

NO. DESSIN / DRAWING NO. 65-693-205-201

NO. PROJET / PROJECT NO.	REVISION	FEUILLE / SHT
6515	0	1 / 1

FILE NO. 65-693-205-201.DWG

NO. DESSIN
DRAWING NO. 65-693-205-202



PLAN CLÉ
KEY PLAN

WSP
1075, 3e AVENUE EST
VAL-D'OR (QUÉBEC) CANADA J9P 0J7
TÉL. : 819 825-4274 | TÉLÉC. : 819 824-1514 | WWW.WSPGROUP.COM
Ref. 151-06440-10

NOTES GÉNÉRALES / GENERAL NOTES

POUR CONSTRUCTION
FOR CONSTRUCTION
AGNICO EAGLE
DATE : 2017-06-02

BASIC ENGINEERING FINAL APPROVAL PROCESS

NAME	TITLE	APPROVAL SIGNATURE	DATE
P-A BOSSÉ	PROJECT COORDINATOR		
MARTIN GAUMONT	MELIADINE PROCESS PLANT SUPERINTENDANT		
DANIEL SÉGUIN	ENGINEERING MANAGER MELIADINE		

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG
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AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
0	2017-06-02	ISSUED FOR CONSTRUCTION	E.B.	B.F.	

REVISIONS

TITRE / TITLE
AGNICO EAGLE – MELIADINE DIVISION
693-FINAL WATER TREATMENT PLANT
205-P&ID
COAGULANT & CATIONIC POLYMER

DESSINÉ PAR / DRAWN BY	ERIC BOISSONNEAULT	DATE	2015-08-05
VÉRIFIÉ PAR / CHECKED BY	LUC SÉNÉCAL, P. Eng.		2017-06-02
APPROUVÉ PAR / APPROVED BY	BERTRAND FORTIN, P. Eng.		2017-06-02
ÉCHELLE / SCALE	N/A	DATE	2015-08-05

NO. DESSIN / DRAWING NO. 65-693-205-202

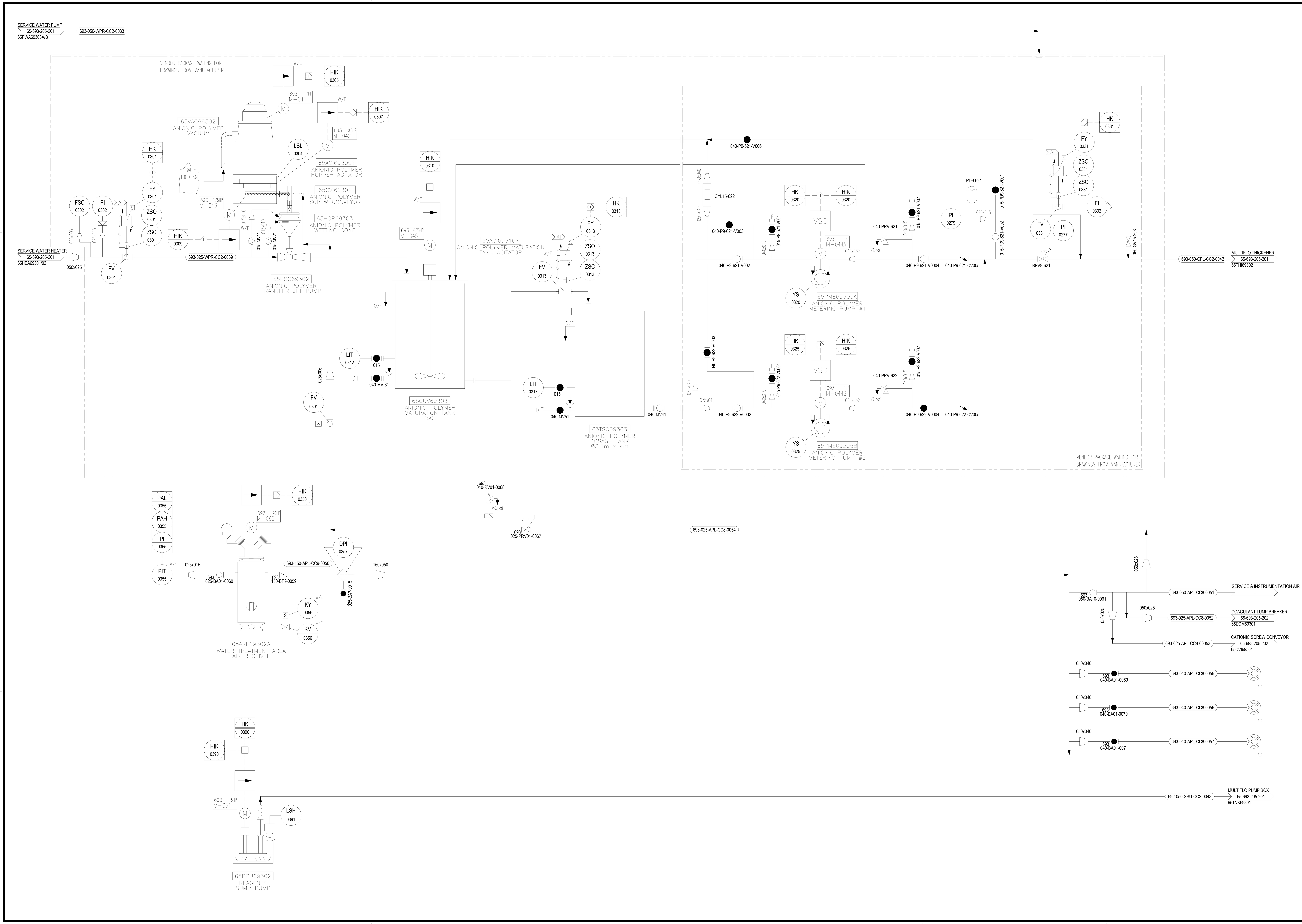
NO. PROJET / PROJECT NO.	REVISION	FEUILLE / SHT
6515	0	1 / 1

AE-CART-ARCH D

\\CAVDO10AT01\Projet_15X-XXXX-XX\151-06440-10\03-TECH_ORANGE\Dessin\Plant 3D\Process Plant\PID DWG\65-693-205-202.DWG-2017-06-02 11:49:33

FILE NO. 65-693-205-202.DWG

NO. DESSIN DRAWING NO. 65-693-205-203



POUR CONSTRUCTION
FOR CONSTRUCTION
AGNICO EAGLE
DATE : 2017-06-02

WSP
1075, 3e AVENUE EST
VAL-D'OR (QUÉBEC) CANADA J9P 0J7
TÉL. : 819 825-4274 | TÉLÉC. : 819 824-1514 | WWW.WSPGROUP.COM
Ref. 151-06440-10

NOTES GÉNÉRALES / GENERAL NOTES

BASIC ENGINEERING FINAL APPROVAL PROCESS

NAME	TITLE	APPROVAL SIGNATURE	DATE
P-A BOSSÉ	PROJECT COORDINATOR		
MARTIN GAUMONT	MELIADINE PROCESS PLANT SUPERINTENDANT		
DANIEL SÉGUIN	ENGINEERING MANAGER MELIADINE		

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG
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AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
0	2017-06-02	ISSUED FOR CONSTRUCTION	E.B.	B.F.	

REVISIONS

TITRE / TITLE
AGNICO EAGLE – MELIADINE DIVISION
693-FINAL WATER TREATMENT PLANT
205-P&ID
ANIOTIC POLYMER & AIR COMPRESSOR

DESSINÉ PAR DRAWN BY	ERIC BOISSONNEAULT	DATE 2015-08-05
VERIFIÉ PAR CHECKED BY	LUC SÉNÉCAL, P. Eng.	2017-06-02
APPROUVÉ PAR APPROVED BY	BERTRAND FORTIN, P. Eng.	2017-06-02
ÉCHELLE SCALE N/A		DATE 2015-08-05

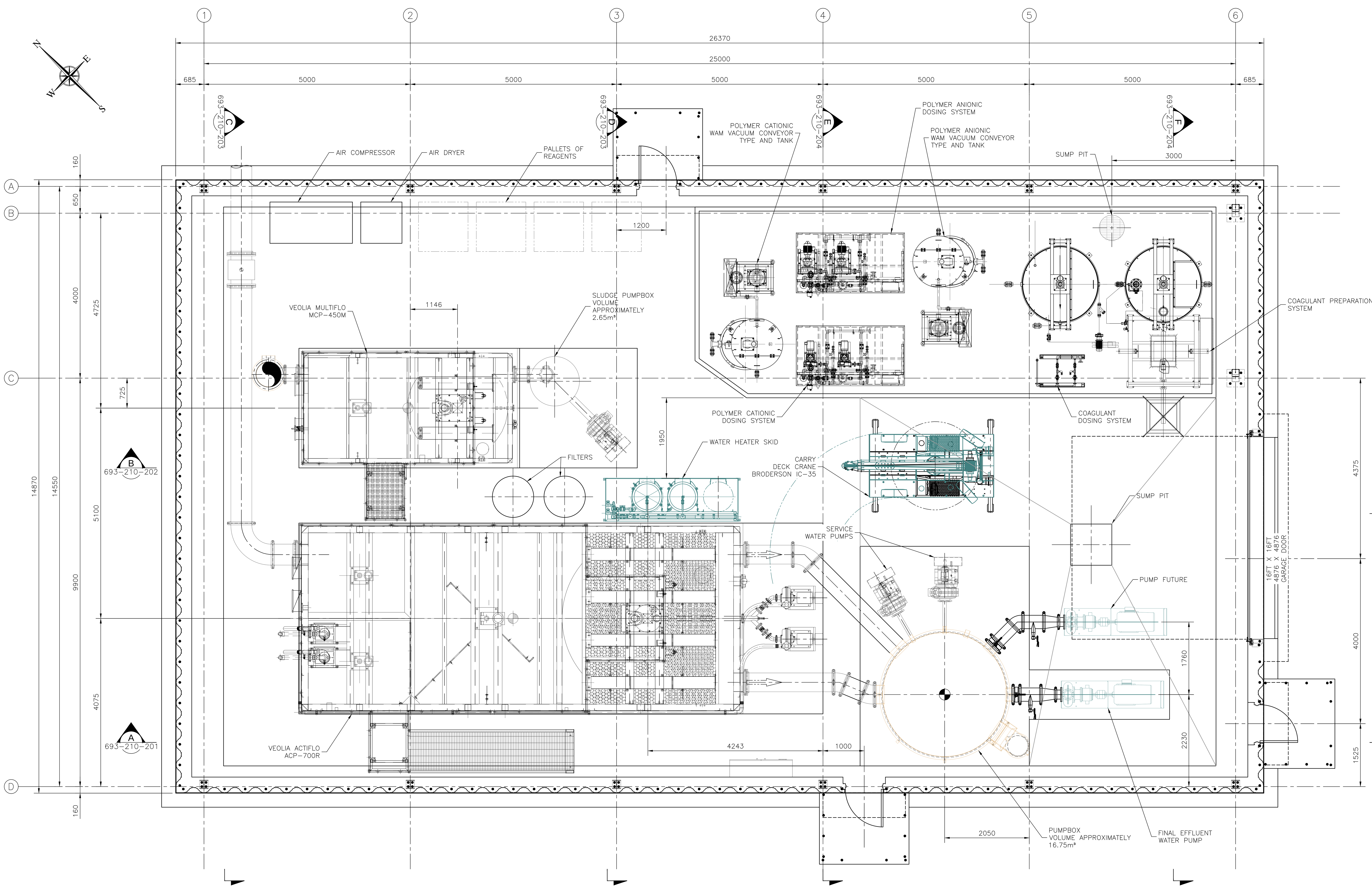
NO. DESSIN DRAWING NO. 65-693-205-203

NO. PROJET PROJECT NO.	REVISION	FEUILLE / SHT
6515	0	1 / 1

FILE NO. 65-693-205-203.dwg

NO. DESSIN DRAWING NO. 65-693-210-200_R4

FORMAT ARCHD



FINAL WATER TREATMENT PLANT – PLAN VIEW

SCALE: 1:50

POUR CONSTRUCTION
FOR CONSTRUCTION
DATE : 2017-06-21
AGNICO EAGLE

PLAN CLÉ
KEY PLAN

WSP
1075, 3e AVENUE EST
VAL-D'OR (QUÉBEC) CANADA J9P 0J7
TÉL. : 819 825-4274 | TÉLÉC. : 819 824-1514 | WWW.WSPGROUP.COM
Ref. 151-06440-10

NOTES GÉNÉRALES / GENERAL NOTES

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG
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AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
4	2017-06-21	GENERAL REVISION FOR HONCO BUILDING	V.T.	B.F.	
3	2017-04-28	BUILDING REVISION	V.T.	B.F.	
2	2017-03-24	ISSUED FOR CONSTRUCTION	I.G.	B.F.	
1	2017-03-03	GENERAL REVISION, AFTER RFQ	V.T.	B.F.	
0	2016-12-13	ISSUED FOR TENDER	I.G.	B.F.	

REVISIONS

TITRE / TITLE
AGNICO EAGLE – MELIADINE DIVISION
693 – FINAL WATER TREATMENT PLANT
210– GENERAL ARRANGEMENT
PLAN VIEW

DESSINÉ PAR / DRAWN BY	STEVEN PERRON	DATE 2015-11-30
VERIFIÉ PAR / CHECKED BY	STEVEN PERRON	2015-12-02
APPROUVÉ PAR / APPROVED BY	BERTRAND FORTIN, ing.	2015-12-02
ÉCHELLE / SCALE: INDICATED		DATE 2015-11-30
NO. DESSIN / DRAWING NO.	65-693-210-200	
NO. PROJET / PROJECT NO. 6515	REVISION 4	FEUILLE / SHT 1 / 1

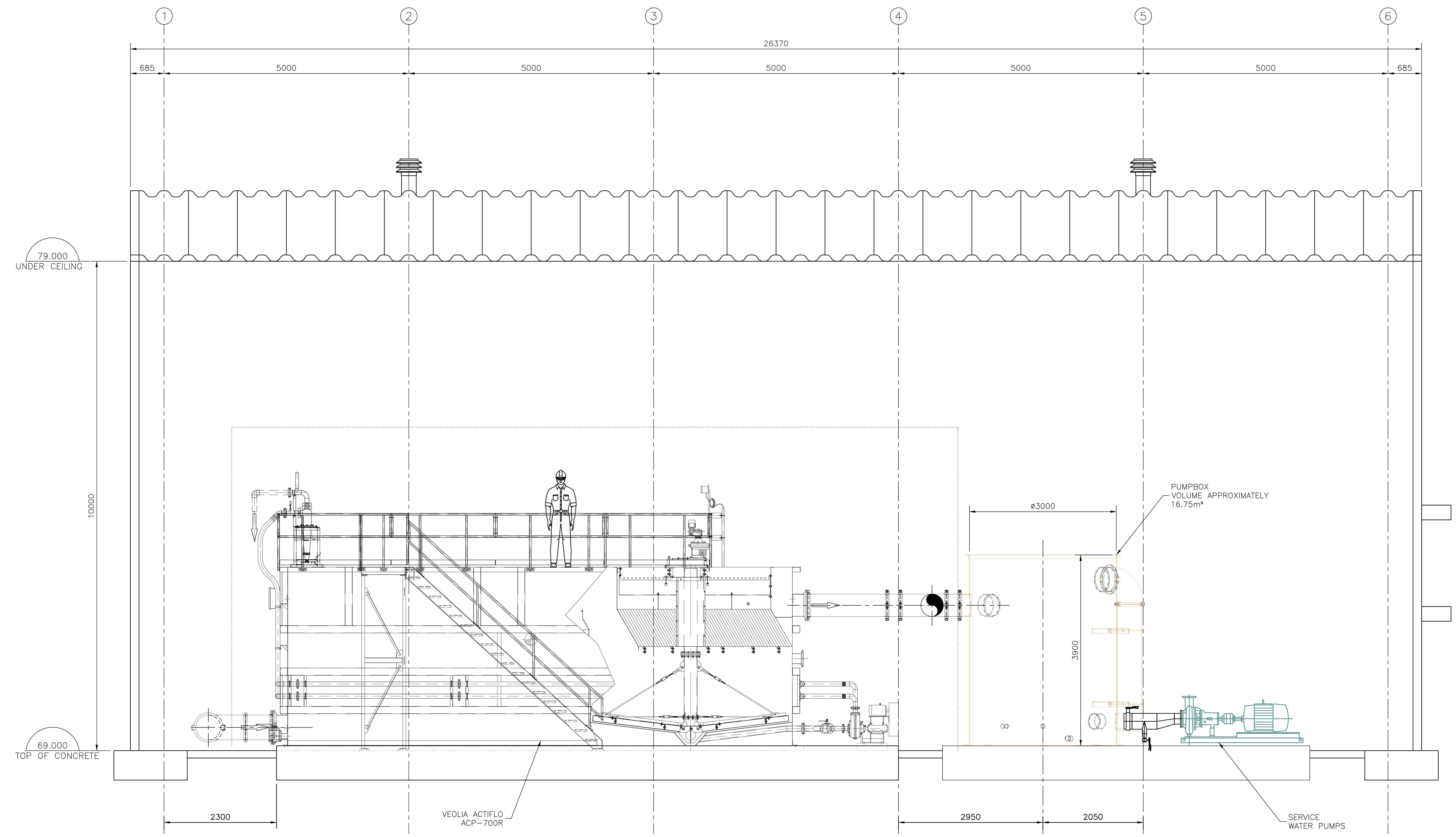
AE-CART-ARCH D

P:_15X-XXXX-XX\151-06440-10\01-COMM\Envoyé_AEM\WSP-AEM-151-06440-10-1361 (Gen Arr final water treatment plant Rev)\65-693-210-200_R4.dwg-2017-06-21 11:16:18

FILE NO. 65-693-210-200_R4.dwg

NO. DESSIN
DRAWING NO. 65-693-210-201_R4

FORMAT ARCHD



SECTION A
693-210-200
SCALE: 1:50

POUR CONSTRUCTION
FOR CONSTRUCTION
AGNICO EAGLE
DATE : 2017-06-21

PLAN CLÉ
KEY PLAN

WSP
1075, 3e AVENUE EST
VAL-D'OR (QUÉBEC) CANADA J9P 0J7
TÉL. : 819 825-4274 | TÉLÉC. : 819 824-1514 | WWW.WSPGROUP.COM
Ref. 151-06440-10

NOTES GÉNÉRALES / GENERAL NOTES

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG
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AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
4	2017–06–21	GENERAL REVISION FOR HONCO BUILDING	V.T.	B.F.	
3	2017–04–28	BUILDING REVISION	V.T.	B.F.	
2	2017–03–24	ISSUED FOR CONSTRUCTION	I.G.	B.F.	
1	2017–03–03	GENERAL REVISION, AFTER RFQ	V.T.	B.F.	
0	2016–12–13	ISSUED FOR TENDER	I.G.	B.F.	

REVISIONS

TITRE / TITLE
AGNICO EAGLE – MELIADINE DIVISION
693 – FINAL WATER TREATMENT PLANT
210– GENERAL ARRANGEMENT
SECTION A

DESSINÉ PAR / DRAWN BY	STEVEN PERRON	DATE 2015–11–30
VERIFIÉ PAR / CHECKED BY	STEVEN PERRON	2015–12–02
APPROUVÉ PAR / APPROVED BY	BERTRAND FORTIN, ing.	2015–12–02
ÉCHELLE / SCALE	INDICATED	DATE 2015–11–30

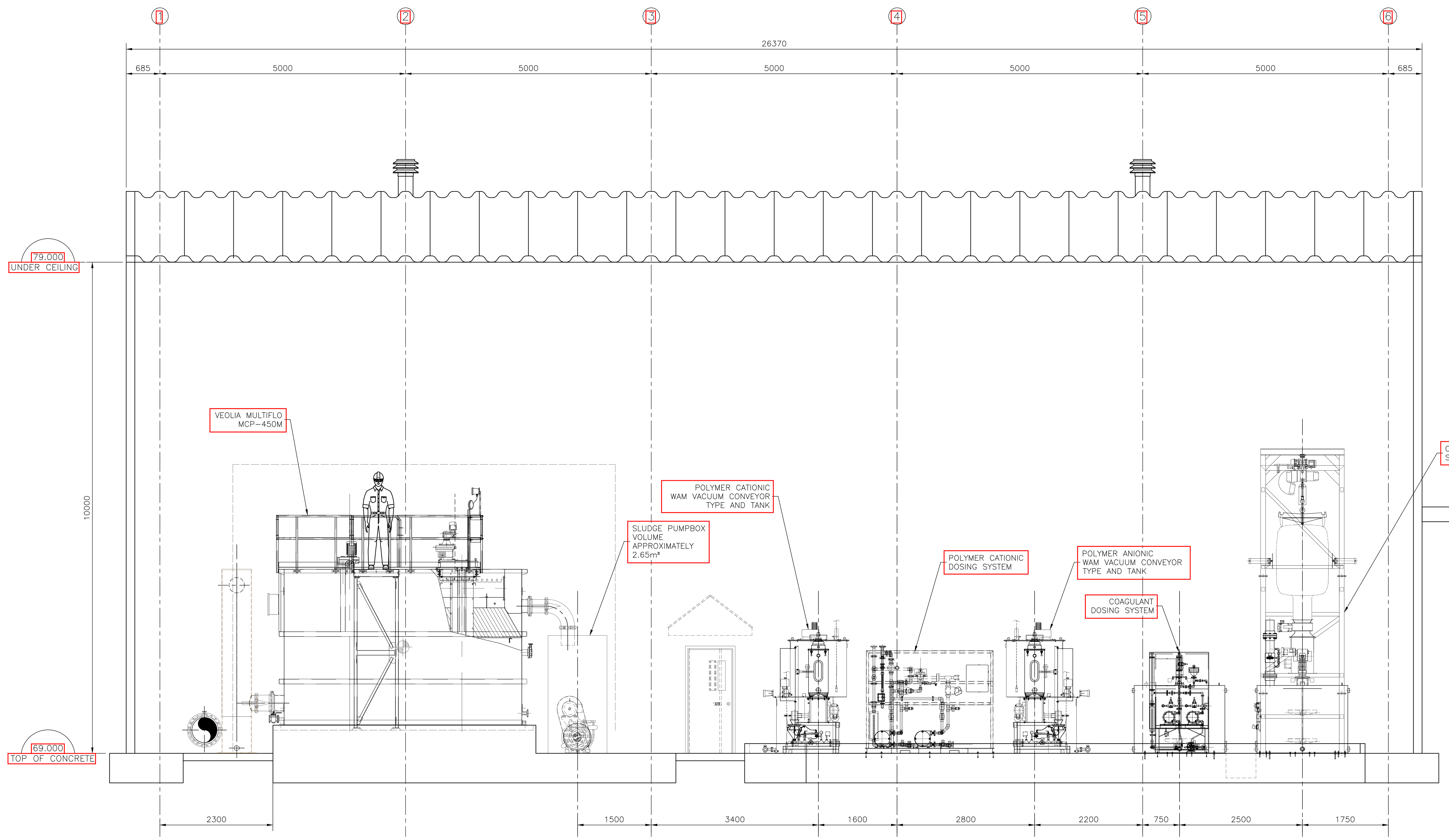
NO. DESSIN
DRAWING NO. 65–693–210–201

NO. PROJET / PROJECT NO.	REVISION	FEUILLE / SHT
6515	4	1 / 1

AE-CART-ARCH D

NO. DESSIN
DRAWING NO. 65-693-210-202_R4

FORMAT ARCHD



SECTION B
SCALE: 1:50
693-210-202

POUR CONSTRUCTION
FOR CONSTRUCTION
AGNICO EAGLE
DATE : 2017-06-21

PLAN CLÉ
KEY PLAN

WSP
1075, 3e AVENUE EST
VAL-D'OR (QUÉBEC) CANADA J9P 0J7
TÉL. : 819 825-4274 | TÉLÉC. : 819 824-1514 | WWW.WSPGROUP.COM
Ref. 151-06440-10

NOTES GÉNÉRALES / GENERAL NOTES

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG
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-	-
-	-
-	-
-	-
-	-

AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
4	2017-06-21	GENERAL REVISION FOR HONCO BUILDING	V.T.	B.F.	
3	2017-04-28	BUILDING REVISION	V.T.	B.F.	
2	2017-03-24	ISSUED FOR CONSTRUCTION	I.G.	B.F.	
1	2017-03-03	GENERAL REVISION, AFTER RFQ	V.T.	B.F.	
0	2016-12-13	ISSUED FOR TENDER	I.G.	B.F.	

REVISIONS

TITRE / TITLE
AGNICO EAGLE – MELIADINE DIVISION
693 – FINAL WATER TREATMENT PLANT
210– GENERAL ARRANGEMENT
SECTION B

DESSINÉ PAR / DRAWN BY	STEVEN PERRON	DATE 2015-11-30
VERIFIÉ PAR / CHECKED BY	STEVEN PERRON	2015-12-02
APPROUVÉ PAR / APPROVED BY	BERTRAND FORTIN, ing.	2015-12-02
ÉCHELLE / SCALE	INDICATED	DATE 2015-11-30
NO. DESSIN / DRAWING NO.	65-693-210-202	
NO. PROJET / PROJECT NO. 6515	REVISION 4	FEUILLE / SHT 1 / 1

AE-CART-ARCH D

P:_15X-XXXX-XX\151-06440-10\01-COMM\Envoyé_AEM\WSP-AEM-151-06440-10-1361 (Gen Arr final water treatment plant Rev)\65-693-210-202_R4.dwg-2017-06-21 11:15:26

FILE NO. 65-693-210-202_R4.dwg

NO. DESSIN
DRAWING NO. 65-693-210-203_R2

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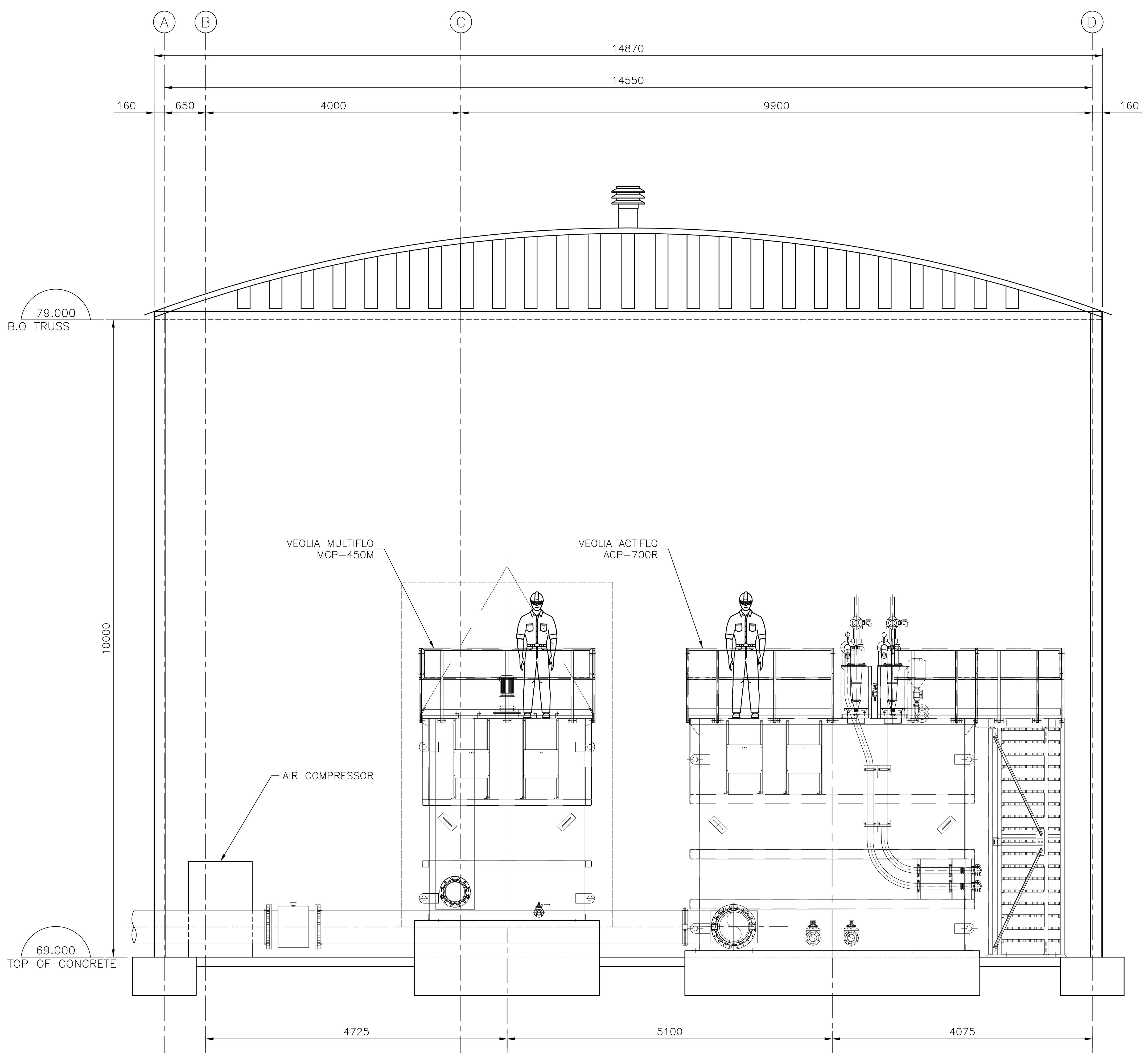

SECTION C
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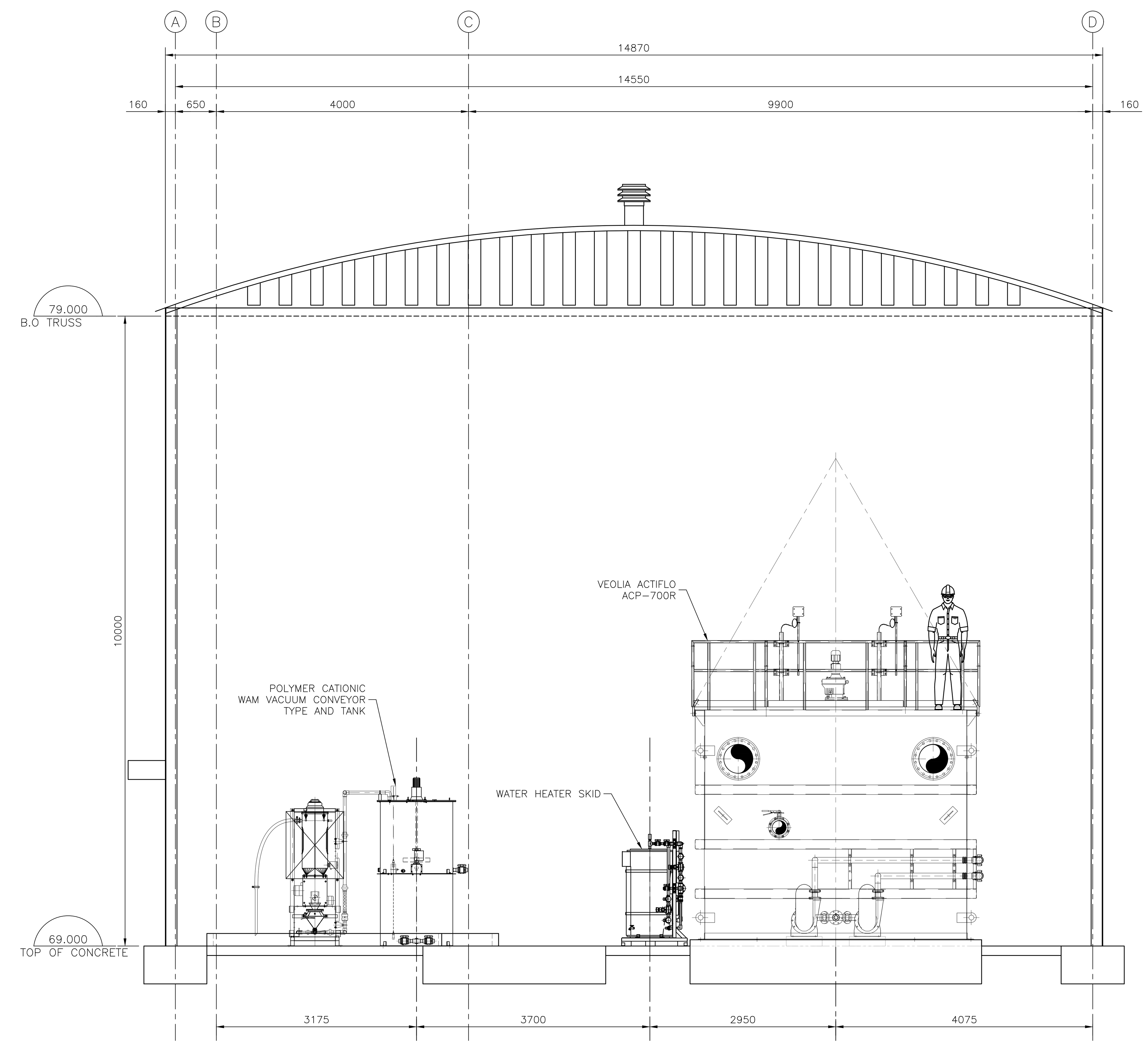
693-210-200



SECTION D
SCALE: 1:50
693-210-200

POUR CONSTRUCTION
FOR CONSTRUCTION
AGNICO EAGLE
DATE : 2017-06-21

PLAN CLÉ
KEY PLAN

WSP
1075, 3e AVENUE EST
VAL-D'OR (QUÉBEC) CANADA J9P 0J7
TÉL. : 819 825-4274 | TÉLÉC. : 819 824-1514 | WWW.WSPGROUP.COM
Réf. 151-06440-10

NOTES GÉNÉRALES / GENERAL NOTES

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG
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AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
2	2017-06-21	GENERAL REVISION FOR HONCO BUILDING	V.T.	B.F.	
1	2017-04-28	BUILDING REVISION	V.T.	B.F.	
0	2017-03-24	ISSUED FOR CONSTRUCTION	I.G.	B.F.	
A	2017-03-03	ISSUED FOR APPROVAL	V.T.	B.F.	

REVISIONS

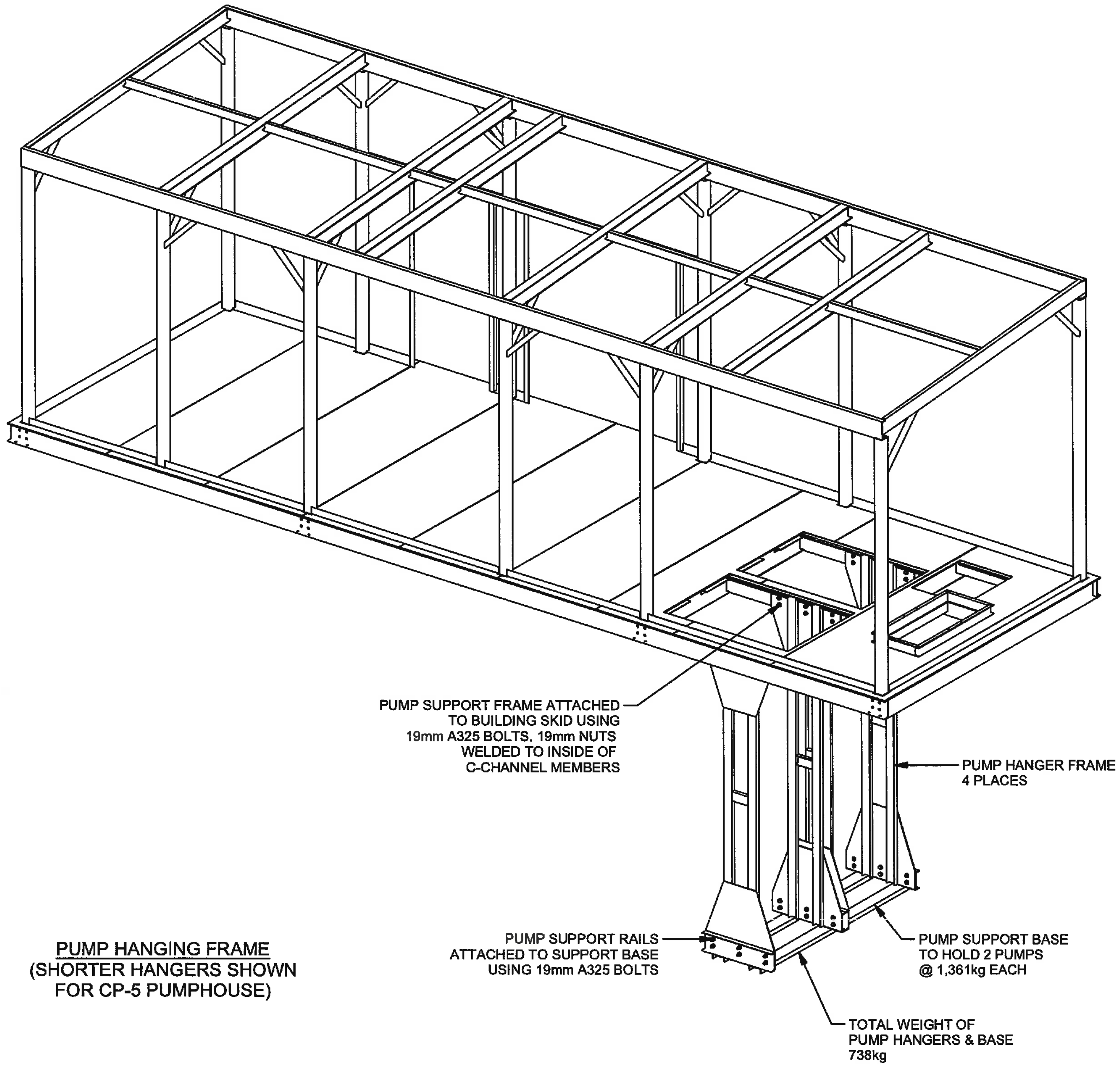
TITRE / TITLE
AGNICO EAGLE – MELIADINE DIVISION
693 – FINAL WATER TREATMENT PLANT
210– GENERAL ARRANGEMENT
SECTIONS C AND D

DESSINÉ PAR / DRAWN BY	STEVEN PERRON	DATE 2017-02-23
VERIFIÉ PAR / CHECKED BY	STEVEN PERRON	2017-03-03
APPROUVÉ PAR / APPROVED BY	BERTRAND FORTIN, ing.	2017-03-03
ÉCHELLE / SCALE	INDICATED	DATE 2017-02-23
NO. DESSIN / DRAWING NO.	65-693-210-203	
NO. PROJET / PROJECT NO. 6515	REVISION 2	FEUILLE / SHT 1 / 1

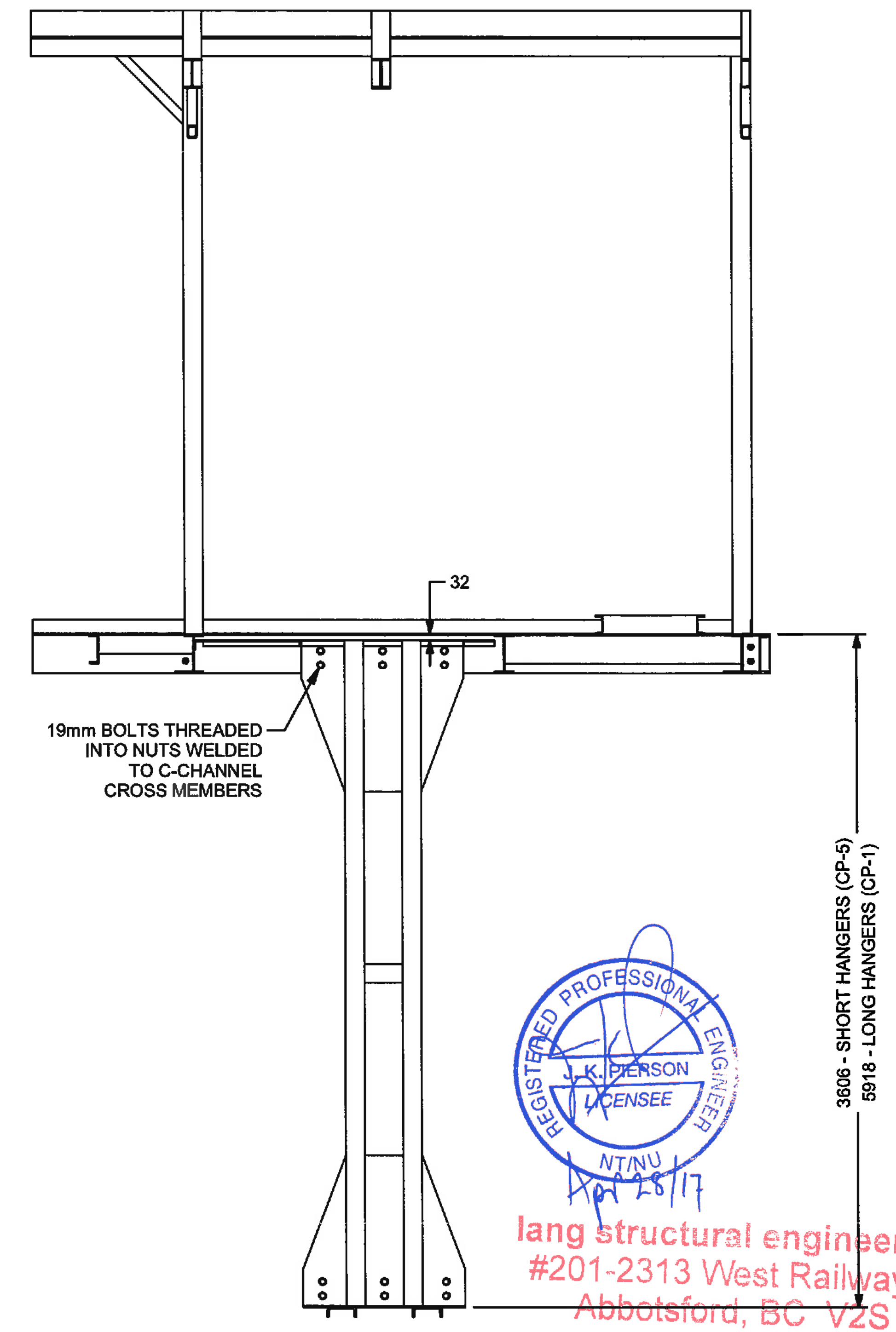
AE-CART-ARCH D

P:_15X-XXXX-XX\151-06440-10\01-COMM\Envoyé_AEM\WSP-AEM-151-06440-10-1361 (Gen Arr final water treatment plant Rev)\65-693-210-203_R2.dwg-2017-06-21 11:15:00

FILE NO. 65-693-210-203_R2.dwg



PUMP HANGING FRAME
(SHORTER HANGERS SHOWN FOR CP-5 PUMPHOUSE)



SIDE ELEVATION

REGISTERED PROFESSIONAL ENGINEER
K. PIERSON
LICENSEE
NT/NU
Apr 28/17

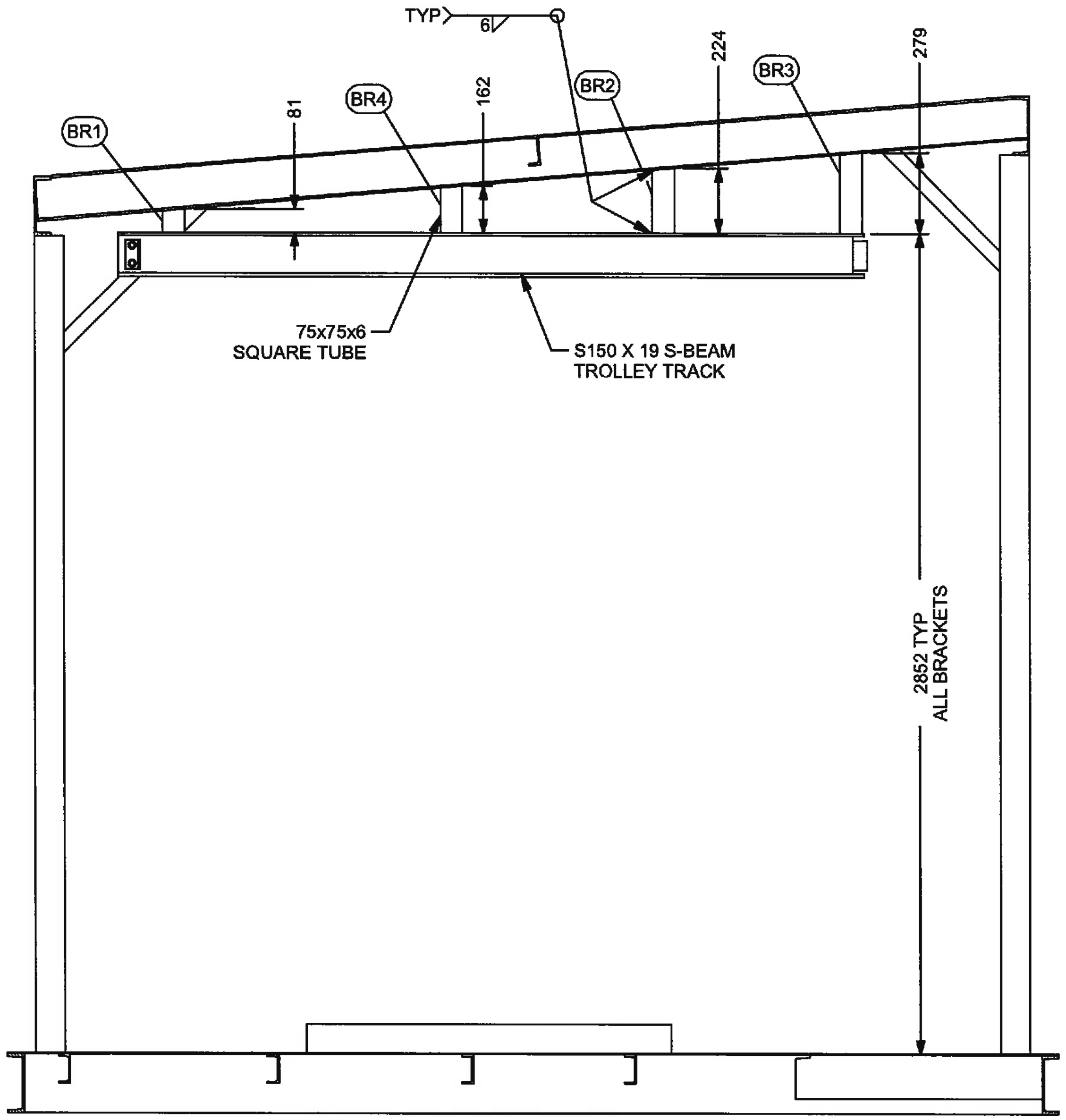
lang structural engineering inc.
#201-2313 West Railway Street
Abbotsford, BC V2S 2E3
604 853-8522

DATE: APRIL 28/17 FILE: 117-039

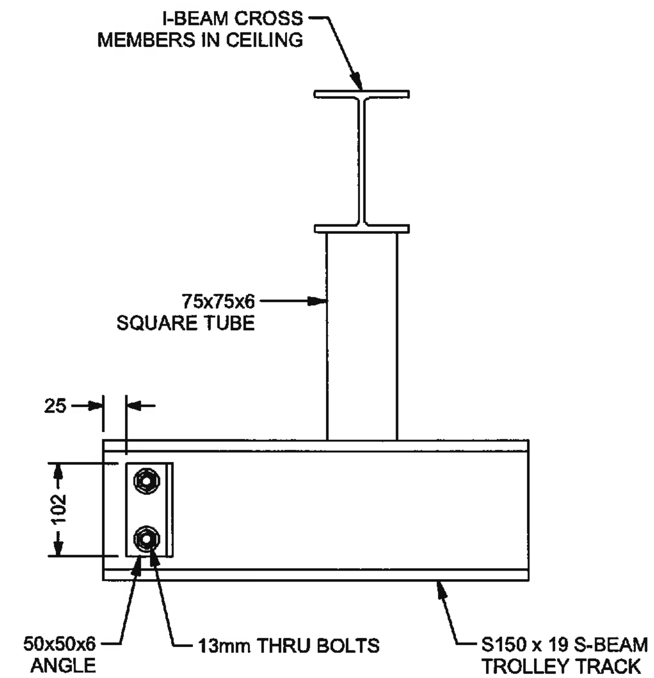
BI Pure Water (Canada) Inc. #2, 9790 - 190th Street Surrey, BC V4N 3M9 Phone: (604) 882-6650 Fax: (604) 882-6659 http://www.bipurewater.ca	THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF **BI PURE WATER (CANADA) INC.** ANY REPRODUCTION IN PART OR WHOLE OF THE INFORMATION HEREIN, WITHOUT THE WRITTEN PERMISSION OF BI PUREWATER (CANADA) INC., IS STRICTLY PROHIBITED.	Status: ISSUED FOR CONSTRUCTION	

Issue	Date	App'd	Revision Description
07	3/7/2017		ADDED LOADS ON LEVELING BRACKETS
06	3/7/2017		REVISED LEVELING BRACKETS
05	3/2/2017		REMOVED HOLES FOR VALVE BRACKETS
04	2/27/2017		ADDED PIPE SUPPORT CROSS CROSS MEMBERS, ISSUED FOR CONSTRUCTION
03	2/15/2017		REVISED PUMP HANGING DETAILS
02	2/9/2017		REVISED TROLLRY TRACK DESIGN
01	1/20/2017		ISSUED FOR APPROVAL

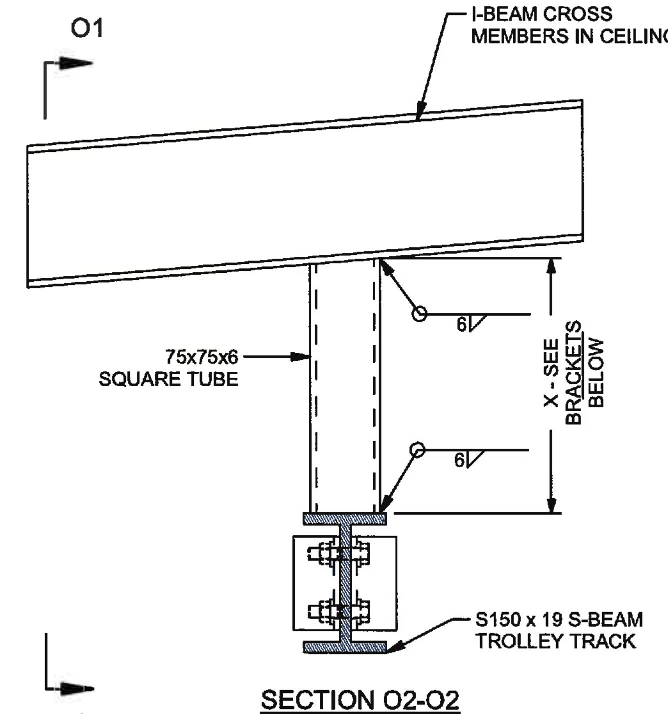
Design By:	RS
Drawn By:	RS
Checked By:	
Submitted	
Approved	
Client:	AGNICO EAGLE MINES
Title:	SKID FRAME
Project:	6515-S-265-094 PERMANENT PUMPING STATIONS CP-1 & CP-5
Drawing #:	2898-M-102
Scale	
Date	1/20/2017
Sheet	12 of 19
Job#	
Rev:	07



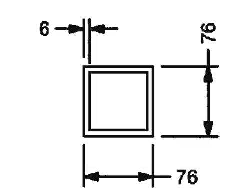
SECTION O-O

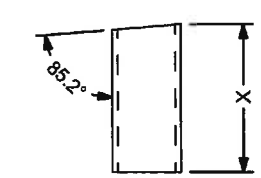


VIEW O1-O1
TROLLEY STOP ANGLES
TYP AT BOTH ENDS
OF EACH TROLLEY TRACK



SECTION O2-O2
TYPICAL TROLLEY TRACK
HANGER DETAIL





TROLLEY BRACKETS

PROFESSIONAL ENGINEER
REGISTERED
J. K. PIERSON
LICENSEE
NT/NU
Apr 28/17

lang structural engineering inc.
#201-2313 West Railway Street
Abbotsford, BC V2S 2E3
604 853-8522

DATE: MARC 28/17 FILE: 117-039

TROLLEY BRACKETS		
BRACKET	LENGTH (X)	QTY
BR1	81 mm	1
BR2	224 mm	1
BR3	278 mm	3
BR4	162 mm	3

BI Pure Water (Canada) Inc.
BI Pure WATER
#2, 9790 - 190th Street
Surrey, BC V4N 3M9
Phone: (604) 882-6650
Fax: (604) 882-6659
http://www.bipurewater.ca

Status: ISSUED FOR CONSTRUCTION

Issue	Date	App'd	Revision Description
07	3/7/2017		ADDED LOADS ON LEVELING BRACKETS
06	3/7/2017		REVISED LEVELING BRACKETS
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04	2/27/2017		ADDED PIPE SUPPORT CROSS CROSS MEMBERS, ISSUED FOR CONSTRUCTION
03	2/15/2017		REVISED PUMP HANGING DETAILS
02	2/9/2017		REVISED TROLLRY TRACK DESIGN
01	1/20/2017		ISSUED FOR APPROVAL

Design By: RS
Drawn By: RS
Checked By:
Submitted
Approved

Client: AGNICO EAGLE MINES

Title:	SKID FRAME	Scale	
		Date	1/20/2017
Project:	6515-S-265-094 PERMANENT PUMPING STATIONS CP-1 & CP-5	Sheet	16 of 19
		Job#	
Drawing #:	2898-M-102	Rev:	07