Notice of Alteration Form

Manitoba Sustainable Development

Client File No. :	Environment Act Licence No. : 2525
Legal name of the Licencee: City of Winkler	
Name of the development: Winkler WWTP: Project Update and Responses to the TAC	
Category and Type of development per Classes of Development Regulation: Waste Treatment and Storage Wastewater treatment plants	
Licencee Contact Person: J. Scott Toews, M.Sc., P.Eng. Mailing address of the Licencee: 185 Main Street City: Winkler Province: Manitoba Postal Code: R6W 1B4 Phone Number: (204) 325-9524 Fax: Email: SToews@cityofwinkler.ca	
Name of proponent contact person for purposes of the environmental assessment (e.g. consultant): Paul Barsalou, P.Eng.	
Phone: (204) 477-5381 Fax: (204) 284-2040	Mailing address: 99 Commerce Drive, Winnipeg, MB
Email address: paul.barsalou@aecom.com	
Description of Alteration *(max 90 characters):* This NOA for the 2014 EAP outlines the changes made to the project design of the WWTP and consequential environmental effects of those changes and addresses the 2014 TAC comments.	
Alteration fee attached: Yes: ☑ No: ☐ If No, please explain:	
Date: Nov 22, '16	Signature: [signature] Printed name: Scott Toews

A complete Notice of Alteration **(NoA)** consists of the following components:

- ☑ **Cover letter**
- ☑ **Notice of Alteration Form**
- ☑ **4 hard copies and 1 electronic copy of the NOA detailed report** (see "Information Bulletin - Alteration to Developments with Environment Act Licences")
- ☑ **$500 Application fee, if applicable** (Cheque, payable to the Minister of Finance)

Submit the complete NOA to:

Director
Environmental Approvals Branch
Manitoba Sustainable Development
Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

For more information:

Phone: (204) 945-8321
Fax: (204) 945-5229
http://www.gov.mb.ca/conservation/eal

City of Winkler

Notice of Alteration - Winkler Wastewater Treatment Plant: Project Update and Responses to the Technical Advisory Committee

Prepared by:

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204 477 5381 tel
204 284 2040 fax

November, 2016

Project Number: 60430450

Distribution List

# Hard Copies	PDF Required	Association / Company Name
1	1	City of Winkler

Revision History

Revision #	Date	Revised By:	Revision Description
1	November	K. Cusitar	Final

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The attached Report (the “Report”) has been prepared by AECOM Canada Ltd. (“AECOM”) for the benefit of the Client (“Client”) in accordance with the agreement between AECOM and Client, including the scope of work detailed therein (the “Agreement”).

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AECOM

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November 22, 2016

Ms. Tracey Braun, M.Sc.
Director, Environmental Assessment and Licensing
Department of Sustainable Development
123 Main Street
Ste. 160 Union Station
Winnipeg, Manitoba R3C 1A5

Dear Ms. Braun

Project No: 60430450

Regarding: Notice of Alteration - Winkler Wastewater Treatment Plant: Project Update and Responses to the Technical Advisory Committee

Please find enclosed four hard copies and one electronic copy of the Notice of Alteration (NOA) and supporting information to obtain approval for an upgrade to the Winkler Wastewater Treatment Plant (WWTP) upgrade.

The existing wastewater collection system operates under Environment Act License. No. 2525, issued in January 2002. The City of Winkler submitted an Environment Act Proposal (EAP) for a new Winkler Wastewater Treatment Facility in April 2014 to seek an alteration to the existing licence. The filed EAP was reviewed by the Technical Advisory Committee (TAC), and resulted in comments in July 2015. Since the comments issued were by TAC, the project design has been updated. This NOA outlines the changes made to the project design, and consequential environmental effects of those changes. The NOA also address the TAC comments received on the 2014 EAP submission.

Please also find enclosed the NOA Form and a cheque for the application fee of $500.

We trust that the information on the form and the attached supporting information are sufficient. Should you have any questions, please do not hesitate to contact Somia Sadiq directly at 204-928-8494.

Sincerely,
AECOM Canada Ltd.

Somia Sadiq, EP (NRM), MCIP, RPP
Impact Assessment & Permitting Lead, MB/SK
Western Canada, Environment

KC:dh
Encl. Application Fee
cc: City of Winkler

Quality Information

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Impact Assessment & Permitting Lead, MB/SK

Paul Barsalou, P.Eng.
Process Engineer, Project Manager

Executive Summary

The City of Winkler (the “City”) submitted an Environment Act Proposal (EAP) for a new Winkler Wastewater Treatment Facility to the Manitoba Department of Sustainable Development (DSD) in April 2014. Following a review of the submission, the City received a letter in July, 2015 from Manitoba DSD, outlining comments and requests for additional information from the Technical Advisory Committee (TAC).

This Notice of Alteration (NOA) for the 2014 EAP outlines the changes made to the project design of the wastewater treatment plant (“WWTP”) and consequential environmental effects of those changes. The NOA also address the Technical Advisory TAC comments received on the 2014 EAP submission.

The City WWTP is being designed for receiving and treating domestic, commercial, and industrial wastewater. The project has been designed with a planning horizon of 20 years, assuming commissioning by 2018 and a design life of 20 years. The combined domestic wastewater from the City and the RM of Stanley (includes the Villages of Schanzenfeld, Reinfeld, and other rural developments) will be treated at the proposed WWTP.

In the new licence, it is proposed that the effluent only be stored during the frozen months for a minimum of 120 days from of December to March, which would result in four (4) months of storage. The effluent would be held until the discharge route is free of ice and the effluent can flow without freezing

Environmental effects for the 2016 WWTP components have been assessed as follows:

Air Quality and Noise

Although dust is not anticipated to be a major concern at the Project Site, with the implementation of measures such as limiting material stockpile heights, keeping disturbed/exposed areas to a minimum, and using dust suppression when required, the effect of dust is assessed to be negligible.

In regards to potential odours from the WWTP during operation, the most significant odour sources, the screen channels, screen racks, grit removal system, and DAF will be provided with covers that can be removed for maintenance purpose. Air from within these most odourous zones will be treated by an activated carbon based treatment system. Also, the secure cam lock connection that waste haulers will use when transferring septage into the septage receiving station will also reduce potential odours. The aeration in Cell 2 and Cell 3 will also assist in controlling odour generation.

With respect to exhaust emissions, it is anticipated that a maximum of 10 construction vehicles on a daily basis will access the WWTP via the paved Provincial Road No. 428 followed by the existing gravel road. With the implementation of measures such as maintaining vehicles and equipment in proper working order and vehicle idling kept to a minimum, the effects of exhaust emissions is assessed to be negligible.

Noise levels at the Project Site during construction are not expected to be high enough to cause significant disturbance in the Project Area. With the implementation of measures such as providing hearing protection to workers as required and properly maintaining vehicles and equipment are expected to mitigate potential adverse effects. During operation, sources of noise include maintenance vehicles and activities along with hauler trucks arriving to the site approximately four (4) times per day, seven (7) days of the week. Therefore, the effect of noise is assessed to be negligible.

Soil

With respect to soil compaction, mixing, and erosion during construction, the implementation of mitigation measures identified in this NOA are anticipated to mitigate any potential soil compaction/mixing and erosion effects. Therefore, it is anticipated that the residual effect on soil is assessed to be negligible.

Surface Water

The upgraded WWTP will meet the following effluent criteria ((prescribed under Manitoba Water Quality Standards, Objectives, and Guidelines):

- Carbonaceous biochemical oxygen demand ($CBOD_5$) - 25 mg/L;
- Five-day biochemical oxygen demand (BOD5) – 25 mg/L;
- Total Suspended Solids (TSS) - 25 mg/L;
- Total Nitrogen (TN) – 15 mg/L;
- Total dissolved solids (TDS) – 3,000mg/L'
- E.coli – 200 fecal coliforms per100 mL;
- Fecal coliform - 200 organisms per 100 mL;
- Total Ammonia –
    - 6.67 mg/L as N (at 9 °C and pH of 6.5)
    - 5.91 mg/L as N (at 9 °C and pH of 7.0)
    - 4.36 mg/L as N (at 9 °C and pH of 7.5)
    - 3.65 mg/L as N (at 24 °C and pH of 6.5)
    - 3.24 mg/L as N (at 24 °C and pH of 7.0)
    - 3.39 mg/L as N (at 24 °C and pH of 7.5)

With the above criteria as the target key parameter, the quality of effluent that will be discharged to Dead Horse Creek will improve. The quantity of effluent will remain the same as noted in the 2014 EAP submission. Therefore, effluent from the upgraded WWTP is not anticipated to have a significant adverse effect on water quality of Dead Horse Creek.

All construction works will be located approximately 650 m away from Dead Horse Creek. With the implementation of measures such as installing silt fences, limiting material stockpile heights, keeping disturbed/exposed areas to a minimum, and using dust suppression if required, the effects of dust is assessed to be negligible.

Conclusion Summary

Considering the implementation of the proposed mitigation measures, design features, existing and proposed environmental licence conditions and the social and ecological context of each environmental component addressed in **Section 4**, the cumulative residual environmental effects of the proposed 2016 upgrade components of the WWTP are expected to negligible in magnitude.

The measures described to mitigate the risk of occurrence of accidents and malfunctions are deemed to be appropriate in mitigating such risks. Therefore, it is our opinion that based on the available information and documented assumptions, the overall potential adverse effects of the proposed project will range from negligible to moderate and insignificant.

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1. Introduction

In May 2015, AECOM Canada Ltd. (“AECOM”) was retained by the City of Winkler (the “City”) to provide engineering and environmental services for a new wastewater treatment plant (“WWTP”). The City is located approximately 100 km southwest of the City of Winnipeg. The WWTP is located approximately 4 km northeast of the City, east of Provincial Road No. 428, as shown in **Figure 01**.

This Notice of Alteration (NOA) for the 2014 EAP outlines the changes made to the project design of the WWTP (**Section 2**) and consequential environmental effects of those changes (**Section 4**). The NOA also address the Technical Advisory TAC comments received on the 2014 EAP submission (**Section 5**).

The City WWTP is being designed for receiving and treating domestic, commercial, and industrial wastewater. The project has been designed with a planning horizon of 20 years, assuming commissioning by 2018 and a design life of 20 years. The combined domestic wastewater from the City and the RM of Stanley (includes the Villages of Schanzenfeld, Reinfeld, and other rural developments) will be treated at the proposed WWTP.

In the new licence, it is proposed that the effluent only be stored during the frozen months for a minimum of 120 days from of December to March, which would result in four (4) months of storage. The effluent would be held until the discharge route is free of ice and the effluent can flow without freezing

1.1 Existing Wastewater Treatment Plant

The existing WWTP is a wastewater stabilization pond (i.e., a lagoon) system for primary treatment and storage of wastewater. The lagoon system is located at SW 23-3-4.

The lagoon system consists of three primary aerated cells and six secondary cells. The volumes of each cell are listed in the tables below:

Table 1: Primary Aerated Cell Volumes

Primary Aerated Cells	Volume
Cell 1	129,100 m^3 (4.3 m depth)
Cell 2	60,600 m^3 (4.3 m depth)
Cell 3	60,600 m^3 (4.3 m depth)
TOTAL	**250,300 m^3**

Table 2: Secondary Cell Volumes

Primary Aerated Cells	Depth (m)	Volume (m^3)
Cell 4	1.5	78,000
Cell 5	1.5	105,000
Cell 6	2.1	234,000
Cell 7	2.5	285,000
Cell 8	2.5	353,000
Cell 9	2.5	348,000
TOTAL	**-**	**1,403,000 m^3**

1.2 Existing Sludge Inventory

A sludge inventory was completed in early 2016 for each of the lagoon cells based on a combination of sludge surveys and observations. The depths of sludge vary from up to 0.9 m in the aerated primary cells to 0.05 m in the newer secondary cells. The following table presents the estimate sludge volumes per cell and provides volumes.

Table 3: Estimated Sludge Inventory in Existing Lagoon

Cell#	Depth of Sludge meters	Cell Depth	Base Cell Area	Estimated Volume of Sludge- Assume 6%	Estimated Volume – Thickened to 10%	Estimated Volume at 25% solids	Landfill	Periodic Application in Future Licence	Leave Inventory for Long Term
1	0.9	4.3	25,000	22,500	14,000	5,400	With Current Upgrade and EAP		
2	0.9	4.3	11,200	10,000	6,000	2,400		Periodic Application	
3	0.9	4.3	11,200	10,000	6,000	2,400		Periodic Application	
4	0.1	1.5	57,000	5,700	3,400	1,400			Yes
5	0.05	1.5	70,000	3,500	2,100	840			Yes
6	0.05	2.1	121,000	6,000	3,600	1,6900			Yes
7	0.05	2.5	118,000	5,900	3,500	1,500			Yes
8	0.05	2.5	134,000	6,700	4,000	1,600			Yes
9	0.05	2.5	133,000	6,700	4,000	1,600			Yes
Prop. Work with Current EAP							5,400 m^3 @ 25% solids		

1.3 Sludge Inventory Management

The proposed treatment plant would use Cell 1 and Cells 3 to 9 for treatment and storage. Cell 2 and Cell 3 will be used for sludge management. The secondary cells of the lagoon system will be reused for winter storage including Cells 3 to 9. During warm weather periods, the lagoon system will be used for treatment of wet weather overflows. In the above table (**Table 3**), there are three (3) columns showing the recommended sludge management process including the following:

- Landfill of Cell 1 sludge as it contains significant debris (part of this NOA);
- Ongoing periodic land application of sludge from Cell 2 and Cell 3 (proposal for a license to be applied for in the future); and
- Specialty land application of sludge from Cell 4 to Cell 9 in the long term (proposal for a license to be applied for in the future).

This will be discussed more thoroughly in **Section 2.3**.

1.4 Regulatory Framework

The existing wastewater collection system and aerated wastewater treatment lagoon operates under Environment Act License. No. 2525 issued January 23, 2002. The following limitations and/or restrictions are outlined in the License:

- Five-day Biological Oxygen Demand (BOD_5) – 30 mg/L;
- Total Coliform – 1,500 CFU per 100 mL;
- Fecal Coliform - 200 CFU per 100 mL; and
- No discharge is permitted between November 1st and June 15th of the following year.

The proposed upgrades at the WWTP are not listed on the *Regulations Designating Physical Activities* under the *Canadian Environmental Assessment Act,* 2012, and as such, a federal environmental assessment is not required.

2. Project Description

2.1 Updated WWTP Design (2016)

The City WWTP is being designed for receiving and treating domestic, commercial, and industrial wastewater. The project has been designed with a planning horizon of 20 years, assuming commissioning by 2018 and a design life of 20 years. The combined domestic wastewater from the City and the RM of Stanley (includes the Villages of Schanzenfeld, Reinfeld, and other rural developments) will be treated at the proposed WWTP. Historically, the main source of industrial wastewater was from Saputo Inc., a cheese processing factory, which has closed down. Various potato processors remain in the area.

The upgraded WWTP is located on City property and will be developed adjacent to the existing lagoon system on previously disturbed soil. Forcemains can all be constructed and valved-off until commissioning. As the existing lagoons cells are adjacent to the mechanical plant, the flow may be diverted at any time if there are temporary operational issues or if the treated effluent does not meet requirements during the start-up period.

The following sections summarize the changes in the project design made in 2016. Additional details are provided in the Functional Design Report – Winkler Wastewater Treatment Plant provided in **Appendix A.**

Potential environmental effects as a result of changes being proposed in the project design will be discussed in **Section 4**.

2.1.1 Population

Design criteria for the upgraded WWTP was based on the population projection for a design period of 20 years (design year 2038). Population projections are based on historical figures and anticipated growth in the community. Based on the anticipated growth within the City and RM of Stanley, population projections of 2.5% annually for the identified areas are shown in **Table 4**.

Table 4: Population Projections (2038)

Development Area	Population	Commercial
City of Winkler	22,280	-
RM Stanley - Reinfield	2,930	-
RM Stanley - Schanzenfeld	2,470	-
RM Stanley - Rosebrook	486	-
RM Stanley – Fringe development	245	-
RM Stanley - Corridor	-	90
Total Population	**28,409**	**90**

2.1.2 Sources of Wastewater

The sources of wastewater identified below are similar to the 2014 EAP.

The new WWTP will serve a number of developments in the area:

- City of Winkler
  - Domestic wastewater
  - Commercial wastewater
  - Industrial wastewater
  - Water treatment plant (WTP) reject water

- RM of Stanley
  - Village of Reinfeld
  - Village of Schanzenfeld
  - Corridor commercial development (between Morden and Winkler)
  - Rosebrook Development

The reject water from the Winkler WTP, which receives its water via groundwater, includes reverse osmosis reject water. Alternative disposal locations have been discussed for this reject water, however it will be disposed of at the upgraded WWTP for the foreseeable future. This reject water has been included in the flow projections (**Section 2.1.3**).

2.1.3 Wastewater Flow Projections

The wastewater flows are slightly different from the 2014 EAP as the design flows have been defined differently for this NOA.

The components of Average Annual Flow (AAF) for the entire calendar year are shown in **Table 5** below.

Table 5: Design Population and Wastewater Flows

Item	Population	Commercial Lots	Flow per capita/lot (L/d)	Total daily flow (m^3/d)
City of Winkler	22,280	-	267	5,944
RM Stanley - Reinfeld	2,930	-	310	909
RM Stanley - Schanzenfeld	2,470	-	310	766
RM Stanley – Rosebrook[1]	486	-	150	73
RM Stanley – Fringe Development[2]	243	-	267	65
RM Stanley – Corridor[3]	-	90	2,507	226
Winkler WTP reject	-	-	-	1,472
Average Annual Flow	-	-	-	9,455 Use 9,460

Note:

1. *Current Rosebrook allowance is 140 lots, increased to 180 lots for future expansion, assumes 2.7 residents per household. Flow per capita reduced based on lower than typical water usage.*
2. *Fringe Development allowing for approximately 90 residential lots to be developed, assumes 2.7 residents per household and similar water usage and I/I values to the City.*
3. *Stanley Corridor Development equating to 90 commercial lots averaging in size from 3-5 acres. Flow is estimated based on 2015 actual consumption rates for the area.*

Based on the Winkler water consumption records, design wastewater flows are estimated to be:

- Average annual flow 9,460 m^3 per day
- Average dry weather flow 8,056 m^3 per day
- Average wet weather flow 11,329 m^3 per day
- Maximum monthly flow (MMF) 14,704 m^3 per day

Peak Dry Weather Flow (PDWF) was used to design the secondary clarifiers. Flows exceeding the rate of 23,641 m^3 per day will be bypassed to the existing Cell 1.

The Maximum Day Flow (MDF) for the design is 37,818 m^3 per day (rounded to 40,000 m^3 per day for the design). This value is based on actual daily flow measurements.

In order to estimate the Peak Wet Weather Flow (PWWF), the maximum capacities of the existing lift stations (LS) are taken into account as follows:

- LS3 & LS5 350 L/s (30.2 megalitres per day (ML/d))
- LS8 265 L/s (22.9 ML/d)
- Reinfeld Main Lift Station (RM of Stanley) 86 L/s (7.4 ML/d)

The PWWF for the City's WWTP is therefore estimated to be 60.5 ML/d, however a rate of 60.0 ML/d will be used.

The wastewater flow projections are summarized in **Table 6**.

Table 6: Wastewater Flow Projections

Item	Flow (ML/d)
Average Annual Flow (AAF)	9.46
Average Dry Weather Flow (ADWF)	8.06
Maximum Monthly Flow (MMF)	14.7
Maximum Day Flow to Headworks (MDF) – overflow at Equalization Basin to lagoon to drop flow to headworks to 40 ML/d	40.0
Peak Wet Weather Flow (PWWF) – overflow in splitter box to lagoon to drop flow to secondary to 23.6 ML/d	23.6
Peak Wet Weather Flow (PWWF) to Equalization Basin	60.0
Peak Hour Flow (PHF)	60.0

2.1.4 Design Wastewater Loads

The proposed wastewater loading is lower in this NOA when compared to the 2014 EAP submission as the loading is based on updated 2015/2016 testing.

Wastewater samples were collected from lift stations LS5 and LS8. The samples were analyzed using ALS Laboratories in Winnipeg on behalf of the City to evaluate the WWTP influent loading.

The average and proposed wastewater loads are summarized in **Table 7.**

Table 7: Proposed Wastewater Loads

Item	COD as mg/l	BOD_5 as mg/l	TKN as N (mg/l)	Ammonia as N (mg/l)	TP as P mg/l	TSS as mg/l	VSS as mg/l
Average Loading 2015 LS8	628	230	49	29	9.0	280	156
Average Loading 2015 LS5	334	79	22	7.0	3.05.54	108	74
Weighted average 2015 for LS5 and LS8 (LS8:81% and LS5:19%)	572	201	44	25	8.0	247	140
Weighted average 2016 for LS5 and LS8 (LS8:81% and LS5:19%)	424	180	36	23	6.0	228	239
Proposed Loading for the WWTP	**590**	**225**	**43**	**26**	**8.2**	**265**	**175**

Additional design parameters (obtained from diurnal wastewater flow and quality monitoring results) are as follows:

- pH 7.1 (ranging from 6.5 to 7.5)
- Temperature 9.0 °C (minimum winter temperature
  20.0 °C (maximum summer temperature (assumed))

2.1.5 Effluent Discharge Standards

Similar to the 2014 EAP submission, the upgraded WWTP will meet the following effluent criteria (prescribed under Manitoba Water Quality Standards, Objectives, and Guidelines):

- Carbonaceous biochemical oxygen demand ($CBOD_5$) - 25 mg/L;
- Five-day biochemical oxygen demand (BOD5) – 25 mg/L;
- Total Suspended Solids (TSS) - 25 mg/L;
- Total Nitrogen (TN) – 15 mg/L;
- Total dissolved solids (TDS) – 3,000mg/L'
- E.coli – 200 fecal coliforms per100 mL;
- Fecal coliform - 200 organisms per 100 mL;
- Total Ammonia –
  - 6.67 mg/L as N (at 9 °C and pH of 6.5)
  - 5.91 mg/L as N (at 9 °C and pH of 7.0)
  - 4.36 mg/L as N (at 9 °C and pH of 7.5)
  - 3.65 mg/L as N (at 24 °C and pH of 6.5)
  - 3.24 mg/L as N (at 24 °C and pH of 7.0)
  - 3.39 mg/L as N (at 24 °C and pH of 7.5)

2.2 Summary of Proposed Treatment Process (2016)

A Biological Nutrient Removal (BNR) process has been selected to remove nitrogen and phosphorus in the wastewater, with chemical precipitation backup for phosphorus control.

The process is based on combining activated sludge with influent wastewater (containing volatile fatty acids) in the anaerobic tank prior to the anoxic or aerobic tanks. A backup chemical phosphorus removal facility (Ferric Sulphate) will be provided to augment the biological phosphorus removal process.

A process flow block diagram is provided in **Figure 03,** which shows the new proposed WWTP components. A detailed site plan showing the 2016 WWTP layout is provided in **Figure 04**.

The following sections summarize the changes in the project design made in 2016. Additional details are provided in the Functional Design Report – Winkler Wastewater Treatment Plant provided in **Appendix A.** A table summarizing the 2016 treatment process is included in **Appendix B**.

2.2.1 Septage Receiving Station

The septage receiving station is a new component not previously proposed in EAP filed in 2014. It will be located to the south of the proposed Headworks Building. For the purpose of this NOA, all hauled wastewater will be referred to as septage. Waste haulers will connect to a pipe via a cam lock that transfers septage into the package septage receiving station that consists of a rock trap and a grinder.

From the rock trap and grinder, septage will then flow into an underground storage tank to be located beneath the septage receiving station. The storage tank will allow for feeding the high strength septage into the treatment plant over time to reduce shock loadings. Liquid will be pumped out of the storage tank and discharged to the influent well upstream of screening.

The septage receiving station will be used to admit septage in the catchment area that cannot be tied into the RM of Stanley low-pressure sewer system. Low-pressure sewer systems in the RM will need to be pumped out every one (1) or two (2) years to remove the accumulated solids. It is anticipated that the facility will be used four (4) times per day, with a total flow of 36 m^3/day. This is approximately 0.4 percent of the plant flow and should not cause process problems, provided the flows are relatively consistent. If there is significant hauling, it could affect the WWTP processes and discussions would need to be held with the hauler. A card swipe and a camera at the discharge point will be included to identify any questionable conditions.

Table 8 below provides a summary of the design criteria used for the septage receiving tank.

Table 8: Septage Receiving Design Criteria

Parameter	Design Criteria	Descriptor
Number of Unit	1	
Capacity m^3/h	40	
Grinder Power kW	3.7	
Storage tank Volume m^3	20	
Septage Station room size m	3 x 2 x 2.6	
Number of Pumps	2 (1+1)	One duty + one standby
Pressure, m	15	
Power, kW	2.8	

2.2.2 Influent Channel

Similar to the 2014 EAP submission, wastewater from the City, RM of Stanley, and the septage station will be discharged into the influent channel.

Overflow will be pumped to the second floor of the proposed Headworks Building and will flow by gravity through the screens, grit removal and out to the bioreactors. Any flow over 40 ML/d will be diverted directly to Cell 1 of the lagoon system for treatment. Any flow under 40 ML/d will pass through both screens and grit removal. During the first 10 years of operation, it is anticipated that there will be very few flow exceedances beyond the 40 ML/d, with the frequency increasing marginally as the facility reaches the 20-year design period.

2.2.3 Screening and Washer/Compactor

The 2016 design includes two (2) mechanical screens while the 2014 EAP submission included one (1) mechanical and one manual screen. Both submissions result in screened wastewater.

Two (2) mechanical 6 mm fine screens will be located in the Headworks Building, upstream of the grit removal system. One extra channel will be provided adjacent to the screen channels for future expansion. Two (2) mechanical screens designed for 30 ML/d each were selected in case one was to fail. The second would be adequate for most flows in an emergency.

The channels are sized to accommodate the two screens coupled with a single screenings transporter/washer/compactor unit. Since there may be a third screen in the future, the transporter /washer/compactor unit will be equipped with three (3) hoppers to accommodate the two proposed and one future screens.

Similar to 2014, the screened material (grit/screenings) will be transferred to the landfill.

2.2.4 Grit Removal

The grit removal process will remain similar as to what was proposed in 2014.

Grit will be removed to minimize abrasive wear on downstream equipment and to prevent accumulation and deposition of heavy, non-biodegradable material in the downstream tankage. The grit process removes heavy inorganic and some organic particulates from the wastewater flow. Grit removed by the grit chambers is classified and dewatered to reduce organics content and increase solids content so that the material is less likely to cause nuisance odours and is therefore, more amenable to landfill disposal. A single vortex grit removal device is being proposed as there is no moving part and it is unlikely to fail. However, duty/standby grit pumps will be provided for the grit pumps.

2.2.5 Primary Clarifier (Future Expansion)

The 2014 EAP submission included a primary clarifier; however, it has not been included in the 2016 design. As part of this current design, a blind flange has been included for future expansion.

2.2.6 Bioreactor

In the 2014 EAP submission, it was proposed to construct two bioreactors in a phased approach. The mechanics and process remains the same as to what was proposed in 2014. The size of the bioreactors are very similar, with minor changes in operation.

The proposed bioreactor will be configured as a Westbank Enhanced Biological Phosphorus Removal (EBPR) process and will include a nitrified mixed liquor return stream from the last aerobic zone to the first anoxic zone of the bioreactor. Within this configuration, the bioreactor will be configured with an arrangement of pre-annoxic, anaerobic, anoxic, and aerobic zones to achieve carbonaceous BOD removal, ammonia oxidation, and nitrogen removal. The influent is step-fed across multiple zones, distributing the readily biodegradable organic material present in the incoming wastewater to where it can be used most effectively by each step of the bioreactor process. Return activated sludge (RAS) from the secondary clarifiers will be introduced at the pre-anoxic zone and mixed liquor will be wasted from the third aerobic zone in order to control the formation of foam in the bioreactors.

Two bioreactor trains will be constructed to provide for a combined treatment capacity of 9,460 m^3 per day (Annual Average Flow). The new bioreactors will be constructed in the annular space around the secondary clarifiers.

Baffles will be installed in each biological reactor to partition each into pre-anoxic, anaerobic, anoxic, and aerobic zones. Mixers will be installed in the unaerated zones to provide completely mixed conditions and low head pumps will be used to return nitrified mixed liquor from the third aerobic zone to the first anoxic zone.

2.2.7 Secondary Clarifiers

In 2014, it was proposed to construct two (2) primary clarifiers in a phased approach. With increasing the size of bioreactors and secondary clarifiers, the primary clarifiers were removed in 2016 proposal. The current 2016 secondary clarifiers are very similar to what was proposed in the 2014 EAP submission.

Mixed liquor from each bioreactor flows into the secondary clarifiers, where the treated wastewater is separated from the biological solids. The clarified effluent is discharged from the surface of the tanks, while the settled biological solids are removed from the bottom, and returned to the bioreactors as return activated sludge (RAS). If ferric sulphate is needed to trim phosphorus levels, it will be added immediately prior to entering the secondary clarifiers.

Mixed liquor will enter each secondary clarifier through an energy dissipation inlet, consisting of a small diffuser chamber in the top centre area of the tank. From this chamber, mixed liquor will discharge through controlled diffuser ports, into the large central flocculation well, through controlled diffuser ports. A circular baffle will be installed to create a centre zone in which incoming mixed liquor will be allowed to flocculate in a low energy mixing regime.

Flocs pass under and out of the flocculation centre well will enter the sedimentation zone of the clarifier, where they will encounter controlled upward flow velocities (overflow rates), designed to prevent the flocs from being transported to the clarifier surface.

The secondary clarifiers will be integrated into the bioreactors to provide a compact and economical design.

Two (2) secondary clarifiers will be constructed, each equipped with a dedicated RAS line. Dry-pit RAS pumps, equipped with flow meters and flow control valves, will be provided for the required return flow to each bioreactor.

2.2.7.1 Clarifier Cover

Covering secondary clarifiers and the bioreactor facilities are important considerations given the cold winters and high winds experienced on the Prairies. As a generalization, most of these BNR facilities in western Canada are not covered.

No covers have been included for the bioreactors or secondary clarifiers at this stage of design, however, this may be reconsidered in detailed design. Covers could consist of a complete building enclosure, a dome, partial concrete covers, or even high perimeter walls to reduce wind. If any changes of this nature are made to the current proposed design, the proponent will file a supplemental document for consideration by the Department of Sustainable Development.

2.2.8 Chemical Dosing

Similar to the 2014 treatment process, the proposed 2016 treatment process will also include chemical dosing. Alum or ferric chloride was proposed in the 2014 EAP. However, this NOA is proposing the use of ferric sulphate.

As Manitoba Water Quality Standards, Objectives, and Guidelines has strict phosphorus discharge standard, it is necessary to provide a secondary chemical phosphorus removal system to augment the biological phosphorus removal process. The proposed chemical phosphorus removal facility will include the following:

- Storage of ferric sulphate (jar tests by the City have selected ferric sulphate); and
- Dosing pumps to allow the mainstream application of a controlled amount of ferric sulphate solution into the secondary clarifier influent.

There will be online phosphorus analysers that will measure phosphorus in the secondary effluent and if the level exceeds a set point of approximately 0.8 mg/L (adjustable), ferric sulphate will be added to the secondary clarifier influent.

The ferric dosing will be automatic, but will be monitored by the operators.

2.2.9 Disinfection

Similar to the 2014 treatment process, the proposed 2016 treatment process will also include UV disinfection.

Sizing of the UV disinfection equipment is a function of the wastewater flow and the characteristics of the wastewater to be disinfected. A design dose of 25 to 30 mJ/cm^2 is recommended for WWTP treatment systems designed to meet an effluent disinfection limit based upon fecal coliform 200 MPN/100mL fecal coliform limits (based on a 30 day geometric mean of consecutive daily grab samples). The WWTP is designed for disinfection of the secondary effluent.

A single channel has been designed for a full capacity of 23.6 ML/d and the second channel will be blocked off. Additional UV equipment could be added at any time in the future. Gates will be provided to isolate the second channel.

The UV system will be designed for two banks in series. If one bank fails or needs removal for repairs, one bank would remain in service to provide disinfection for 11.8 ML/d. During detailed design, options for powering down some UV lamps will be examined to reduce power consumption at low flows. It will also be determined whether the UV system will be designed for a 60% UVT or if it will be reduced to 50% UVT to provide an additional safety factor.

After disinfection, wastewater will be transferred to the lagoon system for storage prior to spring discharge.

2.2.10 Discharge to Receiving Stream

Discharge to Dead Horse Creek will remain the same as was proposed in the 2014 EAP; however the pattern of cell discharges and flow routes will change. Effluent will be discharged to ditches leading to Dead Horse Creek during the warm weather months; however it will be stored in the lagoon system during the cold weather months. At present, the lagoon licence calls for a 196 day storage. The reason for storage is only to reduce impact on downstream infrastructure such as ditches, culverts and bridges. Because the proposed upgrades will result in the generation of effluent, which will meet the requirements for continuous discharge, this storage period of 196 days would no longer apply.

In the new licence, it is proposed that the effluent only be stored during the frozen months for a minimum of 120 days from of December to March, which would result in four (4) months of storage. The effluent would be held until the discharge route is free of ice and the effluent can flow without freezing.

2.3 Sludge Management

The sludge management has been updated since the 2014 EAP submission.

The proposed wastewater treatment process will generate sludge from the bioreactors, and scum from the secondary sedimentation tanks. Sludge management will involve:

- Collecting WAS from the bioreactors and scum from the secondary clarifiers and transferring them to Dissolved Air Flotation (DAF) tank.
- Sludge thickening in DAF system (thickening sludge from 0.4% to 4% W/W).
- Sludge stabilization with aerobic digestion in existing Cell 2.
- Sludge storing in existing Cell 3 meanwhile, mixing and aeration to prevent odour.
- Land application for sludge disposal (will be filed as a separate future Environment Act Proposal).

2.3.1 Dissolved Air Floatation Tank

A Dissolved Air Flotation (DAF) tank will be included in the upgrade to the WWTP, which was not proposed in the 2014 EAP.

WAS and scum will be pumped to a dissolved air flotation (DAF) system in the Headworks Building in order to thicken sludge prior to stabilization and disposal.

Sludge thickening will be designed to have only one DAF tank. The WWTP can function without wasting sludge for short periods during repair times. If maintenance can be planned, it is anticipated that the bioreactor can store sludge without wasting for 10 to 12 days in 2018 and 3 to 4 days at full capacity (2038).

Polymer addition enhances the DAF operation and provides the ability to compensate for unexpected temporary lapses in DAF performance. It improves the capture rate, increases the solids loading capacity, and stabilizes DAF operation significantly. A polymer dilution and feed system will be provided to promote thickening capability and enhance the effluent quality.

2.3.2 Sludge Stabilization

Sludge stabilization is new to the 2016 NOA.

The thickened sludge from the DAF will be transferred to the existing lagoon Cell 2 for stabilisation and then to existing lagoon Cell 3 for storage, to be stored prior to land application (future and subject to environmental approvals). At a concentration of 4% solids, each Cell should have over two (2) years of storage for a total of approximately four (4) years. Though natural processes of evaporation, it is possible that this sludge would increase to 6% or 8% solids, increasing storage time. This will vary depending on the precipitation events and upon actual flows going to the WWTP. In the first years of operation, the storage capacity may be closer to 8 years if both Cells are used. If one Cell is used for isolation and land application (future), the storage time will be approximately half that period. In order to stabilize the sludge it will be intensely aerated and mixed for a 60 day period and lightly aerated during storage. The existing aeration system was designed for aerating raw wastewater and cannot provide sufficient mixing requirement for the sludge stabilization zone.

An area of Cell 2 will be isolated by a floating flexible baffle wall. This smaller section of the lagoon would be fitted with surface aerators and mixers to keep the solids suspended and to provide oxygen for aerobic stabilization. The system would be working in continuous mode as a completely mixed reactor, and with a volume of approximately 4,500 m^3. Stabilized sludge would flow through openings in the baffle to join the rest of the Cell 2. The existing aerators in Cell 2 and Cell 3 would be retained for some degree of mixing and odour control.

2.3.3 Future Land Application of Biosolids

Treated sludge or biosolids, is commonly land applied to improve the structure of the soil and to add nutrients to agricultural fields. Of primary concern with the land application of biosolids materials is the leaching and/or surface runoff of nitrogen and phosphorus into ground or surface water if application rates exceed crop removal rates and soil storage capacity.

When biosolids require removal from the Cells, they will be applied to farm land at agronomic rates. A separate Environment Act Proposal will be submitted for future land application of biosolids. The objective of future land application work would be to manage nitrogen and phosphorus based on beneficial farm management practices.

2.3.4 Disposal of Cell 1 Sludge

Disposal of sludge from Cell 1 has been updated in the project design from what was proposed in the 2014 EAP.

Sludge in Cell 1 will be removed and dewatered prior to commissioning of the WWTP. For decades Cell 1 has had deposition of grit and screenings. Observations made during maintenance and repair of aeration systems show that the sludge is contaminated with debris and thus not suitable for farmland application.

Accumulated sludge and debris will be dewatered and disposed of at the local Solid Waste Area Management Project (SWAMP) Landfill. Preliminary discussions with the SWAMP facility have indicated that this sludge can be accommodated, provided there is adequate preparation time and that it passes the concrete slump test (needs to be a dewatered and not be liquid).

2.4 Overflow and Storm Water Handling

The overflow and storm water handling has been updated since the 2014 EAP submission.

The influent flow will be directed to the inlet chamber, where the wastewater will be directed to the screening and to the existing Cell 1, if the flow exceeds the Maximum Day Flow (MDF) of the headworks. When the total flow to the plant exceeds 40 ML/d, the excess flow will pass over a side weir, located before screen channels (inlet chamber). It will flow by gravity to the existing Cell 1.

The remainder of the influent wastewater flows (up to 40 ML/d) will be screened and de-gritted at the upgraded WWTP. Downstream of these two (2) physical processes, only flows below 23.6 ML/d (PWWF) will be discharged to the secondary processes. Flow between 23.6 ML/d and 40 ML/d will infrequently overflow to Cell 1 from the grit removal effluent channel upstream of the bioreactor.

2.5 Site Water Usage

There will be three (3) streams of water used on site:

- Hauled potable water;
- Chlorinated flushing water; and
- Non-potable firefighting pond.

Additional details on water usage at the site are provided in the Functional Design Report – Winkler Wastewater Treatment Plant provided in **Appendix A**.

2.6 Odour Control

All processes related to wastewater treatment typically generate some odour.

The most prominent odours are expected to emanate from primary treatment facilities (screening and grit removal) and solids handling facilities. In most instances, the odors associated with primary treatment facilities are generated as a result of septic conditions. In the existing City WWTP, the odour generated is likely more noticeable because all of the wastewater reaches the plant through forcemains. The forcemain from the RM of Stanley will be from a low pressure sewer and may be particularly odourous. Forcemains are often associated with odour, because they are closed in and the wastewater starts to ferment, creating conditions similar to a septic tank. Once the forcemain discharges into a tank, the odours that have been generated in the pipe are released all at once.

The most effective way to manage odour is to manage the sources generating the odour. In order to focus on the most significant sources of odour, the screen channels, screen racks, grit removal system, and DAF will be provided with covers that can be removed for maintenance purpose. Air will be drawn from under the covered area to selectively remove the most intense odours prior to them entering the building. This air will be sent through an odour control system for 99% removal of odourous substances and then it will be discharge to atmosphere.

Within the primary treatment areas, there will be 12 air changes per hour to meet National Fire Protection Association (NFPA) 820. This will improve air quality for the operators working in these areas. When operators are not on-site (night time), the air handling will drop to six (6) air changes per hour to reduce heating costs.

There will be minimal odour released on the secondary treatment side of the facility.

2.7 Civil Design

Access to the new process units (2016) is intended to be via a new access road from the south. Access to the existing lagoon will remain the same, using its own access roads as shown in **Figure 02** and **Figure 04**.

Access roads will generally be built over a granular or clay embankment, with a traffic gravel surface. Concrete pads will be provided for heavy trucks at the septage disposal facility and around the Headworks Building. Access roads will generally be designed for semitrailer weights to accommodate water hauling, screenings and grit removal, general repairs and chemical delivery. Access will be provided around the perimeter of the site so that access is available for maintenance work on the north side of the bioreactors

The WWTP site will be graded to provide positive drainage away from all process tankage and the Headworks Building. Appropriate storm drainage will be incorporated in the project design to intercept and manage surface drainage as required. The site will generally be built up with approximately 2 m of fill, to accommodate gravity flow through the plant and to incorporate the lagoon cells into the treatment system. Concrete tanks will be incorporated into the project design and will include earthen berms around the tanks to reduce heat loss.

2.8 Electrical

This following section provides information regarding back up power for the upgraded WWTP design.

The existing lagoon currently has its own 800 amp 347/600 volt service for the existing blowers and blower building. It is anticipated that this service will power the new mixers and floating aerators in lagoon Cell 2 for the aerobic digester. It would also provide power for the lift station pumps used to drain the overflow pipe extending from the Headworks Building to Cell 1.

A second electrical service would be installed specific to the Headworks Building. It is anticipated that this would be an above ground service that is 800 amps and 347/600 volts. This service would feed a subpanel for the septage building and the two (2) bioreactors.

During detailed design, discussions will be held with Manitoba Hydro to further define the service sizes. They may require that the two (2) facilities have a single service with one (1) of the locations backfeeding the other.

2.8.1 Backup Power

The City of Winkler power supply has been very reliable, aside from the ice storm that interrupted many transmission lines in the province in 2012. Most power interruptions are short with limited impact on the treatment process.

The design elevation of the plant was selected so that if there were a significant power failure, the wastewater being pumped to the treatment plant would naturally overflow to the lagoon. It is anticipated that all of the lift stations will have backup power and will be able to pump to some degree even if there was a loss of power in the area.

A 250 kW standby diesel generator will be used, should it be required to meet emergency power needs for the WWTP. The selection of either diesel or natural gas powered generators will be made during detailed design. A 24 hour day tank will be provided for the diesel generators, should diesel generator be selected as a choice for backup. The proposed generator would be located outside the WWTP in a weather proof enclosure near the electrical room. Should natural gas be the choice, it will be piped for an ongoing fuel supply.

A backup generator will, on its own, not be large enough to allow the treatment plant to function. It is only included to supply emergency lighting and some degree of heating and ventilation so that the WWTP meets code and remains safe for occupants. This will keep the facility from freezing and the air quality will remain acceptable so that the operators can complete whatever emergency work is needed. A short shutdown of less than 12 hours is generally not detrimental to the process. Treatment operation should return to normal within a few days. However, a longer shutdown will start to impair process and impair effluent quality. In this instance, the treated water that does not meet requirements will be diverted to the lagoon for further aeration and natural treatment.

An assessment will be made during detailed design to identify key components in the bioreactor area that may need to either be insulated or powered to some degree during a power failure to prevent freezing. This will help protect the infrastructure so that it can restart easily after a power failure.

2.9 Facility Effluent Monitoring and Testing

The effluent monitoring locations is similar to the 2014 plan, but additional information has been provided in the 2016 NOA.

Once the upgraded WWTP is in full operation, it will discharge treated effluent into Dead Horse Creek, as is the current practice. Since the upgraded WWTP will include the lagoon system, the discharge plan is more elaborate than a conventional mechanical treatment plant. Discharge locations for the WWTP are shown in **Figure 04**.

The following table summarizes the discharge and test locations during the different seasons.

Table 9: Discharge and Monitoring Locations

Season of Discharge	Discharge location	Testing
Winter	To Cell 1 and then to cells 4-7 for part of winter and direct to cell 8 and then 9 for part of winter	Plant Effluent in Headworks
Spring	Discharge direct to discharge ditch for ongoing treatment Discharge from lagoon cells 4 to 9 through cells 5 ,6, 7, and 8	Plant Effluent in Headworks and Each Cell Prior to Discharge
Summer/Fall	Discharge direct to the discharge ditch	Plant Effluent in Headworks
All Seasons – Wet Weather Flows	Direct to Cell 1 for aeration	As Noted Above

2.10 Schedule

The proposed updated schedule for the work is listed below in **Table 10**, incorporating the Licencing process as well as design, construction, and commissioning.

Table 10: Project Schedule

Item #	Component of Work	Date Completed
1	Functional Design	October, 2016
2	Completion of the Environment Act Proposal	November, 2016
3	Completion of Environmental Review Process	January, 2017
4	Detailed Design	December 2016 to July 2017
5	Tender Project	August, 2017
6	Construction Period	September 2017 to May 2019
7	Commissioning	May and June, 2019

3. Scope of the Assessment

This NOA utilizes the existing environment information provided in the 2014 EAP submission for the potential environmental effects from the new proposed WWTP components.

To assess the potential environmental impact of the proposed WWTP upgrade, spatial and temporal boundaries were defined as follows:

3.1 Temporal Boundaries

The temporal boundaries of the assessment are divided as follows:

- **Construction Phase:** Construction September 2017 to June 2019;
- **Operation Phase:** June 2019 into the future; and
- **Decommissioning Phase:** This refers to the eventual decommissioning of the WWTP, and all associated infrastructure that is being proposed in this document. There are currently no plans to decommission the WWTP in the foreseeable future. However, when the WWTP needs to be decommissioned at some point in the future, a site decommissioning plan will be filed with appropriate regulators prior to decommissioning. Therefore, effects associated with decommissioning have not been assessed as a part of this environmental assessment.

3.2 Spatial Boundaries

Spatial boundaries used for the assessment are described below. Where specifically noted, the boundaries may be adjusted to suit the Environmental Component (EC) or Social Component (SC) affected.

- **Project Site:** includes all areas subject to direct disturbance as a result of the project;
- **Project Area:** is a 3 km radius surrounding the Project Site, intended to account for the potential effects of the Project immediately outside of the Project Site. The majority of the information used to describe the existing environment is focused on the Project Area; and
- **Project Region:** is a 10 km radius beyond the Project Site, intended to account for the maximum spatial extent of potential impacts of the Project.

The Project Area and Project Region are shown in **Figure 05** and **Figure 06**, respectively.

3.3 Environmental and Social Components

This NOA considers changes to the environment caused by the new components of the proposed WWTP, as well as any consequential socio-economic implications. The Environmental Components (ECs) and Social Components (SCs) were selected following the guidance provided in DSD, "*Environment Act* Proposal Report Guidelines". SCs include components of the socio-economic environment that may be affected by a change in the environment as a result of the project.

A review of the potential environmental effects was assessed and the potential interactions between potential ECs and SCs due to the new proposed WWTP components are identified below:

- Septage Receiving Station (construction and operation phases)
  - Air Quality and Noise
  - Soil
  - Surface Water
- Dissolved Air Floatation Tank (construction and operation phases)
  - Air Quality and Noise
  - Soil
  - Surface Water
- Sludge Removal from Cell 1(construction phase)
  - Air Quality and Noise
  - Soil

Potential interactions were identified based on the professional judgement of the assessor combined with assumed implementation of standard environmentally responsible construction techniques and operating procedures in the course of project construction and operation. These potential interactions are assessed in **Section 4**.

4. Effects Assessment Methodology

This section contains the results of the environmental assessment and only includes discussions and mitigation measures for ECs and SCs that may be potentially affected by the proposed 2016 WWTP upgrades.

Applying professional judgement and a thorough understanding of the newly proposed 2016 components of the proposed project (outlined in **Section 2** of this supplementary filing) and the existing environment (as described in the 2014 EAP submission); AECOM determined the potential for physical and biological components to interact with project components. Mitigation measures that have been incorporated into the proponent's proposed plan are taken into account, as well as the environmental protection practices included in the proponent's operation.

Environmental effects that may be caused as a result of accidents and malfunctions are discussed separately in **Section 4.5**. Definitions of the terms used to guide the effects assessment are provided in **Table 11**.

Table 11. Factors and Definitions Considered in Assessing Environmental Effects

Project Phase:	Refers to the phase of the project as construction, operation or decommissioning.
Potential Effect:	Classification of the type of effects possible during a specific project phase.
Magnitude of Effect:	Refers to the estimated percentage of population or resource that may be affected by activities associated with the construction, operation and decommissioning of the proposed project. Where possible and practical, the population or resource base has been defined in quantitative or ordinal terms (e.g., hectares of soil types, units of habitat). Magnitude of effect has been classified as either less than (<) 1%, 1% to 10%, or greater than (>) 10% of the population or resource base. Where the magnitude of an effect has been defined as virtually immeasurable and represents a non-significant change from background in the population or resource, the effect is considered negligible. An exception to this is in terms of potential human health effects where, for example health issues due to water-borne diseases amounting to 1% of the population being affected would still be considered major.
Direction of Effect:	Refers to whether an effect on a population or a resource is considered to have a positive, adverse or neutral effect.
Duration of Effect:	Refers to the time it takes a population or resource to recover from the effect. If quantitative information was lacking, duration was identified as short-term (<1 year), moderate term (1 to 10 years) and long term (>10 years).
Frequency of Activity:	Refers to the number of times an activity occurs over the project phase, and is identified as once, rare, intermittent, or continuous.
Scope of Effect:	Refers to the geographical area potentially affected by the effect and was rated as Project Site, Project Area or Project Region as defined in **Section 4**. Where possible, quantitative estimates of the resource affected by the effect were provided.
Degree of Reversibility:	Refers to the extent an adverse effect is reversible or irreversible over a 10-year period.
Residual Effect:	A qualitative assessment of the residual effect remaining after employing mitigation measures in reducing the magnitude and/or the duration of the identified effect on the environment.

Magnitude of Effect	**Direction of Effect**	**Duration of Effect**	**Frequency of Effect**	**Scope of Effect**	**Degree of Reversibility of Effect**
Negligible (immeasurable)	Positive	Short term (< 1 year)	Once	Project Site	Reversible
Minor (<1%)	Adverse	Moderate (1 to 10 years)	Rare	Project Area	Irreversible
Moderate (1 to 10%)	Neutral	Long term (>10 years)	Intermittent	Project Region	
Major (>10%)			Continuous		

4.1 Air Quality

4.1.1 Dust

Sources of dust include activities such as clearing, grading, excavating, vehicle movement, and stockpiling of materials. Air quality may be affected by dust and particulates with subsequent effects on human health (including respiratory issues) and vegetation (dust deposition). Dust occurs primarily during summer and fall, with greater likelihood for an increase in dust during dry and windy conditions.

Vehicles commuting to and from the Project Site will utilize the paved Provincial Road No. 428 followed by the existing gravel access road to the existing WWTP site. The existing WWTP is surrounded by agricultural fields with the closes residential receptor located approximately 1.3 km northeast and southeast of the existing WWTP.

Although dust is not anticipated to be a major concern, to further manage potential effects due to dust, the following mitigation measures will be implemented:

- Material stockpile heights will be limited;
- The disturbed/exposed areas will be kept to a minimum; and
- If required, dust suppression activities such as the use of approved dust control agents and/or water will be undertaken.

In our opinion, the mitigation measures proposed above are sufficient to mitigate any adverse effects due to dust during the construction and operation phases. Residual effects on air quality due to dust emissions are therefore assessed to be negligible.

4.1.2 Odour

As indicated in **Section 2.6**, the most intense odours evolve from primary treatment facilities (screening and grit removal) and solids handling facilities. In most instances, the odors associated with primary treatment facilities are generated as a result of septic conditions.

As indicated in **Section 2.1.3**, the septage receiving station is a new component to the 2016 treatment process. Septage has the potential to generate odours therefore, waste haulers will connect to a pipe via a cam lock that transfers septage into the package septage receiving station that consists of a rock trap and a grinder. With this secure connection, the likelihood of odours being generated will be reduced. During operation, it is anticipated that septage will be trucked to the WWTP approximately four (4) times per day, seven (7) days of the week from locations identified in **Section 2.1.3**.

The most prominent odours are expected to emanate from primary treatment facilities (screening and grit removal) and solids handling facilities. In most instances, the odors associated with primary treatment facilities are generated as a result of septic conditions. In the existing City WWTP, the odour generated is likely more noticeable because all of the wastewater reaches the plant through forcemains. The forcemain from the RM of Stanley will be from a low pressure sewer and may be particularly odourous. Forcemains are often associated with odour, because they are closed in and the wastewater starts to ferment, creating conditions similar to a septic tank. Once the forcemain discharges into a tank, the odours that have been generated in the pipe are released all at once.

The most effective way to manage odour is to manage the sources generating the odour. In order to focus on the most significant sources of odour, the screen channels, screen racks, grit removal system, and DAF will be provided with covers that can be removed for maintenance purpose. Air will be drawn from under the covered area to selectively remove the most intense odours prior to them entering the building. This air will be sent through an odour control system for 99% removal of odourous substances and then it will be discharge to atmosphere.

Within the primary treatment areas, there will be 12 air changes per hour to meet National Fire Protection Association (NFPA) 820. This will improve air quality for the operators working in these areas. When operators are not on-site (night time), the air handling will drop to six (6) air changes per hour to reduce heating costs.

There will be minimal odour released on the secondary treatment side of the facility.

In regards to the sludge management at the WWTP, the removal of sludge from the existing Cell 1 could potentially generate odours. Sludge in Cell 1 will be removed and dewatered prior to commissioning the upgraded WWTP.

The new system will include a DAF system. WAS and scum will be pumped to the DAF system in the Headworks Building in order to thicken the sludge prior to stabilization and disposal. The thickened sludge from the DAF will be transferred to the existing lagoon Cell 2 for stabilization and then to existing lagoon Cell 3 for storage. Cell 3 will also have light mixing and aeration to prevent odours. A future EAP will be required to obtain a licence for land application of solids from Cells 2 and 3.

The closest residential receptors to the existing WWTP are located approximately 1.3 km northwest and southwest. Desludging will occur in the fall and/or winter, in low wind events and not when there is a downwind towards the residences. If during construction and operation odour becomes an issue for the neighbouring residences, the City will work with individuals to try to alleviate the concerns.

4.1.3 Exhaust Emissions

During construction, exhaust emissions will be generated during the delivery of materials to the Project Site, construction equipment movement at the Project Site, and septage truck deliveries during operation. These emissions could decrease the quality of the air by increasing the local concentration of carbon monoxide, carbon dioxide, particulate matter, and nitrogen oxides in the air with potential for subsequent effects on human health.

During construction, an anticipated maximum of 10 construction vehicles will access the WWTP site per day via the paved Provincial Road No. 428 followed by the existing gravel access road.

During operation, it is anticipated that septage will be trucked to the WWTP approximately four (4) times per day, seven (7) days of the week from locations identified in **Section 2.1.3**.

The following mitigation measures will be implemented to manage these construction-related exhaust emissions:

- Vehicles and equipment will be properly maintained; and
- Vehicle idling will be kept to a minimum.

With the implementation of the mitigation measures proposed above, any adverse residual impact due to exhaust emissions during construction is anticipated to be negligible.

4.1.4 Noise

An increase in noise levels at the Project Site could potentially affect people.

Sources of noise during construction would be typical of heavy equipment such as graders, excavators, loaders, compactors, and haulage trucks. General construction activities are anticipated to generate intermittent noise over the construction period; approximately 16 months of construction for the WWTP site.

The closest residential receptors to the existing WWTP site are located approximately 1.3 km northwest and southwest. During construction, a maximum of 10 construction vehicles will access the WWTP site via the paved Provincial Road No. 428 followed by the existing gravel access road.

During the operation phase, sources of noise include maintenance vehicles and activities (anticipated to be typical of lawn equipment, trucks, and small hand held tools) along with the septage hauler trucks approximately four (4) times per day, seven (7) days of the week.

Some additional measures to mitigate noise are:

- Vehicle and equipment will be properly maintained; and
- Provide hearing protection to workers as required.

The mitigation measures listed above are judged to be sufficient to mitigate any potential noise related effects at the Project Site. Therefore, residual effects from noise are assessed to be negligible.

4.2 Soil

4.2.1 Soil Compaction and Mixing

As a result of incidental vehicle and equipment movement, along with grading, excavations, and stockpiling of materials at the Project Site during construction, there is the potential to cause soil compaction and mixing of soil horizons which may change the soil structure. Soil compaction also has the potential to change surface drainage patterns and reduce flora growth.

To reduce potential soil compaction and mixing of soil horizons at the Project Site, the following mitigation measures will be implemented:

- Construction equipment and vehicle movements will be limited to designated roads/pathways within and around work areas;
- Construction activities during periods of extensive precipitation/runoff will be limited;
- Disturbed/exposed areas will be kept to a minimum with site restoration occurring as soon as practical where required;
- Topsoil will be stripped and stockpiled on the Project Site for use in site restoration; and
- The contractor will be responsible for the appropriate repair of any areas where equipment has compacted soils with the repairs including appropriate grading and site restoration.

In our opinion, the mitigation measures proposed above are sufficient to mitigate potential adverse effects due to soil compaction and mixing during the construction, operation, and decommissioning phases. Residual effects on soils are therefore assessed to be negligible.

4.2.2 Soil Erosion

Soil may be lost during the construction phase due to erosion as runoff from wind and precipitation. Conditions favourable for erosion have the potential to occur during clearing, grading, excavation, stockpiling, site restoration, and movement of equipment at the Project Site. Erosion of soil and material stockpiles due to wind has the potential to cause consequential effects on air quality (dust and particular matter) and vegetation (dust deposition).

To mitigate potential soil erosion effects, mitigation measures described in **Section 4.1.1** will be implemented. In our opinion, the mitigation measures proposed are sufficient to mitigate any adverse effects due to soil erosion during the construction, operation, and decommissioning phases. Residual effects on air quality due to soil erosion are therefore assessed to be negligible.

4.3 Surface Water

Effluent will continue to be discharged into the ditches that drain into Dead Horse Creek during the warm weather months and will be stored in the lagoon cells during the cold weather months. Water in Dead Horse Creek eventually flows into the Red River via the Plum River. Since the WWTP includes the lagoon system, the discharge plan is more elaborate than a conventional mechanical treatment plant. Discharge locations for the WWTP are shown in **Figure 04**.

Similar to the 2014 EAP submission, the upgraded WWTP will meet the following effluent criteria (prescribed under Manitoba Water Quality Standards, Objectives, and Guidelines):

- Carbonaceous biochemical oxygen demand ($CBOD_5$) - 25 mg/L;
- Five-day biochemical oxygen demand (BOD5) – 25 mg/L;
- Total Suspended Solids (TSS) - 25 mg/L;
- Total Nitrogen (TN) – 15 mg/L;
- Total dissolved solids (TDS) – 3,000mg/L'
- E.coli – 200 fecal coliforms per100 mL;
- Fecal coliform - 200 organisms per 100 mL;
- Total Ammonia –
  - 6.67 mg/L as N (at 9 °C and pH of 6.5)
  - 5.91 mg/L as N (at 9 °C and pH of 7.0)
  - 4.36 mg/L as N (at 9 °C and pH of 7.5)
  - 3.65 mg/L as N (at 24 °C and pH of 6.5)
  - 3.24 mg/L as N (at 24 °C and pH of 7.0)
  - 3.39 mg/L as N (at 24 °C and pH of 7.5)

With the above criteria as the target key parameter, the quality of effluent that will be discharged to Dead Horse Creek will improve. The quantity of effluent is not anticipated to increase from the 2014 EAP submission. Therefore, effluent from the upgraded WWTP is not anticipated to have a significant adverse effect on water quality of Dead Horse Creek.

Soil may be lost during the construction phase due to erosion as runoff from wind and precipitation and could potentially affect surface water quality. Conditions favourable for erosion could occur during clearing, grading, excavation, stockpiling, site restoration, and movement of equipment at the Project Site. The majority of construction will occur approximately 650 m south of Dead Horse Creek. Silt fences will be employed to minimize sediment transport where appropriate. Also, the mitigation measures identified in **Section 4.2.2** will be implemented.

In our opinion, the mitigation measures proposed are sufficient to mitigate any adverse effects due to soil erosion and subsequent transport and deposition of eroded material during the construction phase. Residual effects on surface water are therefore assessed to be negligible.

4.4 Health and Safety

Exposure to fuels, moving vehicles, construction equipment and pinch points could all negatively impact worker health and safety. In Manitoba, worker protection is provided through legislated standards, procedures and training under the *Workplace Safety and Health Act*. All contractors will be subject to site specific environmental, health and safety orientation for the construction phase of the proposed project.

The health and safety program will generally include the following:

- All construction will be carried out in accordance with the *Workplace Safety and Health Act* to minimize health and safety effects;
- Contractors will adhere to the requirements of applicable health and safety legislation and the site specific safety plan developed by the prime contractor or contractor as appropriate; and
- All workers will wear appropriate PPE at all times, including hearing protection as required.

Construction signage will be in place for the safety of the cottagers/campers and the public who use the Trans Canada Trail. The public will not be permitted access to the Project Site as it will be fenced with a gate during both construction and operation.

The new primary Lagoon cell will be completely fenced along with the new Lagoon site to prevent public access and signage will be posted.

With the above provisions in place, we do not expect health and safety as a result of the proposed upgrade, to be of any concern.

4.5 Accidents and Malfunctions

To prevent accidents and malfunctions, all phases of the proposed project will be conducted in accordance with applicable regulatory requirements. The following sections provide additional details on precautionary measures that are proposed to minimize the risk of occurrence for accidents and malfunctions.

4.5.1 Spills

During construction and operation, there is potential for environmental effects due to fuel spills and/or leaks. Accidents (including transportation accidents) could also result in the accidental release of hazardous materials and/or equipment/vehicle fluids and fuels. A number of potential environmental concerns are also associated with the accidental release of chemicals and fuels resulting from improper storage and handling procedures. Spills can affect soil, vegetation, groundwater quality, air quality, and can potentially threaten human health and safety. Activities that may cause a spill are anticipated to occur rarely over the short term during the construction phase of the proposed project. Spills are expected to be predominantly contained to the Project Site. The magnitude of the spill effects are anticipated to range from negligible to moderate depending on the severity of a spill.

To prevent spills from occurring during project activities, the following procedures will be employed:

- All potentially hazardous products (if required on-site) will be stored in a pre-designated, safe and secure product storage area(s) in accordance with applicable legislation;

- Storage and disposal of liquid wastes and filters from equipment maintenance, and any residual material from spill clean-up will be contained in an environmentally safe manner and in accordance with any existing regulations;
- Storage sites (equipment storage, hazardous product storage, etc.) will be inspected periodically for compliance with requirements;
- Service and minor repairs of equipment performed on-site will be performed by trained personnel in appropriate areas;
- Vehicles and equipment will be maintained to minimize leaks. Regular inspections of hydraulic and fuel systems on equipment/machinery will be completed on a routine basis. When detected, leaks will be repaired immediately by trained personnel;
- Any used oils or other hazardous liquids will be collected and disposed of according to provincial requirements;
- Appropriate type and size of spill kits are available on-site; and
- On-site construction staff will be trained in how to deal with spills and clean-up procedures, including review of applicable Spill Response Plans and knowledge of how to properly deploy site spill kit materials; which will be readily accessible at the site at all times.

Adherence to standard environmental management practices will minimize the risks of accidental spills and adverse effects. This includes regular equipment inspection and maintenance to minimize the risk of fuel spills. In the event of an accidental spill, a regulatory report will be made to Environment Canada and Department of Sustainable Development. Following a spill, measures will be taken immediately with a spill kit or suitable alternative to prevent migration of the spilled material. Recovery measures will be implemented as necessary in consultation with the appropriate provincial authorities. Following initial response, a remediation program will be undertaken if necessary with contaminated material appropriately managed (in accordance with federal and provincial regulations).

With the implementation of the above mitigation measures as necessary and assuming the implementation of safe work practices, the risk of spills is considered to be appropriately mitigated.

4.5.2 Fire/Explosions

During construction and operation there exists the potential for fires at the Project Site involving mechanical equipment and fuels. Effects related to fires include, but are not limited to, harm to on-site personnel, equipment, and the potential release of contaminants and hazardous materials.

All precautions necessary will be taken to prevent fire hazards at the Project Site; these include, but are not limited to:

- All flammable waste will be removed on a regular basis and disposed of at an appropriate disposal site;
- Appropriate fire extinguisher(s) are available on the Project Site. Such equipment will comply with and be maintained to, the manufacturers' standards;
- All on-site fire prevention/response equipment is checked on a routine basis, in accordance with local fire safety regulations, to ensure the equipment is in proper working order at all times; and
- Greasy or oily rags or materials subject to spontaneous combustion are deposited and stored in appropriate receptacles. This material will be removed from the Project Site on a regular basis and be disposed of at an appropriate waste disposal facility.

With these mitigation measures employed and assuming the implementation of typical safe work practices, the risk of fires and explosions is considered to be appropriately mitigated.

5. Responses to TAC

Comments were received from the following organizations:

- Manitoba Conservation and Water Stewardship (Sustainable Development) – Environmental Approvals Branch, dated July 3, 2015
- Water Science and Management Branch – Manitoba Conservation and Water Stewardship, dated July 7, 2014;
- Office of Drinking Water – Manitoba Conservation and Water Stewardship, dated July 4, 2014;
- Air Quality – Environmental Programs & Strategies – Manitoba Conservation and Water Stewardship, dated June 27, 2014; and
- Office of the Fire Commissioner, dated June 19, 2014

The following section provides responses to TAC comments from the above organizations.

5.1 Sustainable Development

Question 1:

"Please provide supplementary information regarding specific characteristics of the sludge contained in the existing aerated cells and proposed methods of handling and disposing of this sludge as a component of this EAP."

Response:

Cell#1 – Disposal of Biosolids with Current Environment Act Proposal

Sludge samples were not collected from Cell 1, as a homogeneous sample could not reasonably be collected. All work completed in Cell 1 has visually and physically identified rags and other debris. This cell has acted as the repository for screenings and grit for decades and it is not recommended that it be applied to land. It is anticipated that there will be 5,400 m^3 of sludge at 25% solids but this may decrease to 2,700m^3 if the sludge dewaters to 50% solids. It is proposed that this sludge and debris be dewatered such that it can be disposed of at the local SWAMP Landfill. This has been discussed with the operators at the landfill and there is preliminary approval for disposal. Photo 1 below shows the debris typical to what is found in Cell 1.

Photo 1: Debris Typical to Cell 1

Future Sludge Inventory Management

Although only Cell 1 will be desludged as a part of the WWTP upgrade, the remaining cells have sludge within them. Cell 2 and Cell 3 will be used to stabilize sludge with the proposed treatment plant. **Table 12** provides a description of sludge inventories in the existing lagoon cells.

Table 12. Estimated Sludge Inventory in Existing Lagoon

Cell#	Depth of Sludge meters	Cell Depth	Base Cell Area	Estimated Volume of Sludge- Assume 6%	Estimated Volume – Thickened to 10%	Estimated Volume at 25% solids	Landfill	Periodic Application in Future Licence	Leave Inventory for Long Term
1	0.9	4.3	25,000	22,500	14,0000	5,400	With Current Upgrade and EAP		
2	0.9	4.3	11,200	10,000	6,000	2,400		Periodic Application	
3	0.9	4.3	11,200	10,000	6,000	2,400		Periodic Application	
4	0.1	1.5	57,000	5,700	3,400	1,400			Yes
5	0.05	1.5	70,000	3,500	2,100	840			Yes
6	0.05	2.1	121,000	6,000	3,600	1,500			Yes
7	0.05	2.5	118,000	5,900	3,500	1,400			Yes
8	0.05	2.5	134,000	6,700	4,000	1,600			Yes
9	0.05	2.5	133,000	6,700	4,000	1,600			Yes
Prop. Work with Current EAP							5,400 m^3 @ 25% solids		

Based on the above sludge inventory, three (3) categories of management processes are as follows:

- Landfill of Cell 1 - sludge as it contains significant debris (part of current licence application)
- Cell 2 and Cell 3 - Ongoing periodic land application of sludge from (future EAP application)
- Cells 4 to 9 - Specialty land application of sludge in the long term as required. (future EAP application)

Land Application of Sludge with Future Licence

In future years, the sludge inventory will be monitored and it is anticipated that Cell 2 and Cell 3 will need desludging through land application every four (4) years (depending on the weather and wastewater flow). This application program will include identifying and testing suitable land, composite sampling of sludge, and completion of an Environment Act Proposal for the land application of sludge. Nutrients will be applied at an agronomic rate on suitable land.

Composite samples were collected and tested for Cells 2, 3, and Cells 4 and 5. The samples are included in **Appendix C**. It should be noted that there is variability in the sample but that there is available nitrogen and phosphorus, with low metals concentrations. The cells will need to be resampled in the future prior to completion of the Environment Act Proposal for their disposal.

Question 2:

"Please provide an indication of planned completion dates respecting all components… discussed in the EAP."

Response:

The anticipated completion dates are provided in **Table 13** below.

Table 13. Estimated Sludge Inventory in Existing Lagoon

Item #	Component of Work	Date Completed
1	Functional Design	October, 2016
2	Completion of the Environment Act Proposal	November, 2016
3	Completion of Environmental Review Process	January, 2017
4	Detailed Design	December 2016 to July 2017
5	Tender Project	August, 2017
6	Construction Period	September 2017 to May 2019
7	Commissioning	May and June, 2019

5.2 Water Science and Management Branch

Question 1:

"How will the Proponent use the Biological Nutrient Removal (BNR) process for the beneficial reuse of valuable resources such as nutrients, organic matter and energy contained within municipal biosolids and sludge?"

Response:

The biosolids generated by this Biological Nutrient Removal (BNR) process will be stabilized in an aerobic digester and applied to farm land periodically. The aerobic digester will consist of a separate baffled part of Cell 2 with both mixing and aeration. The sludge will be considered biosolids once it is aerated and mixed for an average of 60 days, prior to passing into a storage area for ongoing light aeration. As the majority of the phosphorus removed in this process will be biological, the phosphorus in the biosolids will be available for use as a fertilizer.

Biosolids will be stored for approximately two (2) to four (4) years following stabilization. It is anticipated that the biosolids will be in the range of 5% to 10% solids, depending upon the weather and if any decanting is possible. A separate Environment Act Proposal will be provided for periodic emptying of the Cell 2 and Cell 3 and land applying the biosolids to farmland. This will be completed at an agronomic rate and all offsets will be followed. Land application of the biosolids will reuse the organic matter and nutrients.

The proponent considered other processes such as anaerobic digestion of the biosolids and cogeneration of biogas, which could capture some of the energy contained within the sludge. However, this is not believed to be economical due to the small mass of biogas and the amount of additional infrastructure that would be required. This would include infrastructure such as anaerobic digesters, gas storage and compression, gas cleaning, cogeneration facilities, and significant changes to the electrical and heating and ventilation system.

Question 2:

"Can the Proponent handle the sludge in a way that does not require adding alum or ferric to the sludge at the Primary Sludge Pump Station?"

Response:

The facility will be operated as a BNR facility with the intention of biological phosphorus removal in the bioreactors. The current proposal has removed the primary clarifiers from the process train. Ferric sulphate will be available for trimming the phosphorus levels during start-up, and during process upsets by adding it to the conduit immediately prior to the secondary clarifiers. Ferric may also be added to a small degree on an ongoing basis if there are not adequate levels of volatile fatty acid (VFA's) in the wastewater. The City's raw wastewater is believed (through testing) to possess enough VFA to support biological phosphorus removal and the RM wastewater should have a significant amount due to its long collection system. The system is designed to minimize ferric sulphate dosing.

An auto analyzer will be included on the secondary clarifier effluent. If the level of phosphorus rises above an adjustable level such as 0.8 mg/L, ferric sulphate will be metered in, immediately prior to entering the secondary clarifiers to help keep concentrations below licenced levels.

As this is BNR sludge, it will start to release sludge in anoxic or anaerobic conditions. For this reason, the sludge is being thickened with an aerobic process; dissolved air floatation, so that the sludge can be thickened while the phosphorus is retained in solid form. This sludge then goes to the aerobic digester for further stabilization. There will be no return stream back to the treatment plant from the sludge system, as this would likely contain a high level of phosphorus, which would need to be removed again. By keeping the concentrated phosphorus in the sludge stream, we minimize stress on the treatment plant and minimize chemicals needed to augment phosphorus removal.

Question 3:

"Can the Proponent operate the BNR facility such that adding alum or ferric to the mixing box or Primary Sedimentation Tank prior to the BNR process is not necessary?"

Response:

This supplementary filing and current design does not include a primary clarifier in the design as the current loading is less than the previous EAP application. Dosing will typically take place immediately upstream of the secondary clarifiers. The phosphorus level in the clarifier effluent will be monitored with an auto analyzer and will automatically feed ferric sulphate into the secondary clarifier influent if levels exceed a set point such as 0.8 mg/L.

Please refer to response to Question 2 (Water Science and Management Branch) for discussion on minimizing ferric sulphate usage.

Question 4:

“Can the Proponent please clarify if chemical dosing will be automated or manually adjusted based on total phosphorous?”

Response:

Dosage of ferric sulphate will be automated, and based on autosampler monitoring of the secondary clarifier effluent. The first year of operation will fine tune the amount of ferric sulphate that needs to be added to trim phosphorus levels to below licence limits if any is required. The design assumes that the ferric sulphate feed is a backup as the primary method of phosphorus removal is biological. Please refer to responses to Question 2 and Question 3 (Water Science and Management Branch) for additional details.

5.3 Office of Drinking Water

Comment 1:

“Section 8.4 of the EAP notes the treated effluent return to the environment will be to Dead Horse Creek, which flows into the Plum River. The Plum River flows into the Red River upstream of the raw water intake for the Morris Regional Water Treatment Plant. Office of Drinking Water recommends that a requirement be included in the EA Licence that contact information for the Morris Regional Water Treatment Plant be included in the emergency response plans for the new Winkler WWTP with an instruction that, in the event of a major spill of partially treated or untreated wastewater or sludge from the WWTP into Deadhorse Creek, the Morris Regional Water Treatment Plant operators be notified.”

Response:

This is noted and it will be included as part of the operating manual.

Comment 2:

“This Section also notes that at some future point, treated water from the WWTP might be injected into the ground for aquifer recharge. Office of Drinking Water recommends the implications of such recharge on domestic water uses of the aquifer to be carefully studies before any such recharge be licenced.”

Response:

Treated water from the WWTP will not be injected into the ground for aquifer recharge as part of this project. If this is something that the City would like to look at in the future, the aquifer will be carefully studied, and applicable approvals secured with the relevant agencies prior to undertaking such activity.

Comment 3:

“Requirements of The Manitoba Plumbing Code respecting protection of potable water supplies from cross-connection and backflow/backsyphonage should be adhered to in the building plumbing systems.”

Response:

Designs will meet the Manitoba Plumbing Code. Care will be taken not to allow for cross connections. Potable water will only be provided for human use in a few select locations.

5.4 Air Quality – Environmental Programs & Strategies

Comment 1:

"While the proposal did not mention about dust and particulate emissions, it is expected that appropriate control measures will be undertaken to minimize dust and particulate matter emissions during construction."

Response:

Dust control is regularly practiced by the City on granular topped roads. This dust control work will continue in the construction areas due to increased traffic in the area.

Comment 2:

"Air Quality Section suggests that the EA Clause regarding odour nuisance be included in the licence."

Response:

All processes related to wastewater treatment typically generate some odour.

The most prominent odours are expected to emanate from primary treatment facilities (screening and grit removal) and solids handling facilities. In most instances, the odors associated with primary treatment facilities are generated as a result of septic conditions. In the existing City WWTP, the odour generated is likely more noticeable because all of the wastewater reaches the plant through forcemains. The forcemain from the RM of Stanley will be from a low pressure sewer and may be particularly odourous. Forcemains are often associated with odour, because they are closed in and the wastewater starts to ferment, creating conditions similar to a septic tank. Once the forcemain discharges into a tank, the odours that have been generated in the pipe are released all at once.

The most effective way to manage odour is to manage the sources generating the odour. In order to focus on the most significant sources of odour, the screen channels, screen racks, grit removal system, and DAF will be provided with covers that can be removed for maintenance purpose. Air will be drawn from under the covered area to selectively remove the most intense odours prior to them entering the building. This air will be sent through an odour control system for 99% removal of odourous substances and then it will be discharge to atmosphere.

Within the primary treatment areas, there will be 12 air changes per hour to meet National Fire Protection Association (NFPA) 820. This will improve air quality for the operators working in these areas. When operators are not on-site (night time), the air handling will drop to six (6) air changes per hour to reduce heating costs.

There will be minimal odour released on the secondary treatment side of the facility.

5.5 Office of the Fire Commissioner

Comment 1:

"…the Office of the Fire Commissioner (OFC) will require the proponent to obtain a valid building permit from the Building Code authority, the MSTW Planning District at 180-5th Street in Morden. Prior to any occupancy of this new facility, the proponent shall also obtain a valid Occupancy Permit from the MSTW Planning District. The proponent shall also submit a fire safety plan, with respect to Section 2.8 of the Manitoba Fire Code, to the Winkler Fire Department."

Response:

It has been noted that a valid Building and Occupancy permit will be required. A fire safety plant will also be provided.

6. Conclusion

The results of the effects assessment can be summarized as follows:

Air Quality and Noise

Although dust is not anticipated to be a major concern at the Project Site, with the implementation of measures such as limiting material stockpile heights, keeping disturbed/exposed areas to a minimum, and using dust suppression when required, the effect of dust is assessed to be negligible.

In regards to potential odours from the WWTP during operation, the most significant odour sources, the screen channels, screen racks, grit removal system, and DAF will be provided with covers that can be removed for maintenance purpose. Air from within these most odourous zones will be treated by an activated carbon based treatment system. Also, the secure cam lock connection that waste haulers will use when transferring septage into the septage receiving station will also reduce potential odours. The aeration in Cell 2 and Cell 3 will also assist in controlling odour generation.

With respect to exhaust emissions, it is anticipated that a maximum of 10 construction vehicles on a daily basis will access the WWTP via the paved Provincial Road No. 428 followed by the existing gravel road. With the implementation of measures such as maintaining vehicles and equipment in proper working order and vehicle idling kept to a minimum, the effects of exhaust emissions is assessed to be negligible.

Noise levels at the Project Site during construction are not expected to be high enough to cause significant disturbance in the Project Area. With the implementation of measures such as providing hearing protection to workers as required and properly maintaining vehicles and equipment are expected to mitigate potential adverse effects. During operation, sources of noise include maintenance vehicles and activities along with hauler trucks arriving to the site approximately four (4) times per day, seven (7) days of the week. Therefore, the effect of noise is assessed to be negligible.

Soil

With respect to soil compaction, mixing, and erosion during construction, the implementation of mitigation measures identified in this NOA are anticipated to mitigate any potential soil compaction/mixing and erosion effects. Therefore, it is anticipated that the residual effect on soil is assessed to be negligible.

Surface Water

The upgraded WWTP will meet the following effluent criteria ((prescribed under Manitoba Water Quality Standards, Objectives, and Guidelines):

- Carbonaceous biochemical oxygen demand ($CBOD_5$) - 25 mg/L;
- Five-day biochemical oxygen demand (BOD5) – 25 mg/L;
- Total Suspended Solids (TSS) - 25 mg/L;
- Total Nitrogen (TN) – 15 mg/L;
- Total dissolved solids (TDS) – 3,000mg/L’
- E.coli – 200 fecal coliforms per100 mL;

- Fecal coliform - 200 organisms per 100 mL;
- Total Ammonia –
  - 6.67 mg/L as N (at 9 °C and pH of 6.5)
  - 5.91 mg/L as N (at 9 °C and pH of 7.0)
  - 4.36 mg/L as N (at 9 °C and pH of 7.5)
  - 3.65 mg/L as N (at 24 °C and pH of 6.5)
  - 3.24 mg/L as N (at 24 °C and pH of 7.0)
  - 3.39 mg/L as N (at 24 °C and pH of 7.5)

With the above criteria as the target key parameter, the quality of effluent that will be discharged to Dead Horse Creek will improve. The quantity of effluent will remain the same as noted in the 2014 EAP submission. Therefore, effluent from the upgraded WWTP is not anticipated to have a significant adverse effect on water quality of Dead Horse Creek.

All construction works will be located approximately 650 m away from Dead Horse Creek. With the implementation of measures such as installing silt fences, limiting material stockpile heights, keeping disturbed/exposed areas to a minimum, and using dust suppression if required, the effects of dust is assessed to be negligible.

Conclusion Summary

Considering the implementation of the proposed mitigation measures, design features, existing and proposed environmental licence conditions and the social and ecological context of each environmental component addressed in **Section 4**, the cumulative residual environmental effects of the proposed 2016 upgrade components of the WWTP are expected to negligible in magnitude.

The measures described to mitigate the risk of occurrence of accidents and malfunctions are deemed to be appropriate in mitigating such risks. Therefore, it is our opinion that based on the available information and documented assumptions, the overall potential adverse effects of the proposed project will range from negligible to moderate and insignificant.

Figures

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Project Management Initials: Designer: Checked: Approved:

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Environment Act Proposal - Winkler
Wastewater Treatment Plant Upgrade
City of Winkler

Location Plan

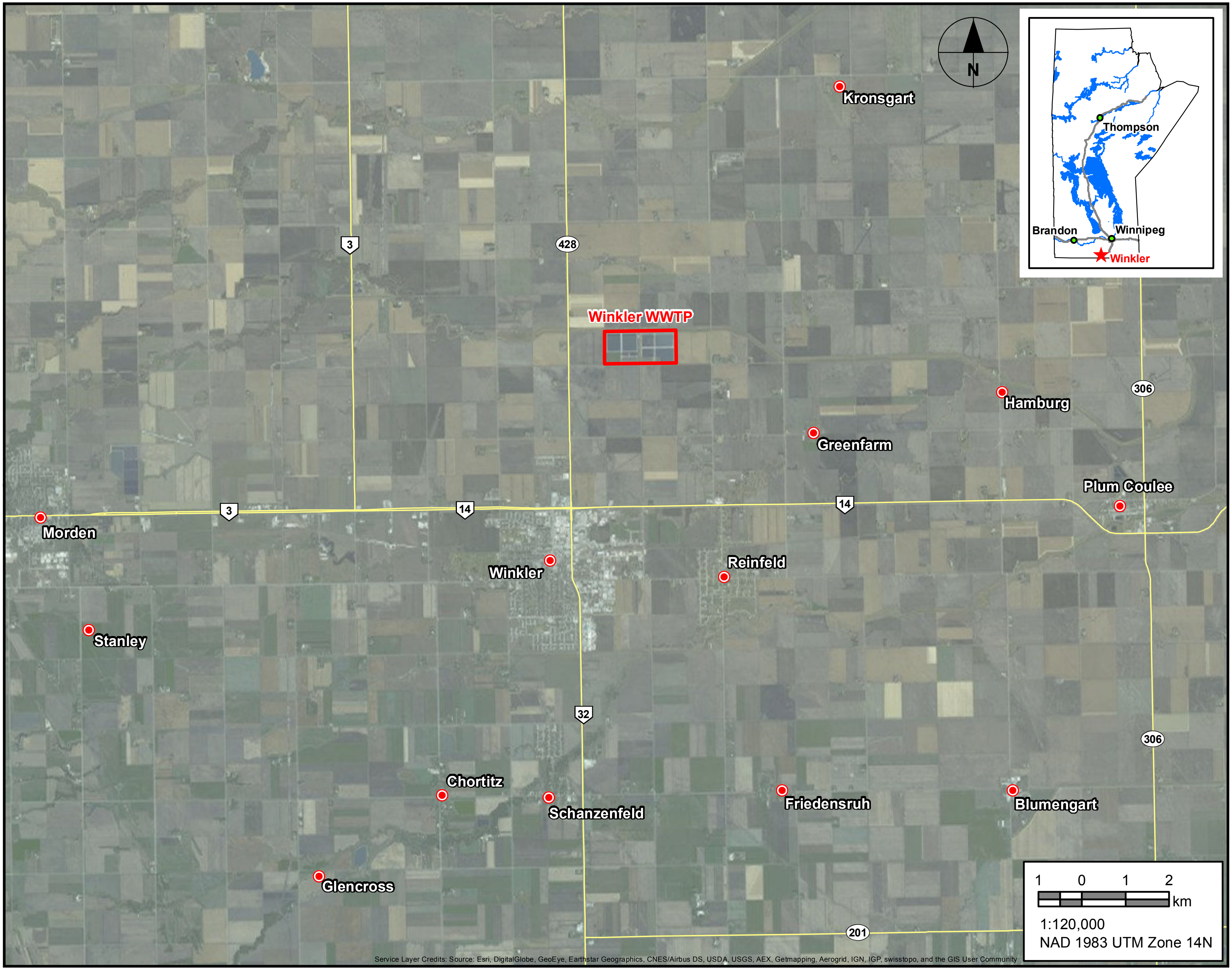

Figure: 01

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Project Management Initials: Designer: Checked: Approved:

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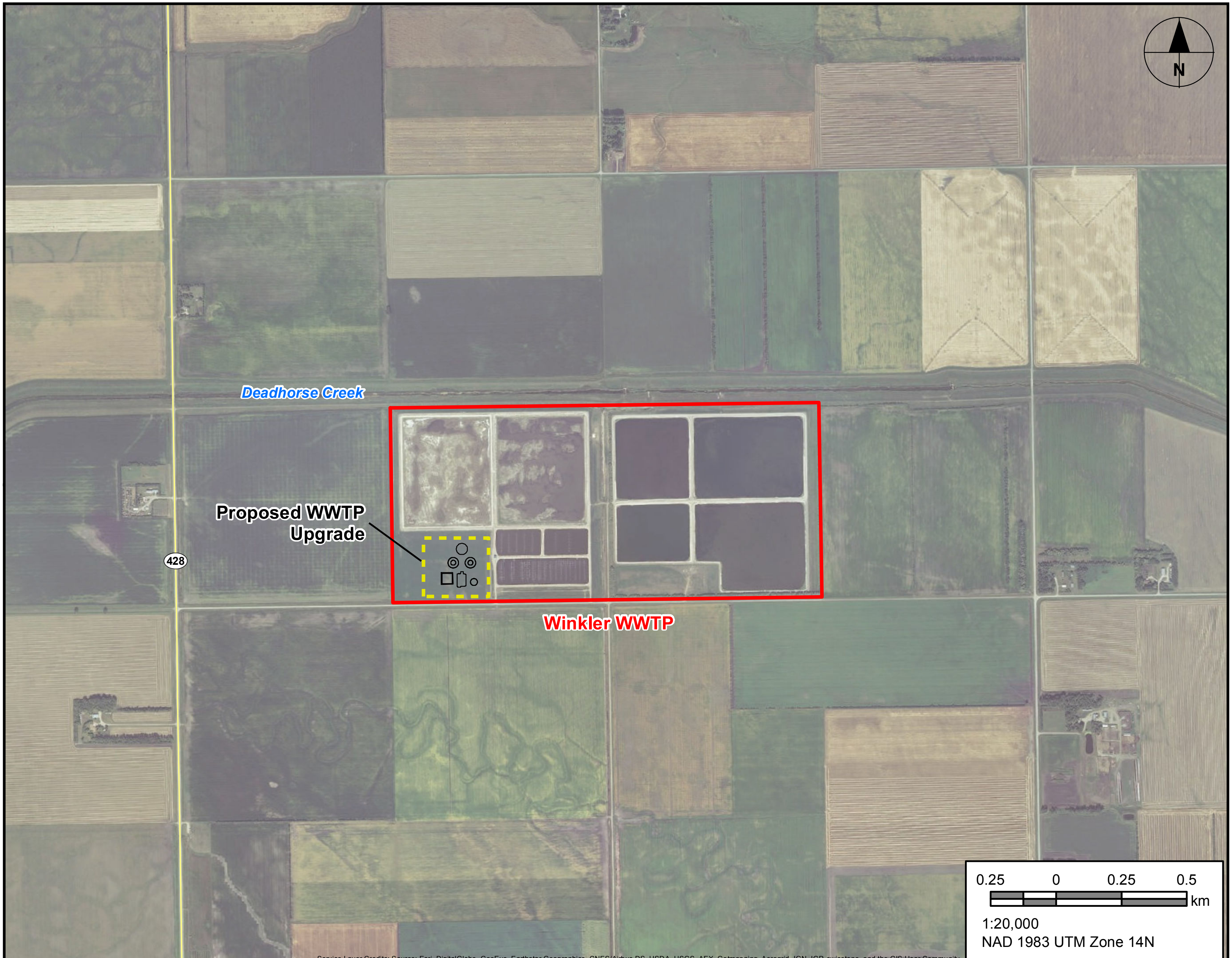
Environment Act Proposal - Winkler
Wastewater Treatment Plant Upgrade
City of Winkler

Site Plan



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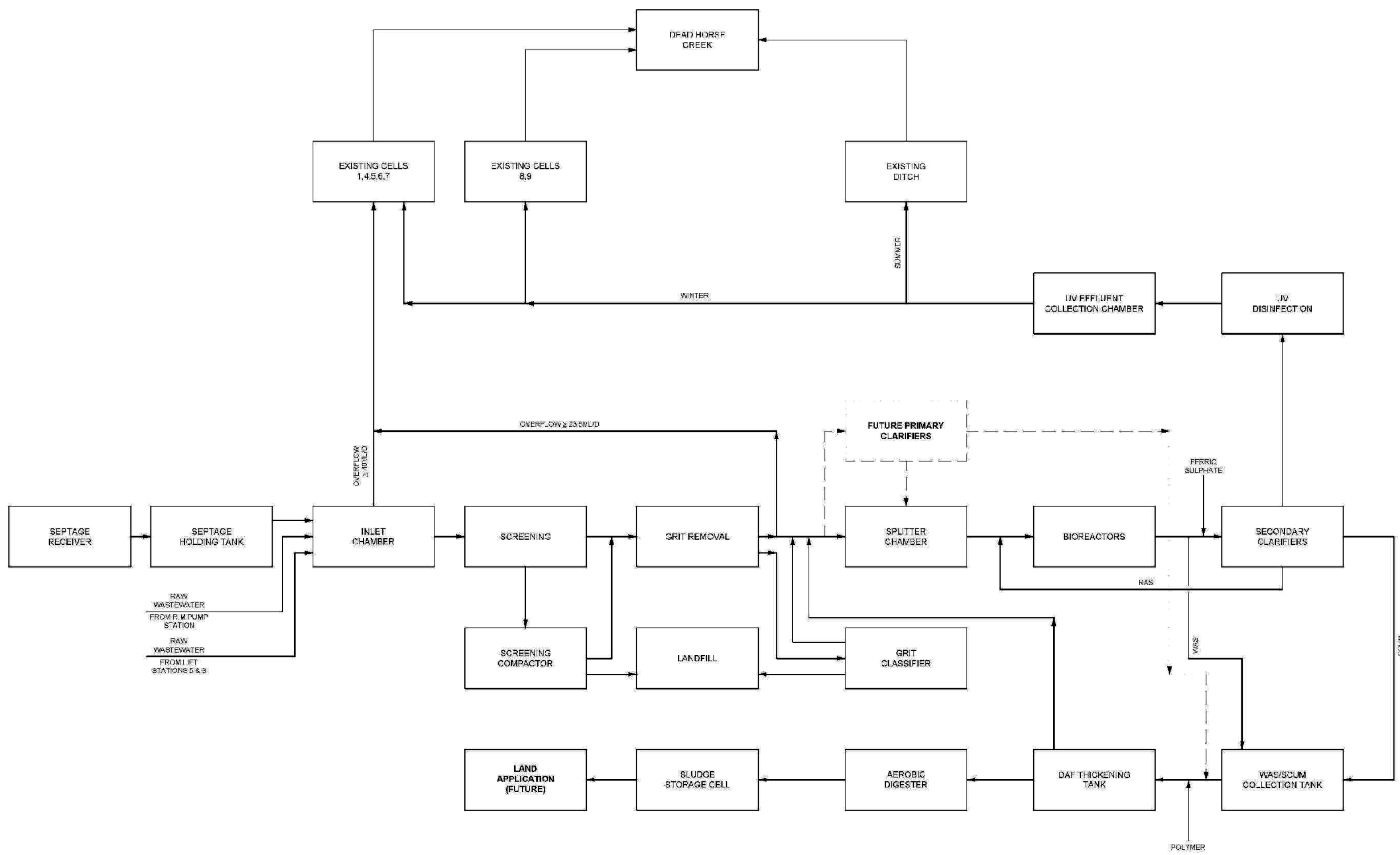

Environment Act Proposal - Winkler
Wastewater Treatment Plant Upgrade
City of Winkler

Process Block Flow Diagram

Figure: 03

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Project Management Initials: Designer: Checked: Approved:

ANSI A 215.9mm x 279.4mm

Environment Act Proposal - Winkler
Wasterwater Treatment Plant Upgrade
City of Winkler

Overall Site Plan

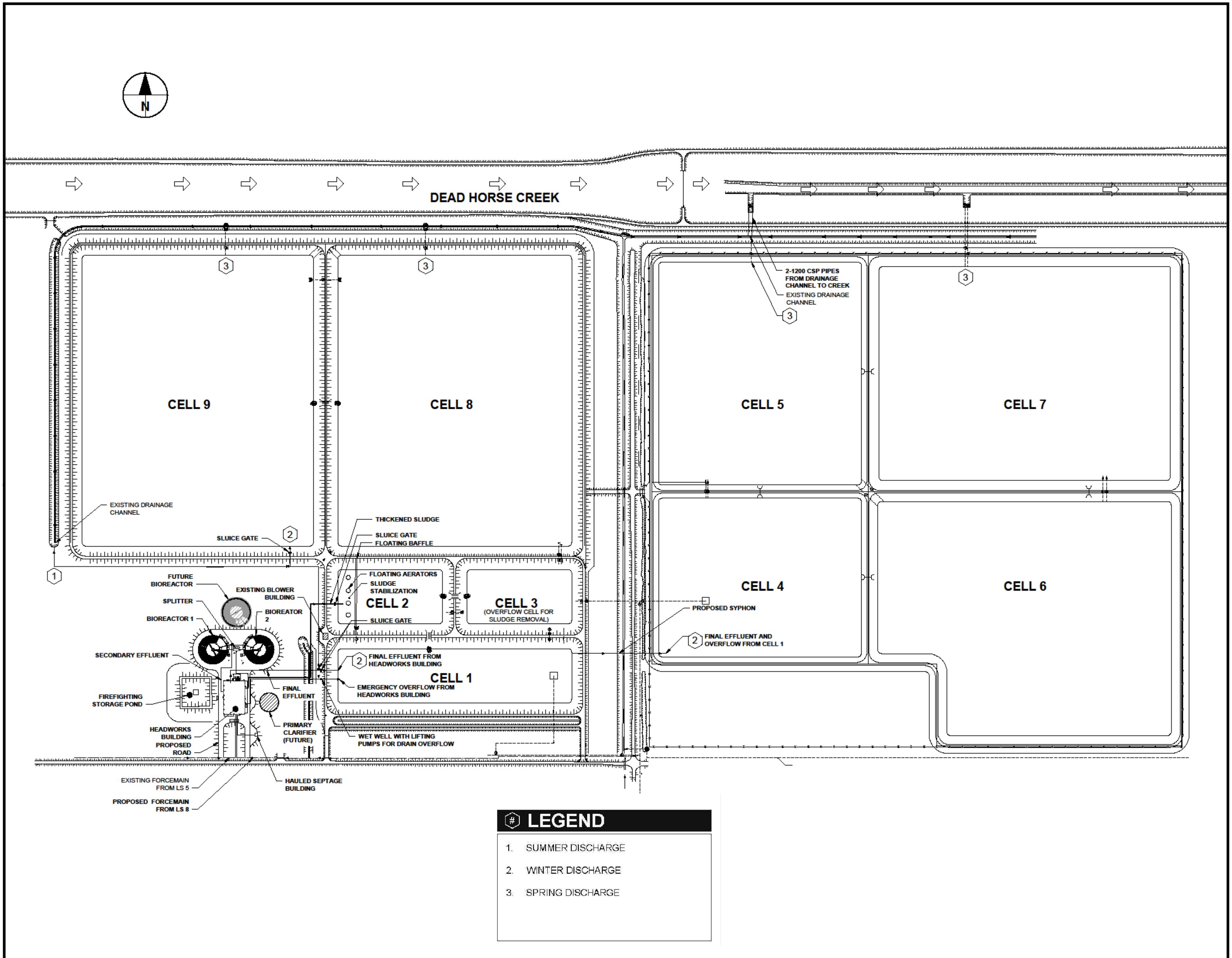

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Figure: 04

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Project Management Initials: Designer: Checked: Approved:

ANSI A 215.9mm x 279.4mm

Environment Act Proposal - Winkler
Wastewater Treatment Plant Upgrade
City of Winkler

Project Area -
3 km Radius from the Project Site

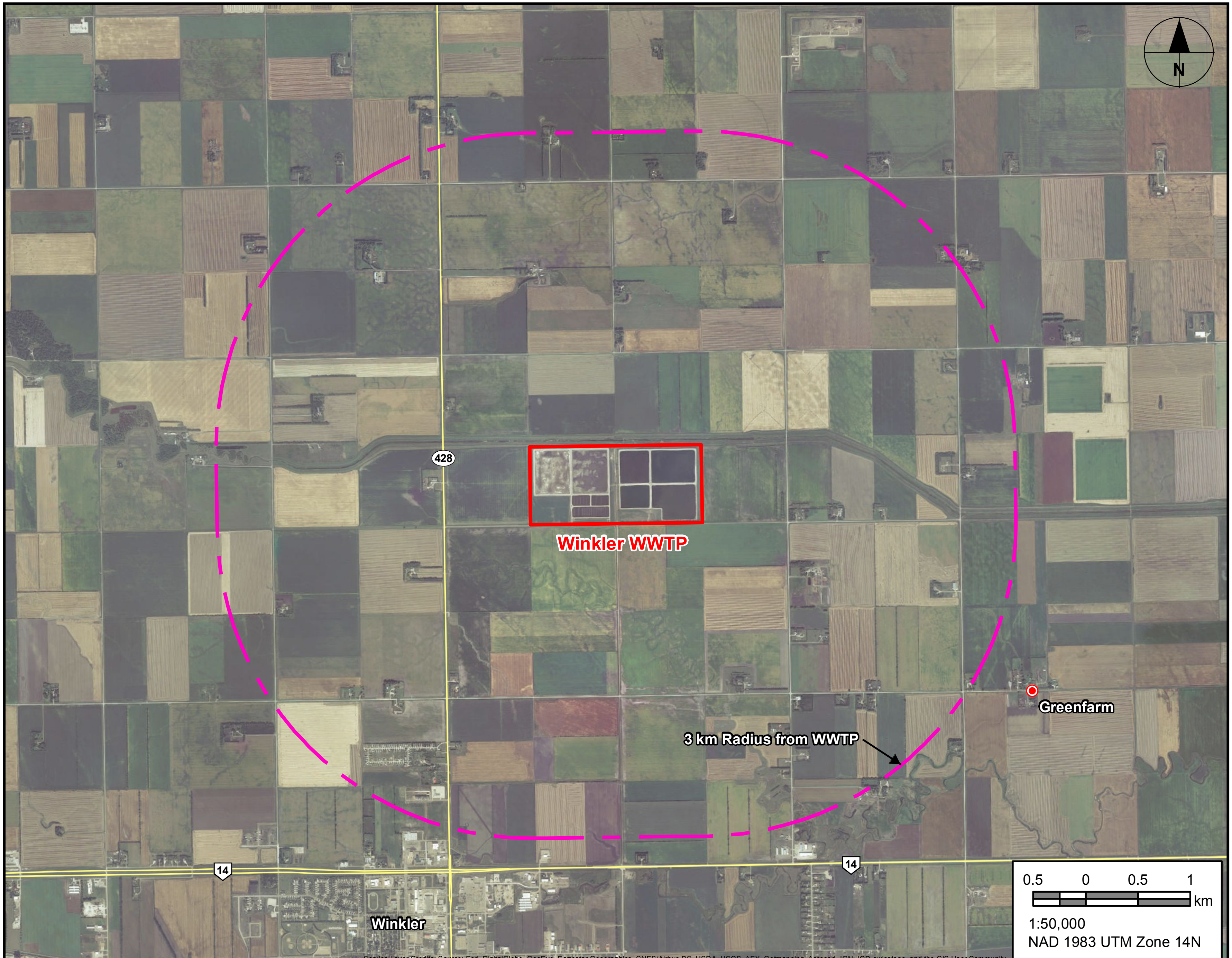

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Figure: 05

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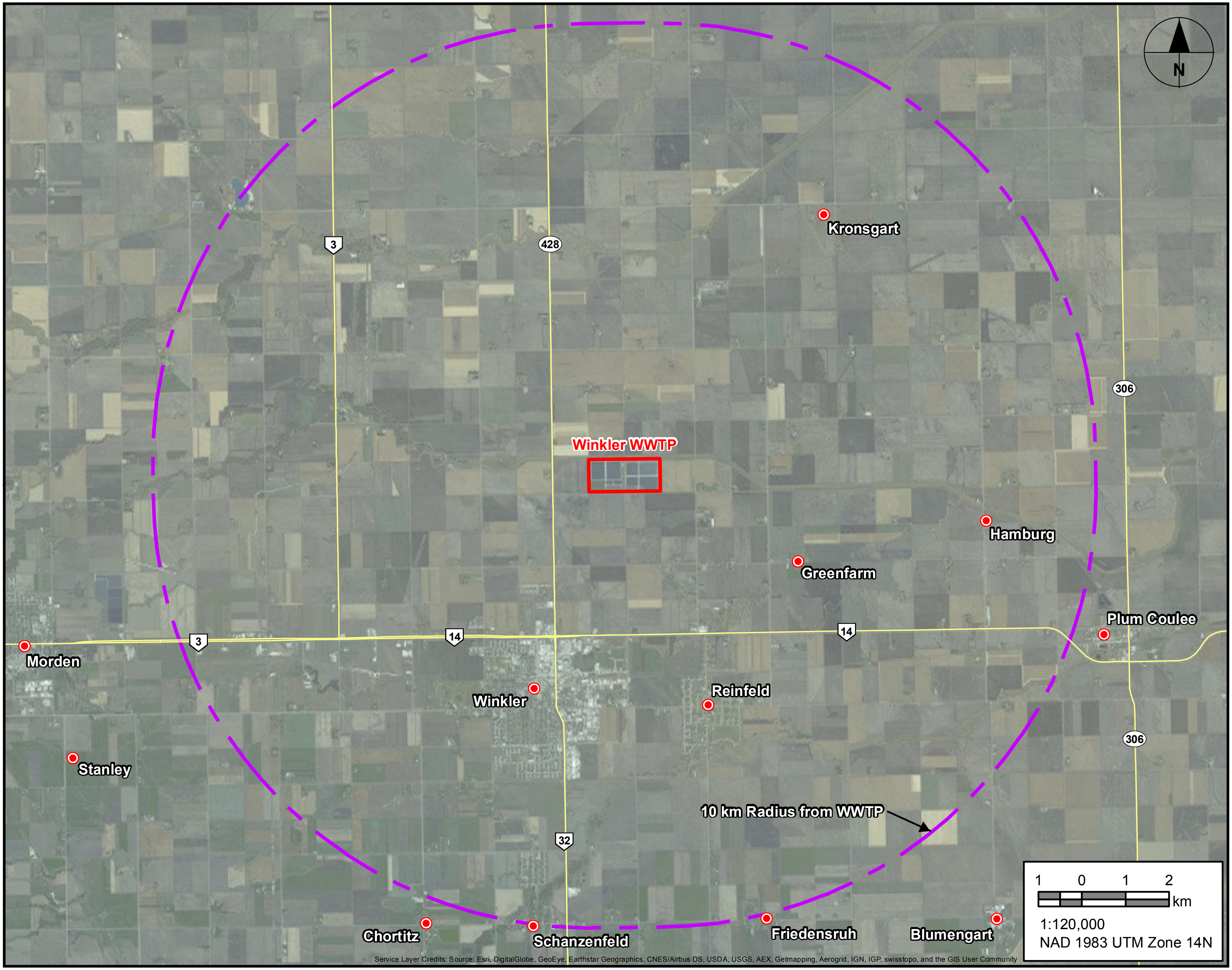

Environment Act Proposal - Winkler
Wasterwater Treatment Plant Upgrade
City of Winkler

Project Region -
10 km Radius from the Project Site

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Figure: 06

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Appendix A

Functional Design Report – Winkler Wastewater Treatment Plant

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City of Winkler

Functional Design Report
Winkler Wastewater Treatment Plant

Prepared by:

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November, 2016

Project Number: 60430450

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Revision History

Revision #	Date	Revised By:	Revision Description
0	August 11, 2016	P. Barsalou	Draft
1	October 25, 2016	P. Barsalou	Final
2	November 7, 2016	P. Barsalou	Revised Final

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November 7, 2016

J. Scott Toews, M.Sc., P.Eng.
Director of Planning & Engineering
City of Winkler
185 Main Street
Winkler, MB R6W 1B4

Dear Scott:

Project No: **60430450**

Regarding: **Functional Design Report**
Winkler Wastewater Treatment Plant

AECOM is pleased to submit this final report regarding the Functional Design for the City of Winkler Wastewater Treatment Plant. Your comments on the draft document have been incorporated into this report.

If you have any questions or comments regarding this final report, please do not hesitate to contact me at (204) 928-8333.

Sincerely,

AECOM Canada Ltd.

Paul Barsalou, M.Sc., P.Eng.
Project Manager
Paul.Barsalou@aecom.com

PB:ag
Encl.

Quality Information

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Process Engineer

Report Reviewed By:

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Process Engineer

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Appendices

1. Introduction

1.1 Background

In May 2015, AECOM was retained by the City of Winkler to provide engineering and environmental services for a new wastewater treatment facility. The scope of work included completion of a functional design for the new treatment facility and completion of an Environment Act Proposal (EAP) to obtain a new licence.

There have been numerous meetings and assessments of flows, loads and treatment processes. Our design direction is summarized below in this Functional Design Report.

1.2 Existing Treatment Plant

The City of Winkler is approximately 100 km southwest of Winnipeg, along Provincial Highway 14. The wastewater treatment plant (WWTP) serving the City of Winkler consists of a series of nine cells, including partially aerated cells for primary treatment and unaerated cells for secondary storage of wastewater.

There are three primary aerated cells and six secondary cells within the lagoon system. Design volumes for each of the cells are listed below:

Primary Cells

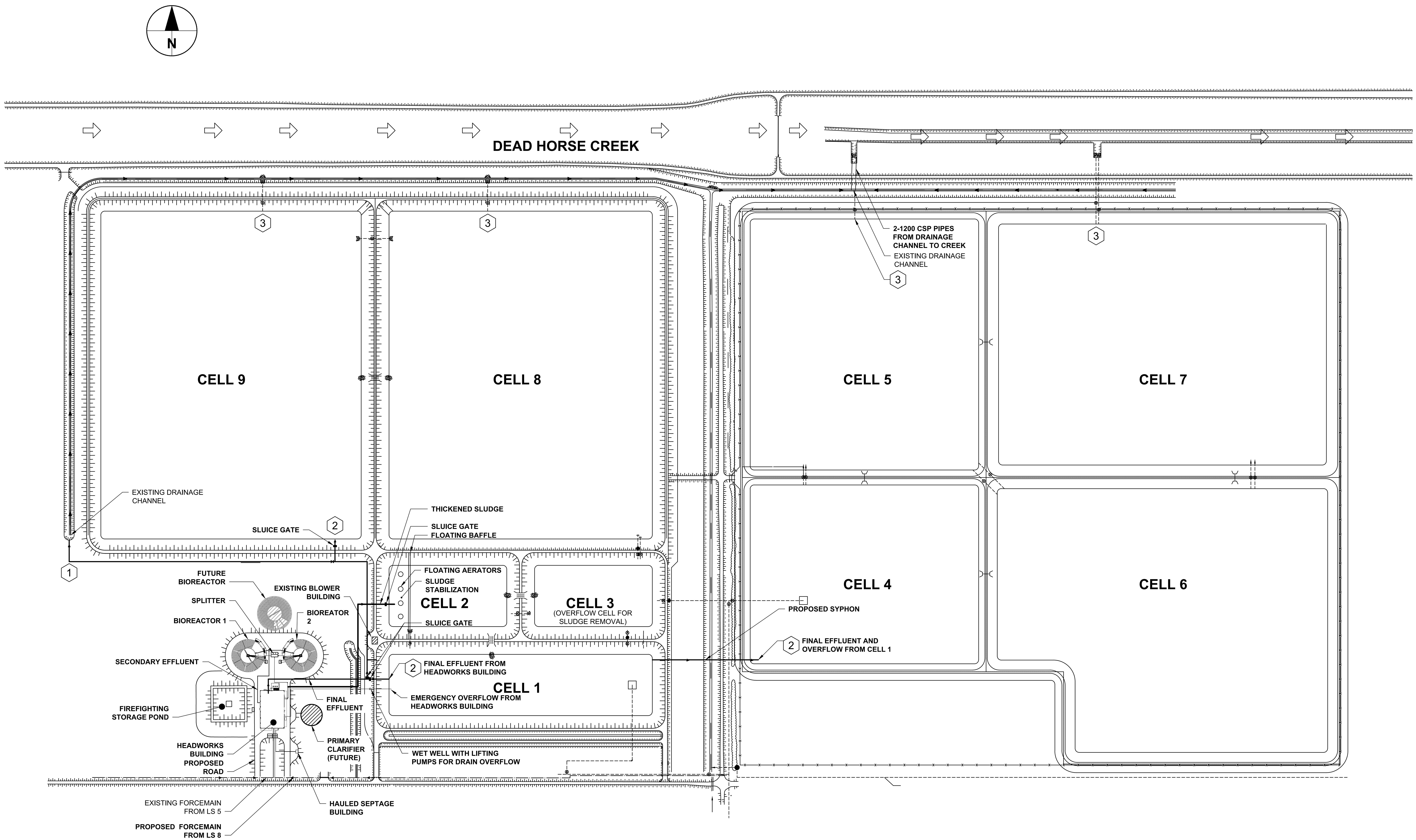
- Primary aerated cell 1 = 129,100 m^3 (4.3 m depth)
- Primary aerated cell 2 = 60,600 m^3 (4.3 m depth)
- Primary aerated cell 3 = 60,600 m^3 (4.3 m depth)
- Total primary volume = **250,300 m^3**

Secondary Cells

- Secondary cell 4 = 78,000 m^3 (1.5 m depth)
- Secondary cell 5 = 105,000 m^3 (1.5 m depth)
- Secondary cell 6 = 234,000 m^3 (2.1 m depth)
- Secondary cell 7 = 285,000 m^3 (2.5 m depth)
- Secondary cell 8 = 353,000 m^3 (2.5 m depth)
- Secondary cell 9 = 348,000 m^3 (2.5 m depth)
- Total secondary volume = **1,403,000 m^3**

Total Lagoon Volume = 1,653,000 m^3

According to the current licence the wastewater must be stored for a minimum of 196 days over winter before being discharged to Deadhorse Creek, which empties into the Red River. **Figure 1.1** shows the existing lagoon layout and the proposed upgrade. The City started dosing ferric sulphate in lagoon cells prior to discharge in 2016 in order to meet the new limits of 1.0 mg/L of effluent phosphorus.



OVERALL SITE PLAN
Scale 1:2500

LEGEND
1. SUMMER DISCHARGE
2. WINTER DISCHARGE
3. SPRING DISCHARGE

AECOM

PROJECT
WASTEWATER TREATMENT PLANT UPGRADE PROJECT

CLIENT
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185 Main Street
Winkler, Manitoba
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REGISTRATION

PRELIMINARY
NOT FOR CONSTRUCTION
Date: 2016-11-04

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	2016.11.04	FUNCTIONAL DESIGN

PROJECT NUMBER
60430450

SHEET TITLE
GENERAL & SITEWORKS
CIVIL
OVERALL SITE PLAN

SHEET NUMBER
00-C001

Project Management Initials: Designer: Checked: Approved: ANSI D 864mm x 559mm

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Figure 1.1: Overall Site Plan

1.3 Existing Sludge Inventory

An inventory has been completed for the lagoon cells based on a combination of sludge surveys and observations once the cells have been discharged to the receiving stream. The depths of sludge vary from up to 0.9 m in the aerated primary cells to negligible or 0.05 m in the newer secondary cells. **Table 1.1** presents the estimated sludge volumes per cell and provides a volume, assuming the sludge is thickened to 10% solids before removing to land application and 25% for sludge that would go to landfill disposal.

Table 1.1: Estimated Sludge Inventory in Existing Lagoon

Cell#	Depth of Sludge meters	Cell Depth	Base Cell Area	Estimated Volume of Sludge- Assume 6%	Estimated Volume – Thickened to 10%	Estimated Volume at 25% solids	Landfill	Periodic Application in Future Licence	Leave Inventory for Long Term
1	0.9	4.3	25,000	22,500	14,0000	5,400	With Current Upgrade and EAP		
2	0.9	4.3	11,200	10,000	6,000	2,400		Periodic Application	
3	0.9	4.3	11,200	10,000	6,000	2,400		Periodic Application	
4	0.1	1.5	57,000	5,700	3,400	1,400			Yes
5	0.05	1.5	70,000	3,500	2,100	840			Yes
6	0.05	2.1	121,000	6,000	3,600	1,500			Yes
7	0.05	2.5	118,000	5,900	3,500	1,400			Yes
8	0.05	2.5	134,000	6,700	4,000	1,600			Yes
9	0.05	2.5	133,000	6,700	4,000	1,600			Yes
Prop. Work with Current EAP							5,400 m^3 @ 25% solids		

1.4 Sludge Inventory Management

The proposed treatment plant would reuse the full lagoon secondary cell system for winter storage and during warm weather periods, the lagoon will be used for treatment of wet weather overflows. In **Table 1.1** there are three columns showing the recommended sludge management process including:

- Landfill of Cell 1 sludge as it contains significant debris (part of current licence application).
- Ongoing periodic land application of sludge from Cells 2 and 3 (future proposed licence).
- Specialty land application of sludge from cells 4 to 9 in the long term. (future proposed licence).

This will be discussed more thoroughly in Section 3.14.

2. Basis of Design

The Winkler WWTP is being designed for receiving and treating a combined domestic, commercial and industrial wastewater. The basis of design has a planning horizon of 20 years assuming commissioning by 2019 and a design life to 2038. The combined domestic wastewater from the City of Winkler and the Rural Municipality of Stanley (Villages of Schanzenfeld and Reinfeld and other rural developments) will be treated in the proposed facility. Historically, the main source of industrial wastewater was from the Saputo cheese processing factory, which has since closed down. However, various wet food processing industries remain.

2.1 Population

Design criteria for the upgraded WWTP will be based on the population projection for a design period to 2038. This section of the report deals with our assessment and recommendations for the Winkler population projections for the 20 year design. Population projections are based on historical figures and anticipated growth in the community. The historical populations of Winkler are shown in **Table 2.1**.

Table 2.1: Historical City of Winkler Population

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Population	9104	9496	9888	10280	10670	10973	11720	12396	12625	12783

Based on anticipated growth within the City and the RM of Stanley, population projections of 2.5% growth annually for the identified areas are shown in **Table 2.2**.

Table 2.2: Population Projections (2038)

Development Area	Population	Commercial
City of Winkler	22,280	
RM Stanley – Reinfield	2,930	
RM Stanley – Schanzenfeld	2,470	
RM Stanley – Rosebrook	486	
RM Stanley – Fringe Development	243	
RM Stanley – Corridor		90
Total Population	**28,409**	**90**

2.2 Wastewater Sources

The new wastewater treatment plant will serve a number of development areas:

City of Winkler:

- Domestic wastewater
- Commercial wastewater
- Industrial wastewater
- Water treatment plant reject water

RM of Stanley:

- Village of Reinfield
- Village of Schanzenfeld
- Corridor commercial development (between Morden and Winkler)
- Rosebrook development

Development within the City and RM is based on current planning.

The wastewater stream consisting of the Winkler water treatment plant (WTP) reject water includes reverse osmosis reject water for the ground water based treatment facility. Discussion continues on alternate disposal locations; however, it will be disposed of at the new treatment facility for the foreseeable future. This reject water has been included in the flow projections.

2.3 Wastewater Flow Projections

Wastewater flow was evaluated for a number of average and peak conditions as they are needed for design and sizing of specific components of the plant. All of these flows are presented in consistent terms of cubic meters per day (m^3/d). The flow components are:

- **Average Annual Flow (AAF):** Average flow for the entire calendar year.
- **Infiltration & Inflow (I&I)** is the contribution to wastewater flows from extraneous groundwater or stormwater entering the collection system. Infiltration is characterized by leaky collection pipes and manholes allowing groundwater to infiltrate the collection system. Inflow is the direct connection of stormwater to the wastewater collection system through sources such as manhole cleanout lids, roof downspouts, domestic weeping tiles and catch basins.
- **Average Dry Weather Flow (ADWF)** is the average daily flows sustained during dry-weather periods with limited infiltration. This flow factor is used to assess the flow generated from households, employment, and industrial customers.
- **Peak Dry Weather Flow (PDWF)** is the highest measured hourly flows during dry weather day.
- **Average Wet Weather Flow (AWWF)** is the average daily flows sustained during wet-weather periods when infiltration is a factor.
- **Peak Wet Weather Flow (PWWF):** PWWF consists of PDWF plus extraneous flows including Infiltration & Inflow. PWWF is the highest measured hourly flow that occurs during wet weather.
- **Maximum Monthly Flow (MMF)** is the average daily flow during the maximum calendar month.
- **Maximum Day Flow (MDF)** is the maximum flow during one 24-hour period (midnight to midnight) during the year. This flow factor is typically used to size pump stations and unit WWTP processes that rely on short-term hydraulic detention times for proper performance such as equalization basin.
- **Peak Hourly Flow (PHF)** is defined as the sustained flow rate occurring during the peak one-hour period. This is usually the highest instantaneous flow that will be encountered. It is typically used to design components whose performance can be affected by sudden high hydraulic loads: collection and interceptor sewers, pump stations, piping, flow meters, and certain physical WWTP processes such as overflows to equalization, screening, grit chamber and clarifier tanks, etc.

The domestic wastewater flow projections for Winkler are based on a unit flow per capita including base infiltration and inflow experienced in the areas. The components of Average Annual Flow are shown in **Table 2.3**.

Table 2.3: Design Population and Wastewater Flows (AAF)

Population Center	Population	Commercial Lots	Flow per capita/lot (L/d)	Total daily flow (m^3/d)
City of Winkler	22,280		267	5,944
RM Stanley - Reinfeld	2,930		310	909
RM Stanley - Schanzenfeld	2,470		310	766
RM – Rosebrook[1]	486		150	73
RM – Fringe Development[2]	243		267	65
RM – Corridor[3]		90	2,507	226
Winkler WTP reject				1,472
Average Annual Flow (AAF)				9,455 Use 9,460

Note:
1. *Current Rosebrook allowance is 140 lots, increased to 180 lots for future expansion, assumes 2.7 residents per household. Flow per capita reduced based on lower than typical water usage.*
2. *Fringe Development allowing for approximately 90 residential lots to be developed, assumes 2.7 residents per household and similar water usage and I/I values to the City.*
3. *Stanley Corridor Development equating to 90 commercial lots averaging in size from 3-5 acres. Flow is estimated based on 2015 actual consumption rate for the area.*

Based on Winkler water consumption records, design wastewater flows are estimated to be:

- AAF = 9,460 m^3 per day
- ADWF = 8,056 m^3 per day
- AWWF = 11,329 m^3 per day
- MMF = 14,704 m^3 per day

Peak Dry Weather Flow is estimated using the Harmon's Peaking Factor

PDWF: AAF x Harmon's Peaking Factor

Where:

Harmon's Peaking Factor = $1 + (14 / (4 + (P / 1000)^{0.5}))$

P = Population

Considering a Population of 28,409,
Harmon's Peaking Factor = $1 + (14 / (4 + (28409 / 1000)^{0.5}))=2.5$

- Peak Dry Weather Flow (PDWF) = 2.5 x 9,455=23,641 m^3 per day

It is recommended to use PDWF for secondary clarifiers design. Flows exceeding this rate would be bypassed to the existing lagoon cell 1.

Maximum Day Flow (MDF) has been estimated using a peak factor of MDF/ AAF = 4:

- MDF= 4 x 9,460 = 37,840 m^3 per day (Will be rounded to 40,000 m^3 per day for designing)

A high factor for MDF was selected based on observed values during the period of 2009 to 2014 where an MDF of 4 was observed. There was a strong desire to limit nuisance overflows due to storm events at the beginning of the headworks facility to limit odour generation and disposal of screenings and grit in the cleaned out lagoon. The number of 37.8 ML/d was rounded to 40 ML, as the review of actual conditions was over a 5 year period, and actual peaks could be marginally higher.

To estimate PWWF maximum capacities of the existing lift stations shall be taken into account as follows:

- Lift Stations 3&5: Based on Design Report- Upgrade of Lift Stations 3 & 5 (City of Winkler in Partnership with Manitoba Water Service Board), the maximum hydraulic capacities of LS3 and LS5 and the capacity of the newly constructed force main with an extension to the WWTP will be 350 L/s (30.2 ML/d).
- Lift Station 8: AECOM has analysed a hydraulic model for lift station 8 and the maximum wastewater pumping capacity will be feasible when LS8 runs with its 3 existing pumps simultaneously, total pumping flow is 265 L/s (22.9 ML/d).
  RM of Stanley: AECOM has analysed a hydraulic model for Schanzenfeld and Reinfeld low pressure sewer system (Low Pressure Sewer Pre-Design for Schanzenfeld and Reinfeld – Final Report) and the design pumping rate of Reinfeld Main lift station (which includes Schanzenfeld and Reinfeld wastewater) is 86 L/s (7.4 ML/d) for the 20-year development scenario.

The PWWF and PHF for the Winkler WWTP is estimated by adding the total capacities of LS3&5+ LS8 + RM LS which is 30.2 ML/d + 22.9 ML/d + 7.4 ML/d = 60.5 ML/d (rounded to 60 ML/d for design).

Wastewater flow Projections are summarized in **Table 2.4**.

Table 2.4: Wastewater Flow Projections

Item	Flow (ML/d)
Average Annual flow (AAF)	9.46
Average Dry Weather Flow (ADWF)	8.06
Maximum Monthly Flow (MMF)	14.7
Maximum Day Flow to Headworks (MDF) – overflow at inlet channel to lagoon to drop headworks flow to 40 ML/d	40.0
Peak Dry Weather Flow (PWWF) – overflow in grit channel effluent to lagoon, dropping flow to secondary component to 23.6 ML/d	23.6
Peak Wet Weather flow (PWWF) to Equalization Basin	60.0
Peak Hour Flow (PHF) equal to PWWF as all pumps are operating	60.0

2.4 Design Wastewater Loads

To evaluate the WWTP influent loading, wastewater samples were collected from lift station 5 (LS5) and lift station 8 (LS8) and analysed at both the University of Manitoba and ALS laboratories in Winnipeg. The samples identified in **Table 2.5** are primarily 24 hour composites, with proper collection, storage and handling time.

Table 2.5: Historical Raw Sewage Analyses Results

Date	COD mg/L	BOD_5 mg/L	TKN as N (mg/L)	Ammonia as N (mg/L)	TP as mg/L	TSS mg/L	VSS mg/L	Alkalinity as $CaCO^3$ (mg/L)	Location
2/16/2012	997	300	61.6	39	21.4	313		319	Lift Station 8
3/26/2012	613	86.5	50.8	35	15.7	230	163	367	Lift Station 8
7/28/2015	665	249	44.6	26.4	8.94	160	104		Lift Station 8
7/28/2015	206	57	17	0.82	1.81	94	73		Lift Station 5
7/29/2015	677	244	42.2	26.3	9.23	286	200		Lift Station 8
7/29/2015	245	70	22.6	12	3.21	111	95		Lift Station 5
8/11/2015	854	265	49.3	22.6	10.7	624	368		Lift Station 8
8/11/2015	226	86	25.4	10.2	2.58	125	111		Lift Station 5
8/12/2015	721	306	50.8	34.8	11.4	364	67		Lift Station 8
8/12/2015	194	72	21	11.9	2.57	116	25		Lift Station 5
11/1/2015	435	195	49.3	36.9	6.17	134	102		Lift Station 8
11/4/2015	670	264	52.8	3.8	10.8	216	180		Lift Station 8
11/4/2015	800	109	22.7	1.53	2.67	93	67		Lift Station 5
11/31/2015	435	195	49.3	36.9	6.17	134	102		Lift Station 8
12/7/2015	563	118	53.8	42.8	8.1	318	125		Lift Station 8
31/5/2016	321	136	29.1	18	3.77	186	144		Lift Station 8
3/23/2016	292	46	26.2	21.3	3.65	166	134		Lift Station 5
4/6/2016	687	330	55	41.3	10.9	536	324		Lift Station 8
4/7/2016	368	240	31	21.4	3.95	136	124		Lift Station 5
4/13/2016	764	283	60.2	31.1	11.2		620		Lift Station 8
4/19/2016	270	121	25.7	15.5	4.76	200	120		Lift Station 8
4/19/2016	311	128	30.2	17.6	5.2	120	238		Lift Station 8
5/28/2016	321	136	29.1	18	3.77	186	144		Lift Station 8

The average and proposed design wastewater loads are summarized in **Table 2.6**.

Table 2.6: Proposed Wastewater Loads (mg/L)

Item	COD mg/L	BOD_5 mg/L	TKN as N (mg/L)	Ammonia as N (mg/L)	TP as P mg/L	TSS mg/L	VSS mg/L
Average Loading 2015 LS8	628	230	49	29	9	280	156
Average Loading 2015 LS5	334	79	22	7	3	108	74
Weighted average 2015 for LS5 and LS8 (LS8:81% and LS5:19%)	572	201	44	25	8	247	140
Average Loading 2016 LS8	446	189	38	24	7	246	265
Average Loading 2016 LS5	330	143	28.6	21.35	3.8	151	129
Weighted average 2016 for LS5 and LS8 (LS8:81% and LS5:19%)	424	180	36	23	6	228	239
Proposed Loading for the WWTP	**590**	**225**	**43**	**26**	**8.2**	**265**	**175**

Other design parameters (obtained from diurnal wastewater flow and quality monitoring results):

pH	=	7.1 (ranging from 6.5 to 7.5)
Temperature	=	9.0 °C minimum winter temperature
	=	20.0 °C maximum summer temperature (assumed)

The key wastewater characteristics assumed for the purposes of the process engineering design were as follows, with typical values (Wastewater Engineering Treatment and Resource Recovery, Metcalf & Eddy/ AECOM, 2014):

- Biodegradable chemical oxygen demand bCOD = 1.6 x cBOD = 400 mg/L
- Soluble 5-d biochemical oxygen demand sBOD=0.5 x $cBOD_5$ = 113 mg/L
- Soluble chemical oxygen demand sCOD=0.45 x COD = 266 mg/L

2.5 Effluent Discharge Standards

Based on the provincial effluent discharge standards (Manitoba Water Quality Standards, Objectives and Guidelines, Nov 28, 2011), it is anticipated that the following discharge standards would apply to treated effluent discharged locally to Dead Horse Creek:

$CBOD_5$	≤	25 mg/L
BOD_5	≤	25 mg/L
TSS	≤	25 mg/L
TN	≤	15 mg/L
TP	≤	1 mg/L
TDS	≤	3000 mg/L
E coli	≤	200 fecal coliforms/100 mL
Fecal coliforms	≤	200 organisms/100 mL
Total ammonia	≤	6.67 mg/L as N (at 9 °C and pH of 6.5)
	≤	5.91 mg/L as N (at 9 °C and pH of 7.0)

- $\leq$ 4.36 mg/L as N (at 9 °C and pH of 7.5)
- $\leq$ 3.65 mg/L as N (at 24 °C and pH of 6.5)
- $\leq$ 3.24 mg/L as N (at 24 °C and pH of 7.0)
- $\leq$ 3.39 mg/L as N (at 24 °C and pH of 7.5)

3. TREATMENT PROCESS DESIGN

A biological nutrient removal (BNR) process has been selected to remove nitrogen and phosphorous in the biological treatment process, with chemical precipitation backup for phosphorous control.

3.1 Design Flow Philosophy

The wastewater treatment plant is designed to accept a projected 20 year growth from the RM of Stanley and the City of Winkler. By designing for the future, it is anticipated that the plant will be at approximately 60% of the design load within the first two years of operation. Some accommodations for this low load may be required including taking certain components out of service during winter months.

All wastewater entering the treatment plant will be from forcemains serving the City of Winkler and the RM of Stanley, with a minor contribution from the RM's receiving station. Under normal or even high flow circumstances, all wastewater will flow through the treatment system and be discharge to the receiving stream. However, at peak flows towards the end of the design life, there will be some overflow. The flows will be divided according to the following:

- Average annual flow – 9.46 ML/d – full treatment in mechanical plant.
- Peak dry weather flow – 23.6 ML/d – full treatment in mechanical plant.
- Flow from 23.6 to 40.0 ML/d – screen and grit removal – flow to lagoon for treatment.
- Flow from 40.0 to 60.0 ML/d – no mechanical treatment – flow direct to lagoon for treatment.
- All sludge – to lagoon cells 2 and 3 for treatment and storage.

3.2 Discharge to Receiving Stream

Effluent will be discharged to ditches leading to Dead Horse Creek during the warm weather months; however it will be stored in the lagoon system during the cold weather months. At present, the lagoon licence calls for a 196 day storage. This storage period should no longer apply since the effluent from the treatment plant will meet the requirements for continuous discharge. The reason for storage is only to reduce impact on downstream infrastructure such as ditches, culverts and bridges.

In the new licence, it is proposed that the effluent only be stored during the frozen months for a minimum of 120 days from of December to March, which would result in 4 months of storage. The effluent would be held until the discharge route is ice free and the effluent will be capable of flowing without freezing.

At average dry weather flows, the storage volume at the 20 year buildout capacity will be:

- 967 ML (8.06 ML/d x 120 days) minimum anticipated storage period.
- 1209 ML (8.06 ML/d x 150 days) during a long cold winter.

This volume can be accommodated by utilizing the existing secondary cells 4 to 9, with a maximum full storage volume of 1,403 ML.

3.3 Biological Nutrient Removal

The Biological Nutrient Removal (BNR) process will be used in the Winkler WWTP, as it biologically removes both nitrogen and phosphorus from the wastewater. Nitrogen removal is through processes of nitrification for ammonia removal and denitrification for nitrate removal. Some of this nitrogen is vented to the atmosphere as nitrogen gas, some is concentrated in waste sludge and the remainder of it passes out with the effluent (provided it is below the licence limits).

The BNR process removes phosphorus by providing a specific environment in which specific bacteria in the mixed liquor concentrate and can consume and store phosphorus internally. Periodically this mixed liquor is wasted, thereby removing the phosphorus from the liquid stream. If this solids stream is allowed to turn septic by lack of aeration, much of this concentrated phosphorus will be released back into the liquid stream. This is one reason the proposed treatment plant has no return flow from the sludge treatment system back to the BNR facility and why sludge thickening is an aerobic process of dissolved air floatation (DAF).

It is important that the raw wastewater contain some volatile fatty acids (VFAs) prior to entering the anoxic or aerobic tanks to allow for biological phosphorus removal. Wastewater from the City of Winkler has a moderate amount of VFA (develops in the forcemains) and the RM will have an anticipated high level of VFA in its wastewater (typical of long forcemains and low pressure sewer systems). At times when the natural VFA's are low, ferric sulphate chemical will be added downstream of the bioreactors to help trim the additional phosphorus that cannot be fully removed biologically. However, the use of this backup system should be minimized by proper bioreactor operation.

The process flow diagram (PFD) and block flow diagrams (BFD) are included in **Appendix B** and the BNR process is discussed more thoroughly in later sections.

3.4 Septage Receiving

A septage receiving station will be located south of the headworks building. The station may receive a variety of waste types including holding tank wastewater and septage. For the purpose of this report, all hauled wastewater would be referred to as septage. Waste haulers will cam lock connect to a pipe that transfers septage into the package receiving station (**Figure 3.1**). The receiving station will have a rock trap and grinder to help remove heavy inorganics and reduce the size of solids that may bind transfer pumps.

The liquids will flow into an underground storage tank beneath the receiving station. The storage tank will allow for feeding the high strength septage into the treatment plant over time to reduce shock loadings. Liquid will be pumped out of the storage tank and discharged to the influent well upstream of screening.

The septage receiving station will be used to admit septage from people in the catchment area that cannot practically be tied into the RM low pressure sewer system. Low pressure sewer systems in the RM will need to be pumped out every 1 or 2 years to remove the accumulated solids. It is anticipated that the facility will be used 4 times per day, with a total flow of 36 m^3/day. This is approximately 0.4 percent of the plant flow and should not cause process problems, provided the flows are relatively consistent. If there is significant hauling, it could affect the WWTP processes and discussions would need to be held with the hauler. At present, the plan is to include a card swipe for security and a camera at the discharge point to identify questionable conditions.

Figure 3.1: Typical Package Septage Station (Image from Flowpoint)

Table 3.1 provides a summary of design criteria used for the septage receiving tank.

Table 3.1: Septage Receiving Design Criteria

Parameter	Design Criteria	Descriptor
Number of Unit	1	
Capacity m^3/h	40	
Grinder Power kW	3.7	
Storage tank Volume m^3	20	
Septage Station room size m	3 x 2 x 2.6	
Number of Pumps	2 (1+1)	One duty+ one standby
Pressure, m	15	
Power, kW	2.8	

3.5 Influent Channel

Wastewater from the City of Winkler, the RM of Stanley and the septage station will be discharged into the influent channel. It will be pumped to the second floor of the Headworks Facility and will flow by gravity through the screens, grit removal and out to the bioreactors. Any flow over 40 ML/d will diverted directly to cell 1 of the lagoon system for treatment. Any flow under 40 ML/d will pass through both screening and grit removal. During the first 10 years of operation, it is anticipated that there will be very few flow exceedances, with the frequency increasing marginally as the facility reaches the 20 year design period.

3.6 Screening and Washer/Compactor

Two mechanical 6 mm fine screens will be located in the Headworks Building, upstream of the grit removal system. One extra channel will be provided adjacent to the screen channels for future expansion.

Two mechanical screens designed for 30 ML/d each were selected in case one were to fail. The second would be adequate for most flows in an emergency.

The channels are sized to accommodate the two screens coupled with a single screenings transporter/washer/compactor unit. Since there may be a third screen in the future, the transporter /washer/compactor unit will be equipped with three (3) hoppers to accommodate the two proposed and one future screens.

A typical mechanical screen with a transporter/washer/compactor is shown in **Figure 3.2**.

Figure 3.2: Mechanical Screens (Image from Headworks)

Table 3.2 provides a summary of design criteria used for the mechanical fine screening system.

Table 3.2: Mechanical Fine Screen Design Criteria

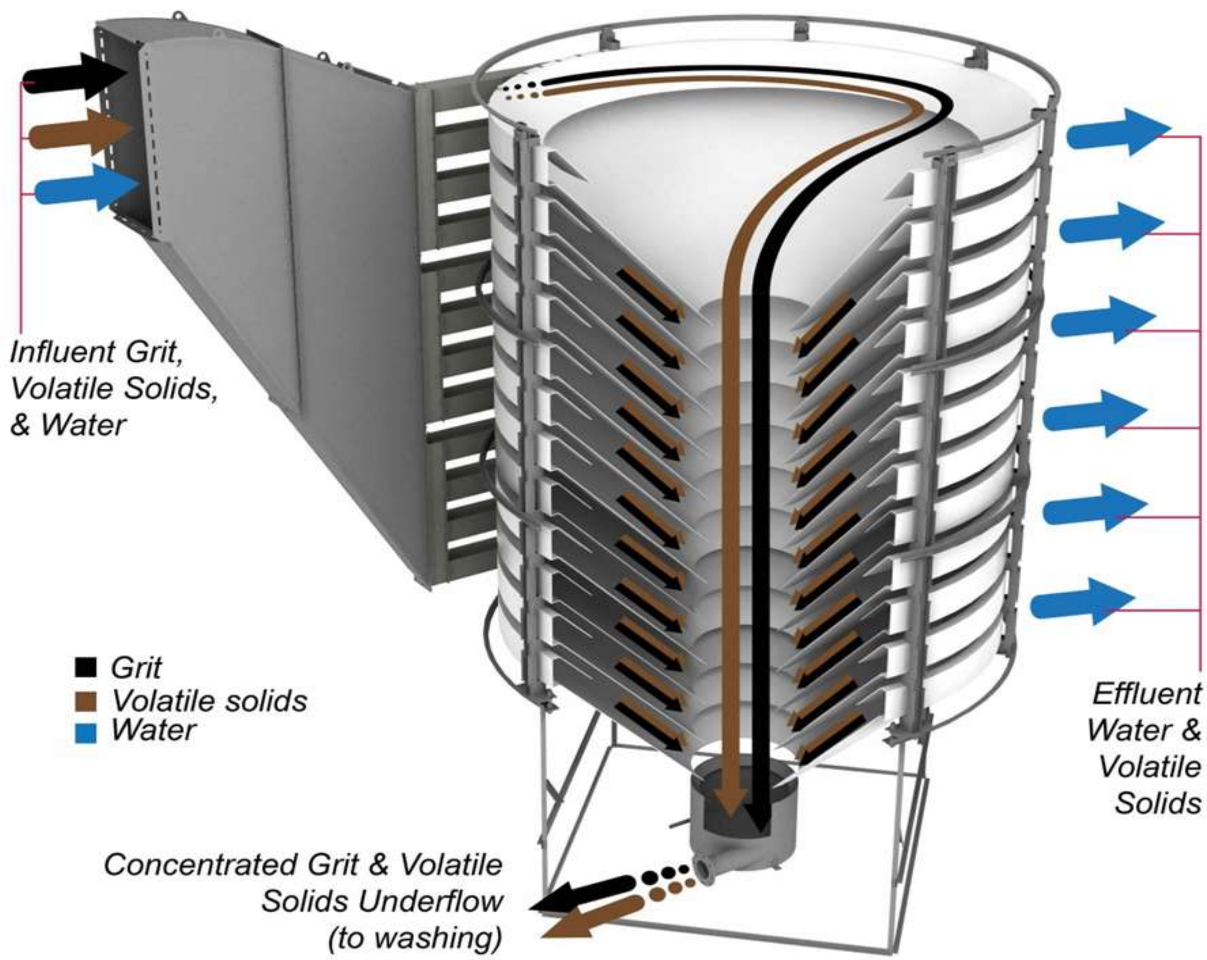
Parameter	Design Criteria	Comments
Number of Screening Channel	3	
Channel Width, m	1.10	
Designed liquid depth, m	0.80	
Total Channel Depth, m	1.30	
Number of Units, Total/Duty	2/1	The third channel will act as a bypass and will be reserved for future expansion
Type	Bar	
Screen Capacity Each, ML/d	30.	The third one can have a capacity of up to 30. ML/d
Opening Size, mm	6	
Screen Power, kW	0.75	
Washer/compactor Power, kW	3	

3.7 Grit Removal

Grit is removed to minimize abrasion of downstream equipment and to prevent accumulation and deposition of heavy, non-biodegradable material in downstream tankage. The grit process removes heavy inorganic and some organic particulates from the wastewater. Grit is washed and dewatered to reduce organics content and increase solids content. By washing the grit, the material is less likely to cause nuisance odours and be more amenable to landfill disposal.

A hydraulically operated vortex grit chamber, classifier and grit dewatering screw have been included in the design. A typical flow pattern in the hydraulically operated vortex grit chamber is shown in **Figure 3.3**.

Figure 3.3: Hydraulically Operated Vortex Grit Chamber (Image from Hydro International)



Grit that is captured will be pumped to the classifier/dewatering screw and discharged into the dewatered screenings bin. The grit removal system (typically as supplied by Hydro International) is made with multiple-tray vortex type grit removal devices. In the future, flow capacity can be increased by adding additional trays on the top of the proposed system.

A typical hydraulically operated vortex grit chamber is shown in **Figure 3.4**.

Figure 3.4: Hydraulically Operated Vortex Grit Chamber (Image from Hydro International)

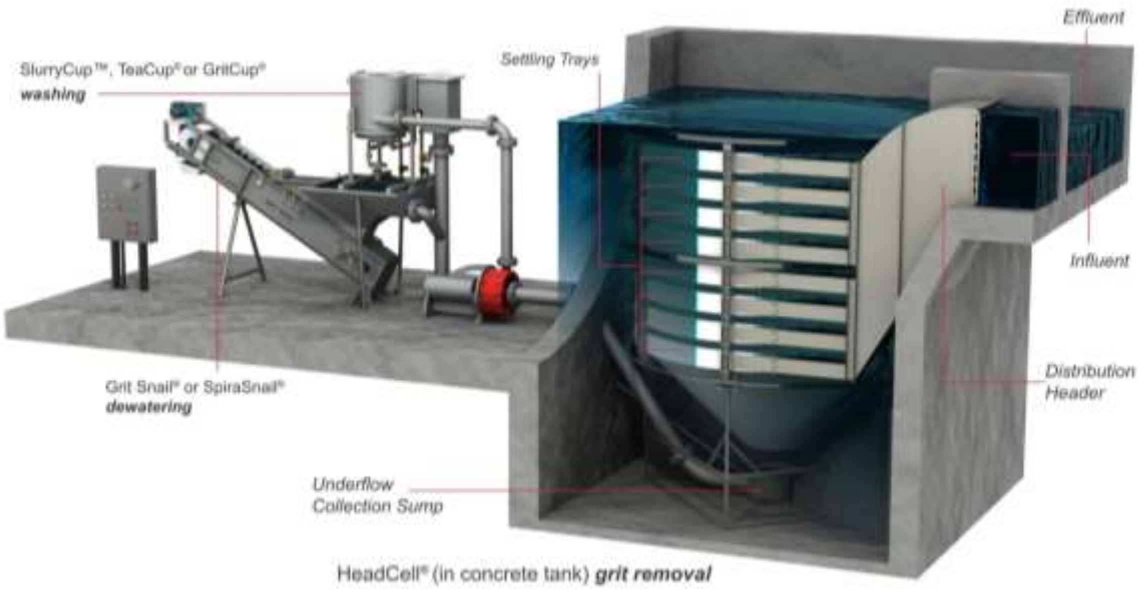


Table 3.3 provides a summary of design criteria used for the grit removal system.

Table 3.3: Grit Removal Design Criteria

Parameter	Design Criteria	Descriptor
Number of Units	1	
Type	Vortex	
Design Flow ML/d	40	Current Design
Future Design Flow (PHF) ML/d	60	Same structure with adding additional trays
Diameter, m	2.7	
Number of Trays	7	Can be increased up to 10 trays to accept 60,000 m^3/d in the future
Number of Grit Pumps	2 (1+1)	Designed for MDF
Grit Pump capacity, m^3/h	34	Each
Grit Pump Head, m	9	
Grit Pump Power, kW	3.7	Each
Number of Washing/Classification unit	2 (1+1)	Considering enough space to add one more in the future
Washing/Classification Power, kW	0.75	Each

A single vortex grit removal device is recommended as there are no moving parts and it is unlikely to fail. However, duty and standby will be provided for the grit pumps as they are more susceptible to clogging or failure.

3.8 Primary Clarifier (Future Expansion)

A primary clarifier has not been included with the current design; however, it can be accommodated hydraulically. A blind flange connection has been included so that a primary clarifier could be added in the future. This would increase WWTP capacity.

The current WWTP will comply with the anticipated future 2016 discharge limits, without the use of a primary clarifier. Based on estimates, it was more economical to design the bioreactors slightly larger to handle nutrients and remove the need for primary clarifiers. These will be considered for expansion in 2038.

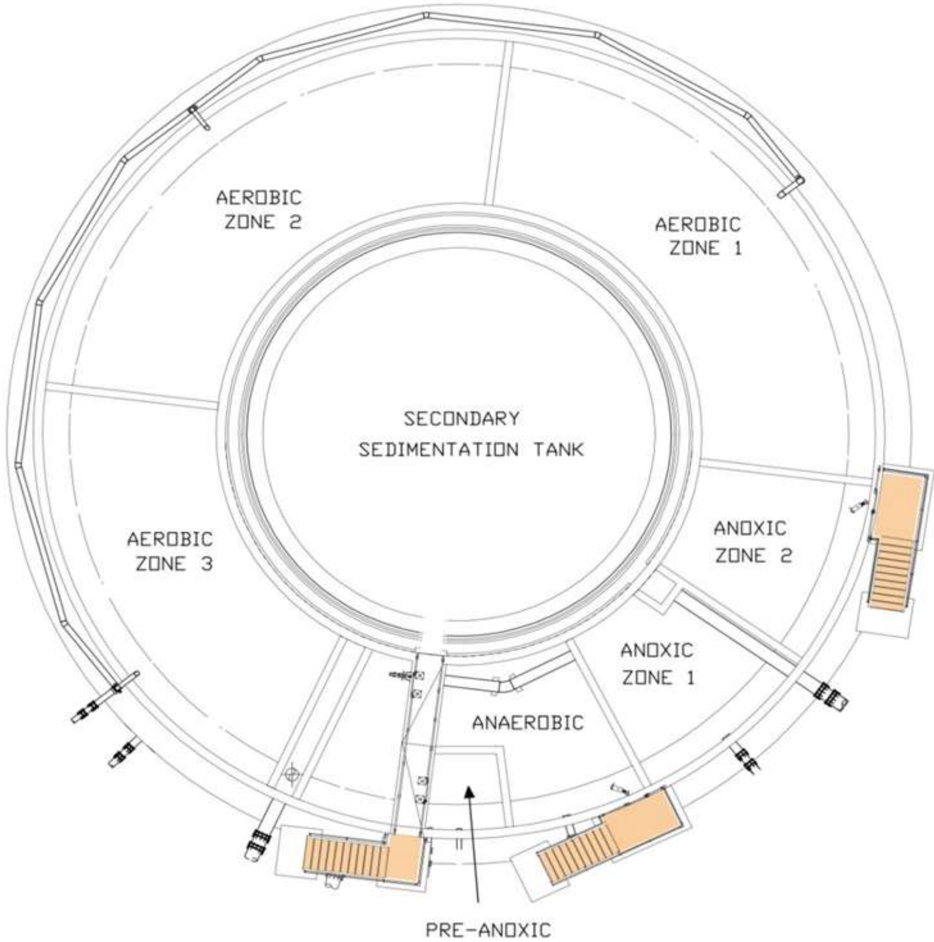
3.9 Bioreactor

The bioreactors for the Winkler WWTP will be configured as a Westbank EBPR (enhanced biological phosphorous removal) process and includes a nitrified mixed liquor return stream from the last aerobic zone to the first anoxic zone. Experiences at several wastewater facilities across Western Canada indicate that this configuration best satisfies the design criteria and functionality requirements.

In this configuration, the bioreactor is configured with an arrangement of pre-anoxic, anaerobic, anoxic, and aerobic zones to achieve carbonaceous BOD removal, ammonia oxidation and nitrogen removal. Influent is step-feed at various points in the reactor, distributing the readily biodegradable organic material present in the incoming wastewater to where it can be used most effectively in each zone. Return activated sludge from the secondary clarifiers is introduced at the pre-anoxic zone, and mixed liquor is wasted from the surface of the third aerobic zone to control foam in bioreactors.

Two bioreactor trains will be constructed to provide for a combined treatment capacity of 9,460 m^3/d (AAF). The new bioreactors will be constructed in the annular space around the secondary clarifiers. An illustration showing the proposed arrangement of a bioreactor around a secondary clarifier is provided in **Figure 3.5**.

Figure 3.5: Schematic of Bioreactors with Secondary Clarifiers



Baffles will be installed in each biological reactor to partition each into pre-anoxic, anaerobic, anoxic and aerobic zones. Mixers will be installed in the unaerated zones to provide completely mixed conditions and low head pumps will be used to return nitrified mixed liquor from the third aerobic zone to the first anoxic zone.

The design criteria for the bioreactors are presented in **Table 3.4**.

Table 3.4: Bioreactor Design Criteria (per train)

Parameter	Design Criteria	
Design Flow, m^3/d	9,460	
Number of Trains	2	
Side Water Depth, m	5.5	
Minimum Freeboard, mm	700	
Pre Anoxic Volume per Train (liquid), m^3	54	
Anaerobic Volume per Train (liquid), m^3	198	
Anoxic Volume per Train(liquid), m^3	684	
Aerobic Volume per Train (liquid), m^3	4,284	
Total liquid Volume per Train, m^3	5,220	
Total liquid Volume, m^3	10,440	
Nominal Pre Anoxic HRT(1) at AWWF, hours	0.3	
Nominal Anaerobic HRT at AWWF, hours	1	
Nominal Anoxic HRT at AWWF, hours	3.5	
Nominal Aerobic HRT at AWWF, hours	21.85	
Nominal Total HRT at AWWF, hours	26.6	
Nominal HRT at Peak hourly Flow, hours	10.64	
Aerobic SRT at AWWF, day	11	
Total SRT(2) at AWWF, day	13.4	
Design MLSS(3), mg/L	3,800	
Number of Blowers	3 (2+1)	two duty+ one standby
Blower Capacity m^3/h	5000	
Pressure, kPa	65	
Power, kW	132	
Number of Internal Pumps	4 (2+2)	one duty+ one standby for each train
Internal Pump Power, Each, kW	8	
Number of Submersible Mixer in Anaerobic Zone	4 (2+2)	one duty+ one standby for each train
Submersible Mixer Power, Each, kW	2.85	
Number of Submersible Mixer in Anoxic Zone	4 (2+2)	one duty+ one standby for each train
Submersible Mixer Power, Each, kW	2.85	
Number of WAS Pumps	1+1	one duty+ one standby
WAS Pump Flow Capacity, m^3/h	70	
WAS Pump Head, m	12	
WAS Pump Power, Each, kW	4.5	

Note:

1) *Hydraulic Retention Time*
2) *Solids Retention Time*
3) *Based on Metcalf & Eddy / AECOM, Wastewater Engineering Treatment and Resource Recovery2014*

3.10 Secondary Clarifiers

Mixed liquor from each bioreactor flows to the secondary clarifiers, where the treated wastewater is separated from the biological solids. The clarified effluent is discharged from the surface of the tanks, while the settled biological solids are removed from the bottom, and returned to the bioreactors as return activated sludge (RAS). If ferric sulphate is needed to trim phosphorus levels it will be added immediately prior to entering the secondary clarifiers.

Mixed liquor will enter each secondary clarifier through an energy dissipation inlet consisting of a small diffuser chamber in the top centre area of the tank. From this chamber, mixed liquor will discharge through controlled diffuser ports into the large central flocculation well through controlled diffuser ports. A circular baffle will be installed to create a centre zone in which incoming mixed liquor will be allowed to flocculate in a low energy mixing regime. Flocculation is a process in which small biological solids collide and aggregate with other small particles to form larger particles, or flocs. The flocs are held together by bridging between particles and due to their larger size, they settle more readily than the individual smaller particles. The key to successful flocculation of mixed liquor is the maintenance of a low energy mixing regime in the flocculating centre well which provides enough energy to promote transport and attachment of particles but is not enough to disrupt the flocs by fluid shear forces.

Flocs pass under and out of the flocculation centre well will enter the sedimentation zone of the clarifier where they will encounter controlled upward flow velocities (overflow rates) designed to prevent the flocs from being transported to the clarifier surface. Clarified supernatant that overflows a continuous V-notch weir into a peripheral launder will discharge into a gravity flow pipe leading to the subsequent UV disinfection process.

The secondary clarifiers will be integrated into the bioreactors to provide a compact and economical design.

Two secondary clarifiers will be constructed and each will be equipped with a dedicated RAS line. Dry-pit RAS pumps equipped with flow meters and flow control valves will be provided for the required return flow to each bioreactor.

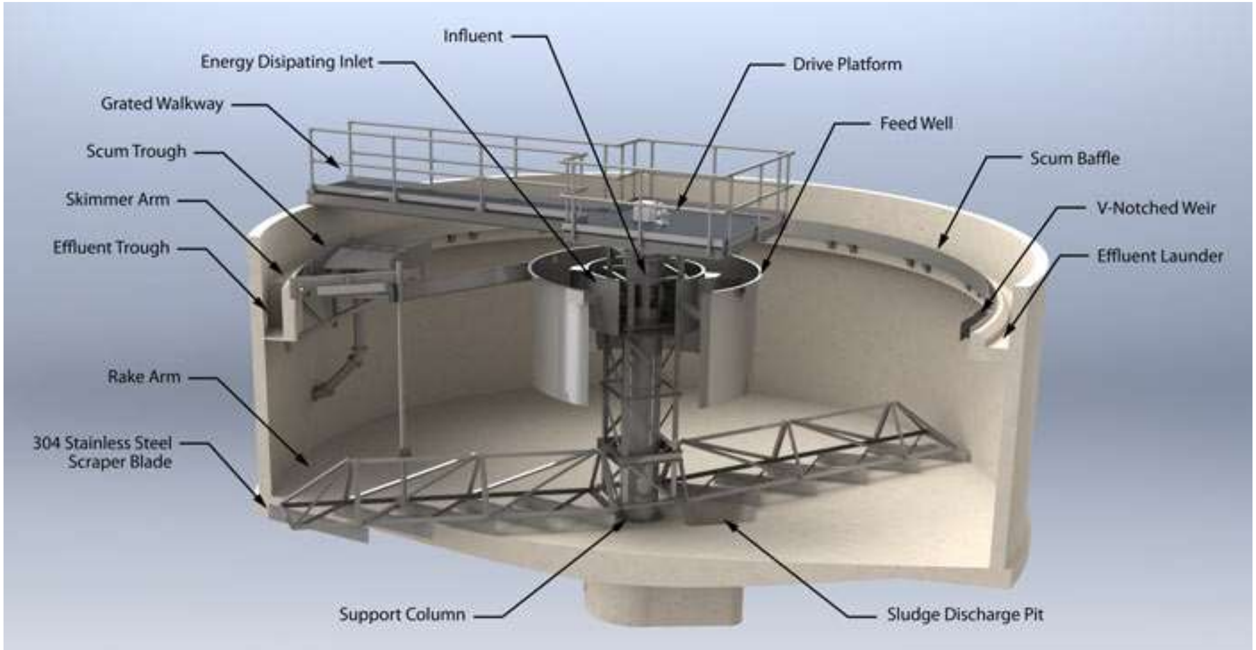
Design parameters for the secondary clarifiers are presented in **Table 3.5**.

Table 3.5: Secondary Clarifier Design Criteria

Parameter	Design Criteria	
Design Flow, ML/d	23.6	
Number of Units, Total/Duty	2/2	
Type	Circular, Centre Feed	
Diameter of Each Clarifier, m	18.5	Each
Total Clarifier Surface Area, m^2	538	Each
Flow Average Day Flow, ML/d Peak Hourly Flow, ML/d	 9.46 23.6	Total
MLSS, mg/l	3800	
$SSVI_{3.5}$, mL/g	75	
Surface overflow Rate at Peak Hourly Flow, m^3/m^2hr	1.89	
Number of Scrapers	2	Each
Scraper Power, Each, kW	0.5	Each
Number of RAS Pumps	3 (2+1)	two duty+ one standby
RAS Pump Flow Capacity, m^3/h	160	
RAS Pump Head, m	12	
RAS Pump Power, kW	7.5	Each

An illustration showing a secondary clarifier is provided in **Figure 3.6**.

Figure 3.6: Schematic of Bioreactors with Secondary Clarifiers



The facility layout has been designed to accommodate an expansion of the system for a third combined bioreactor and secondary clarifier unit in a future expansion.

3.11 Clarifier Cover

Covering secondary clarifiers and the bioreactor facilities is a question that is often considered due to the cold winters and the high winds experienced on the prairies. As a generalization, most of these BNR facilities in western Canada are not covered.

No covers have been included for the bioreactors or secondary clarifiers at this stage of design; however, this may be reconsidered in detailed design. Covers could consist of a complete building enclosure, a dome, partial concrete covers, or even high perimeter walls to reduce wind.

3.12 Chemical Dosing – Ferric Sulphate

As Manitoba Water Quality Standards have a strict phosphorus discharge requirement, it is necessary to provide a secondary chemical phosphorus removal system to augment the biological phosphorus removal process. The proposed chemical phosphorus removal facility would include the following:

- Storage of ferric sulphate (Jar tests by the City of Winkler have selected ferric sulphate).
- Dosing pumps to allow the mainstream application of a controlled amount of ferric sulphate solution into the secondary clarifier influent.

There will be online phosphorus analysers that will measure phosphorus in the secondary effluent and if the level exceeds a set point of approximately 0.8 mg/L (adjustable), ferric sulphate will be added to the secondary clarifier influent. The chemical dose will be minimized, while keeping the phosphorus levels below 1.0 mg/L reliably.

The ferric dosing will be automatic, but will be monitored by the operators. It will be their objective to operate the process to minimize chemical dosage and cost.

3.13 Disinfection

Sizing of the UV disinfection equipment is a function of the secondary effluent wastewater flow and characteristics. A design dose of 25 to 30 mJ/cm^2 is recommended for WWTP treatment systems designed to meet a typical effluent disinfection limit of 200 MPN/100mL fecal coliform limits (based on a 30 day geometric mean of consecutive daily grab samples).

The most important wastewater characteristic that influences UV disinfection is UV transmittance (UVT), which is a measure of the transparency of the wastewater to the passage of UV light.

The WWTP is designed for disinfection of the secondary effluent. Design parameters for the proposed UV disinfection system are presented in **Table 3.6**.

Table 3.6: Design Criteria for UV Disinfection System

Parameter	Unit	Value	Descriptor
Design flow	ML/d	23.6	
Type		UV in open Channel	
Number of Channel		2	1 duty + 1 bypass
Total Number of Banks		2	
Number of Modules per Bank		4	
Number of Lamps per Module		8	
Total Number of UV Lamps		64	
Minimum UVT	%	60	
Minimum UV Dose	mJ/cm^2	25	
Power	kW	16	
Maximum Influent TSS	mg/L	30	
Effluent *Escherichia coli (E.coli)*		200 MPN/100 mL	
Cleaning system		Automatic	
Minimum Rated Life of UV Lamps	h	12,000	

It is recommended that a single channel will be designed for a full capacity of 23.6 ML/d and the second channel will be blocked off. Additional UV equipment could be added at any time in the future. Gates will be provided to isolate the second channel.

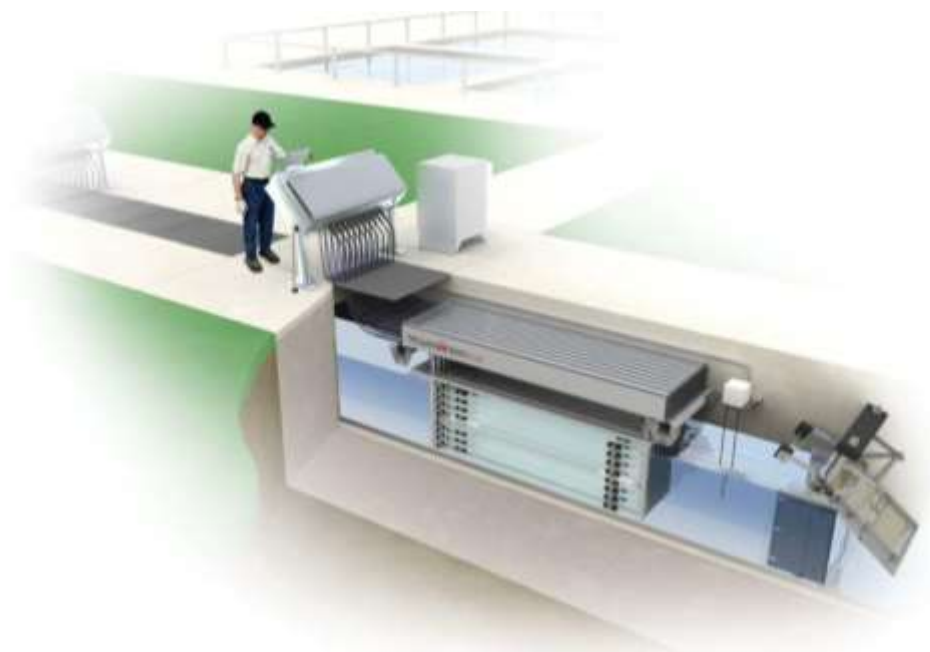
The UV system will be designed for two banks in series. If one bank fails or needs removal for repairs, one bank would remain in service to provide disinfection for 11.8 ML/d. During detailed design, options for powering down some UV lamps will be examined to reduce power consumption at low flows. It will also be determined whether the UV system will be designed for a 60% UVT or if it will be reduced to 50% UVT to provide an additional safety factor.

An illustration showing a system with UV in channels provided in **Figure 3.7.**

Figure 3.7: UV in Channel (Image from Neotec UV)

An illustration showing a general installation of an in channel UV system is provided in **Figure 3.8**.

Figure 3.8: UV Installation in Channel (Image from Trojan UV)



3.14 Sludge and Scum Handling, Stabilization and Disposal

The proposed wastewater treatment process generates sludge from bioreactors (mixed liquor) and scum from secondary clarifier tanks. Proposed sludge management involves:

- Collecting waste activated sludge (WAS) from the bioreactors and the scum from the secondary clarifiers and transferring it to the dissolved air flotation (DAF) tank.
- Sludge thickening in DAF system (thickening sludge from 0.4% to 4% by weight).
- Sludge stabilization with aerobic digestion in segregated area of existing cell 2.
- Sludge storing in existing cell 3 meanwhile, mixing and aeration to prevent odour.
- Periodic land application of sludge.

3.14.1 Sludge Thickening (DAF)

It is proposed that WAS and scum be pumped to a dissolved air flotation (DAF) system in the Headworks Building in order to thicken sludge prior to stabilization and disposal. Design parameters for the proposed DAF thickening system is presented in **Table 3.7**.

Table 3.7: Design Criteria for DAF

Parameter	Unit	Value	Descriptor
Dry Solids	kg/d	2955	
Sludge flow	m^3/d	780	
Type		DAF	
Number of trains		1	
Influent Solid Concentration	%TS	0.4	Mixed Liquor and Scum from Bioreactors
Effluent Solid Concentration	%	3.5	
Working hour per day in design year(2038)	h	12	
Hydraulic Loading Rate	m/hr	1.3	
Solid Loading Rate	$kg/m^2/hr$	3.5	
A:S Ratio		0.02	
Effective Surface Area	m^2	72	
Microbubble Generation Power	kW	1.5	
Subnatant Pump Power	kW	2.5	

Sludge thickening will be designed to have only one DAF tank as it is an expensive system and most of the parts can be replaced quickly. Also, the WWTP can function without wasting sludge for short periods during repair times required for all but the most catastrophic failures and major overhauls. If maintenance can be planned, it is anticipated that the bioreactor can store sludge without wasting for 10-12 days in 2018 and 3 to 4 days at full capacity (2038).

Polymer addition enhances the DAF operation and provides the ability to compensate for unexpected temporary lapses in DAF performance. It improves the capture rate, increases the solids loading capacity and stabilizes DAF operation significantly. A polymer dosing system will be provided to promote thickening capability and enhance the effluent quality.

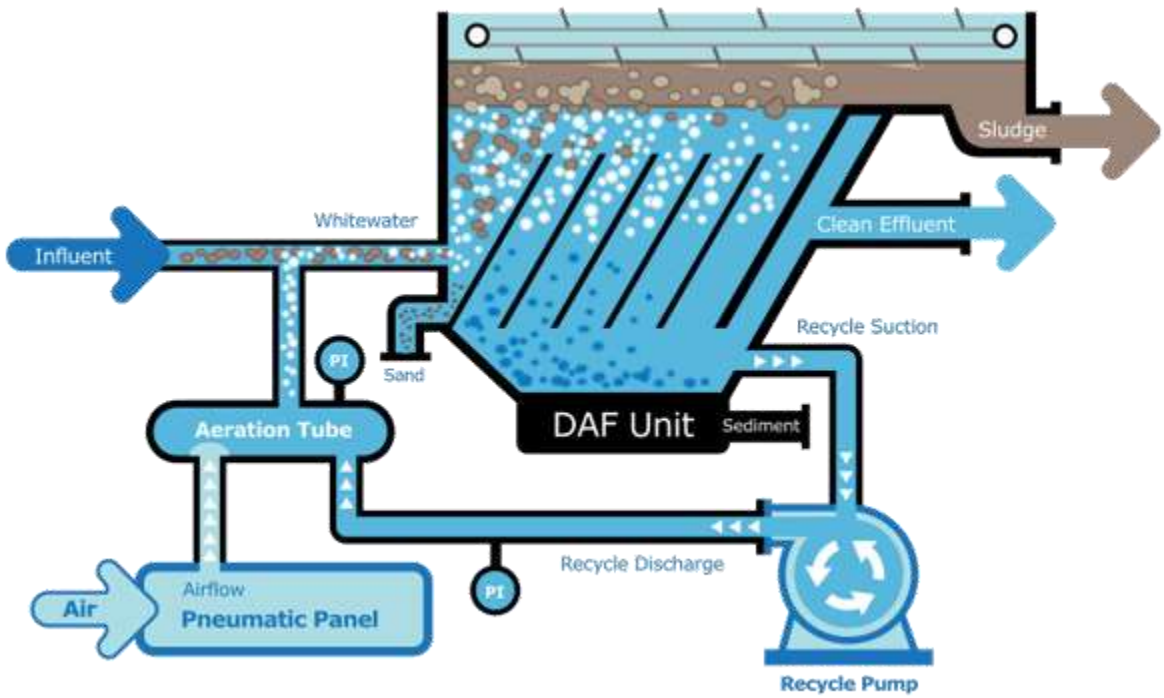
The proposed process related equipment associated with the DAF sludge thickening system is summarized in **Table 3.8**.

Table 3.8: Process Equipment for DAF Sludge Thickening

Process Equipment Description	Unit/Number	Descriptor
DAF tank	1	
Microbubble generation system	2	1 duty + 1 standby
Subnatant pump	2	1 duty + 1 standby
Polymer make down and feed system	1	

An illustration showing a flow path through a DAF unit is provided in **Figure 3.9.**

Figure 3.9: Typical Stream Pattern Through a DAF



An illustration showing DAF tanks is provided in **Figure 3.10**.

Figure 3.10: DAF Tanks

3.14.2 Sludge Stabilization

Thickened sludge will be transferred to existing lagoon cell 2 for stabilization and then overflow to existing lagoon cell 3 to be stored prior to land application. Stabilized sludge is to be hauled for farmland application from cell 3 and from cell 2 if required. At a concentration of 4% solids, each cell should have over two years of storage for a total of approximately 4 years. Though natural processes of evaporation, it is possible that this sludge would increase to 6% or 8% solids, increasing storage time. This will vary depending on the precipitation events and upon actual flows going to the treatment plant. In the first years of operation, the storage capacity may be closer to 8 years if both cells are used. If one cell is used for isolation and land application, the storage time will be approximately half that period. In order to stabilize the sludge it will be intensely aerated and mixed for a 60 day period and lightly aerated during storage. The existing aeration systems were designed for aerating raw wastewater and cannot provide sufficient mixing requirement for the sludge stabilization zone.

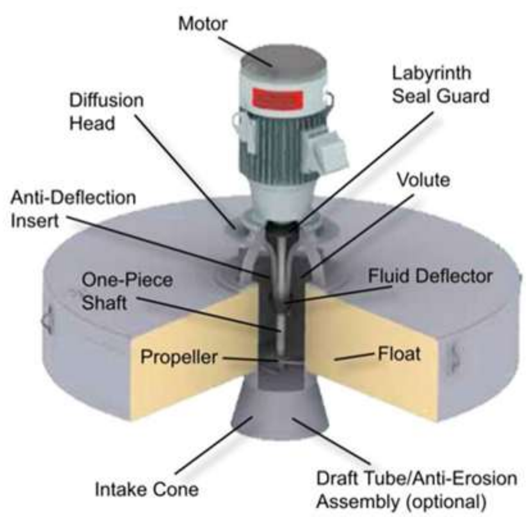
An area of cell 2 will be isolated by a floating flexible baffle wall. This smaller section of the lagoon would be fitted with surface aerators and mixers to keep the solids suspended and to provide oxygen for aerobic stabilization. The system would be working in continuous mode as a completely mixed reactor, with a volume of approximately 4,500 m^3. Stabilized sludge would flow through openings in the baffle to join the rest of the cell 2. The existing aerators in cells 2 and 3 would be retained for some degree of mixing and odour control, however their operation will be managed to minimize operating cost.

An illustration showing floating mechanical mixer/aerator provided in **Figure 3.11**.

Figure 3.11: Floating Mechanical Mixer/Aerator (Image from Aqua-Jet)

An illustration showing floating mechanical mixer/aerator components provided in **Figure 3.12**.

Figure 3.12: Floating Mechanical Mixer/Aerator Component (Image from Aqua-Jet)



3.14.3 Future Land Application of Biosolids

Treated sludge, or biosolids, is commonly land applied to improve the structure of the soil and to add nutrients to agricultural fields. Of primary concern with the land application of biosolids materials is the leaching and/or surface runoff of nitrogen and phosphorus into ground or surface water if application rates exceed crop removal rates and soil storage capacity.

When biosolids require removal, they will be applied to farm land at agronomic rates. A separate Environment Act Proposal will be submitted for future biosolids application. The objective of future land application work would be to manage nitrogen and phosphorus based on beneficial farm management practices.

Soil physical (texture) and chemical (pH, electrical conductivity, nutrients and metals) parameters will be assessed through a field sampling program and laboratory analytical testing, immediately after harvest or approximately three weeks prior to land application of biosolids. Based on these soil and biosolids analytical results, agronomically appropriate application rates for each parcel of land receiving these materials will be calculated.

The biosolids material from Cell 2 and Cell 3 will be land applied based on appropriate agronomic rates calculated for each of the agricultural fields participating in the application program. Biosolids are likely to be 6% solids and it is anticipated that the biosolids will be disposed of every 4 to 8 years at onset every 2 to 4 years at design capacity.

An illustration showing land application through injection is provided in **Figure 3.13**.

Figure 3.13: Land Application Method (Image from Chamness Technology)

Sludge samples were collected in 2015 and 2016 from the cells to confirm that the sludge would be appropriate for land application. In general, the sample results have shown that the sludge is typical of older digested sludge with high concentrations of inorganic solids, relatively low nitrogen availability but high phosphorus levels. This sludge will be appropriate for future application to farm land but it should be noted that it may be rate limited by phosphorus levels, as nitrogen levels are relatively low.

In the future, the cells will need to be isolated and mixed prior to collection of a final representative sample that could be used to set application rates. This will need to be done at the time of completing a future Environment Act Proposal for land application. Results for the current sampling are included in **Appendix A**.

3.14.4 Disposal of Cell 1 Sludge

Sludge in cell 1 will be removed from the cell and dewatered prior to commissioning the treatment system. For decades the cell has had deposition of grit and screenings. Observations made during cell maintenance and repair of aeration systems show that the sludge is contaminated with debris and is not suitable for farmland application.

Accumulated sludge and debris will be dewatered and it is anticipated that it will be disposed of at the local SWAMP solid waste disposal site. Preliminary discussions with the SWAMP facility have indicated that it can be accommodated, provided there is adequate preparation time and that it passes the concrete slump test (needs to be a solid not liquid). **Figure 3.14** shows an example of debris observed in cell 1, during a maintenance event.

Figure 3.14: Debris Accumulation in Cell 1

3.15 Overflow and Storm Water Handling

The influent flow will be directed to the inlet chamber, where the wastewater will be directed to the screening and to the existing cell no 1 if the flow exceeds the Maximum Day Flow (MDF) of the headworks. When the total flow to the plant exceeds 40 ML/d, the excess flow will pass over a side weir, located before screen channels (inlet chamber). It will flow by gravity to the existing cell no 1.

The remainder of the influent wastewater flows (up to 40 ML/d) will be screened and degritted at the new WWTP. Downstream of these two physical processes, only flows below 23.6 MLD (PWWF) will be discharged to the secondary processes. Flow between 23.6 ML/d and 40 ML/d will infrequently be diverted to cell 1 over a second weir in the grit removal effluent channel upstream of the splitter.

3.16 Site Water Usage

There will be three streams of water used on site including hauled potable water, chlorinated flushing water and potentially a non-potable firefighting pond.

3.16.1 Potable Water System

The wastewater treatment facilities need utility water mainly for the operators and for laboratory work. Flushing water will be used for other water requirements more related to the treatment process. The potable water system will consist of hauled potable water from the City of Winkler distribution system. It will consist of the following:

- External buried polyethylene 12,000 litre potable water tank complete with low level sensor
- Card access for water hauler
- Internal distribution pump for potable water use
- Cross connection control to prevent contamination of potable system

A potable water supply will also be provided back to the septage disposal system for system washing and maintenance.

3.16.2 Utility or Flushing Water System

The wastewater treatment facilities will use a significant volume of water for general cleaning, foam control, makeup water for chemical feed facilities and pump flushing water. Duplex pumps will draw disinfected water from the UV effluent channels, and a 13% sodium hypochlorite solution will be fed to the line, paced by a flushing water flow meter. Two pressure tanks will be used for a short contact time and for mixing, prior to usage within the Headworks Building and at the bioreactors.

3.16.3 Fire Fighting Pond

A firefighting pond west of the Headworks Building is currently part of the design. It will be an earthen lagoon lined with either a single layer of high density polyethylene (HDPE) or with impermeable clay. This pond will provide approximately 500 m^3 of non-potable water below winter ice levels, in case a fire was to occur. A dry hydrant will be provided so that the pumper trucks could draw from the pond. The pond would be filled by any of a number of sources including spring runoff or secondary effluent after disinfection. This component of the project is for firefighting and will not be part of the WWTP licence. Depending upon the cost of the project in detailed design, this component may be removed and the community would rely on either hauled firefighting water or a pipeline may be installed from the Pembina Valley Coop approximately 1.5 km away.

3.17 Odour Control

All processes related to wastewater treatment will produce odour to some degree. The most intense odours evolve from primary treatment facilities (screening and grit removal) and solids handling facilities. In most instances, the odors associated with primary treatment facilities are generated as a result of septic conditions. In the City of Winkler wastewater treatment plant, the odour generated may be more significant than many facilities, as all of the wastewater reaches the plant through forcemains. In fact, the forcemain from the Rural Municipality of Stanley will be from a low pressure sewer and may be particularly odourous. Forcemains are often associated with odour, because they are closed in and the wastewater starts to ferment, creating conditions similar to a septic tank. Once the forcemain discharges into a tank, the odours that have been generated in the pipe are released all at once.

In order to focus on the most significant odour sources, the screen channels, screen racks, grit removal system and DAF will be provided with covers that can be removed for maintenance purpose. Air will be drawn from under the covered area to selectively remove the most intense odours prior to them entering the room. This air will be send through an odour control system for 99% removal of odourous substances and then it will be discharge to atmosphere.

Within the primary treatment areas, there will be 12 air changes per hour to meet NFPA 820. This will improve air quality for the operators working in those areas. When operators are not on site (night time), the air handling will drop to 6 air changes per hour to reduce heating costs. There will be minimal odour released on the secondary treatment side of the facility so ventilation requirements will not be as onerous.

3.18 Process Flow Summary

A summary of the selected treatment processes is presented in Functional Design drawings in **Appendix B.**

4. Civil Design

4.1 Plant Elevation

This section provides a brief description of the existing conditions, design issues, and functional plan of non-process components of the works, which include utilities piping, land drainage, plant roadways, fencing, parking and grading.

4.2 Access Roads and Internal Roads

Access to the new process units is intended to be via a new access road from the south. Access to the existing lagoon will remain the same, using its own access roads. Access roads will generally be built over a granular or clay embankment, with traffic gravel toping. Concrete pads will be provided for heavy trucks at the septage disposal facility and around the Headworks Building. Access roads will generally be designed for semitrailer weights to accommodate water hauling, screenings and grit removal, general repairs and chemical delivery. Access will be provided around the perimeter of the site so that access is available for maintenance work on the north side of the bioreactors

4.3 Site Grading, Drainage

The site will be graded to provide positive drainage away from all process tankage and the Headworks Building. Appropriate storm drainage will be designed to intercept and manage surface drainage as required. The site will generally be built up with approximately 2 m of fill, to accommodate gravity flow through the plant and to incorporate the lagoon cells into the treatment system. During detailed design, the concrete tanks will be design based on some exterior berming to reduce heat loss.

5. Electrical

5.1 Electrical Service

The existing lagoon currently has its own 800 amp 347/600 volt service for the existing blowers and blower building. It is anticipated that this service will power the new mixers and floating aerators in lagoon cell 2 for the aerobic digester. It would also provide power for the lift station pumps used to drain the overflow pipe extending from the Headworks Building to cell 1.

A second electrical service would be installed specific to the Headworks building. It is anticipated that this would be an above ground service that is 800 amps and 347/600 volts. This service would feed a subpanel for the septage building and the two bioreactors.

During detailed design, discussions will be held with Manitoba Hydro to further define the service sizes. They may require that the two facilities have a single service with one of the locations back feeding the other.

5.2 Backup Power

The City of Winkler power supply has been very reliable, aside from the ice storm that interrupted many transmission lines in the province in 2012. Most power interruptions are short with limited impact on the treatment process.

The design elevation of the plant was selected so that if there was a significant power failure, the wastewater being pumped to the treatment plant would naturally overflow to the lagoon. It is anticipated that all of the lift stations will have backup power and will be able to pump to some degree even if there was a loss of power in the area.

A 250 kW standby diesel generator is proposed to meet emergency power needs for the Winkler WWTP. The selection of either diesel or natural gas powered generators will be made during detailed design. A 24 hour day tank would be provided for the diesel generators, while natural gas will be piped for an ongoing fuel supply. The proposed generator would be located outside the WWTP in a weather proof enclosure near the electrical room.

The backup generator is not large enough to allow the treatment plant to function. It is only included to supply emergency lighting and some degree of heating and ventilation so that the WWTP meets code and remains safe for occupants. This will keep the facility from freezing and the air quality will remain acceptable so that the operators can complete whatever emergency work is needed. A short shutdown of less than 12 hours is generally not detrimental to the process. Treatment operation should return to normal within a few days. However, a longer shutdown will start to impair process and impair effluent quality. In this instance, the treated water that does not meet requirements will be diverted to the lagoon for further aeration and natural treatment.

An assessment will be made during detailed design to identify key components in the bioreactor area that may need to either be insulated or powered to some degree during a power failure to prevent freezing. This will help protect the infrastructure so that it can restart easily after a power failure.

5.3 Heating and Ventilation

The Headworks building will be heated by a natural gas boiler with a number of heat exchangers in key areas. Due to the high cost of heating and ventilating classified areas with 12 air changes per hour, heat exchange coils would be used to recover 90% of the heat. The secondary treatment side of the WWTP will have a much lower ventilation rate due to less stringent electrical classifications and lower odour generation potential.

Based on preliminary discussions with Manitoba Hydro, it is anticipated that the natural gas service will be from approximately 4 km to the south. This is a long gas line that is expected to have a contribution cost of approximately $90,000. This cost may be waived based on final heating loads calculated during detailed design.

6. Schedule

The proposed schedule for the work is listed below in **Table 6.1**, incorporating Licencing process as well as design, construction and commissioning.

Table 6.1: Proposed Schedule

Item #	Component of Work	Date Completed
1	Functional Design	October, 2016
2	Completion of the Environment Act Proposal	November, 2016
3	Obtain New Licence	January, 2017
4	Detailed Design	December 2016 to July 2017
5	Tender Project	August, 2017
6	Construction Period	September 2017 to May 2019
7	Commissioning	May and June, 2019

If the commissioning date becomes a key item, it may be possible to condense the schedule during the design period by a month and the construction period by four months. This will need to be discussed with the Owners during detailed design, as it is preferred to start-up biological systems in warm weather (spring) rather than mid-winter.

7. Construction Sequencing and Tie-ins

The construction tie-in will be relatively simple as this is a greenfield site and the only tie ins are for the incoming wastewater pipes and pipes to incorporate lagoon reuse. The treatment plant can be constructed completely off line. Forcemains can all be constructed and valved off until commissioning. Since the lagoons will be adjacent to the mechanical plant, the flow may be diverted at any time if there are temporary operational issues or if the treated effluent does not meet requirements during the start-up period. A preliminary schedule for construction is provided in Table 8.1, ending with a commissioned facility in summer 2019.

Table 7.1: Preliminary Construction Sequence

Period of Construction	Primary Tasks
Fall 2017	Foundation Piles, shop drawings, set up laydown and contractor area
Winter 2017/2018	Concrete foundation for Headworks, start erecting building
Spring 2018	Complete Headworks Building shell, construct bioreactors, splitter box, install lagoon piping
Summer 2018	Process mechanical, electrical, HVAC for Headworks Building, work on bioreactors
Fall 2018	Finish bioreactors, work on Headworks Building, yard piping and forcemain tie-ins, install septage station and install site fill
Winter 2019	Start-up and commissioning with fresh water
Spring 2019	Dewater cell 1, commission plant and use cell 1 as overflow. Install aerators in cell 2 and floating baffle
Summer 2019	Process commissioned

8. Facility Discharge Monitoring and Testing

Once the facility is in full operation it will need to discharge treated effluent to the receiving stream. Since the WWTP includes the lagoon facility, the discharge plan is more elaborate than a conventional mechanical treatment plant. The discharge locations for the treatment plant are shown in **Table 8.1** in Section 1.2.

Table 8.1 summarizes the discharge and test locations during different seasons.

Table 8.1: Discharge and Monitoring Locations

Season of Discharge	Discharge location	Testing
Winter	To Cell 1 and then to cells 4-7 for part of winter and direct to cell 8 and then 9 for part of winter	Plant Effluent in Headworks
Spring	Discharge direct to discharge ditch for ongoing treatment Discharge from lagoon cells 4 to 9 through cells 5, 6, 7, and 8	Plant Effluent in Headworks and Each Cell Prior to Discharge
Summer/Fall	Discharge direct to the discharge ditch	Plant Effluent in Headworks
All Seasons – Wet Weather Flows	Direct to Cell 1 for aeration	As Noted Above

9. Costing

9.1 Capital Costs

Costs have been estimated for the proposed work based on the functional design drawings and plans. Quotes have been used for all significant components while percentage estimates have been used for other components of the work. This is a Class C estimate with a 15% contingency assuming a November 2016 cost period. An inflation of 1% per year was added to project costs to the end of 2018.

The capital cost summary is provided in **Table 9.1** below. A total capital cost of $42.3 million has been projected.

Table 9.1: Capital Cost Summary

Description	Total Cost
Septage Receiving Station	$ 235,617
Headworks Building	$ 9,559,407
Bioreactors	$ 8,181,190
Secondary Clarifiers	$ 871,695
UV Disinfection	$ 282,742
DAF Sludge Thickening	$ 929,707
Digester (in Lagoon aeration and baffle)	$ 472,346
Ferric Sulphate Feed	$ 134,033
Odour Control	$ 337,669
Site Civil Works	$ 1,451,600
Mechanical (HVAC/Plumbing)	$ 1,680,352
Electrical, Instruments and Control	$ 2,310,484
Piping (Civil + Process)	$ 2,577,850
Backup Generator	$ 145,234
Biosolids Disposal Cell 1	$ 965,140
Tools and Equipment	$ 183,600
SUBTOTAL	**$ 30,318,665**
Division 1 (GC) = 8%	$ 2,425,493
Contingency = 15%	$ 4,547,800
TOTAL CONSTRUCTION	**$ 37,291,958**
Engineering (Detailed Design/Tender and Contract Admin.) = 10%	$ 3,729,196
Carrying Costs MWSB = 3% (City Portion)	$ 410,212
End of 2018 (2 years of 1% - Total of 2% Inflation)	$ 828,627
GRAND TOTAL	**$ 42,259,994** **Use Rounded $42.3 million**

9.2 Operating Costs

Operating costs have been estimated based on the functional design of the WWTP. Costs are summarized in **Table 9.2** below.

Table 9.2: Operating Costs

Cost Item	Cost ($/year)	Comment
Staff	$ 210,000	3 staff including soft costs, 60k, 60k and 90k
Chemicals	$ 50,000	Ferric sulphate, chlorine
Electricity	$ 260,000	Includes lagoon aeration 500 kW @ $0.06
Lighting	$ 5,000	79,000 kWh/yr
Natural Gas	$ 136,000	485,000 m^3 /yr @ $0.28/$m^3$
Repairs	$ 75,000	0.25% of 30 million
Sludge disposal costs	$ 150,000	Assume 600k every 4 years, $20/$m^3$ applied
Laboratory offsite	$ 20.000	Estimate
Consumables	$ 30,000	Estimate
Totals	**$ 936,000**	

Appendix A

Results of Sludge Analyses

City of Winkler
ATTN: TIM WIEBE
185 Main Street
Winkler MB R6W 1B4

Date Received: 24-SEP-15
Report Date: 09-OCT-15 15:08 (MT)
Version: FINAL

Client Phone: 204-325-9524

Certificate of Analysis

Lab Work Order #: L1678243

Project P.O. #: NOT SUBMITTED
Job Reference: C1505
C of C Numbers:
Legal Site Desc:

Chantal Bouchard
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1678243-1 C3-01 - C3-05 COMP CELL 3							
Sampled By: CLIENT on 23-SEP-15 @ 09:00							
Matrix: SLUDGE							
Miscellaneous Parameters							
Ammonia, Total (as N)	62		50	mg/L		01-OCT-15	R3281129
Conductivity	1980		1.0	umhos/cm		30-SEP-15	R3279705
Mercury (Hg)-Total	<0.020	DLM	0.020	mg/L	29-SEP-15	29-SEP-15	R3279192
Phosphorus (P)-Total	408		2.0	mg/L		30-SEP-15	R3279277
Total Kjeldahl Nitrogen	91	DLA	10	mg/L		04-OCT-15	R3282082
Total Suspended Solids	24600		5.0	mg/L		30-SEP-15	R3285311
pH	7.66		0.10	pH units		30-SEP-15	R3279705
Total Solids and Total Volatile Solids							
Total Solids	1.17		0.10	%	09-OCT-15	09-OCT-15	R3286851
Total Volatile Solids (dry basis)	20.5		0.10	%	09-OCT-15	09-OCT-15	R3286851
Total Metals by ICP-MS							
Arsenic (As)-Total	1.14	DLM	0.10	mg/L	29-SEP-15	29-SEP-15	R3279108
Cadmium (Cd)-Total	0.057	DLM	0.020	mg/L	29-SEP-15	29-SEP-15	R3279108
Chromium (Cr)-Total	1.88	DLM	0.20	mg/L	29-SEP-15	29-SEP-15	R3279108
Copper (Cu)-Total	9.97	DLM	0.20	mg/L	29-SEP-15	29-SEP-15	R3279108
Lead (Pb)-Total	0.96	DLM	0.10	mg/L	29-SEP-15	29-SEP-15	R3279108
Nickel (Ni)-Total	1.49	DLM	0.20	mg/L	29-SEP-15	29-SEP-15	R3279108
Potassium (K)-Total	242	DLM	10	mg/L	29-SEP-15	29-SEP-15	R3279108
Zinc (Zn)-Total	20.4	DLM	2.0	mg/L	29-SEP-15	29-SEP-15	R3279108
Nitrogen Total							
Nitrate in Water by IC							
Nitrate (as N)	<0.20	HTD	0.20	mg/L		29-SEP-15	R3279571
Nitrate+Nitrite							
Nitrate and Nitrite as N	0.55		0.22	mg/L		30-SEP-15	
Nitrite in Water by IC							
Nitrite (as N)	0.55	HTD	0.10	mg/L		29-SEP-15	R3279571
Total Nitrogen Calculated							
Total Nitrogen	91		10	mg/L		08-OCT-15	
L1678243-2 C2-01 - C3-05 COMP CELL 2							
Sampled By: CLIENT on 23-SEP-15 @ 09:00							
Matrix: SLUDGE							
Miscellaneous Parameters							
Mercury (Hg)	0.160		0.050	mg/kg	02-OCT-15	02-OCT-15	R3283627
Total Kjeldahl Nitrogen	0.820		0.020	%	03-OCT-15	04-OCT-15	R3282145
Total Solids and Total Volatile Solids							
Total Solids	15.1		0.10	%	03-OCT-15	03-OCT-15	R3281552
Total Volatile Solids (dry basis)	20.1		0.10	%	03-OCT-15	03-OCT-15	R3281552
pH and EC (1:2 Soil:Water Extraction)							
Conductivity (1:2)	4.45		0.050	dS m-1	03-OCT-15	03-OCT-15	R3281944
pH (1:2 soil:water)	7.90		0.10	pH	03-OCT-15	03-OCT-15	R3281944
Nitrate, Nitrite and Nitrate+Nitrite-N							
Nitrite-N	0.43		0.40	mg/kg	02-OCT-15	02-OCT-15	R3281979
Nitrate+Nitrite-N	<2.0		2.0	mg/kg	02-OCT-15	02-OCT-15	R3281979
Nitrate-N	<2.0		2.0	mg/kg	02-OCT-15	02-OCT-15	R3281979
Metals							
Aluminum (Al)	9820		5.0	mg/kg	02-OCT-15	02-OCT-15	R3282232
Antimony (Sb)	0.83		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Arsenic (As)	12.4		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Barium (Ba)	259		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Beryllium (Be)	0.38		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Bismuth (Bi)	5.39		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1678243-2 C2-01 - C3-05 COMP CELL 2							
Sampled By: CLIENT on 23-SEP-15 @ 09:00							
Matrix: SLUDGE							
Metals							
Boron (B)	19		10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Cadmium (Cd)	0.879		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Calcium (Ca)	80100		100	mg/kg	02-OCT-15	02-OCT-15	R3282232
Chromium (Cr)	22.8		1.0	mg/kg	02-OCT-15	02-OCT-15	R3282232
Cobalt (Co)	4.43		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Copper (Cu)	191		1.0	mg/kg	02-OCT-15	02-OCT-15	R3282232
Iron (Fe)	14400		25	mg/kg	02-OCT-15	02-OCT-15	R3282232
Lead (Pb)	13.2		0.20	mg/kg	02-OCT-15	02-OCT-15	R3282232
Magnesium (Mg)	14200		10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Manganese (Mn)	582		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Molybdenum (Mo)	27.9		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Nickel (Ni)	13.5		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Phosphorus (P)	6000		100	mg/kg	02-OCT-15	02-OCT-15	R3282232
Potassium (K)	1830		25	mg/kg	02-OCT-15	02-OCT-15	R3282232
Selenium (Se)	12.2		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Silver (Ag)	14.7		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Sodium (Na)	1430		10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Strontium (Sr)	262		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Thallium (Tl)	0.18		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Tin (Sn)	9.4		5.0	mg/kg	02-OCT-15	02-OCT-15	R3282232
Titanium (Ti)	50.8		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Uranium (U)	39.0		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Vanadium (V)	31.3		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Zinc (Zn)	236		10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Total Organic N-liquid manure -as rec'd							
Ammonium - N in Liquid Manure - as rec'd							
Ammonia, Total (as N)	2.2		1.0	lb/1000gal	02-OCT-15	02-OCT-15	R3281243
Nitrogen, Total Organic							
Total Organic Nitrogen	16.4		1.0	lb/1000gal		04-OCT-15	
Total N in Liquid Manure -as rec'd							
Total Nitrogen	18.7		1.0	lb/1000gal	02-OCT-15	02-OCT-15	R3281239
L1678243-3 C4/5-01 COMP CELL 4+5							
Sampled By: CLIENT on 23-SEP-15 @ 09:00							
Matrix: SLUDGE							
Miscellaneous Parameters							
Mercury (Hg)	0.83		0.10	mg/kg	02-OCT-15	02-OCT-15	R3283627
Total Kjeldahl Nitrogen	0.260		0.020	%	03-OCT-15	04-OCT-15	R3282145
Total Solids and Total Volatile Solids							
Total Solids	62.5		0.10	%	03-OCT-15	03-OCT-15	R3281552
Total Volatile Solids (dry basis)	5.67		0.10	%	03-OCT-15	03-OCT-15	R3281552
pH and EC (1:2 Soil:Water Extraction)							
Conductivity (1:2)	2.27		0.050	dS m-1	03-OCT-15	03-OCT-15	R3281944
pH (1:2 soil:water)	8.41		0.10	pH	03-OCT-15	03-OCT-15	R3281944
Nitrate, Nitrite and Nitrate+Nitrite-N							
Nitrite-N	3.30		0.40	mg/kg	02-OCT-15	02-OCT-15	R3281979
Nitrate+Nitrite-N	17.8		2.0	mg/kg	02-OCT-15	02-OCT-15	R3281979
Nitrate-N	14.5		2.0	mg/kg	02-OCT-15	02-OCT-15	R3281979
Metals							
Aluminum (Al)	5300		5.0	mg/kg	02-OCT-15	02-OCT-15	R3282232
Antimony (Sb)	0.23		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Arsenic (As)	3.29		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1678243-3 C4/5-01 COMP CELL 4+5							
Sampled By: CLIENT on 23-SEP-15 @ 09:00							
Matrix: SLUDGE							
Metals							
Barium (Ba)	76.7		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Beryllium (Be)	0.22		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Bismuth (Bi)	0.768		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Boron (B)	15		10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Cadmium (Cd)	0.271		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Calcium (Ca)	43700		100	mg/kg	02-OCT-15	02-OCT-15	R3282232
Chromium (Cr)	11.7		1.0	mg/kg	02-OCT-15	02-OCT-15	R3282232
Cobalt (Co)	3.62		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Copper (Cu)	28.1		1.0	mg/kg	02-OCT-15	02-OCT-15	R3282232
Iron (Fe)	8520		25	mg/kg	02-OCT-15	02-OCT-15	R3282232
Lead (Pb)	17.5		0.20	mg/kg	02-OCT-15	02-OCT-15	R3282232
Magnesium (Mg)	9290		10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Manganese (Mn)	342		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Molybdenum (Mo)	1.51		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Nickel (Ni)	7.62		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Phosphorus (P)	2840		100	mg/kg	02-OCT-15	02-OCT-15	R3282232
Potassium (K)	1200		25	mg/kg	02-OCT-15	02-OCT-15	R3282232
Selenium (Se)	1.30		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Silver (Ag)	2.01		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Sodium (Na)	692		10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Strontium (Sr)	119		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Thallium (Tl)	<0.10		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Tin (Sn)	<5.0		5.0	mg/kg	02-OCT-15	02-OCT-15	R3282232
Titanium (Ti)	104		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Uranium (U)	6.72		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Vanadium (V)	19.9		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Zinc (Zn)	60		10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Total Organic N-liquid manure -as rec'd							
Ammonium - N in Liquid Manure - as rec'd							
Ammonia, Total (as N)	1.3		1.0	lb/1000gal	02-OCT-15	02-OCT-15	R3281243
Nitrogen, Total Organic							
Total Organic Nitrogen	15.7		1.0	lb/1000gal		04-OCT-15	
Total N in Liquid Manure -as rec'd							
Total Nitrogen	17.0		1.0	lb/1000gal	02-OCT-15	02-OCT-15	R3281239

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DLM	Detection Limit Adjusted due to sample matrix effects.
HTD	Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
EC-WP	Water	Conductivity	APHA 2510B

Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.

ALS Test Code	Matrix	Test Description	Method Reference**
ETL-N-TOT-ANY-WP	Water	Total Nitrogen Calculated	Calculated
ETL-N-TOTORG-AGL-SK	Manure	Nitrogen, Total Organic	APHA 4500 Norg-Calculated as TKN - NH3-N
HG-200.2-CVAF-WP	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

ALS Test Code	Matrix	Test Description	Method Reference**
HG-T-CVAF-WP	Water	Mercury Total	EPA245.7 V2.0

Mercury in filtered and unfiltered waters is oxidized with Bromine monochloride and analyzed by cold-vapour atomic fluorescence spectrometry.

ALS Test Code	Matrix	Test Description	Method Reference**
MET-200.2-MS-WP	Soil	Metals	EPA 200.2/6020A

Samples for analysis are homogenized, dried at 60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve, and a representative subsample of the dry material is weighed. The sample is then digested by block digester (EPA 200.2). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may become "environmentally available." By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

ALS Test Code	Matrix	Test Description	Method Reference**
MET-T-MS-WP	Water	Total Metals by ICP-MS	APHA 3030E/EPA 6020A-T

This analysis involves preliminary sample treatment by hotblock acid digestion (APHA 3030E). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

ALS Test Code	Matrix	Test Description	Method Reference**
N-TOT-LECO-AGL-SK	Manure	Total N in Liquid Manure -as rec'd	RMMA A3769 3.3

The sample is introduced into a quartz tube where it undergoes combustion at 900 C in the presence of oxygen.
Combustion gases are first carried through a catalyst bed in the bottom of the combustion tube, where oxidation is completed and then carried through a reducing agent (copper), where the nitrogen oxides are reduced to elemental nitrogen.
This mixture of N_2, CO_2, and H_2O is then passed through an absorber column containing magnesium perchlorate to remove water. N_2 and CO_2 gases are then separated in a gas chromatographic column and detected by thermal conductivity.

Reference:
Reference: Wolf, A., Watson, M. and Nancy Wolf. 2005. In: John Peters(ed.) Recommended Methods for Manure Analysis. Method 3.3

ALS Test Code	Matrix	Test Description	Method Reference**
N-TOTKJ-COL-SK	Soil	Total Kjeldahl Nitrogen	CSSS (1993) 22.2.3

The soil is digested with sulfuric acid in the presence of $CuSO_4$ and K_2SO_4 catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.

ALS Test Code	Matrix	Test Description	Method Reference**
N2/N3-AVAIL-SK	Soil	Nitrate, Nitrite and Nitrate+Nitrite-N	APHA 4500 NO3F

Available Nitrate and Nitrite are extracted from the soil using a dilute calcium chloride solution. Nitrate plus Nitrite is quantitatively reduced to nitrite by passage of the sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. The resulting water soluble dye has a magenta color which is measured at colorimetrically at 520nm. Nitrite is determined on the same extract by following the same instrumental procedure without a cadmium column.
Reference: Recommended Methods of Soil Analysis for Canadian Prairie Agricultural Soils. Alberta Agriculture (1988) p. 19 and 28

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
NH3-COL-WP	Water	Ammonia by colour	APHA 4500 NH3 F

Ammonia in water samples forms indophenol when reacted with hypochlorite and phenol. The intensity is amplified by the addition of sodium nitroprusside and measured colourmetrically.

ALS Test Code	Matrix	Test Description	Method Reference**
NH4-AGL-SK	Manure	Ammonium - N in Liquid Manure - as rec'd	RMMA A3769 4.1

Ammonium is determined by steam distillation into boric acid followed by titration with standard acid.

Reference: Wolf, A., Watson, M. and Nancy Wolf. 2005. In: John Peters(ed.) Recommended Methods for Manure Analysis. Method 4.1

ALS Test Code	Matrix	Test Description	Method Reference**
NO2+NO3-CALC-WP	Water	Nitrate+Nitrite	CALCULATION
NO2-IC-N-WP	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
NO3-IC-N-WP	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
P-T-COL-WP	Water	Phosphorus, Total	APHA 4500 P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

ALS Test Code	Matrix	Test Description	Method Reference**
PH,EC-1:2-SK	Soil	pH and EC (1:2 Soil:Water Extraction)	CSSC 3.13/CSSS 18.3.1

1 part dry soil and 2 parts de-ionized water (by volume) is mixed. The slurry is allowed to stand with occasional stirring for 30 - 60 minutes. After equilibration, pH of the slurry is measured using a pH meter. Conductivity of the filtered extract is measured by a conductivity meter.

ALS Test Code	Matrix	Test Description	Method Reference**
PH-WP	Water	pH	APHA 4500H

The pH of a sample is the determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode.

ALS Test Code	Matrix	Test Description	Method Reference**
SOLIDS-TOT/TOTVOL-SK	Manure	Total Solids and Total Volatile Solids	APHA 2540G

A well-mixed sample is evaporated in a weighed dish and dried to constant weight in an oven at 103-105"C. The increase in weight over that of the empty dish represents the Total Solids. The crucible is then ignited at 550"–10"C for 1 hour. The remaining solids represent the Total Fixed Solids, while the weight lost on ignition represents the Total Volatile Solids.

ALS Test Code	Matrix	Test Description	Method Reference**
SOLIDS-TOTSUS-WP	Water	Total Suspended Solids	APHA 2540 D (modified)

Total suspended solids in aquesous matrices is determined gravimetrically after drying the residue at 103 105°C.

ALS Test Code	Matrix	Test Description	Method Reference**
TKN-F-CL	Water	Total Kjeldahl Nitrogen by Fluorescence	APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

CITY OF WINKLER
SLUDGE TESTING REQUIRMENTS
REFERENCE ALS COC 14-455314

L1678243-COFC

Sludge Testing Component

Component
Conductivity
pH
Total solids
Volatile solids
Nitrate nitrogen
Total Kjeldahl nitrogen
Ammonia Nitrogen
Total phosphorus
Total Lead
Total Mercury
Total Nickel
Total potassium
Total Cadmium
Total Copper
Total Zinc
Total Chromium
Total Arsenic
Metals to be tested after strong acid digestion

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1678243-COFC

COC Number: 14 - 455314

Page 1 of 1

Report To
Company: City of Winkler
Contact: Tim Wiebe
Address: 185 Main St Winkler MB
Phone: 204-325-9524

Report Format / Distribution
Select Report Format: [x] PDF [ ] EXCEL [ ] EDD (DIGITAL)
Quality Control (QC) Report with Report [ ] Yes [ ] No
[ ] Criteria on Report - provide details below if box checked
Select Distribution: [x] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax: TWiebe@cityofwinkler.ca
Email 2

Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
R [x] Regular (Standard TAT if received by 3pm)
P [ ] Priority (2-4 business days if received by 3pm)
E [ ] Emergency (1-2 business days if received by 3pm)
E2 [ ] Same day or weekend emergency if received by 10am – contact ALS for surcharge.
Specify Date Required for E2,E or P:

Invoice To
Same as Report To [x] Yes [ ] No
Copy of Invoice with Report [ ] Yes [ ] No
Company:
Contact:

Invoice Distribution
Select Invoice Distribution: [ ] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax
Email 2

Project Information
ALS Quote #:
Job #: C1505
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)
Approver ID:
Cost Center:
GL Account:
Routing Code:
Activity Code:
Location:

ALS Lab Work Order # (lab use only)
ALS Contact:
Sampler:

Analysis Request
Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

See Attached Test Sheet

Number of Containers

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type
	C3-01 → C3-05 Comp. Cell 3	Sept 23	9:00 am	Sludge
	C2-01 → C3-05 Comp. Cell 2	Sept 23	9:00 am	Sludge
	C4/5-01 Comp. Cell 4+5	Sept 23	9:00 am	Sludge

Drinking Water (DW) Samples[1] (client use)
Are samples taken from a Regulated DW System? [ ] Yes [x] No
Are samples for human drinking water use? [ ] Yes [x] No

Special Instructions / Specify Criteria to add on report (client Use)
Do Not send to MB Conservation

SAMPLE CONDITION AS RECEIVED (lab use only)
Frozen [ ] SIF Observations Yes [ ] No [ ]
Ice packs Yes [ ] No [ ] Custody seal intact Yes [ ] No [ ]
Cooling Initiated [ ]
INITIAL COOLER TEMPERATURES °C
FINAL COOLER TEMPERATURES °C

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: [signature]	Date: Sept 23	Time:	Received by: CB	Date: 09/24/15	Time: 8:00	Received by:	Date:	Time:

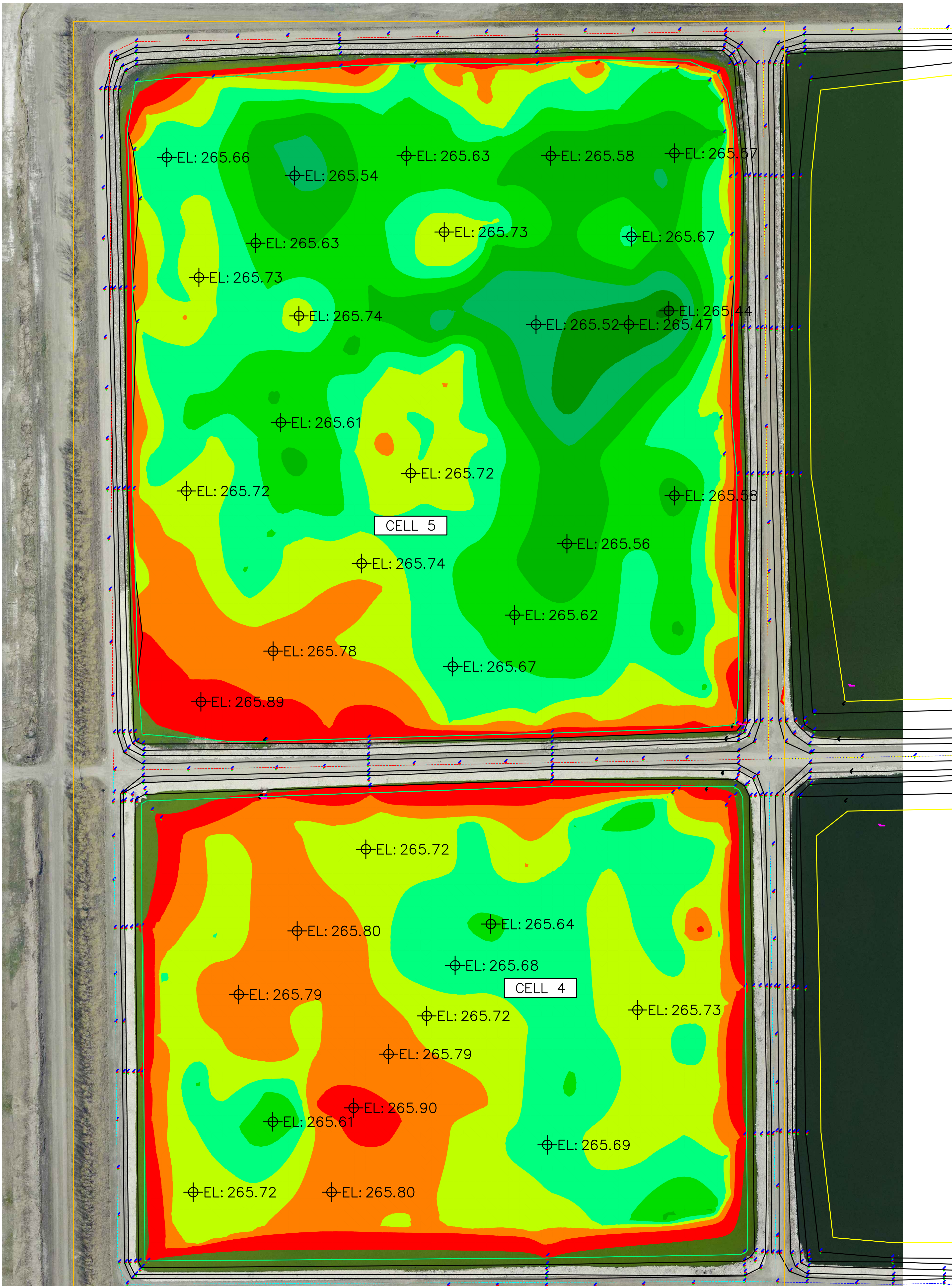
REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION
WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA FM-0326a v06 Front/03 October 2013

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

2°C



Elevations Table

Number	Minimum Elevation	Maximum Elevation	Color
1	265.40	265.45	
2	265.45	265.50	
3	265.50	265.55	
4	265.55	265.60	
5	265.60	265.65	
6	265.65	265.70	
7	265.70	265.75	
8	265.75	265.85	
9	265.85	266.10	

Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
s4	**1.000**	**1.000**	58012.76sq.m	4223.86 Cu. M.	349.58 Cu. M.	3874.28 Cu. M.<Cut>
s5	**1.000**	**1.000**	82812.71sq.m	1902.22 Cu. M.	4378.97 Cu. M.	2476.75 Cu. M.<Fill>
Totals			140825.48sq.m	6126.08 Cu. M.	4728.55 Cu. M.	1397.52 Cu. M.<Cut>

City of Winkler
ATTN: TIM WIEBE
185 Main Street
Winkler MB R6W 1B4

Date Received: 20-OCT-16
Report Date: 31-OCT-16 14:08 (MT)
Version: FINAL

Client Phone: 204-325-9524

Certificate of Analysis

Lab Work Order #: L1845996
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Hua Wo
Chemistry Laboratory Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1845996-1 BLACK LIQUID IN TROUT PAIL							
Sampled By: CLIENT							
Matrix:							
Miscellaneous Parameters							
Mercury (Hg)	0.252		0.010	mg/kg	26-OCT-16	27-OCT-16	R3582417
Total Solids and Total Volatile Solids							
Total Solids	37.4		0.10	%	28-OCT-16	28-OCT-16	R3582327
Total Volatile Solids (dry basis)	14.6		0.10	%	28-OCT-16	28-OCT-16	R3582327
pH and EC (1:2 Soil:Water Extraction)							
Conductivity (1:2)	2.27		0.050	dS m-1	29-OCT-16	29-OCT-16	R3582955
pH (1:2 soil:water)	7.91		0.10	pH	29-OCT-16	29-OCT-16	R3582955
Nitrate, Nitrite and Nitrate+Nitrite-N							
Nitrite-N	1.46	DLR	0.80	mg/kg	29-OCT-16	29-OCT-16	R3583059
Nitrate+Nitrite-N	17.6	DLR	2.0	mg/kg	29-OCT-16	29-OCT-16	R3583059
Nitrate-N	16.2	DLR	2.0	mg/kg	29-OCT-16	29-OCT-16	R3583059
Metals							
Aluminum (Al)	9290		5.0	mg/kg	26-OCT-16	26-OCT-16	R3580733
Antimony (Sb)	0.54		0.10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Arsenic (As)	11.0		0.10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Barium (Ba)	236		0.50	mg/kg	26-OCT-16	26-OCT-16	R3580733
Beryllium (Be)	0.37		0.10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Bismuth (Bi)	3.69		0.020	mg/kg	26-OCT-16	26-OCT-16	R3580733
Boron (B)	18		10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Cadmium (Cd)	0.842		0.020	mg/kg	26-OCT-16	26-OCT-16	R3580733
Calcium (Ca)	161000		100	mg/kg	26-OCT-16	26-OCT-16	R3580733
Chromium (Cr)	21.1		1.0	mg/kg	26-OCT-16	26-OCT-16	R3580733
Cobalt (Co)	4.24		0.020	mg/kg	26-OCT-16	26-OCT-16	R3580733
Copper (Cu)	94.2		1.0	mg/kg	26-OCT-16	26-OCT-16	R3580733
Iron (Fe)	12800		25	mg/kg	26-OCT-16	26-OCT-16	R3580733
Lead (Pb)	28.4		0.20	mg/kg	26-OCT-16	26-OCT-16	R3580733
Magnesium (Mg)	9720		10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Manganese (Mn)	570		0.50	mg/kg	26-OCT-16	26-OCT-16	R3580733
Molybdenum (Mo)	14.5		0.020	mg/kg	26-OCT-16	26-OCT-16	R3580733
Nickel (Ni)	15.0		0.50	mg/kg	26-OCT-16	26-OCT-16	R3580733
Phosphorus (P)	7680		100	mg/kg	26-OCT-16	26-OCT-16	R3580733
Potassium (K)	1750		25	mg/kg	26-OCT-16	26-OCT-16	R3580733
Selenium (Se)	5.67		0.50	mg/kg	26-OCT-16	26-OCT-16	R3580733
Silver (Ag)	15.4		0.10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Sodium (Na)	899		10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Strontium (Sr)	476		0.10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Thallium (Tl)	0.15		0.10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Tin (Sn)	11.4		5.0	mg/kg	26-OCT-16	26-OCT-16	R3580733
Titanium (Ti)	51.2		0.50	mg/kg	26-OCT-16	26-OCT-16	R3580733
Uranium (U)	36.7		0.020	mg/kg	26-OCT-16	26-OCT-16	R3580733
Vanadium (V)	27.3		0.50	mg/kg	26-OCT-16	26-OCT-16	R3580733
Zinc (Zn)	235		10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Total Organic Nitrogen - Soil							
Available Ammonium-N							
Available Ammonium-N	111	NSSM	12	mg/kg	28-OCT-16	28-OCT-16	R3583874
Note: Done as received and cacluated to dry							
Nitrogen, Total Organic - calculation							
Total Organic Nitrogen	0.520		0.020	%		31-OCT-16	
Total Kjeldahl Nitrogen							
Total Kjeldahl Nitrogen	0.53	DLHC	0.10	%	28-OCT-16	29-OCT-16	R3583034

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLR	Detection Limit Raised due to required dilution, limited sample amount, and/or high moisture content (soil samples)
NSSM	Non-standard sample matrix. Modified methods were used for sample processing and analysis.
NSSM	Non-standard sample matrix. Modified methods were used for sample processing and analysis.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ETL-N-TOTORG-CALC-SK	Soil	Nitrogen, Total Organic - calculation	APHA 4500 Norg-Calculated as TKN - NH3-N
HG-200.2-CVAF-WP	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

MET-200.2-MS-WP	Soil	Metals	EPA 200.2/6020A

Samples for analysis are homogenized, dried at 60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve, and a representative subsample of the dry material is weighed. The sample is then digested by block digester (EPA 200.2). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may become "environmentally available." By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

N-TOTKJ-COL-SK	Soil	Total Kjeldahl Nitrogen	CSSS (2008) 22.2.3

The soil is digested with sulfuric acid in the presence of CuSO4 and K2SO4 catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.

N2/N3-AVAIL-SK	Soil	Nitrate, Nitrite and Nitrate+Nitrite-N	APHA 4500 NO3F

Available Nitrate and Nitrite are extracted from the soil using a dilute calcium chloride solution. Nitrate plus Nitrite is quantitatively reduced to nitrite by passage of the sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. The resulting water soluble dye has a magenta color which is measured at colorimetrically at 520nm. Nitrite is determined on the same extract by following the same instrumental procedure without a cadmium column.
Reference: Recommended Methods of Soil Analysis for Canadian Prairie Agricultural Soils. Alberta Agriculture (1988) p. 19 and 28

NH4-AVAIL-SK	Soil	Available Ammonium-N	CSSS(1993) 4.2/COMM SOIL SCI 19(6)

Ammonium (NH4-N) is extracted from the soil using 2 N KCl. Ammonium in the extract is mixed with hypochlorite and salicylate to form indophenol blue, which is determined colorimetrically by auto analysis at 660 nm.

PH,EC-1:2-SK	Soil	pH and EC (1:2 Soil:Water Extraction)	AB Ag (1988) p.7

1 part dry soil and 2 parts de-ionized water (by volume) is mixed. The slurry is allowed to stand with occasional stirring for 30 - 60 minutes. After equilibration, pH of the slurry is measured using a pH meter. Conductivity of the filtered extract is measured by a conductivity meter.

SOLIDS-TOT/TOTVOL-SK	Manure	Total Solids and Total Volatile Solids	APHA 2540G

A well-mixed sample is evaporated in a weighed dish and dried to constant weight in an oven at 103-105”C. The increase in weight over that of the empty dish represents the Total Solids. The crucible is then ignited at 550”–10”C for 1 hour. The remaining solids represent the Total Fixed Solids, while the weight lost on ignition represents the Total Volatile Solids.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

GREYHOUND CDA TRANS CORP

GST NO. 891646655RT1 WAYBILL NO. 51777109834

WINNIPEG MB PREPAID CHARGE	PIECE NUMBER 1 TOTAL PIECES 1
RECIPIENT 400648 A L S LABORATORY GROUP UNIT 12, 1329 NIAKWA RD E WINNIPEG MB R2J3T4 204-255-9720	19Oct16 5:19 PM CDT Billing Weight 17.0 lb Declared Value 100
SHIPPER 427872 CITY OF WINKLER 185 MAIN ST WINKLER MB R6W1B4 204-325-9524	EXPRESS $15.41 FUEL S/C $1.00 TAXES $0.82 TOTAL $17.23
PO/Ref #:	

DOOR TO DOOR

LABEL / LOT SHIPMENT

05051777109834

COC #:

Proj #:

Work Order #:

L1845996-COFC

Please note the following observations that prevent your s... ALS is attempting to contact you for furthe... If our attempts fail, please contact us as soon as possible to ensure your analytical needs are met.

	Observation	Details
	Temperature < freezing point	actual temp, breakdown by cooler:
	Temperature ≥ 10 Celsius	actual temp, breakdown by cooler:
	Containers broken in transit	details:
	Sample integrity compromised	details:
	Regulatory non-compliance	details:
	No COC with shipment	details:
	Discrepancy between COC and label	details:
	COC incomplete or unclear	details:
	Container incompatible with test	details:
	Volume is insufficient for test	details:
	Preservation incompatible with test	details:
	No preservation	details:
	Other observation	details:

Additional information (list all affected sample portions):

No COC, one pail containing about 1/4 of the pail (Black liquid enclosed).

16 Oct
8:00-

AECOM

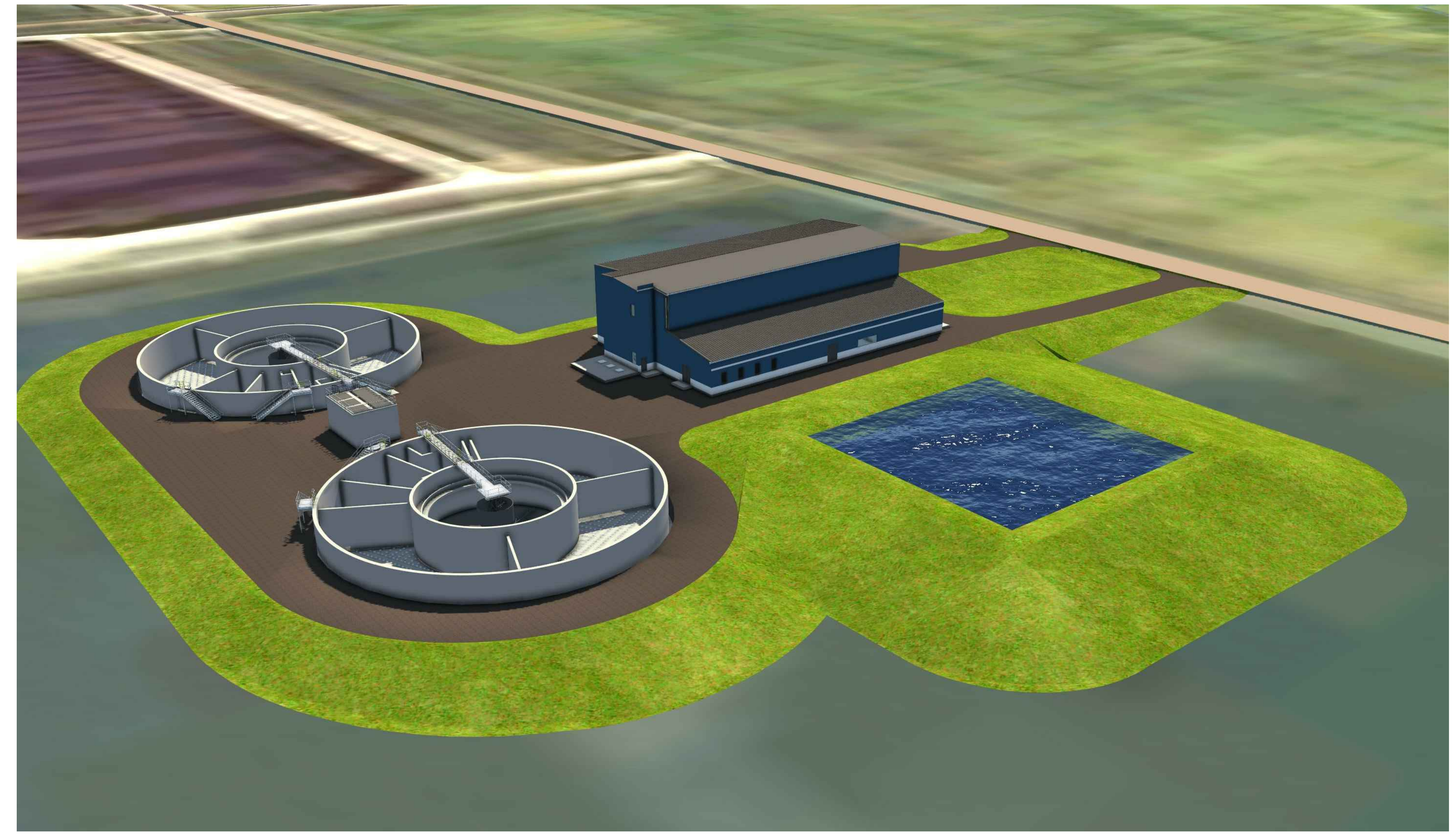
Appendix B

Functional Design Drawings

CITY OF WINKLER
Wastewater Treatment Upgrade Project

FUNCTIONAL DESIGN

60430450



DRAWING NUMBERING CONVENTION

00 - G 000

PROCESS AREA

00	GENERAL & SITEWORKS
05	DIAGRAMS & SCHEMATICS
10	SEPTAGE RECEIVING STRUCTURE
15	EQUALIZATION STRUCTURE
20	HEADWORKS BUILDING
40	SPLITTER CHAMBER
41	SECONDARY TREATMENT UNIT 1
42	SECONDARY TREATMENT UNIT 2
45	SCUM SUMP STRUCTURE
60	AEROBIC DIGESTER 1
61	AEROBIC DIGESTER 2

DISCIPLINE

G	GENERAL
F	GEOTECHNICAL
C	CIVIL
B	BUILDING
S	STRUCTURAL
N	PROCESS & INSTRUMENTATION DIAGRAMS
D	PROCESS MECHANICAL
M	PLUMBING & HVAC
E	ELECTRICAL

DRAWING NUMBER

000	SCHEDULES, LEGENDS, SCHEMATICS
100	PLANS
200	ELEVATIONS
300	SECTIONS
400	DETAILS
500	STANDARD DETAILS

DRAWING INDEX

ANSI D 864mm x 559mm

Approved: ____ Checked: ____ Designer: ____ Project Management Initials:

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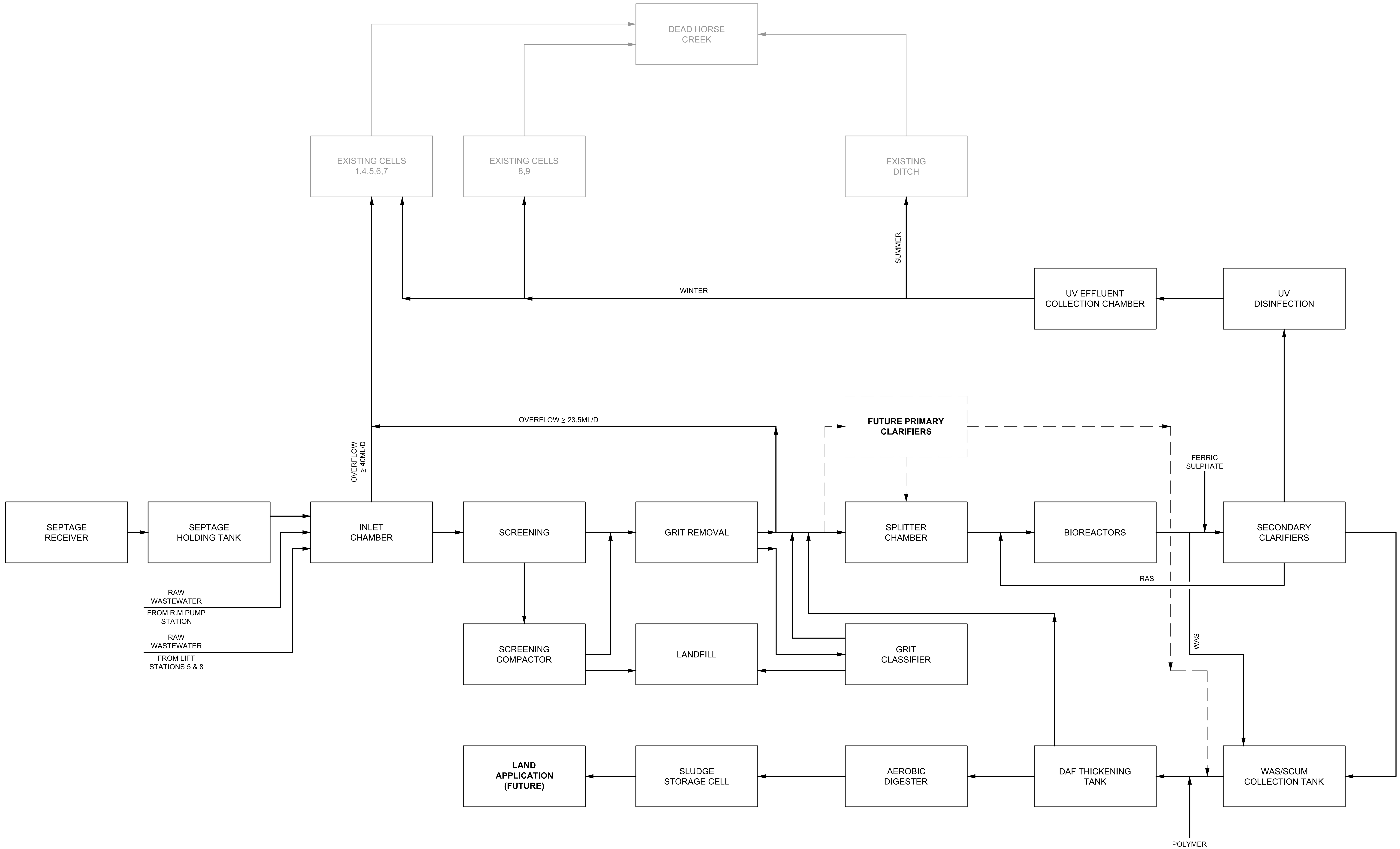

AECOM

PROJECT

WASTEWATER TREATMENT PLANT UPGRADE PROJECT

CLIENT

City of Winkler
185 Main Street
Winkler, Manitoba
R6W 1B4

CONSULTANT

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Date: 2016-11-07

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	2016.11.17	FUNCTIONAL DESIGN

PROJECT NUMBER

60430450

SHEET TITLE

GENERAL & SITEWORKS
GENERAL
PROCESS BLOCK
FLOW DIAGRAM

SHEET NUMBER

00-G002

Project Management Initials: Designer: ___ Checked: ___ Approved: ___ ANSI D 864mm x 559mm

Last saved by: ELLIOTTS1(2016-11-17) Last Plotted: 2016-11-17
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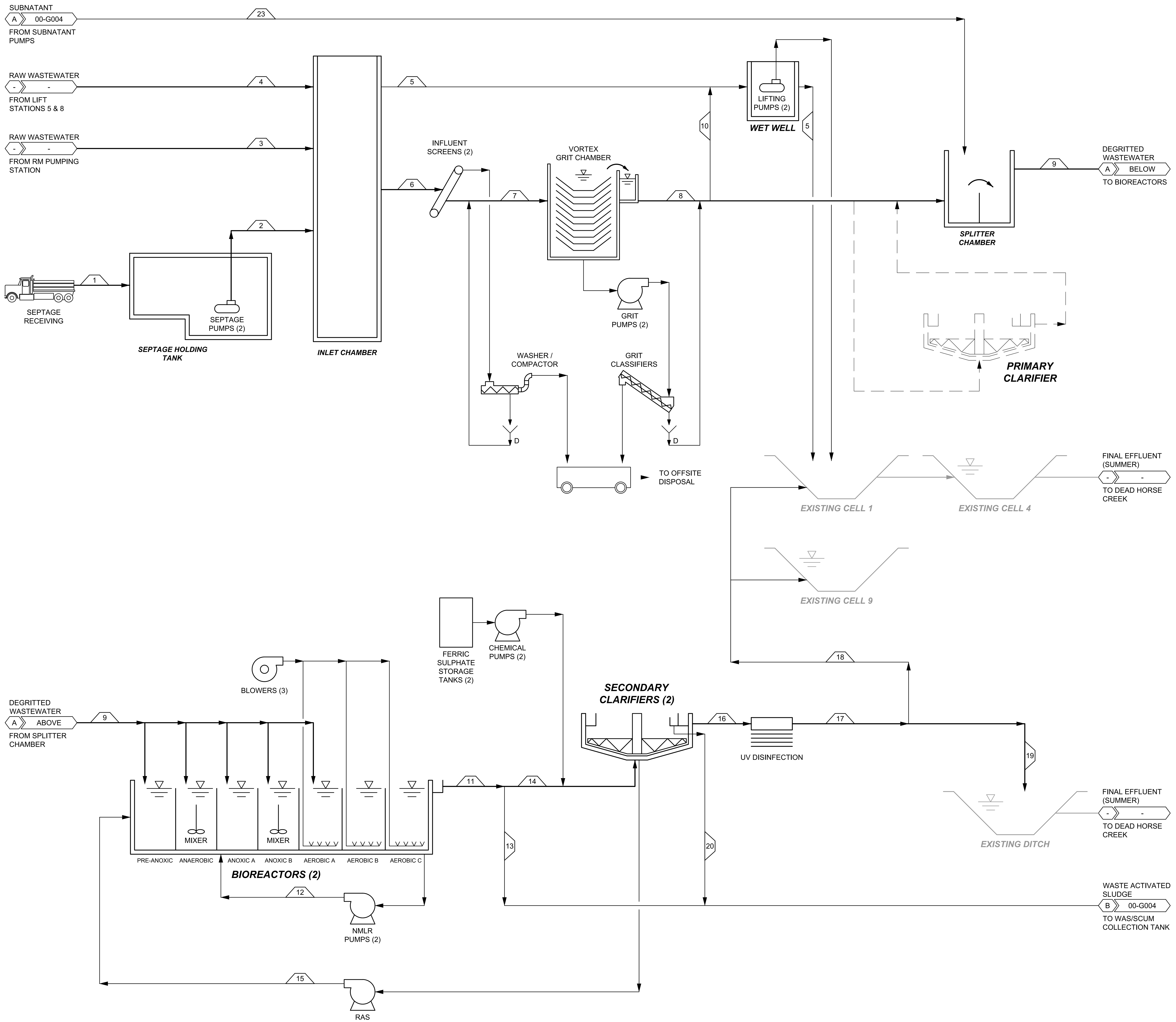

FLOW CALCULATIONS

#	COMMODITY	AVERAGE FLOW (MLD)	PEAK FLOW (MLD)
1	HAULED SEPTAGE	0.020	0.480
2	HAULED SEPTAGE	0.020	0.085
3	RAW WASTEWATER (FROM RM)	2.040	7.400
4	RAW WASTEWATER (FROM LS 5 & 8)	7.415	53.100
5	EMERGENCY OVERFLOW	0.000	60.000
6	RAW WASTEWATER	9.460	40.000
7	SCREENED WASTEWATER	9.460	40.000
8	DEGRITTED WASTEWATER	9.460	40.000
9	DEGRITTED WASTEWATER	9.460	23.640
10	BYPASS/OVERFLOW	0.000	40.000
11	MIXED LIQUOR	9.460	23.640
12	NITRIFIED MIXED LIQUOR RECYCLE	9.460	13.240
13	WASTE ACTIVATED SLUDGE	0.780	1.560
14	MIXED LIQUOR	8.680	23.640
15	RETURN ACTIVATED SLUDGE	5.676	23.640
16	SECONDARY EFFLUENT	8.680	23.640
17	DISINFECTED FINAL EFFLUENT	8.680	23.640
18	FINAL EFFLUENT (WINTER)	8.680	23.640
19	FINAL EFFLUENT (SUMMER)	8.680	23.640
20	SECONDARY SCUM	NEGLIGIBLE	

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I/R	DATE	DESCRIPTION
A	2016.11.04	FUNCTIONAL DESIGN

PROJECT NUMBER

60430450

SHEET TITLE

GENERAL & SITEWORKS
GENERAL
PROCESS FLOW DIAGRAM
LIQUID STREAM

SHEET NUMBER

00-G003

ANSI D 864mm x 559mm
Approved: ____ Checked: ____ Designer: ____ Project Management Initials:
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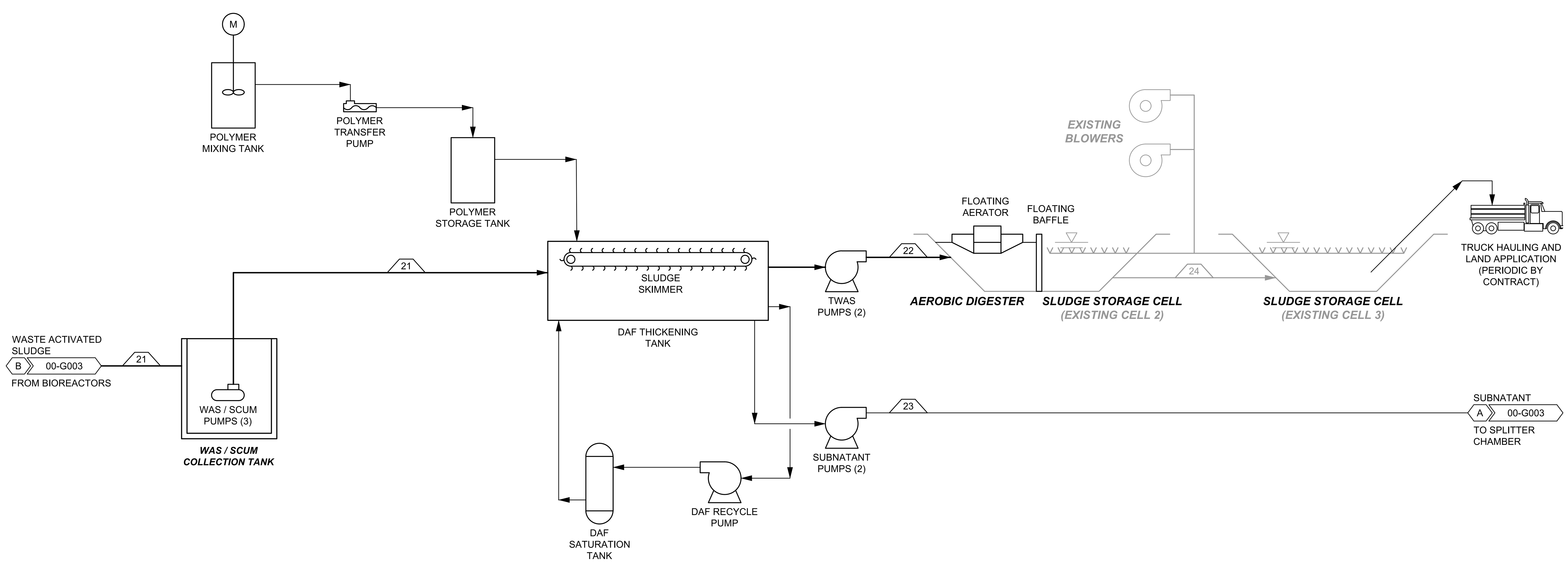
FLOW CALCULATIONS

#	COMMODITY	AVERAGE FLOW (MLD)	PEAK FLOW (MLD)
21	WASTE ACTIVATED SLUDGE	0.780	1.560
22	THICKENED WASTE ACTIVATED SLUDGE	0.082	0.326
23	SUBNATANT	0.696	2.782
24	DIGESTED SLUDGE	0.082	0.326



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PROJECT NUMBER

60430450

SHEET TITLE

GENERAL & SITEWORKS
GENERAL
PROCESS FLOW DIAGRAM
SOLID STREAM

SHEET NUMBER

00-G004

Project Management Initials: Designer: Checked: Approved: ANSI D 864mm x 559mm

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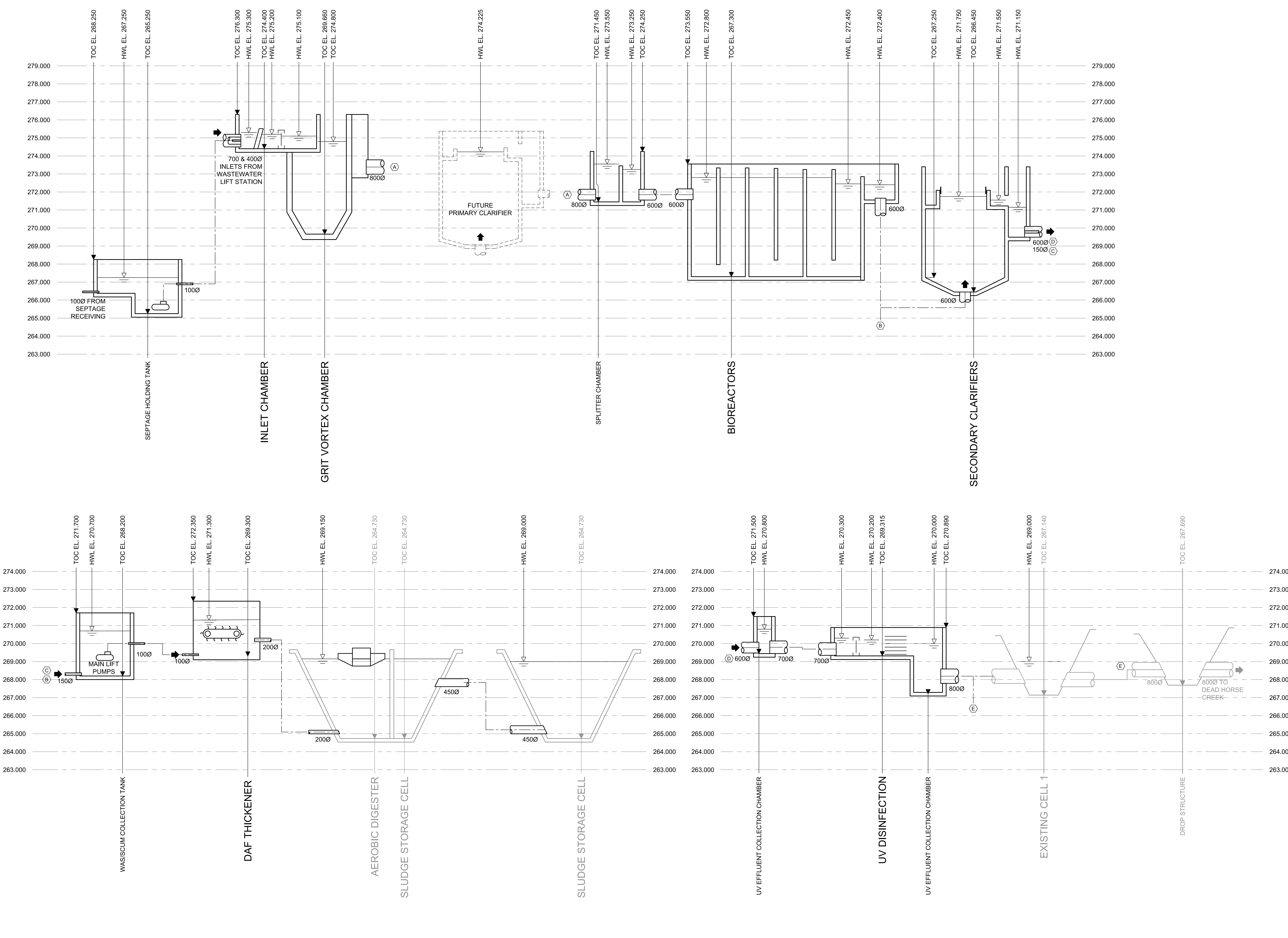

ANSI D 864mm x 559mm

Approved: CGL Checked: KNW Designer: CGL Project Management Initials:

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I/R	DATE	DESCRIPTION

PROJECT NUMBER

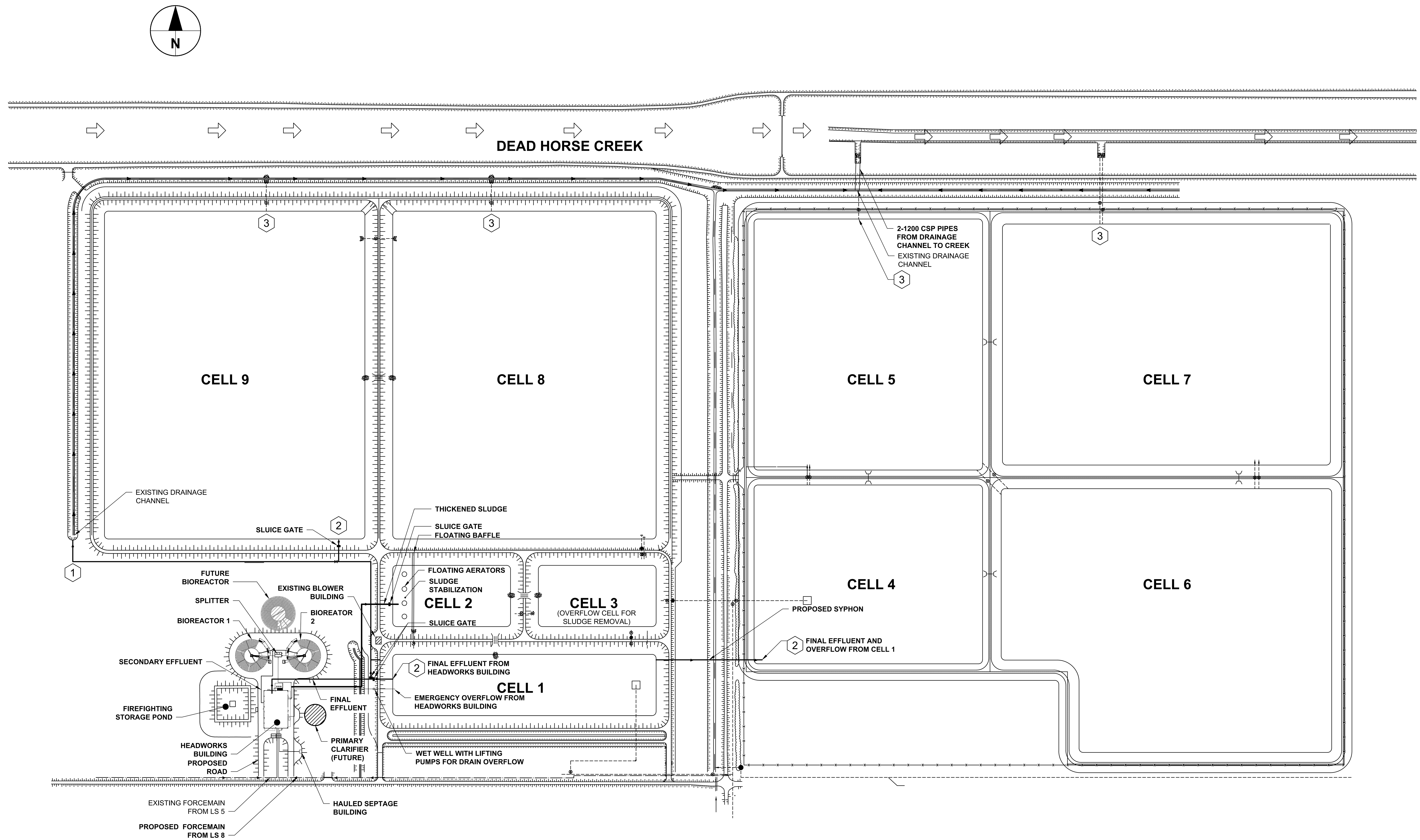
60430450

SHEET TITLE

GENERAL & SITEWORKS
GENERAL
HYDRAULIC PROFILE

SHEET NUMBER

00-G005



OVERALL SITE PLAN

Scale 1:2500

LEGEND

1. SUMMER DISCHARGE
2. WINTER DISCHARGE
3. SPRING DISCHARGE

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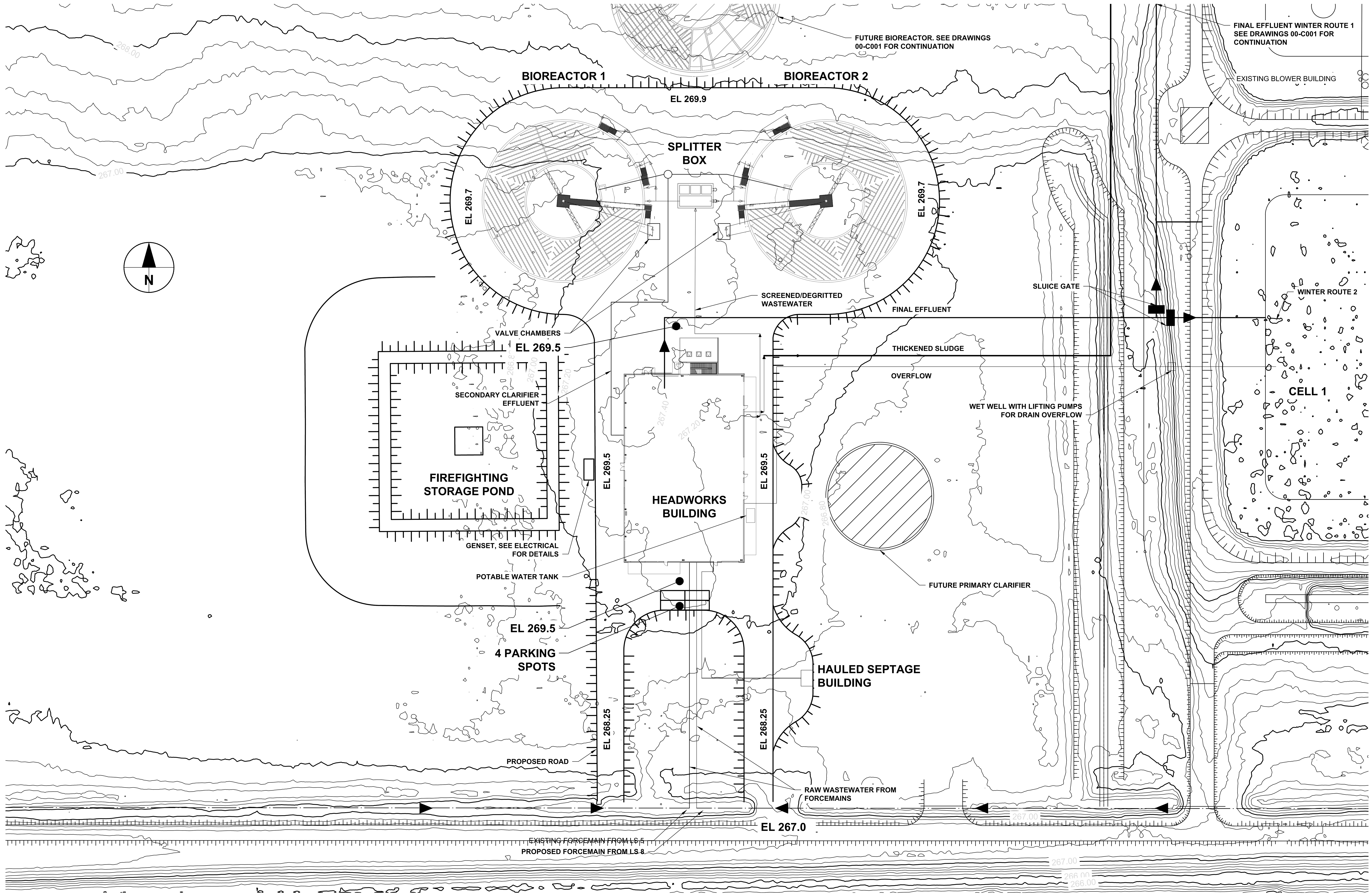
SHEET TITLE

GENERAL & SITEWORKS
CIVIL
OVERALL SITE PLAN

SHEET NUMBER

00-C001



OVERALL SITE PLAN

Scale 1:2500

Project Management Initials: Designer: Checked: Approved: ANSI D 864mm x 559mm

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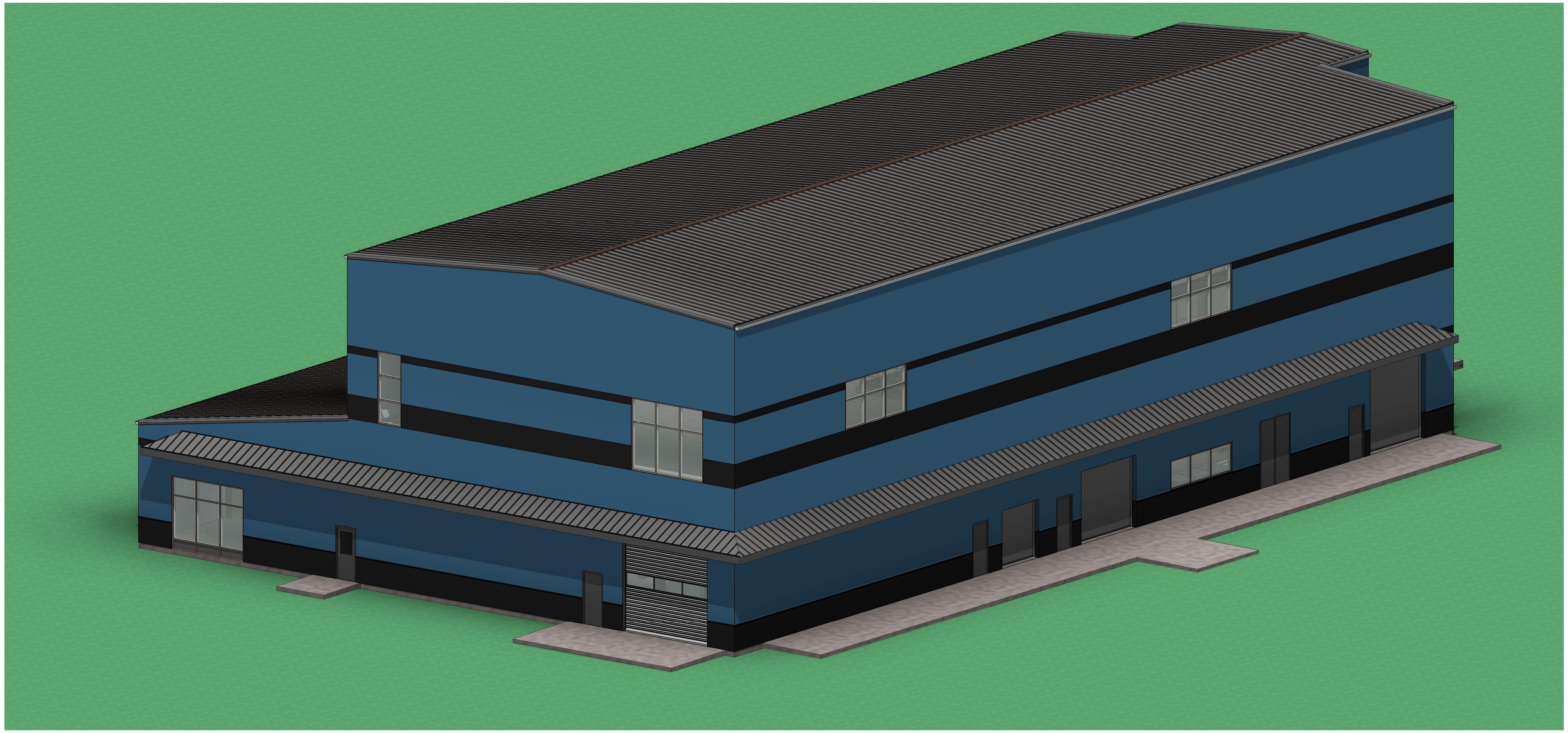
60430450

SHEET TITLE

GENERAL & SITEWORKS
CIVIL
ENLARGED PROPOSED
SITE LAYOUT

SHEET NUMBER

00-C002



1 | 3D VEW
20-S100 SCALE:

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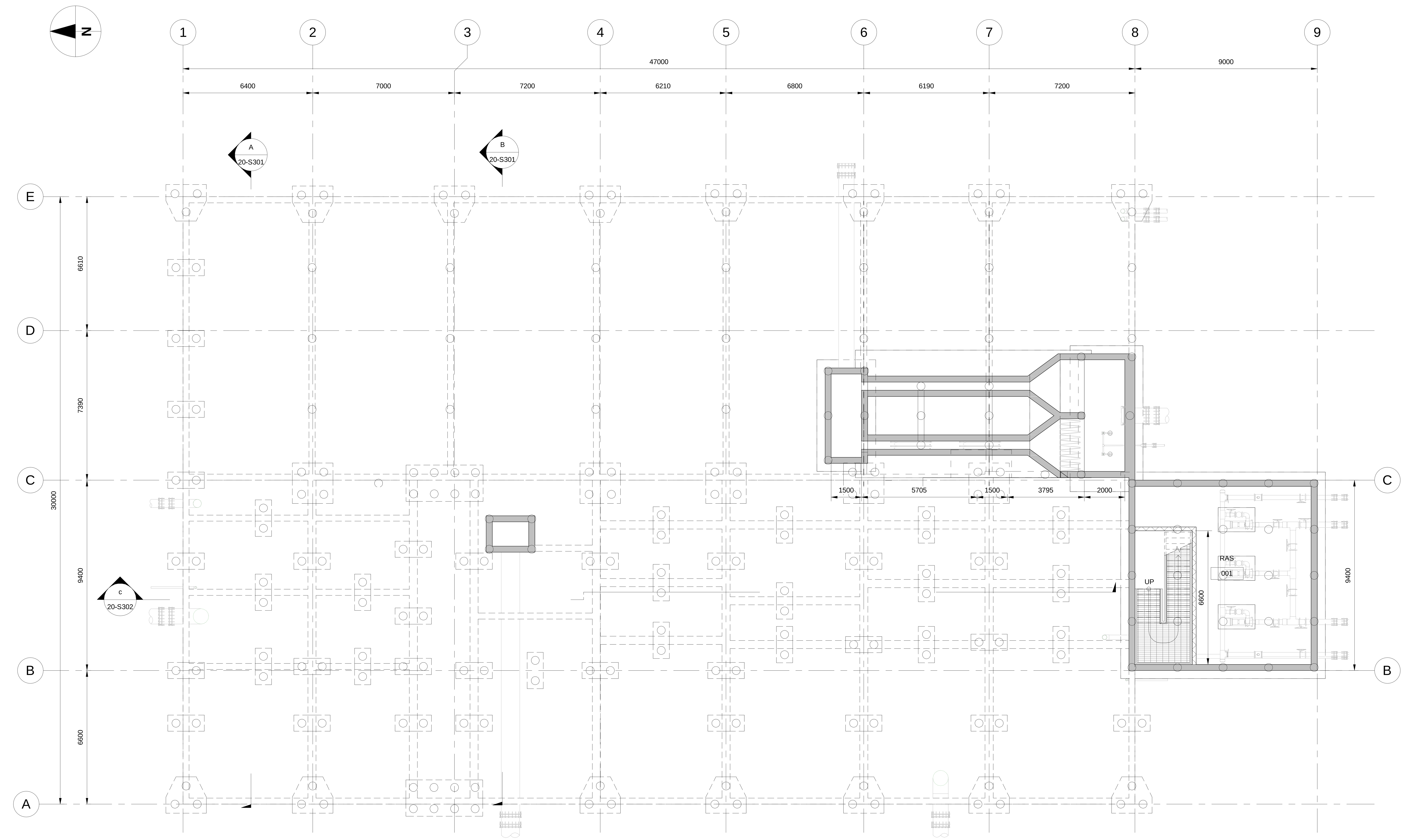
PROJECT NUMBER
60430450

SHEET TITLE
HEADWORKS BUILDING
STRUCTURAL
3D VIEW

SHEET NUMBER
20-S100



1 LOWER LEVEL
20-S101 REF: 20-S302 SCALE: 1 : 100

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PROJECT NUMBER

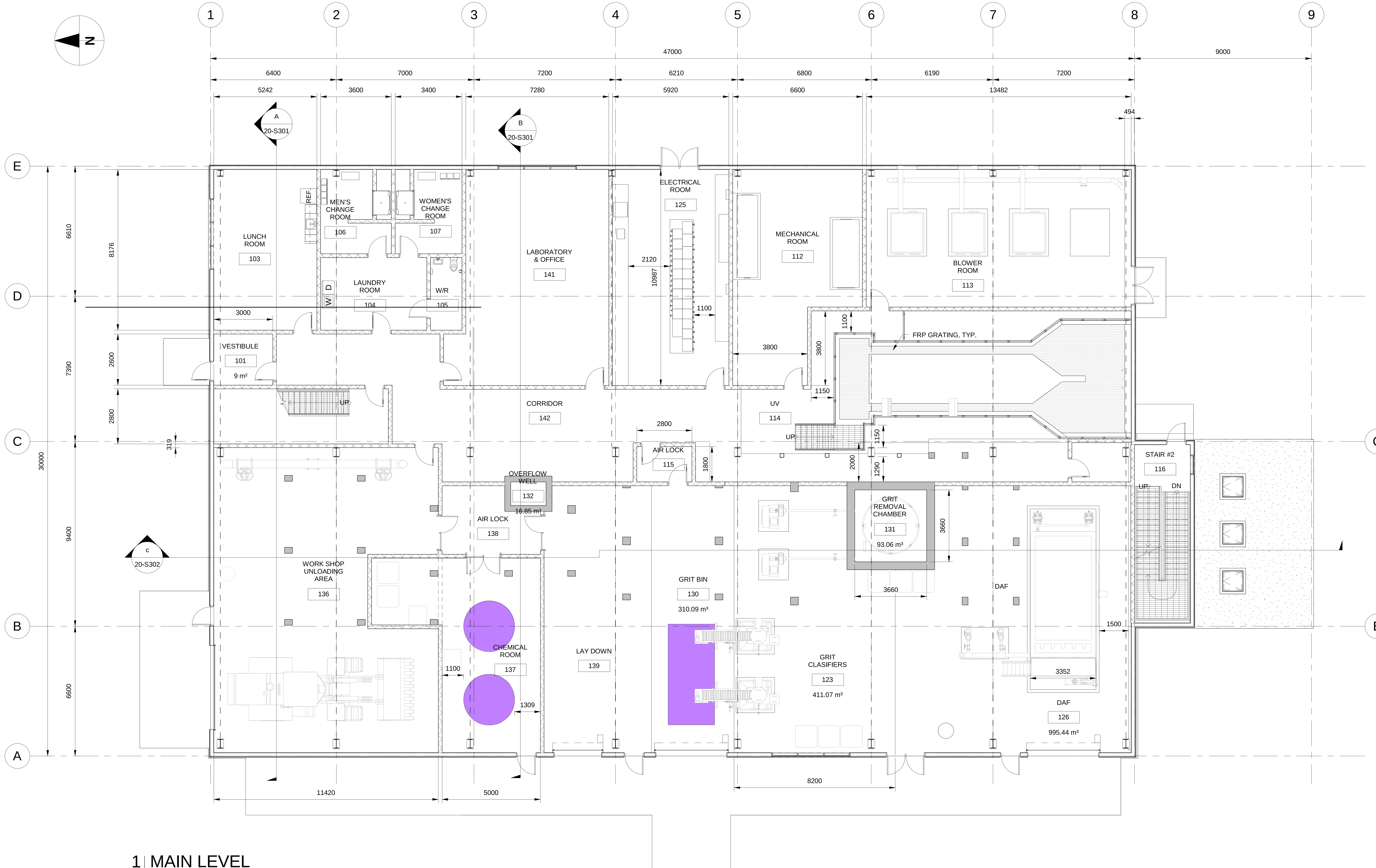
60430450

SHEET TITLE

HEADWORKS BUILDING
STRUCTURAL
LOWER LEVEL PLAN

SHEET NUMBER

20-S101



1 MAIN LEVEL

20-S102 REF: 20-S201 SCALE: 1 : 100

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PROJECT NUMBER

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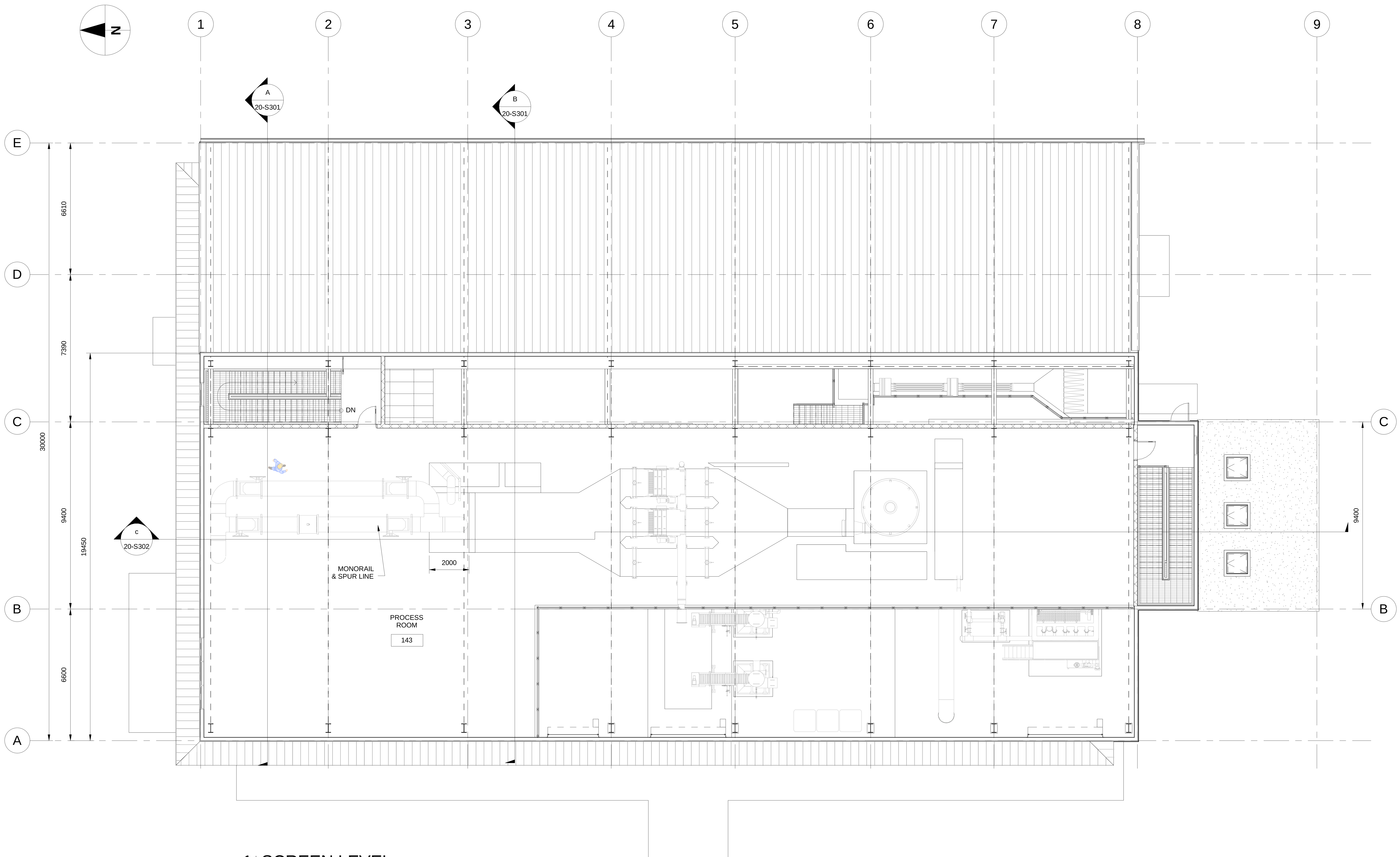
SHEET TITLE

HEADWORKS BUILDING
STRUCTURAL
MAIN LEVEL PLAN

SHEET NUMBER

20-S102



1 SCREEN LEVEL
20-S103 REF: 20-S301 SCALE: 1 : 100

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60430450

SHEET TITLE

HEADWORKS BUILDING
STRUCTURAL
SECOND LEVEL PLAN

SHEET NUMBER

20-S103

Project Management Initials: Designer: Designer Checked: Checker Approved: Approver ANSI D 559mm x 864mm
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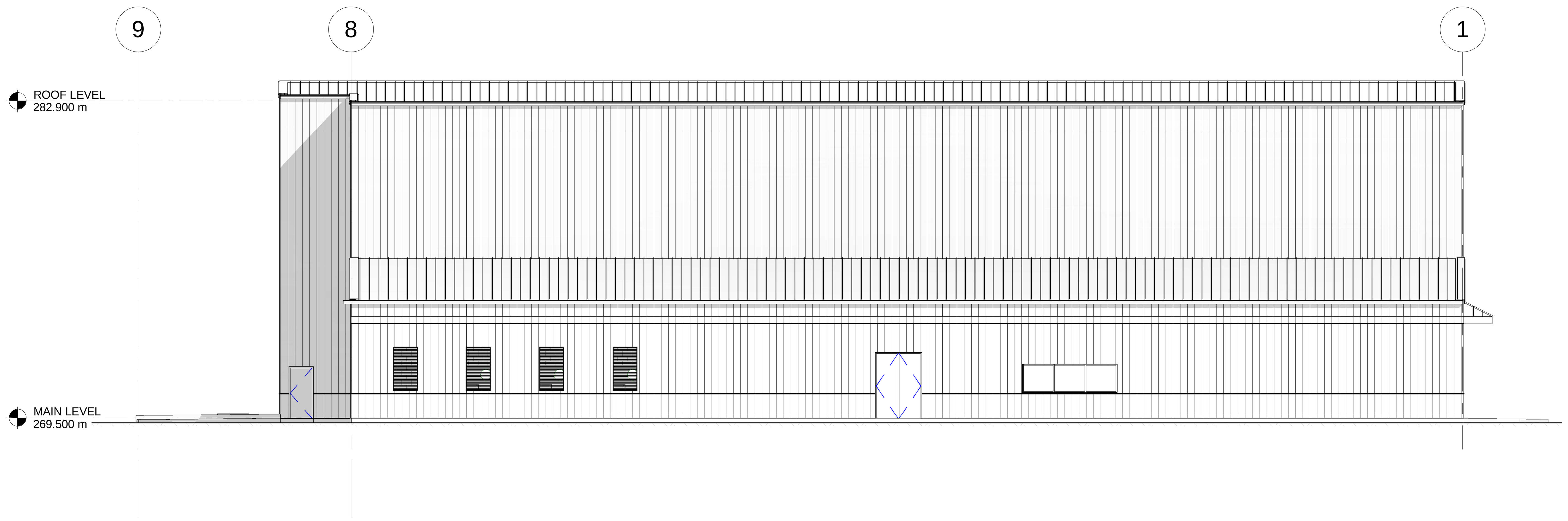
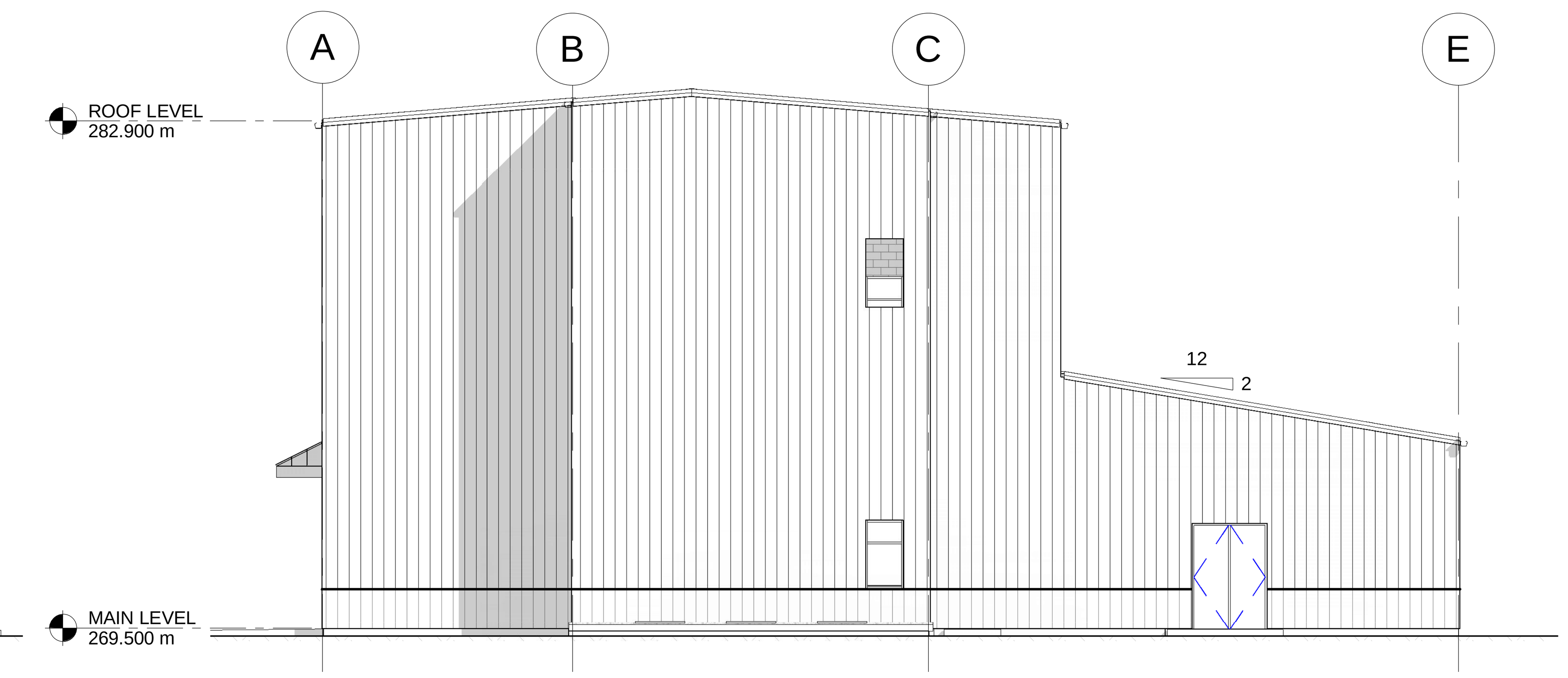
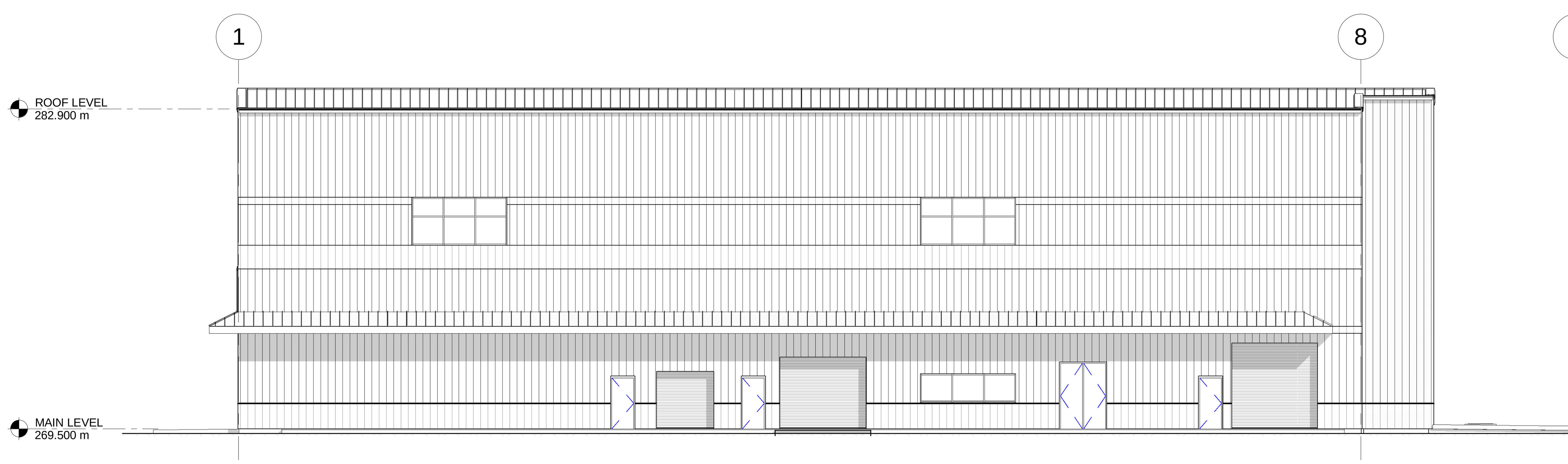


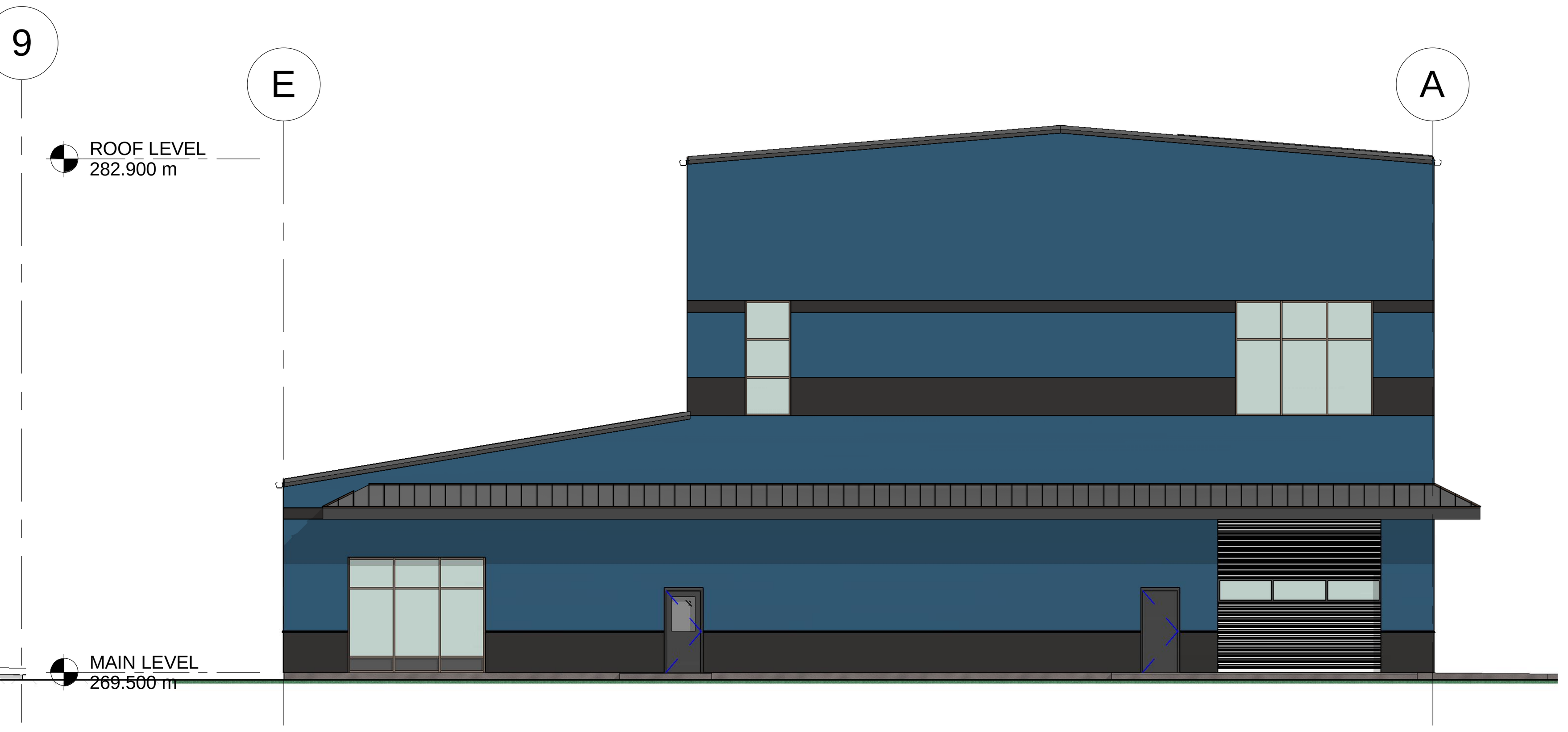
1 | NORTH ELEVATION
20-S201 SCALE: 1 : 150



2 | EAST ELEVATION
20-S201 SCALE: 1 : 150



3 | SOUTH ELEVATION
20-S201 SCALE: 1 : 150



4 | WEST ELEVATION
20-S201 SCALE: 1 : 150

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	2016.11.04	FUNCTIONAL DESIGN

PROJECT NUMBER

60430450

SHEET TITLE

HEADWORKS BUILDING STRUCTURAL ELEVATIONS

SHEET NUMBER

20-S201

Project Management Initials: Designer: Designer Checked: Checker Approved: Approver ANSI D 559mm x 864mm

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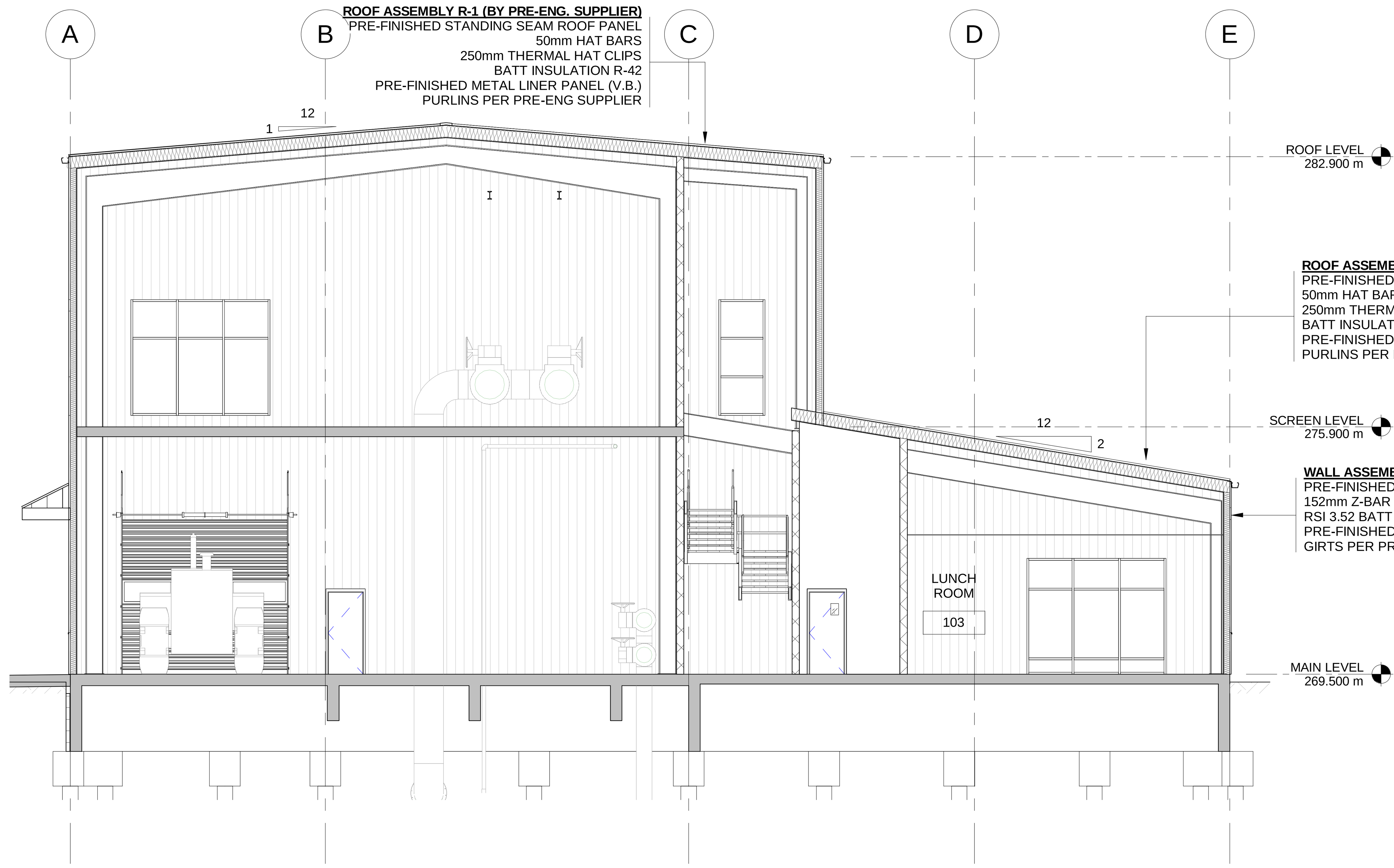
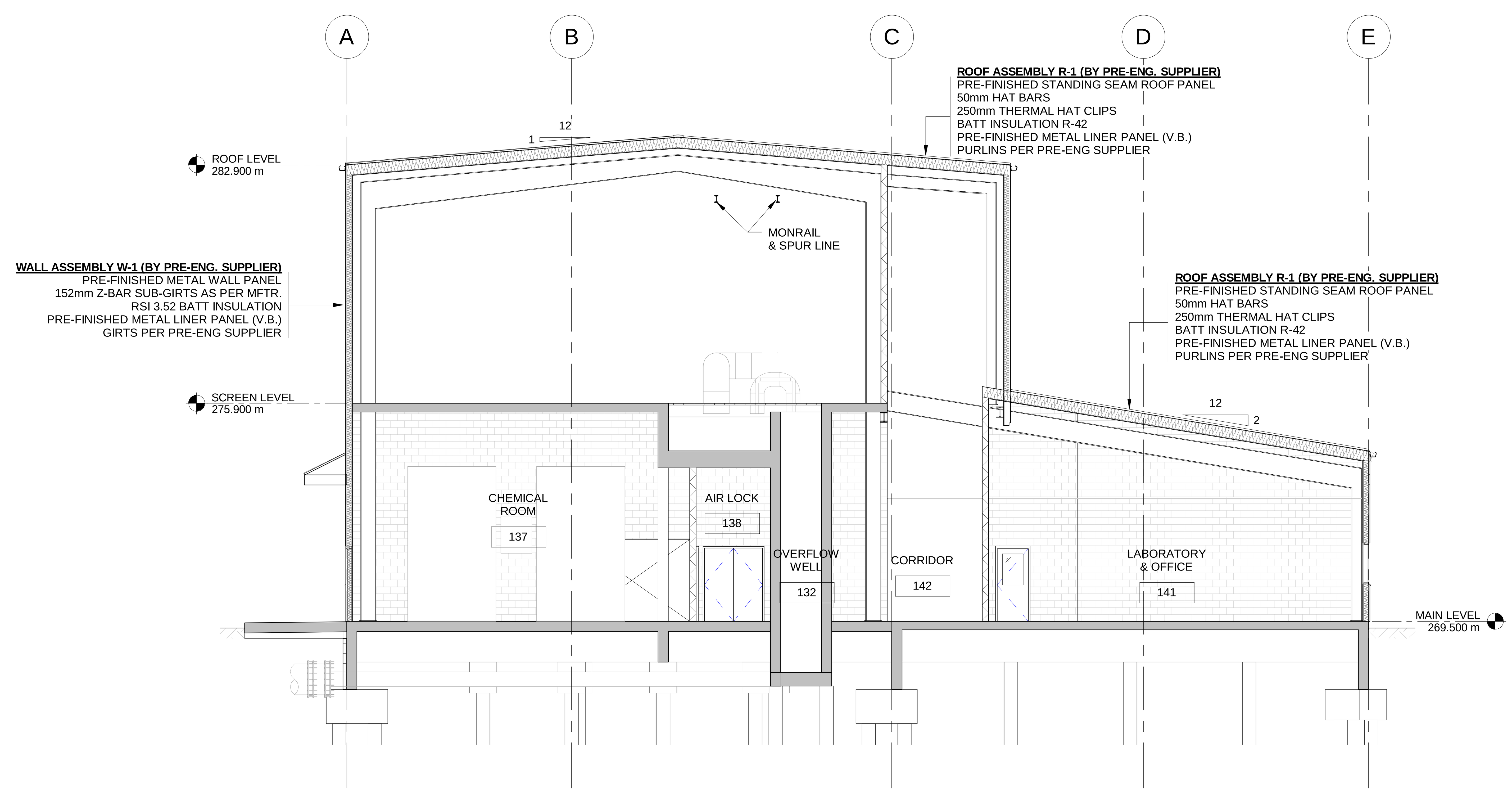


A SECTION
20-S301 REF: 20-S101 SCALE: 1 : 100



B SECTION
20-S301 REF: 20-S101 SCALE: 1 : 100

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PROJECT NUMBER

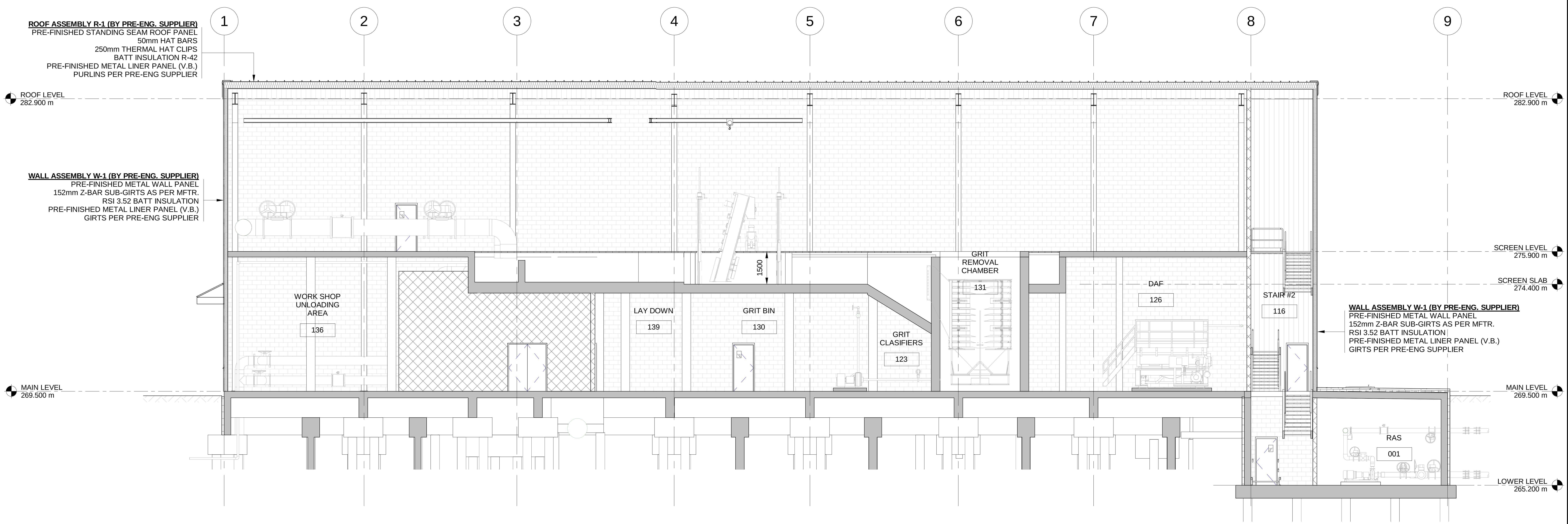
60430450

SHEET TITLE

HEADWORKS BUILDING STRUCTURAL SECTIONS

SHEET NUMBER

20-S301



c SECTION

20-S302 REF: 20-S101 SCALE: 1 : 100

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PROJECT NUMBER

60430450

SHEET TITLE

HEADWORKS BUILDING STRUCTURAL SECTIONS

SHEET NUMBER

20-S302

Project Management Initials: Designer: Designer Checked: Checker Approved: Approver ANSI D 559mm x 864mm

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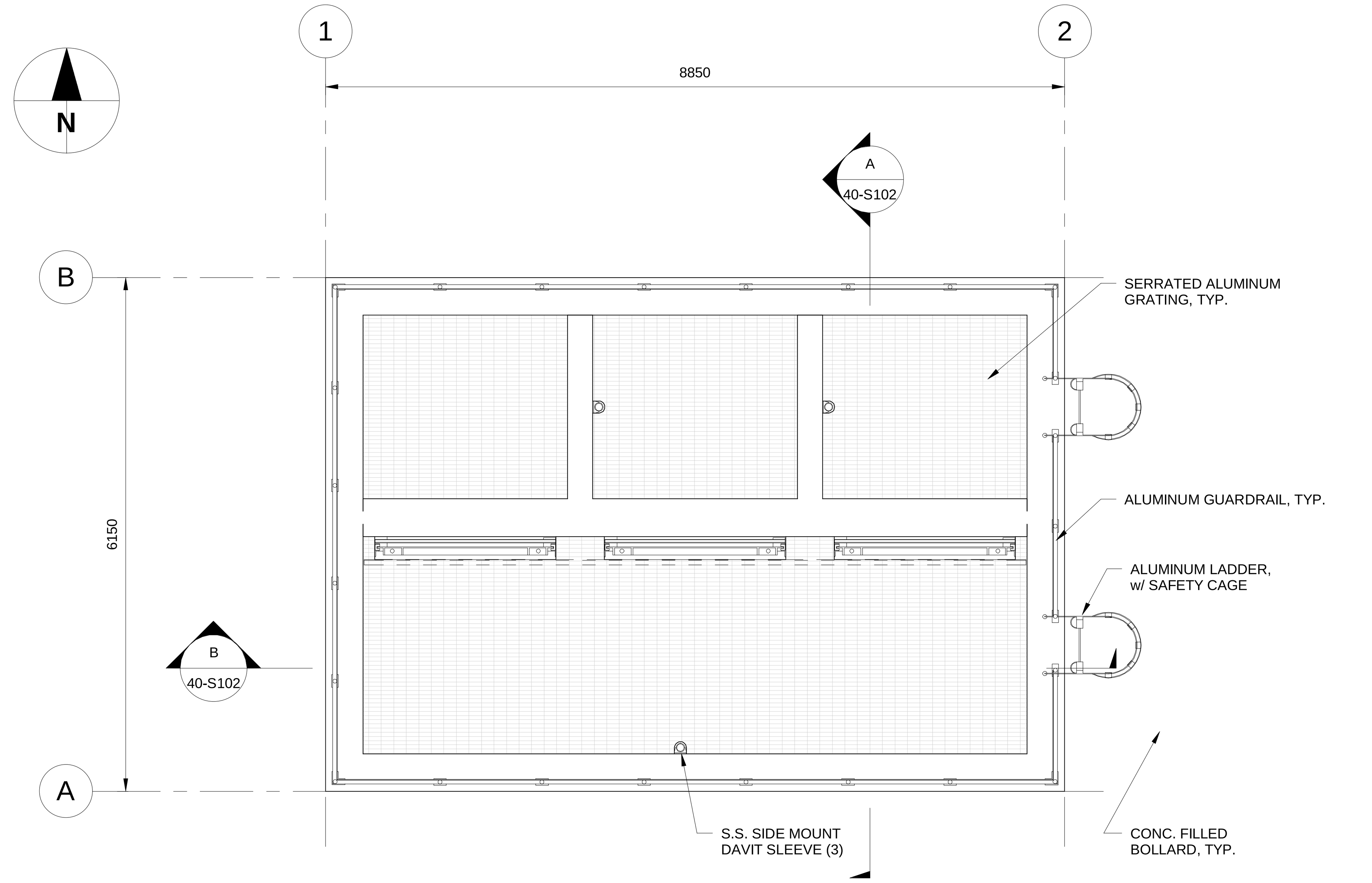
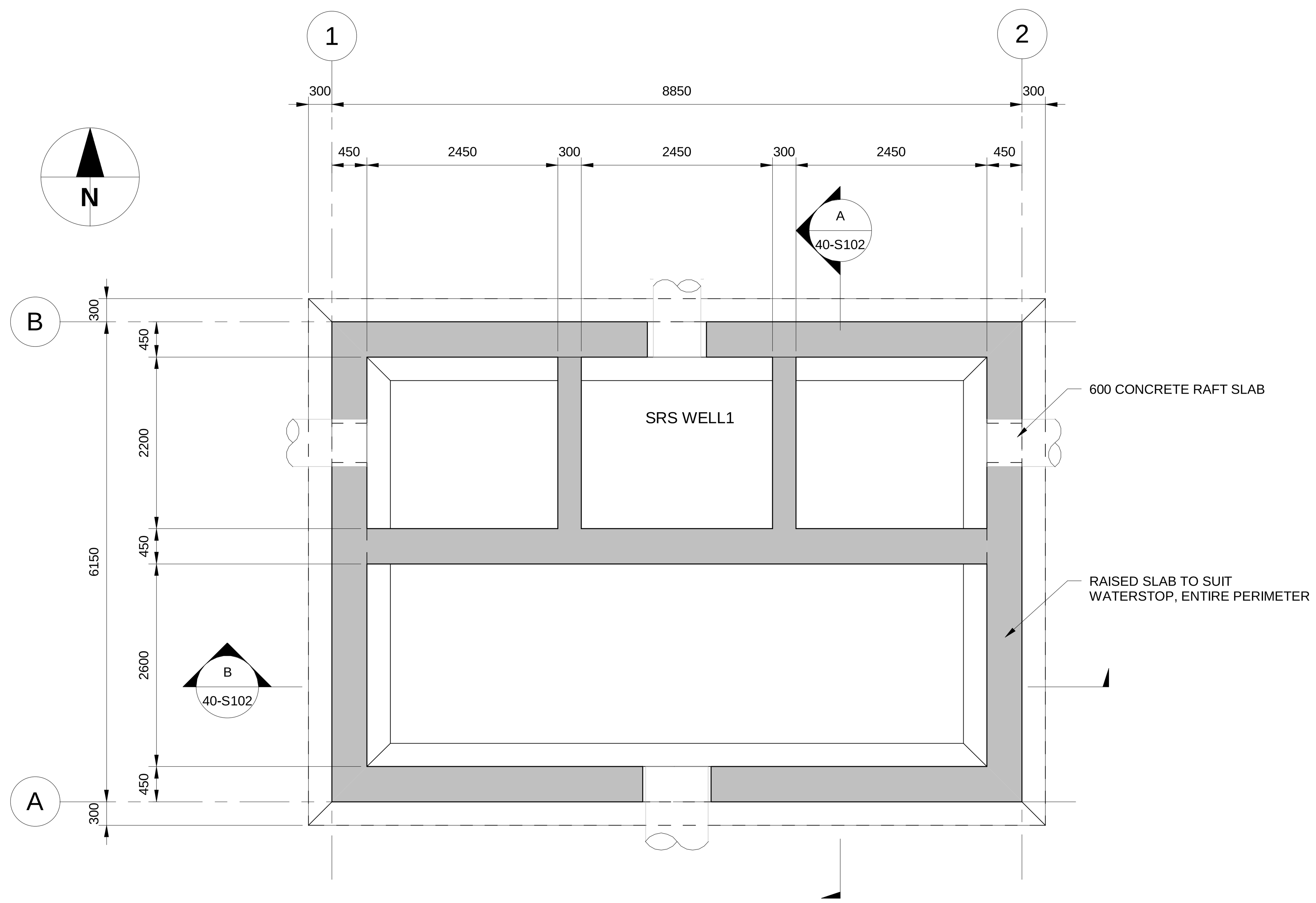


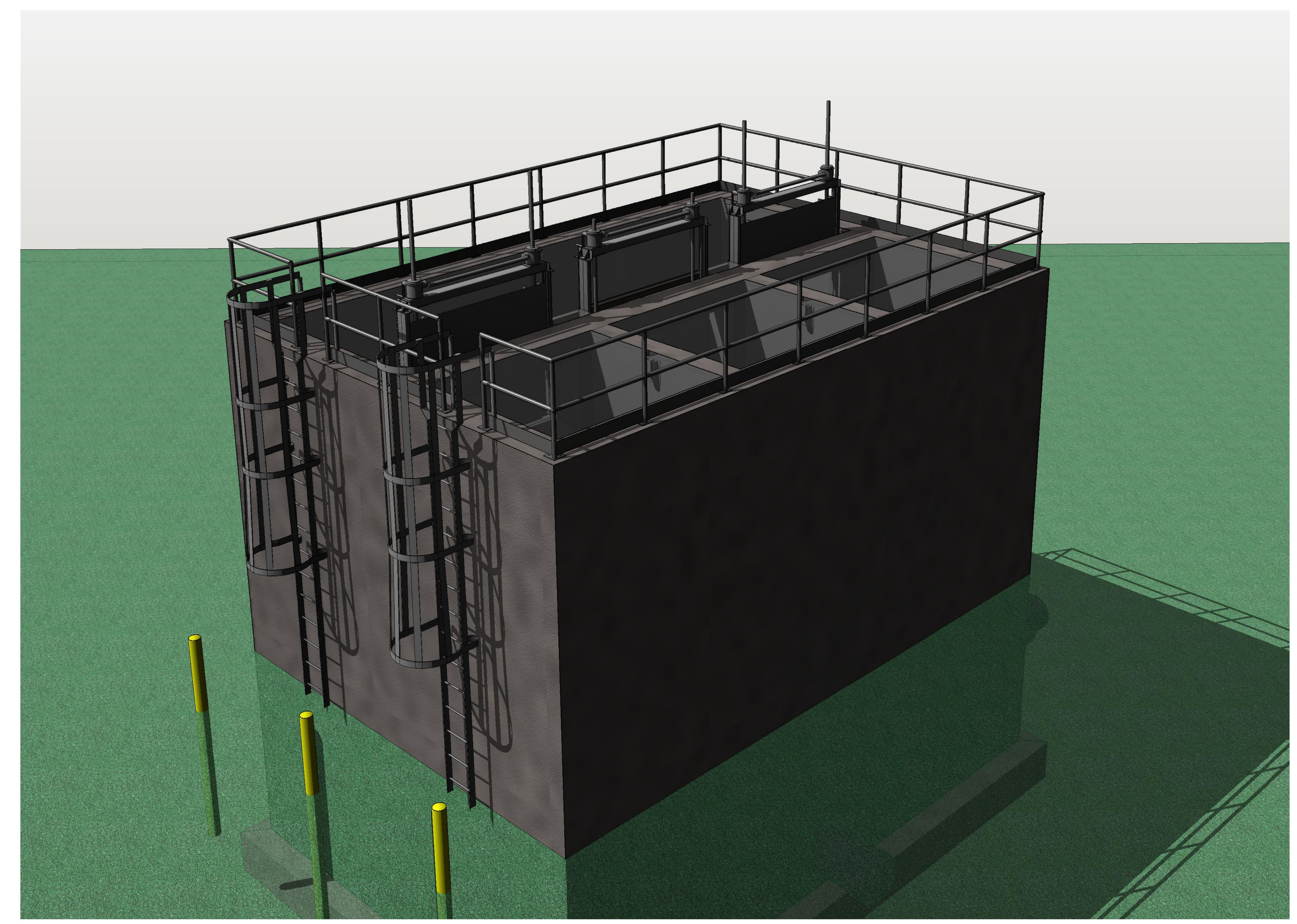
2 MAIN LEVEL

40-S101 REF: 40-S102 SCALE: 1 : 50



1 LOWER LEVEL

40-S101 REF: 40-S102 SCALE: 1 : 50



3 3D View 1

40-S101 SCALE:

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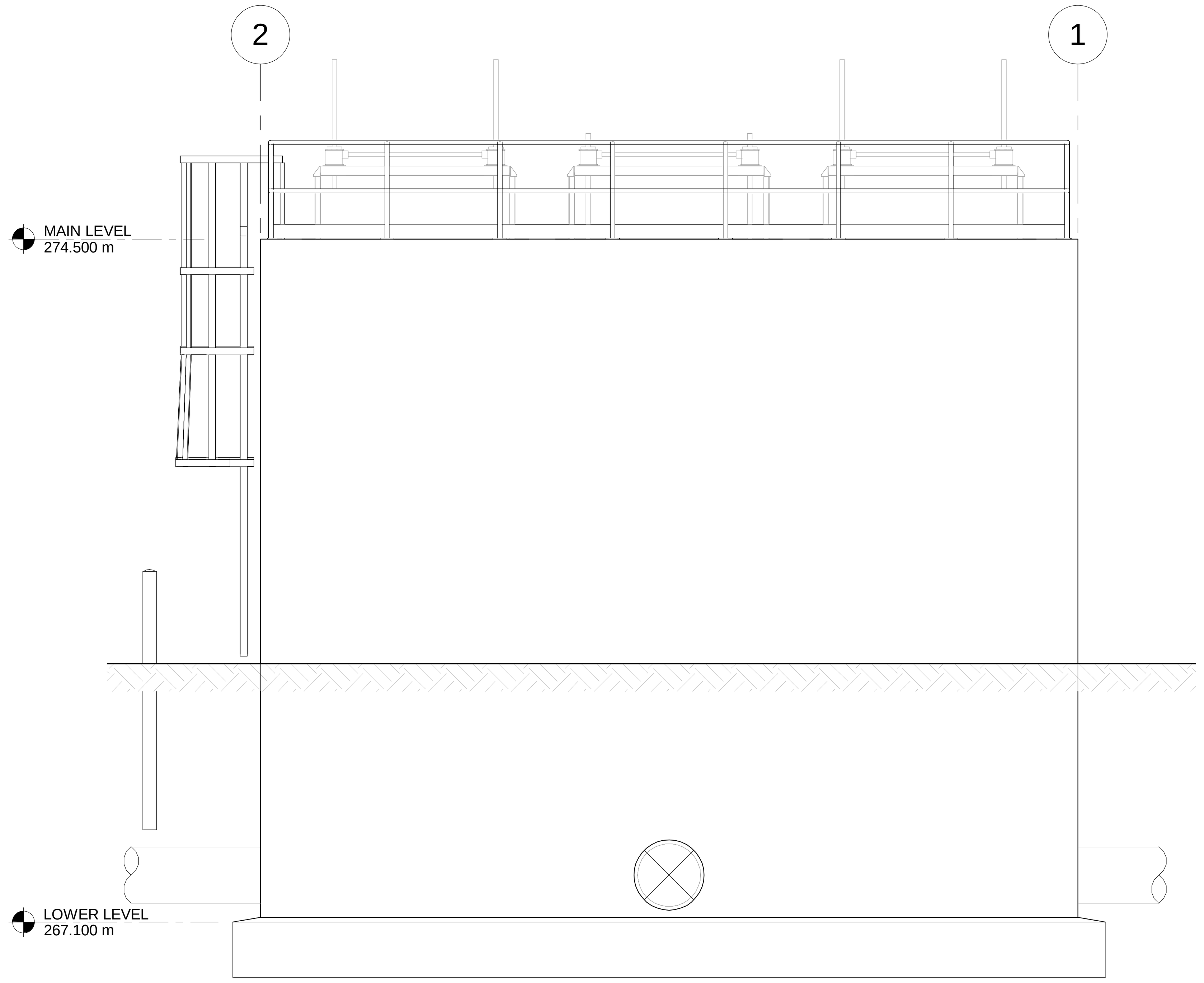
SHEET TITLE

SPLITTER CHAMBER STRUCTURAL PLANS & 3D VIEW

SHEET NUMBER

40-S101



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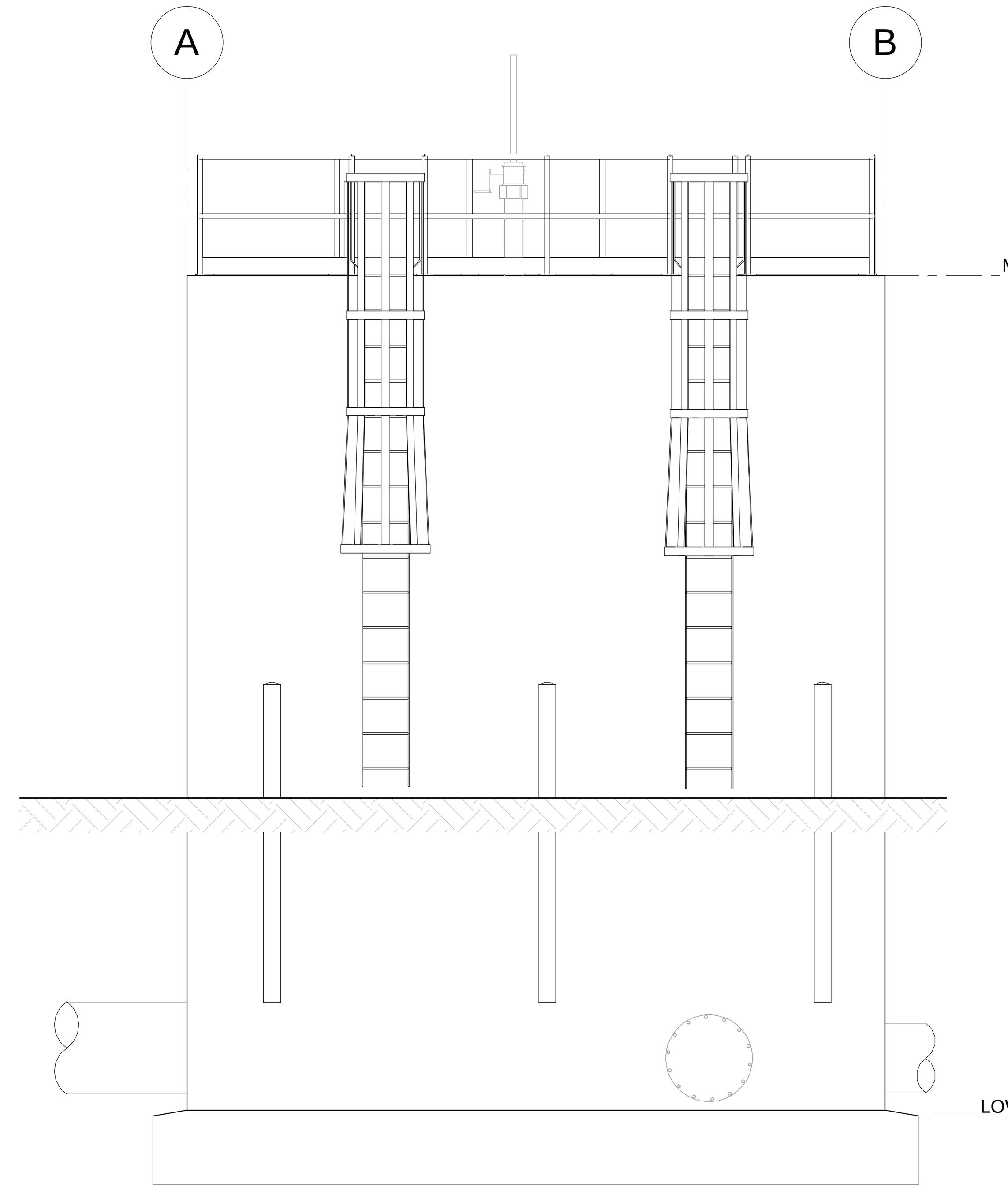
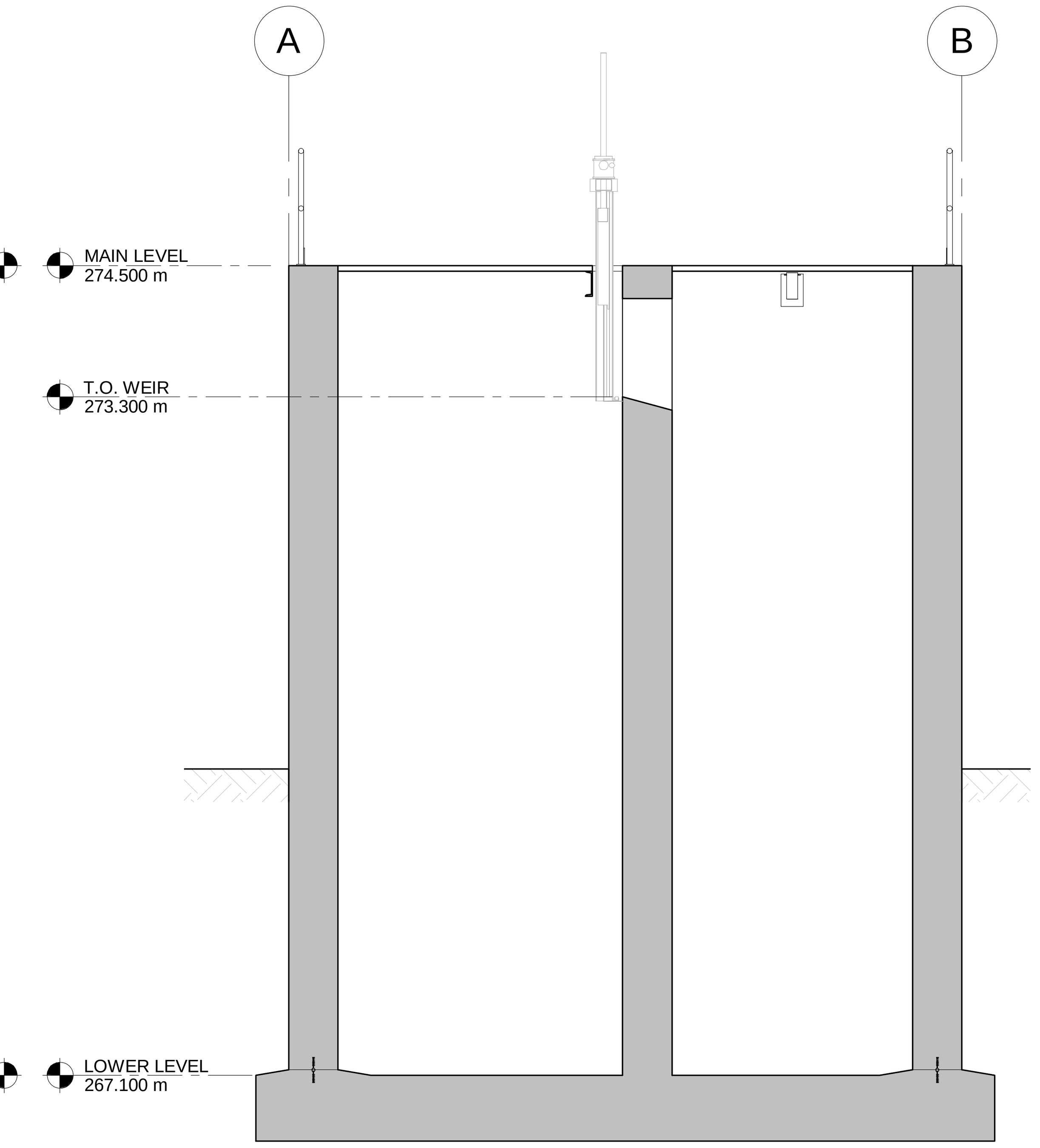
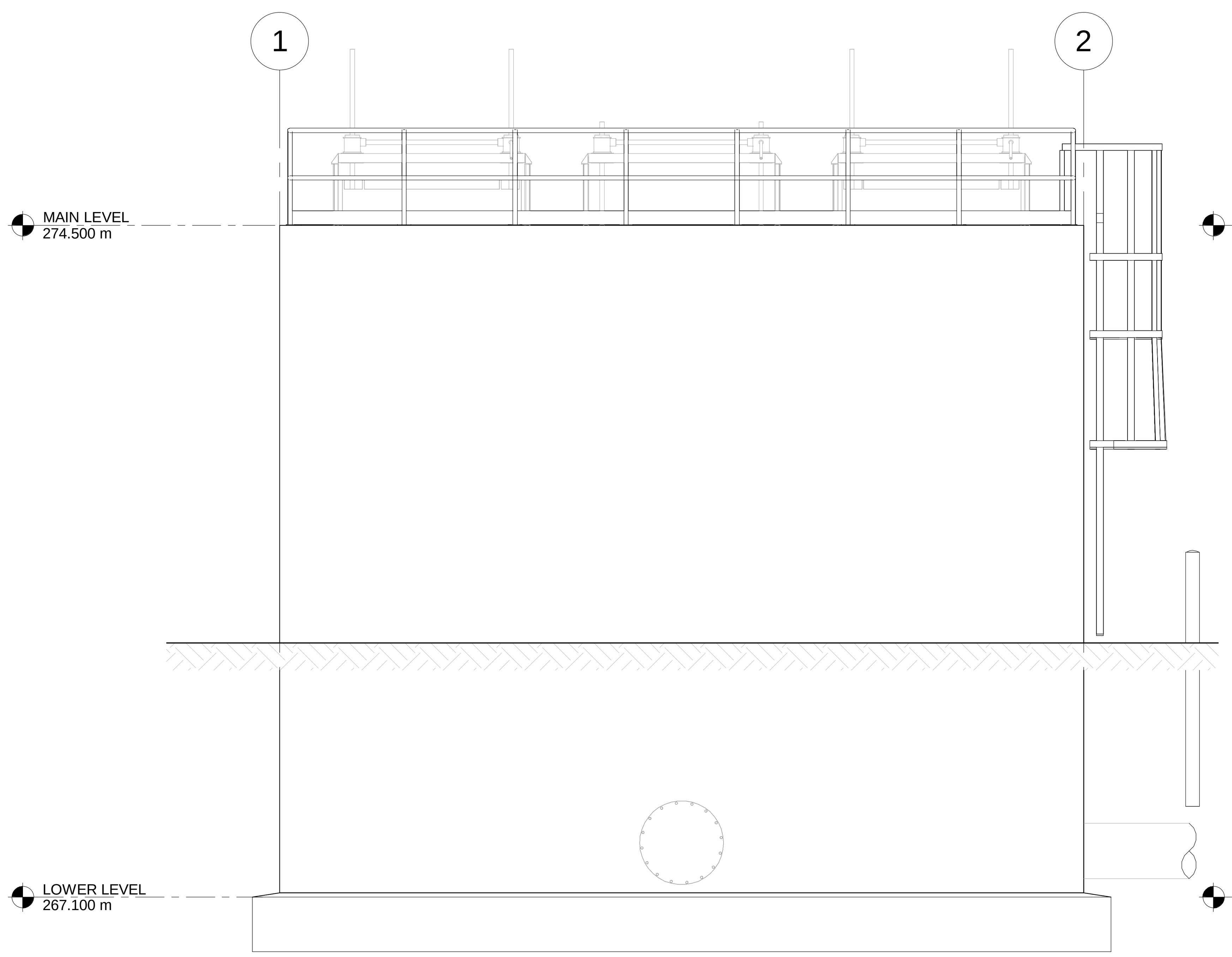
40-S102 SCALE: 1 : 50



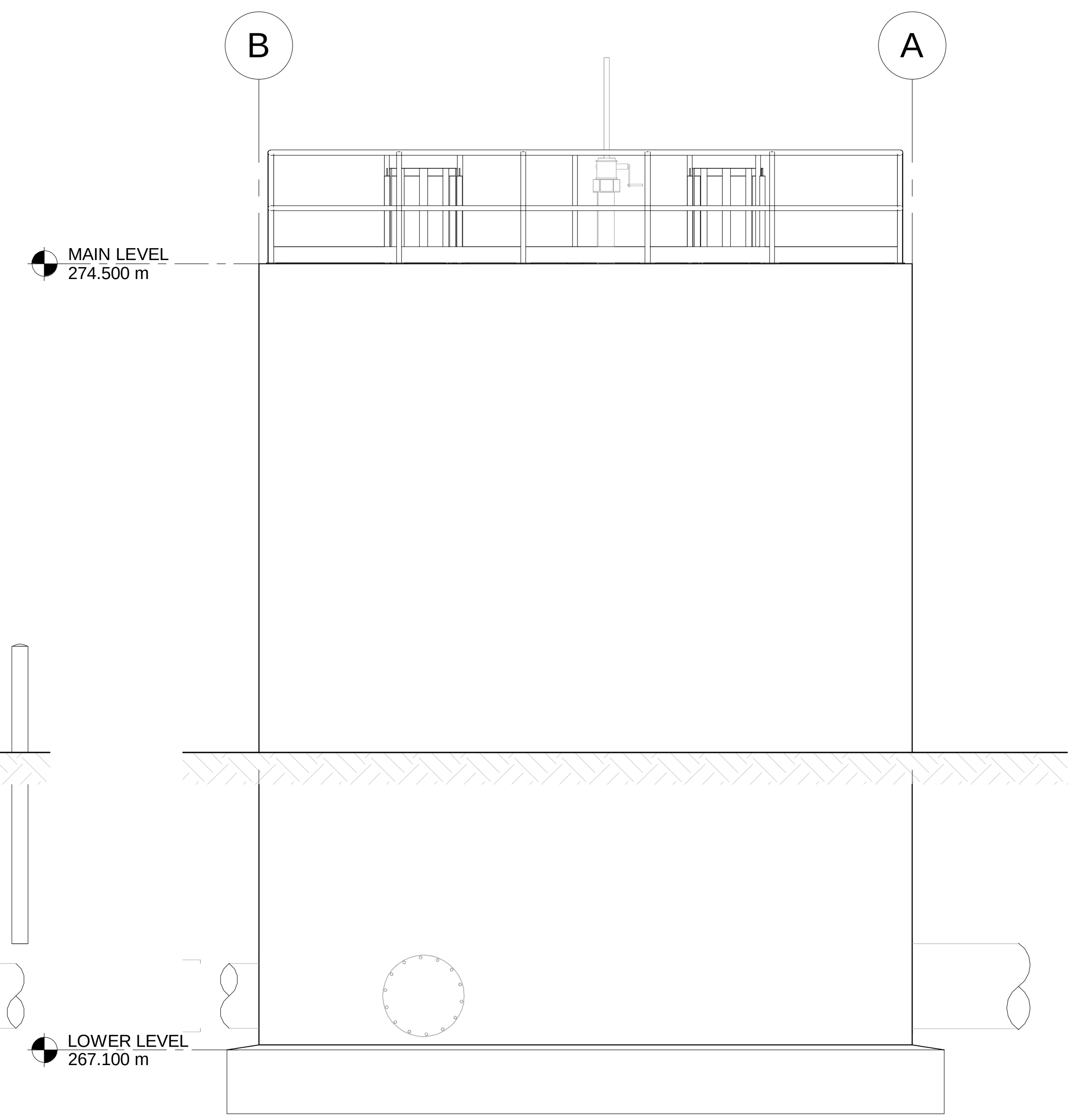
2 | EAST ELEVATION
40-S102 SCALE: 1 : 50



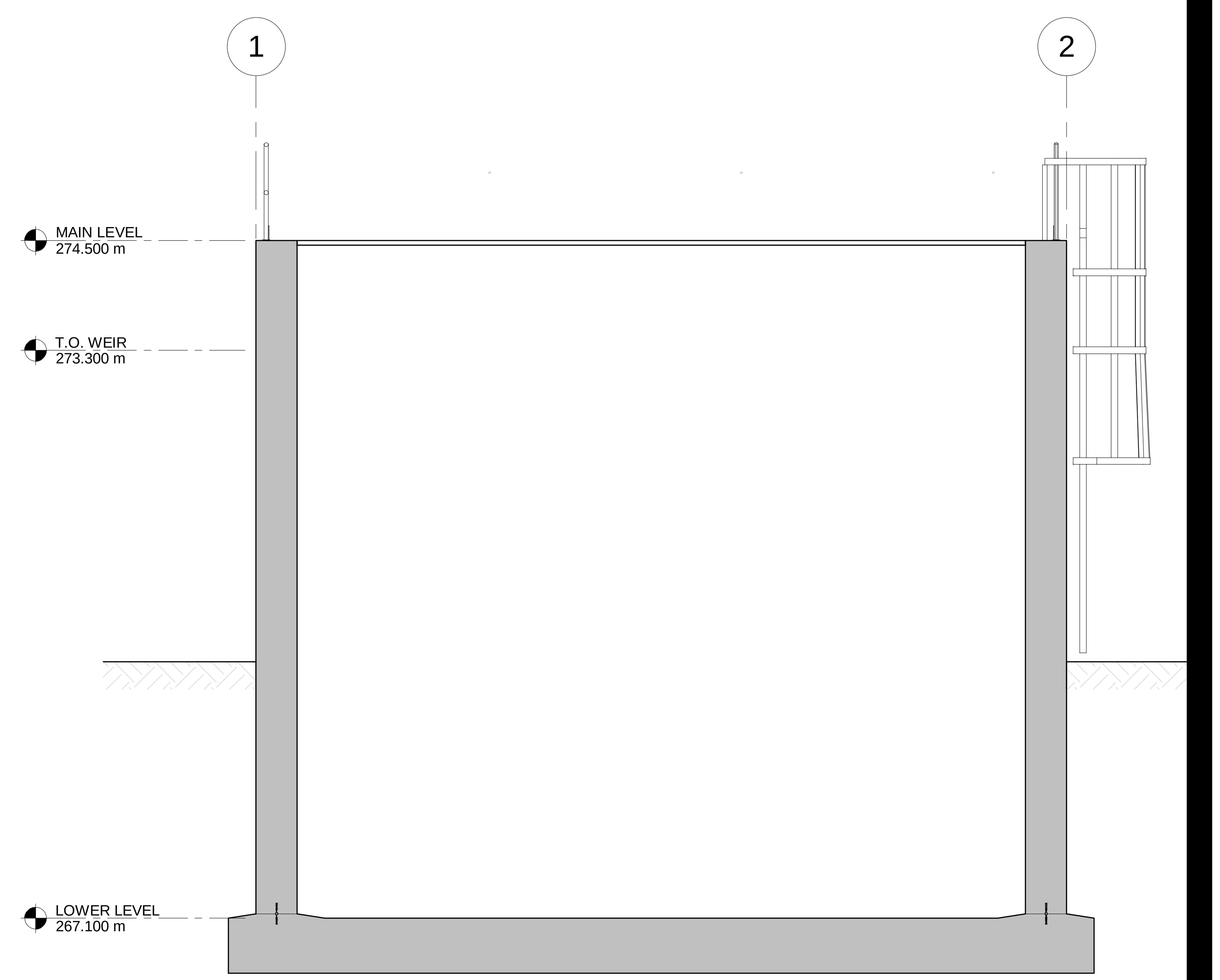
A | SECTION
40-S102 REF: 40-S101 SCALE: 1 : 50



3 | SOUTH ELEVATION
40-S102 SCALE: 1 : 50



4 | WEST ELEVATION
40-S102 SCALE: 1 : 50



B | SECTION
40-S102 REF: 40-S101 SCALE: 1 : 50

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PROJECT

WASTEWATER TREATMENT PLANT UPGRADE PROJECT

CLIENT

City of Winkler

185 Main Street
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REGISTRATION

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ISSUE/REVISION

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PROJECT NUMBER

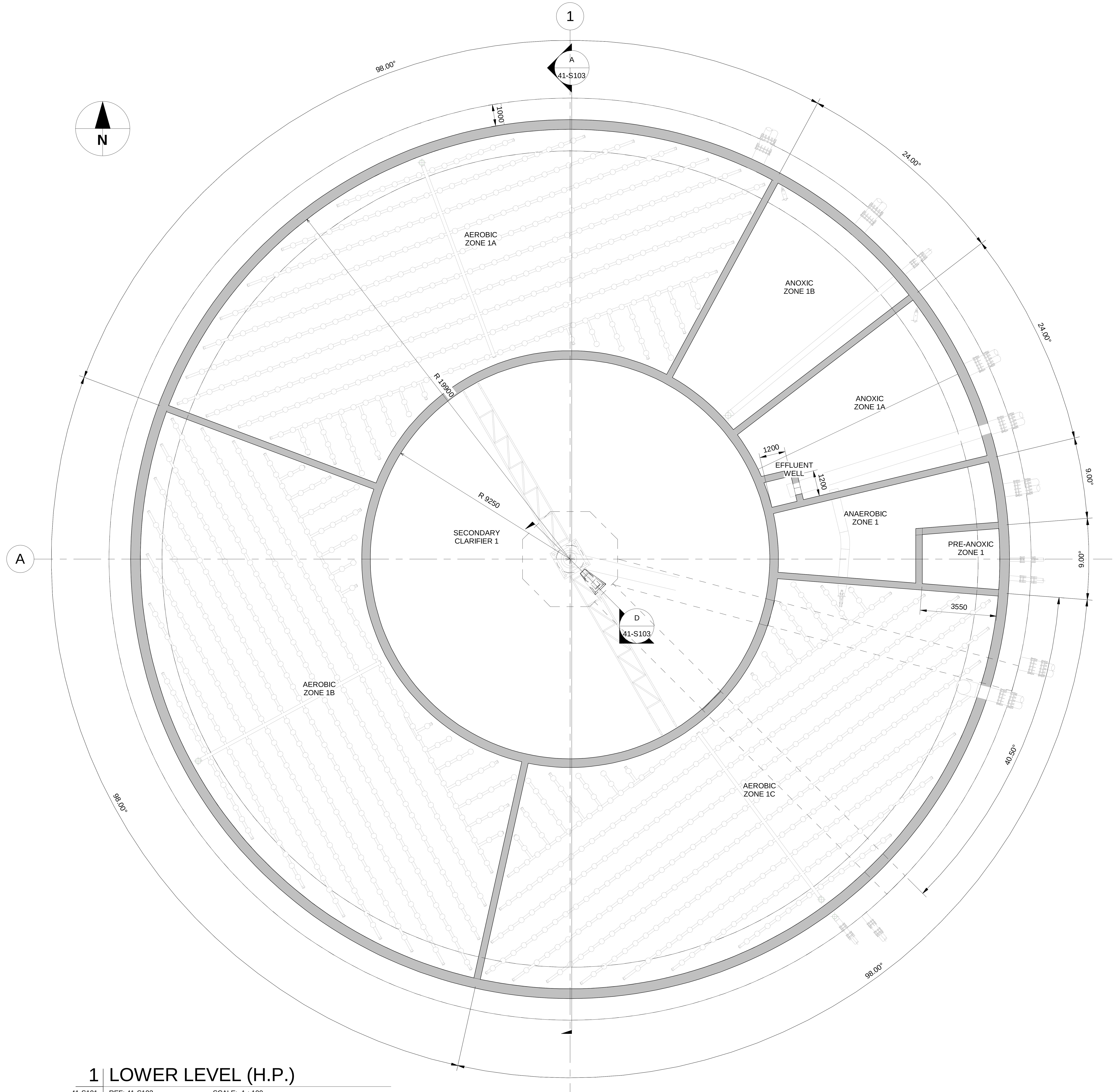
60430450

SHEET TITLE

SPLITTER CHAMBER STRUCTURAL SECTIONS & ELEVATIONS

SHEET NUMBER

40-S102



1 LOWER LEVEL (H.P.)

41-S101 REF: 41-S103 SCALE: 1 : 100

Project Management Initials: Designer: Designer Checked: Checker Approved: Approver ANSI D 559mm x 864mm

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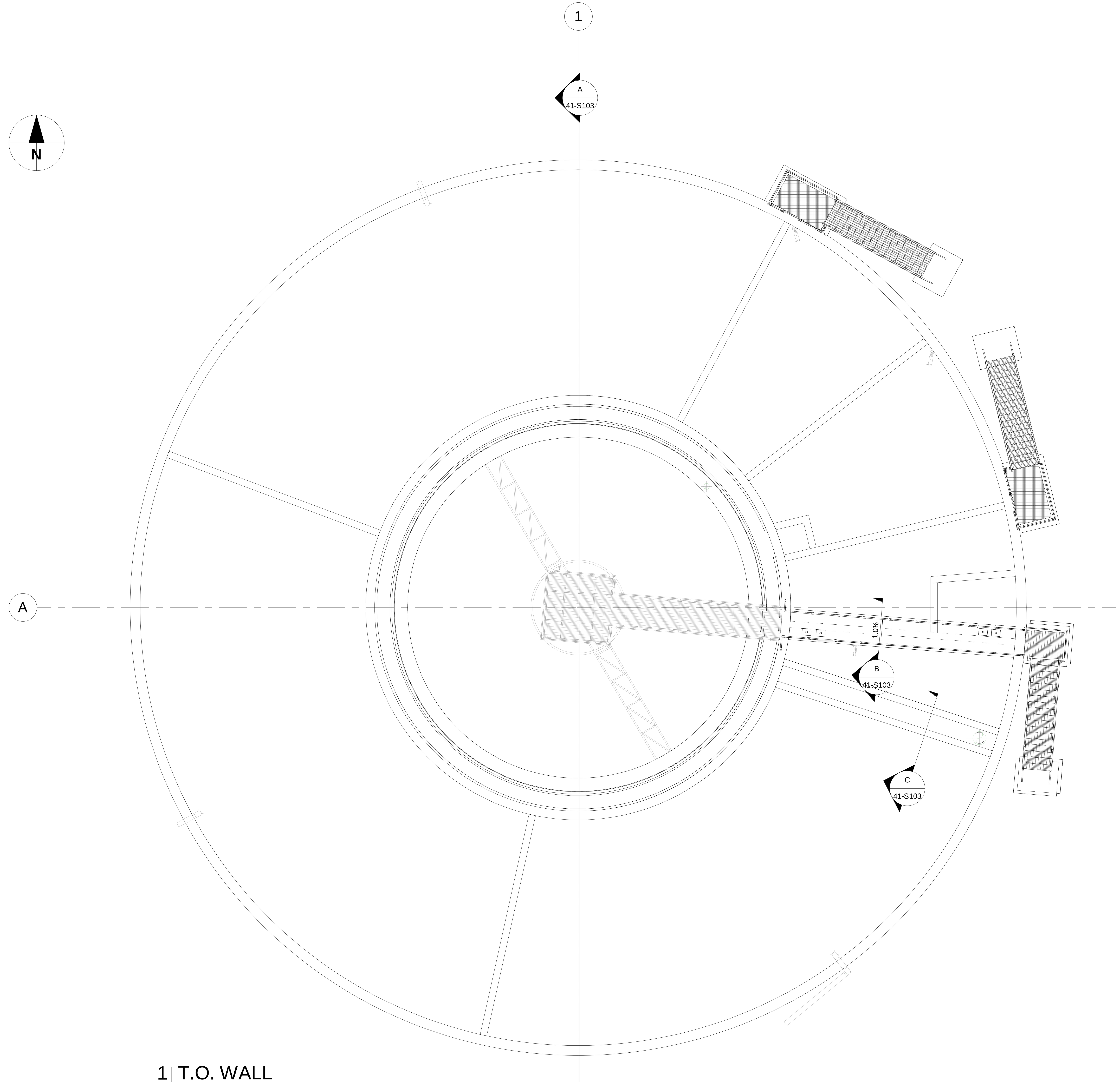
SHEET TITLE

SECONDARY TREATMENT UNIT 1
STRUCTURAL
LOWER LEVEL PLAN

SHEET NUMBER

41-S101

AECOM



1 T.O. WALL
41-S102 REF: 41-S103 SCALE: 1 : 100

PROJECT

WASTEWATER TREATMENT PLANT UPGRADE PROJECT

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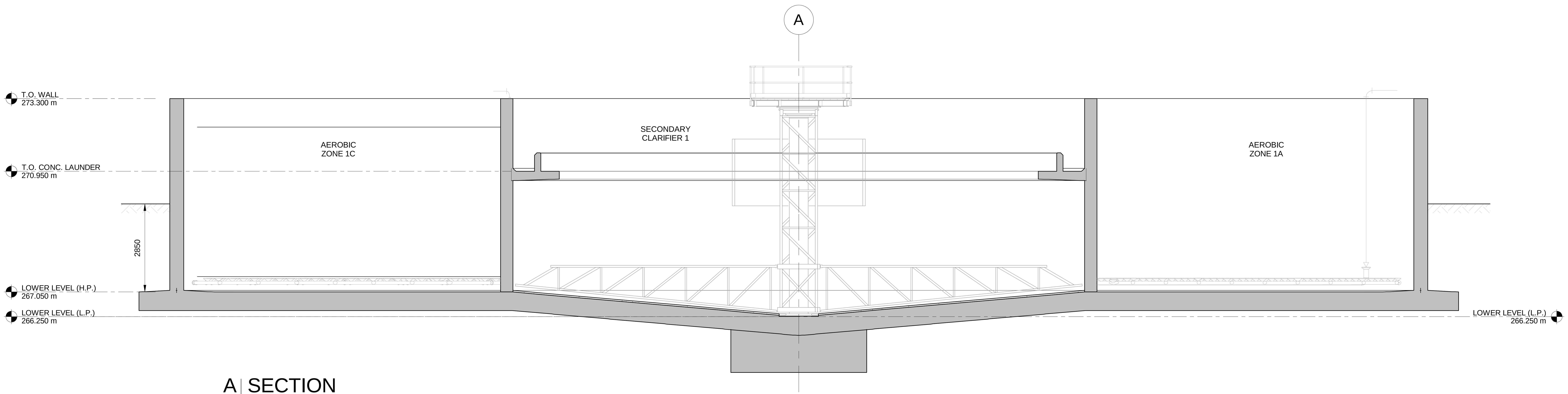
SHEET TITLE

SECONDARY TREATMENT UNIT 1
STRUCTURAL
TOP OF WALL PLAN

SHEET NUMBER

41-S102



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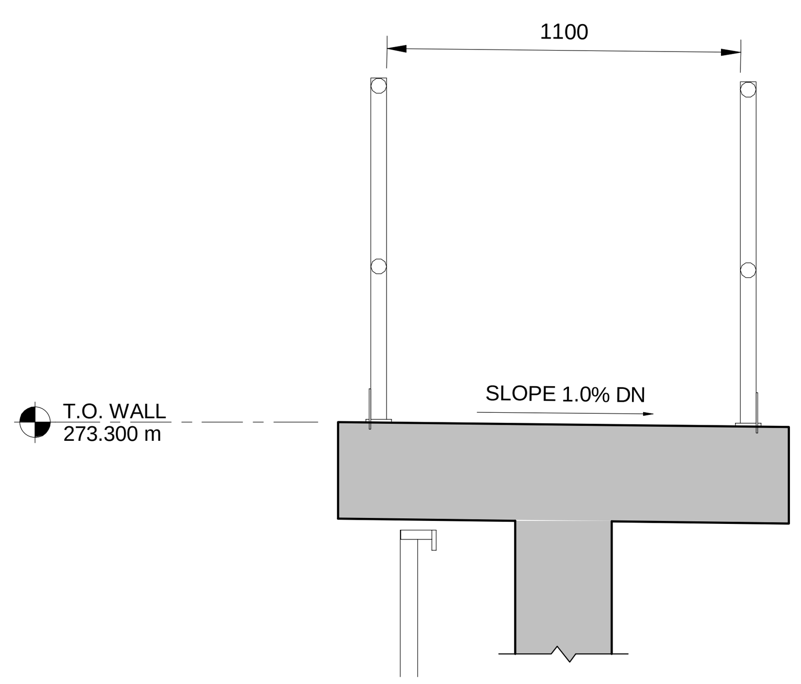

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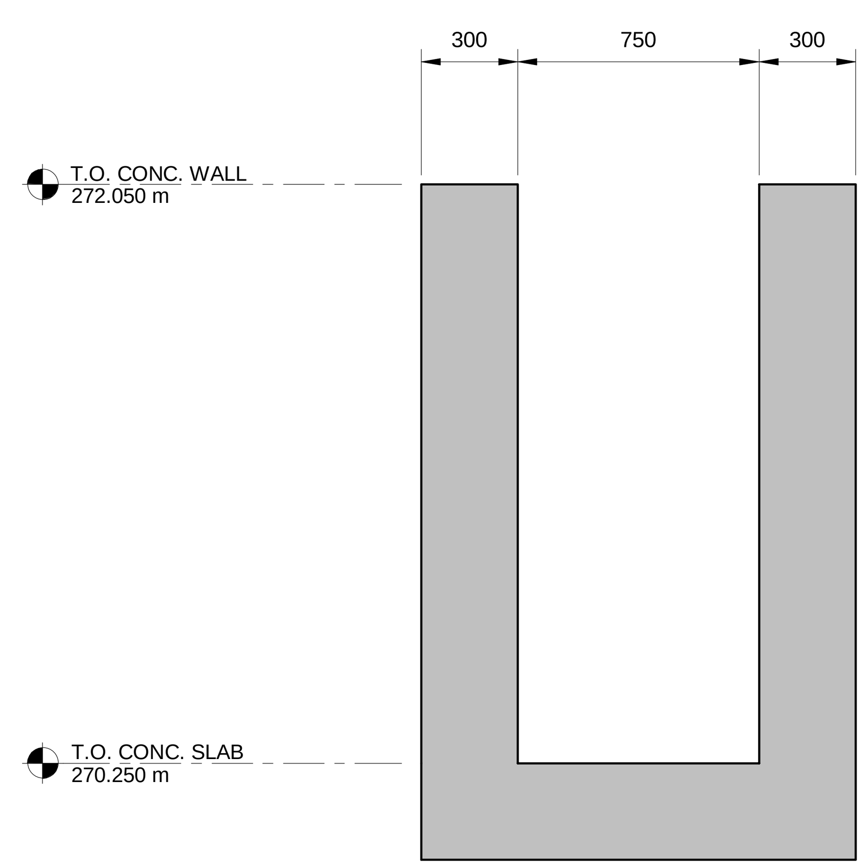

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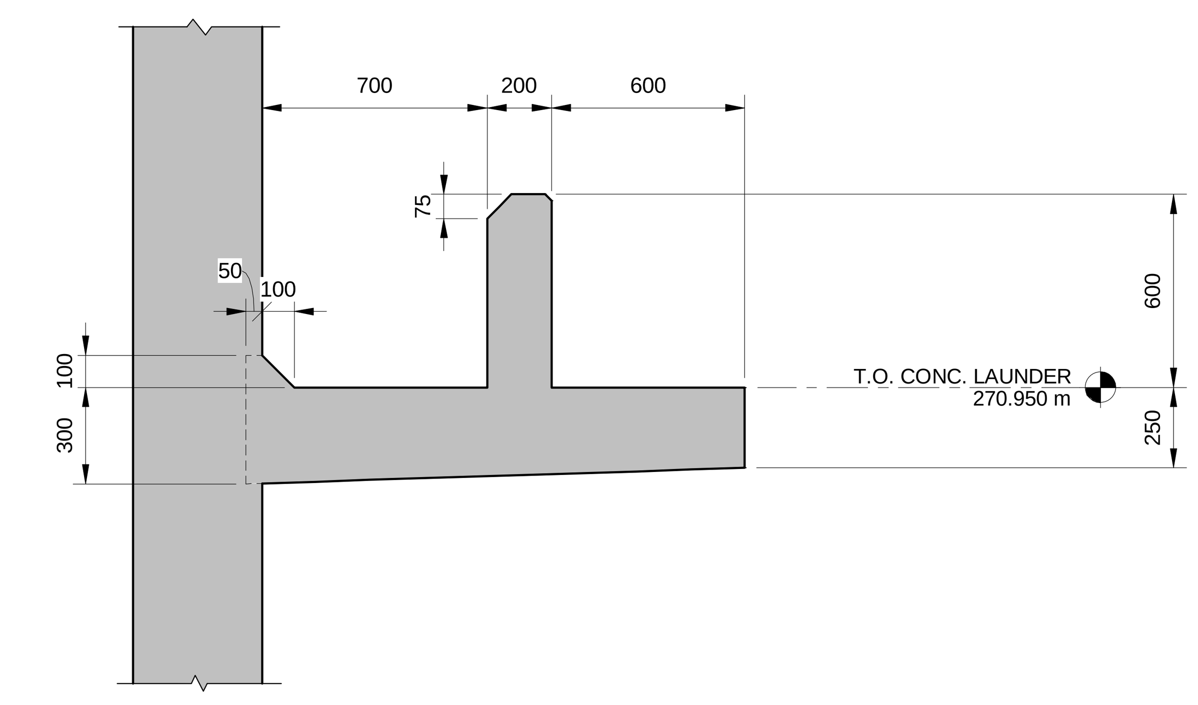

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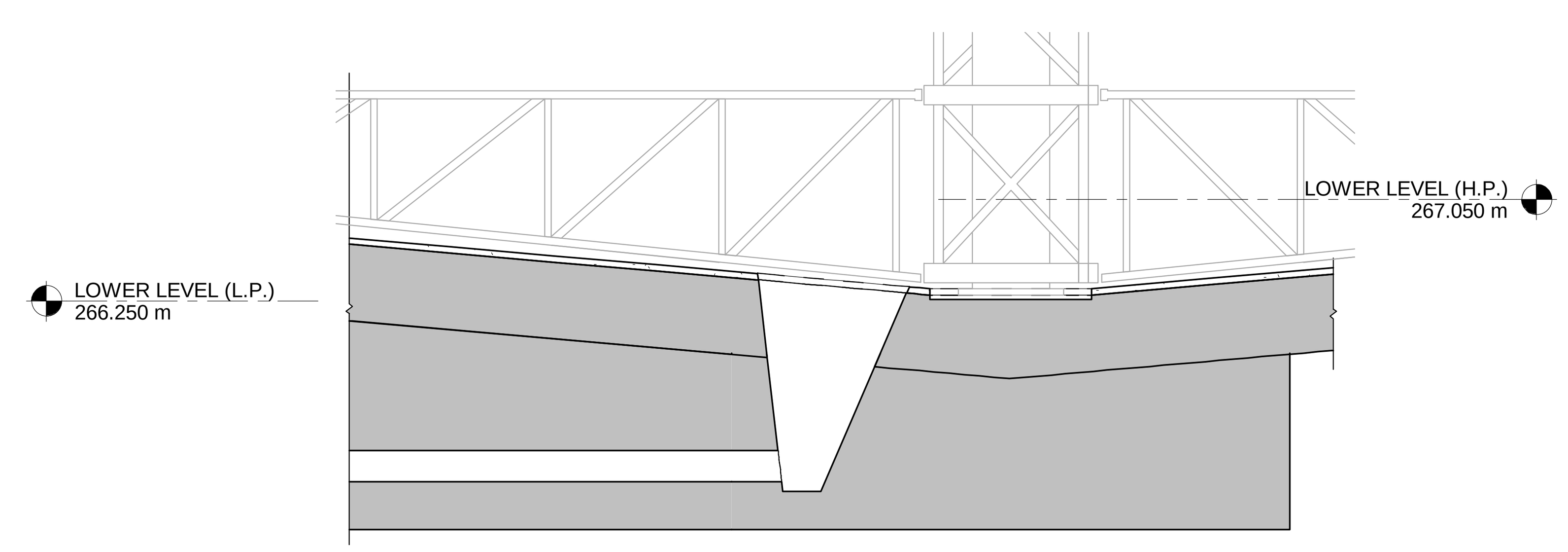
41-S103 | SCALE: 1 : 20



D | SECTION
41-S103 | REF: 41-S101 SCALE: 1 : 50

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SECONDARY TREATMENT UNIT 1
STRUCTURAL
SECTIONS

SHEET NUMBER

41-S103

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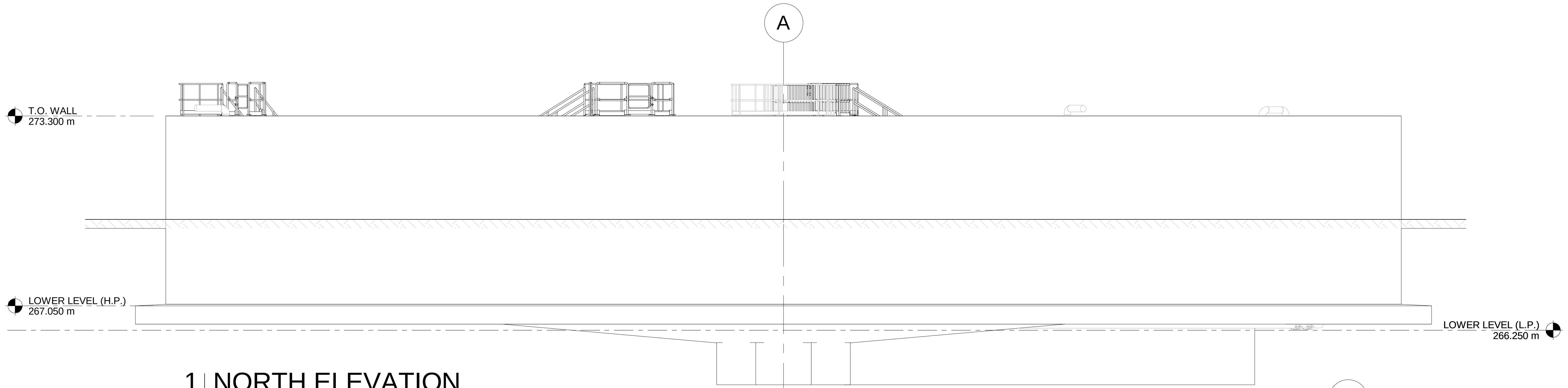

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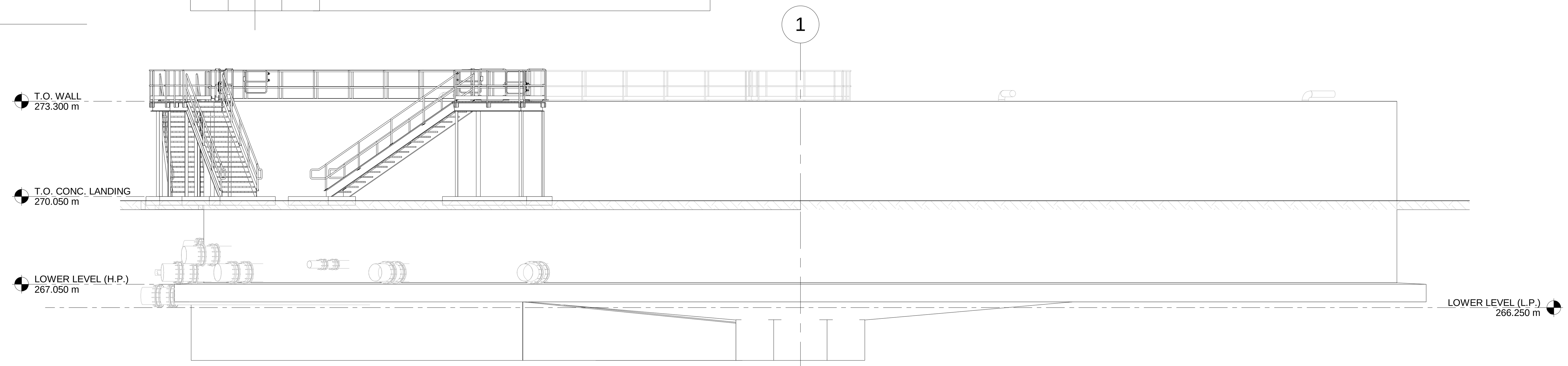
41-S104 SCALE: 1 : 100



2 EAST ELEVATION
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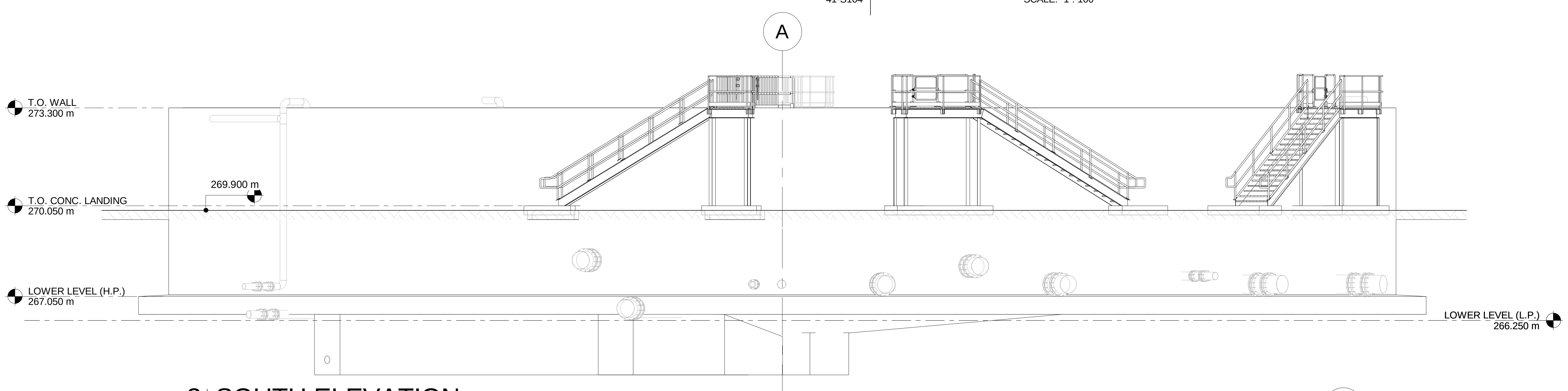

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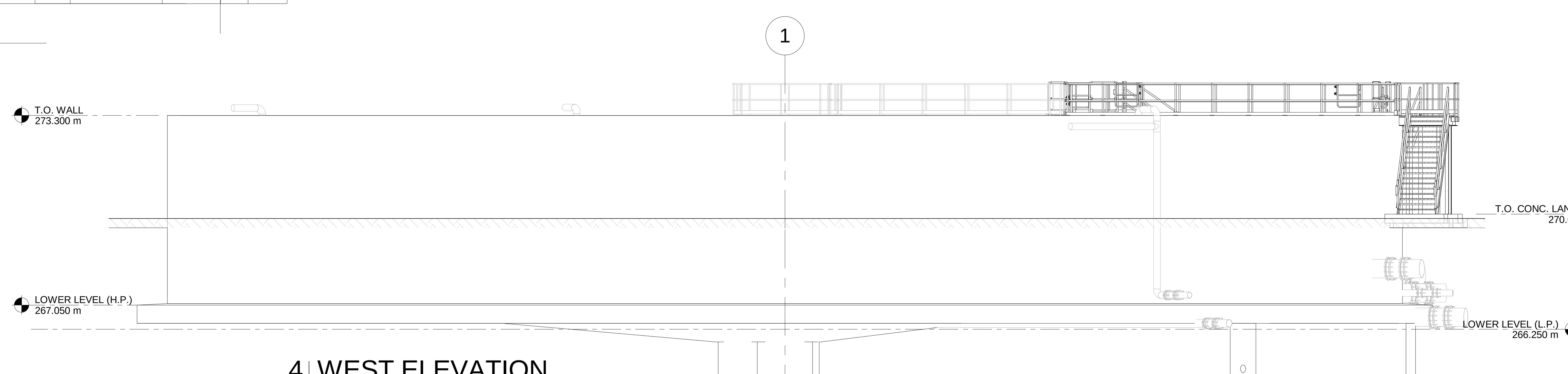

4 WEST ELEVATION
41-S104 SCALE: 1 : 100

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SHEET TITLE

SECONDARY TREATMENT UNIT 1
STRUCTURAL
ELEVATIONS

SHEET NUMBER

41-S104

ANSI D 864mm x 559mm

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VALVE SYMBOLS

TYPE	ABBREVIATION
BALL VALVE (N.O.)	BV
BALL VALVE (N.C.)	BV
CHECK VALVE	CV
BUTTERFLY VALVE	BFV
PLUG VALVE (N.O.)	PV
PLUG VALVE (N.C.)	PV
GATE VALVE (N.O.)	GV
GATE VALVE (N.C.)	GV
BALL CHECK VALVE	BCV
KNIFE GATE VALVE	KV
IRIS VALVE	IV
NEEDLE VALVE	NV
GLOBE VALVE	GLV
BACKFLOW PREVENTER	BFP
BALANCING DAMPER	BD
DOUBLE LEAF CHECK VALVE	CV
DUCKBILL CHECK VALVE	DCV
PINCH VALVE	PNV
TELESCOPIC VALVE	TSV
DIAPHRAGM VALVE	DV
MUD VALVE	MDV
FLOAT VALVE	FV
PRESSURE REGULATOR EXTERNAL PRESSURE TAP	PRV
PRESSURE REGULATOR SELF CONTAINED	PRV
BACK PRESSURE REGULATOR EXTERNAL PRESSURE TAP	BPV
BACK PRESSURE REGULATOR SELF CONTAINED	BPV
THERMAL SHUT OFF VALVE	TOV
PRESSURE RELIEF VALVE	ARV
VACUUM RELIEF VALVE	ARV
PRESSURE & VACUUM RELIEF VALVE	ARV
PRESSURE RELIEF VALVE (RUPTURE DISC)	RD
VACUUM RELIEF VALVE (RUPTURE DISC)	RD
THREE-WAY VALVE	3W
FOUR-WAY VALVE	4W
ANGLE VALVE	AV

GATE SYMBOLS

TYPE	ABBREVIATION
FLAP GATE	FLG
LEVEL CONTROL GATE	LCG
SLIDE GATE	SG
SLUICE GATE	SLG
STOP LOG	SL
WEIR GATE	WG

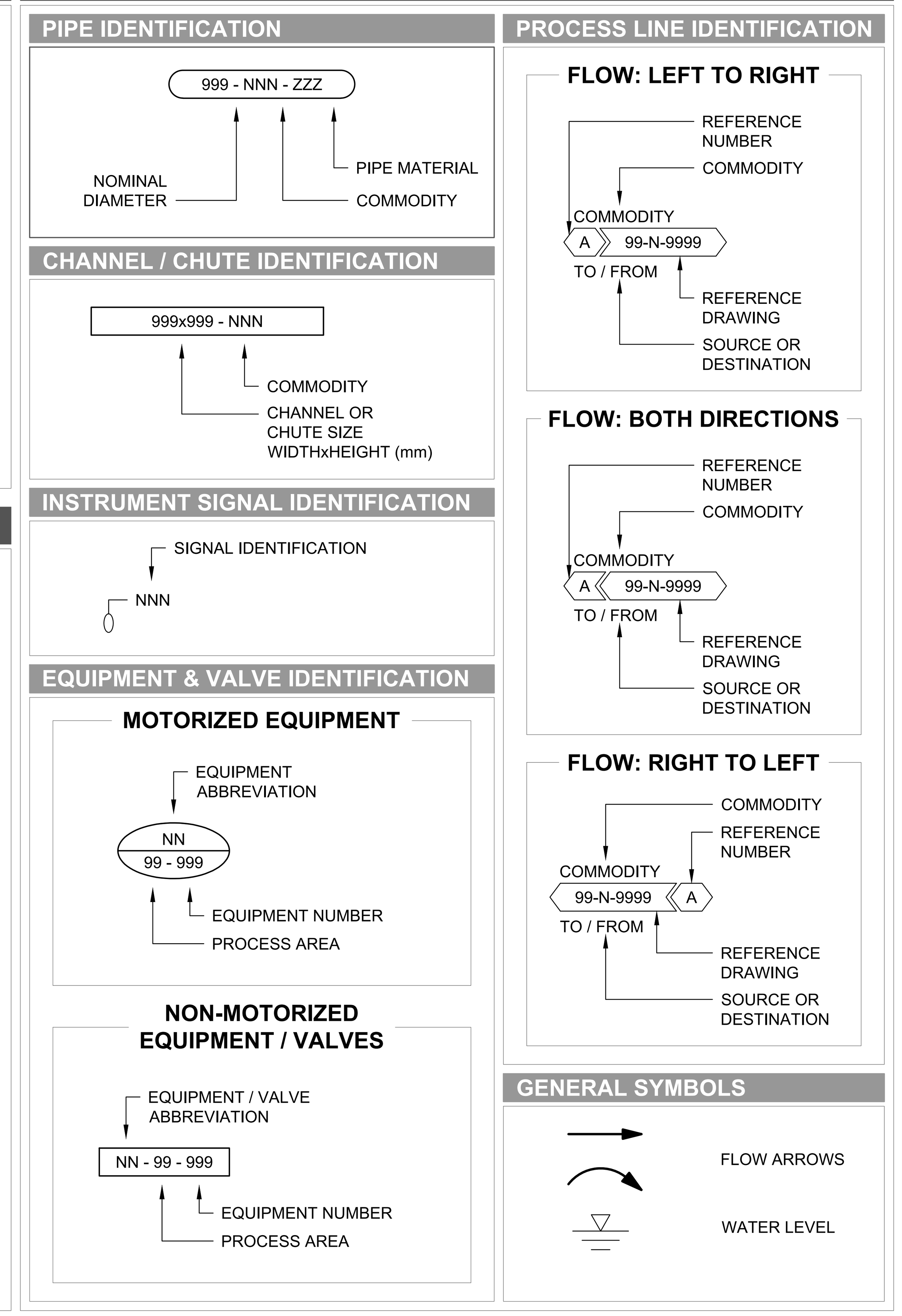
ACTUATORS

- DIAPHRAGM, PRESSURE
- DIAPHRAGM, SPRING
- DIGITAL
- MOTORIZED
- PISTON
- SOLENOID

PROCESS LINE TYPES

- MAJOR PROCESS LINE
- MINOR PROCESS LINE
- PROPOSED STRUCTURE
- VENDOR PACKAGE SUPPLY BOUNDARY
- EQUIPMENT ENCLOSURE / SKID BOUNDARY
- EXISTING PIPING & EQUIPMENT
- EXISTING STRUCTURE
- INSULATED PIPE (WITH HEAT TRACING)
- FUTURE PROCESS LINE
- EXISTING ITEMS TO BE REMOVED

ANNOTATION SYMBOLS



EQUIPMENT SYMBOLS

MOTORIZED EQUIPMENT

TYPE	ABBREVIATION
AERATOR (SURFACE)	AER
AIR DRYER BLOWER EXHAUST FAN	AD BL EF
CENTRIFUGE	CFG
COMPRESSOR	CP
CONVEYOR (BELT)	CON
CONVEYOR (SCREW)	CON
GRINDER	GDR
GRIT CLASSIFIER	GCL
MIXER (PROPELLER)	MXR
SCREEN (BAR)	SCR
SCREEN (ROTARY)	SCR
SCREENINGS WASHER / COMPACTOR	CMP
SLUDGE SKIMMER DAF DRIVE	SSK DDR

NON-MOTORIZED EQUIPMENT

TYPE	ABBREVIATION
CYCLONE	CY
CUT THROAT FLUME PALMER-BOWLUS FLUME PARSHALL FLUME	CFL PBF PFL
INJECTER	INJ
HEAT EXCHANGER	HEX
SAMPLER (AUTOMATIC)	SMP
SAMPLER (AUTOMATIC)	SMP
SCREEN (MANUAL)	SCR
MIXER (STATIC)	SM
MOTOR	-

PUMPS

TYPE	ABBREVIATION
CENTRIFUGAL PUMP	P
COLUMN PUMP	P
DIAPHRAGM PUMP	P
GEAR PUMP	P
METERING PUMP	P
PLUNGER PUMP	P
PROGRESSING CAVITY PUMP	P
ROTARY LOBE PUMP	P
SUBMERSIBLE PUMP	P
SUBMERSIBLE PROPELLER PUMP	P
VERTICAL PUMP	P

PIPE LINE DEVICES

- AIR GAP
- AIR INTAKE
- BLIND FLANGE OR FLANGE CONNECTION
- CALIBRATION CHAMBER
- CAP OR PLUG
- DIFFUSER OR SPRAY NOZZLE
- DRAIN
- EXPANSION JOINT
- EMERGENCY EYEWASH & SHOWER STATION
- FILTER
- FLAME ARRESTER
- FLEXIBLE CONNECTION
- HOSE REEL
- ORIFICE PLATE
- PRESSURE SENSOR (IN-LINE)
- PULSATION DAMPENER
- REDUCER
- SEPARATOR, AIR
- SEPARATOR, LIQUID
- SIGHT GLASS
- SILENCER
- SPECTACLE BLIND
- STRAINER
- STRAINER, BASKET
- TRAP
- UNION
- UTILITY CONNECTION (XX)
- VENT, AIR
- VENT, STEAM
- VENTURI
- QUICK CONNECTOR

STANDARD ABBREVIATIONS

EQUIPMENT ABBREVIATIONS

AC	AIR COMPRESSOR
AD	AIR DRYER
AER	SURFACE AERATOR
AF	AIR FILTER
AFC	AFTERCOOLER
AR	AIR RECEIVER
AST	AIR STRIPPER
AWH	AIR WASH
BA	BIN ACTIVATOR
BPS	BELT FILTER PRESS
BIF	BIOFILTER
BL	BLOWER
BR	BRUSH
BRM	BARMINUTOR
CBA	COMPOST BAY
CBD	COARSE BUBBLE DIFFUSER
CDR	PRIMARY CLARIFIER DRIVE
CFG	CENTRIFUGE
CFL	CUT THROAT FLUME
CGS	CHLORINE GAS SCRUBBER
CHF	CHEMICAL FEEDER
CHL	CHLORINATOR
CMM	COMMINUTOR
CMP	COMPACTOR
COL	COLLECTOR
CON	CONVEYOR
COV	COVER
CP	COMPRESSOR
CPW	CIPOLETTI WEIR
CRN	CRANE OR HOIST
CY	CYCLONE
CYL	CYLINDER
DAF	DISSOLVED AIR FLOTATION THICKENER EQUIPMENT
DDR	DAF DRIVE
DIF	DIFFUSER
DR	DRIVE
DST	ROTARY DISTRIBUTOR
DT	DUMP TRAILER
DWS	DEWATERING SCREW
EF	EXHAUST FAN
EV	EVAPORATOR
EXT	EXPANSION TANK
FAR	FLAME ARRESTER
FBD	FINE BUBBLE DIFFUSER
FCH	FLAME CHECK
FCV	FLOW CONTROL VALVE (MODULATING)
FDR	FERMENTER DRIVE
FIS	FILTER SEPARATOR
FLC	FLOCCULATOR
FLG	FLAP GATE
FLT	FILTER
FOS	FOAM SEPARATOR
FV	FLOW CONTROL VALVE (OPEN/CLOSE)
GBT	GRAVITY BELT THICKENER
GCL	GRIT CLASSIFIER
GDR	GRINDER
HPG	HAND PULL GATE
HSS	HAULED SEPTAGE SCREEN
HV	HAND VALVE
INC	INCINERATOR
INJ	CHEMICAL INJECTOR
LAG	LAGOON
LCG	LEVEL CONTROL GATE
LCP	LOCAL CONTROL PANEL
LG	LEVEL SIGHT GLASS OR CALIBRATION COLUMN
LCV	LEVEL CONTROL VALVE (MODULATING)
LGR	LINEAR GRILLE
LV	LEVEL CONTROL VALVE (OPEN/CLOSE)
MB	MEMBRANE
MCP	MASTER CONTROL PANEL
MLW	MIXED LIQUOR WASTING CHAMBER
MWA	MICROWAVE ANALYZER
MXR	MIXER
ODU	OZONE DESTRUCT UNIT
P	PUMP
PBF	PALMER-BOWLUS FLUME
PBP	PERFORATED BAFFLE PLATE
PCN	PARTICLE COUNTER
PDC	POWER DISTRIBUTION CENTRE
PFL	PARSHALL FLUME
PLT	PELLETIZER
PSE	PLATE SETTLER
PSU	POWER SUPPLY UNIT
PT	PRESSURE TANK
PTO	POWER TAKE OFF/REDUCER
RBC	ROTATING BIOLOGICAL CONTACTOR
RCO	RESIDUAL COLLECTOR
RDT	ROTARY DRUM THICKENER
RM	ROTAMETER
SCB	SCRUBBER
SCM	SCUM COLLECTION MECHANISM
SCR	SCREENING EQUIPMENT
SCW	SCUM WEIR (ROTATING)
SDR	SECONDARY CLARIFIER DRIVE
SEP	SEPARATOR
SG	SLIDE GATE
SL	STOP LOG
SLC	SLUDGE COLLECTOR
SLG	SLUICE GATE
SM	STATIC MIXER
SMP	SAMPLER
SOL	SOLENOID ACTUATOR
SSK	SLUDGE SKIMMER
SRC	SURGE CHAMBER
T	TANK
TB	TURBIDITY METER
TCP	TEMPERATURE CONTROL PANEL
UV	ULTRA VIOLET LAMP BANK
V	VALVE
VAP	VAPORIZER
VDR	VORTEX DRIVE
VFD	VARIABLE FREQUENCY DRIVE
VNT	VENT EQUIPMENT
VSD	VARIABLE SPEED DRIVE
W	WEIR
WG	WEIR GATE

COMMODITY ABBREVIATIONS

AHP	AIR (HIGH PRESSURE)
AIR	AIR
ASH	ASH
AWH	AIR WASH
BCA	BURNER COMBUSTION AIR
BG	BIOGAS
BIS	BIOSOLIDS
BW	BACKWASH WATER (FILTERED)
BWR	BACKWASH RETURN
BWW	BACKWASH WASTE WATER
CA	COMPRESSED AIR (SERVICE)
CDW	WATER (CONDENSATE)
CEN	CENTRATE
CFE	CHLORINATED FINAL EFFLUENT
CLD	CLARIFIER BLOWDOWN
CPA	COMPOST PROCESS AIR
DCL	DECANT
DEWS	WET DEWATERED SLUDGE
DFE	DECHLORINATED FINAL EFFLUENT
DGC	CIRCULATED SLUDGE GAS
DGF	SLUDGE GAS FUEL
DGH	SLUDGE GAS (HIGH PRESSURE)
DRA	DRAIN
DS	DIGESTED SLUDGE
DRS	DEGRITTED RAW WASTEWATER
DSB	DAF SUBNATANT
DSE	DISINFECTED SECONDARY EFFLUENT
FCH	FLAME CHECK
FE	FINAL EFFLUENT
FLI	FILTER INFLUENT
FLW	FLOCCULATION BASIN EFFLUENT
FOA	FOUL AIR
FSL	FERMENTED SLUDGE
FSU	FERMENTER SUPERNATANT
FTW	FILTER TO WASTE
FLT	FILTRATE
FY	FERMENTER SCUM
GAC	ACTIVATED CARBON (GRANULAR)
GACL	ACTIVATED CARBON (SOLUTION)
GACS	RECARBONATION SLUDGE
GR	GRIT
GRS	GREASE
GTS	GRAVITY THICKENED SLUDGE
HF	HYDRAULIC FLUID
HFS	FLUOSILIC ACID
HS	HAULED SEPTAGE
HSC	HAULED SEPTAGE SCREENINGS
HTS	HEAT TREATED SLUDGE
IA	INSTRUMENT AIR
INF	INFLUENT
LPC	LOW PRESSURE CONDENSATE
ML	MIXED LIQUOR
MS	MIXED SLUDGE
NG	NATURAL GAS
NMLR	NITRIFIED MIXED LIQUOR RECYCLE
OF	OVERFLOW
PAC	ACTIVATED CARBON (SLURRY)
PDG	PURIFIED DIGESTER GAS
PE	PRIMARY EFFLUENT
PI	PRIMARY INFLUENT
PA	PROCESS AIR
PRO	PROPANE GAS
PS	PRIMARY SLUDGE
PY	PRIMARY SCUM
RA	RETURN AIR
RAS	RETURN ACTIVATED SLUDGE
REC	RECYCLE
RES	RESIDUAL
RSSC	RAW WASTEWATER SCREENING
RSL	RECIRCULATED SLUDGE
SAM	SAMPLE
SAN	SANITARY SEWER
SBD	SCRUBBER BLOWDOWN
SCN	SCREENINGS
SCS	SCRUBBING SOLUTION
SD	SMOKE DAMPER
SE	SECONDARY CLARIFIER EFFLUENT
SLH	SETTLED HEATED SLUDGE
SPY	SCREENED PRIMARY SCUM
SRHS	RAW HAULED SEPTAGE
SRS	SCREENED RAW WASTEWATER
SRSW	RAW WASTEWATER
STE	STEAM
STW	STORM SEWER
SUB	SUBNATANT
SUP	SUPERNATANT
SVC	SCAVENGER VACUUM
SW	SEAL WATER
SY	SECONDARY CLARIFIER SCUM
TBS	THICKENER BOTTOM SLUDGE
TDS	THICKENED DIGESTED SLUDGE
TOF	THICKENER OVERFLOW
TPS	THICKENED PRIMARY SLUDGE
TR	THICKENER RECYCLE
TSL	THICKENER UNDERFLOW
TWAS	THICKENED WASTE ACTIVATED SLUDGE
UTA	UTILITY AIR
VAC	VACUUM
VE	VENT
W1	POTABLE WATER
W2	POTABLE WATER (AFTER BACKFLOW PREVENTER)
W3	NON-POTABLE WATER (PROCESS EFFLUENT)
WAS	WASTE ACTIVATED SLUDGE
WNS	WASTE NITRIFIED SLUDGE
WW	WELL WATER

CHEMICAL ABBREVIATIONS

AAG	ANHYDROUS AMMONIA, GAS
AAL	ANHYDROUS AMMONIA, LIQUID
AAS	AMMONIUM HYDROXIDE SOLUTION
AAV	AMMONIA GAS (VACUUM)
ACE	ACETIC ACID
ACS	ACTIVATED SILICA
ACTL	ACETYLENE
ALS	ALUM SOLUTION
ALU	ALUM
ASH	ASH
BRS	BRINE SOLUTION
BRW	BRINE WASTE
CAO	LIME (QUICK LIME)
CAOH	LIME (HYDRATED)
CDG	CARBON DIOXIDE
CDL	CARBON DIOXIDE LIQUID
CDW	WATER (CONDENSATE)
CI	SODIUM HEXAMETA PHOSPHATE
CLD	CHLORINE DIOXIDE
CLG	CHLORINE GAS (PRESSURE)
CLL	CHLORINE LIQUID
CLS	CHLORINE SOLUTION
CLV	CHLORINE GAS (VACUUM)
CS	CAUSTIC SODA
CSS	DILUTE CAUSTIC SODA
CUS	COPPER SULFATE
FC	FERRIC CHLORIDE
FCPL	FERRIC CHLORIDE PICKLE LIQUOR
FEC	FERROUS CHLORIDE
FES	FERROUS SULPHATE
FS	FERRIC SULFATE
FSS	FERROUS SULFATE
GOX	GASEOUS OXYGEN
HCL	HYDROCHLORIC ACID
HEL	HELIUM
HFS	FLUOSILIC ACID
HG	HYDROGEN GAS
HL	HYDROGEN LIQUID
HP	HYDROGEN PEROXIDE
LM	LIME (DRY)
LMS	LIME SLUDGE
LOX	LIQUID OXYGEN
LS	LIME SLAKER
MET	METHANOL
N2	NITROGEN
NAAL	SODIUM ALUMINATE
NAOH	SODIUM HYDROXIDE
NASF	SODIUM SILICOFLUORIDE
NOX	NITROUS OXIDE
OIA	OZONE IN AIR
OIO	OZONE IN OXYGEN
OW	OZONATED WATER
PHA	PHOSPHORIC ACID
PACL	POLYALUMINUM CHLORIDE
PLY	POLYMER
PP	POTASSIUM PERMANGANATE
PPP	PHOSPHATE
PYPH	POLYPHOSPHATE
RSS	RECIRCULATED SCRUBBER SOLUTION
SA	SULPHURIC ACID
SAS	SODA ASH SOLUTION
SBC	SODIUM BICARBONATE
SBS	SODIUM BISULFITE
SC	SODA ASH
SDG	SULFUR DIOXIDE GAS (PRESSURE)
SDL	SULFUR DIOXIDE LIQUID
SDS	SULFUR DIOXIDE SOLUTION
SDV	SULFUR DIOXIDE GAS (VACUUM)
SH	SODIUM HYPOCHLORITE
SHS	SODIUM HYPOCHLORITE SOLUTION
SS	SODIUM SILICATE
VAC	VACUUM

AECOM

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DIAGRAMS & SCHEMATICS
PROCESS MECHANICAL
PROCESS
LEGEND & ABBREVIATION

SHEET NUMBER

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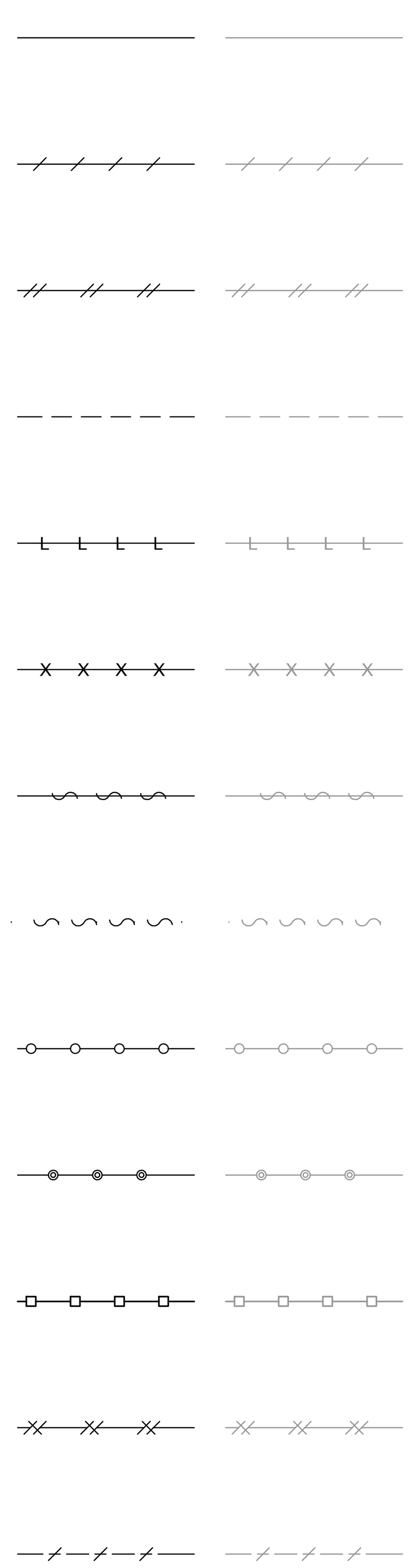
SIGNAL LINE TYPES

PROPOSED - EXISTING - DESCRIPTION



- INSTRUMENT SUPPLY OR PROCESS TAP
- UNDEFINED SIGNAL
- PNEUMATIC SIGNAL
- ELECTRIC SIGNAL
- HYDRAULIC SIGNAL
- CAPILLARY TUBE
- ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
- ELECTROMAGNETIC OR SONIC SIGNAL (NOT GUIDED)
- INTERNAL SYSTEM LINK (SOFTWARE OR DATA LINK)
- MECHANICAL LINK
- FOUNDATION FIELDBUS
- PNEUMATIC BINARY SIGNAL
- ELECTRIC BINARY SIGNAL

STANDARD ABBREVIATIONS

TABLE 1 - INSTRUMENT IDENTIFICATION

INSTRUMENT OR DEVICE IDENTIFIERS

AE	ANALYSIS ELEMENT
AIT	ANALYSIS INDICATING TRANSMITTER (ANALYTIC INST.)
AK	ANALYSIS (SAMPLER) CONTROL STATION
ASH	ANALYSIS SWITCH - HIGH
ASHH	ANALYSIS SWITCH - HIGH-HIGH
AT	ANALYSIS TRANSMITTER (ANALYTIC INST.)
DE	DENSITY ELEMENT
DT	DENSITY TRANSMITTER
EE	VOLTAGE ELEMENT/TRANSFORMER
EI	VOLTAGE INDICATOR
ET	VOLTAGE TRANSMITTER
FE	FLOW ELEMENT
FG	FLOW METER ULTRASONIC GENERATOR
FI	FLOW INDICATOR
FIC	FLOW INDICATING CONTROLLER
FIT	FLOW INDICATING TRANSMITTER
FQI	FLOW TOTALIZING INDICATOR
FQY	FLOW TOTALIZING / INTEGRATING RELAY
FSH	FLOW SWITCH HIGH
FSL	FLOW SWITCH LOW
FT	FLOW TRANSMITTER
HK	HAND CONTROL STATION
HS	HAND SWITCH
IS	CURRENT SWITCH
IE	CURRENT ELEMENT/TRANSFORMER
II	CURRENT INDICATOR
IY	CURRENT RELAY
IT	CURRENT TRANSMITTER
KY	TIMER RELAY
LE	LEVEL ELEMENT
LI	LEVEL INDICATOR
LIC	LEVEL INDICATING CONTROLLER
LIT	LEVEL INDICATING TRANSMITTER
LSL	LEVEL SWITCH LOW
LSH	LEVEL SWITCH HIGH
LSLL	LEVEL SWITCH LOW LOW
LSHH	LEVEL SWITCH HIGH HIGH
NS	MOISTURE SWITCH
PE	PRESSURE ELEMENT
PG	PRESSURE GAUGE
PI	PRESSURE INDICATOR
PIT	PRESSURE INDICATING TRANSMITTER
PS	PRESSURE SWITCH
PSH	PRESSURE SWITCH HIGH
PSHH	PRESSURE SWITCH HIGH HIGH
PSL	PRESSURE SWITCH LOW
PSLL	PRESSURE SWITCH LOW LOW
PT	PRESSURE TRANSMITTER
SC	SPEED CONTROLLER
SI	SPEED INDICATOR
TC	TEMPERATURE CONTROLLER
TE	TEMPERATURE ELEMENT
TG	TEMPERATURE GAUGE
TI	TEMPERATURE INDICATOR
TIT	TEMPERATURE INDICATING TRANSMITTER
TSH	TEMPERATURE SWITCH HIGH
TSHH	TEMPERATURE SWITCH HIGH HIGH
TSL	TEMPERATURE SWITCH LOW
TSLL	TEMPERATURE SWITCH LOW LOW
TT	TEMPERATURE TRANSMITTER
VE	VIBRATION ELEMENT
VT	VIBRATION TRANSMITTER
WE	WEIGHT ELEMENT
WIT	WEIGHT INDICATING TRANSMITTER
ZI	POSITION INDICATOR
ZS	POSITION SWITCH
ZSC	POSITION SWITCH CLOSED (LIMIT SWITCH)
ZSO	POSITION SWITCH OPEN (LIMIT SWITCH)
ZIT	POSITION INDICATING TRANSMITTER
ZT	POSITION TRANSMITTER

INSTRUMENT SIGNAL IDENTIFIERS

AAH	ANALYSIS ALARM - HIGH	DIGITAL INPUT
AAHH	ANALYSIS ALARM - HIGH-HIGH	DIGITAL INPUT
AI	ANALYTICAL INDICATION	ANALOG INPUT
AF	ANALYSIS (SAMPLER) FAIL	DIGITAL INPUT
AM	ANALYSIS (SAMPLER) ON/OFF	DIGITAL INPUT
AN	ANALYSIS (SAMPLER) START	DIGITAL OUTPUT
FAL	FLOW ALARM LOW	DIGITAL INPUT
FAH	FLOW ALARM HIGH	DIGITAL INPUT
FI	FLOW INDICATION	ANALOG INPUT
FF	FLOW RATE FAIL	DIGITAL INPUT
FQ	FLOW TOTALIZER	DIGITAL INPUT
LAH	LEVEL ALARM HIGH	DIGITAL INPUT
LAL	LEVEL ALARM LOW	DIGITAL INPUT
LC	LEVEL CONTROL (SETPOINT)	ANALOG OUTPUT
LDI	LEVEL DIFFERENTIAL INDICATION	DIGITAL INPUT
LF	LEVEL FAIL	DIGITAL INPUT
LI	LEVEL INDICATION	ANALOG INPUT
MF	MOTOR FAILURE	DIGITAL INPUT
MM	MOTOR RUN STATUS	DIGITAL INPUT
MMF	MOTOR RUN STATUS FORWARD	DIGITAL INPUT
MMR	MOTOR RUN STATUS REVERSE	DIGITAL INPUT
MN	MOTOR START/STOP	DIGITAL OUTPUT
MQ	MOTOR RUN HOURS	DIGITAL INPUT
MX	MOTOR UNCLASSIFIED (X = RESET)	DIGITAL INPUT
OAH	TORQUE ALARM HIGH	DIGITAL INPUT
PAH	PRESSURE ALARM HIGH	DIGITAL INPUT
PAL	PRESSURE ALARM LOW	DIGITAL INPUT
PI	PRESSURE INDICATION	ANALOG INPUT
QA	COMMON ALARM (OR TROUBLE)	DIGITAL INPUT
QF	COMMON FAIL ALARM	DIGITAL INPUT
SAL	MOTION ALARM LOW	DIGITAL INPUT
SC	SPEED CONTROL (SETPOINT)	ANALOG OUTPUT
SI	SPEED INDICATION	ANALOG INPUT
TAH	TEMPERATURE ALARM HIGH	DIGITAL INPUT
TI	TEMPERATURE INDICATION	ANALOG INPUT
UA	MULTIFUNCTION ALARM (GENERAL)	DIGITAL INPUT
VB	VALVE CLOSE (OR DECREASE)	DIGITAL \ MODULATING OUTPUT
VD	VALVE OPEN (OR INCREASE)	DIGITAL \ MODULATING OUTPUT
WI	WEIGHT INDICATION	ANALOG INPUT
XA	UNCLASSIFIED ALARM (X = FIRE)	DIGITAL INPUT
XI	UNCLASSIFIED INDICATION	ANALOG INPUT
YK	COMPUTER / LOCAL STATION	DIGITAL INPUT
YM	COMPUTER OPERATIONAL	DIGITAL INPUT
YN/XS	ESD ACTIVATED	DIGITAL INPUT
YS	COMPUTER STATUS (AUTO)	DIGITAL INPUT
YX	COMPUTER UNCLASSIFIED (STATUS ON)	DIGITAL INPUT
ZB	POSITION CLOSED (LIMIT SWITCH)	DIGITAL INPUT
ZC	POSITION CONTROL (SETPOINT)	ANALOG OUTPUT
ZD	POSITION OPEN (LIMIT SWITCH)	DIGITAL INPUT
ZI	POSITION INDICATION	ANALOG INPUT
ZL	POSITION LOW (BELT TENSION)	DIGITAL INPUT
ZN	POSITION OPEN/CLOSE COMMAND	DIGITAL OUTPUT
ZSC	CLOSED STATUS	DIGITAL INPUT
ZSM	MIDDLE STATUS	DIGITAL INPUT
ZSO	OPENED STATUS	DIGITAL INPUT

TABLE 2 - OPERATING FUNCTIONS

ANALYTICAL FUNCTIONS

CH4	METHANE
Cl2	CHLORINE
CO	CARBON MONOXIDE
COMB	COMBUSTIBLE GAS
DO	DISSOLVED OXYGEN
HC	HYDROCARBONS
H2S	HYDROGEN SULFIDE
HUM	HUMIDITY
LEL	LOWER EXPLOSIVE LIMIT
MLSS	MIXED LIQUOR SUSPENDED SOLIDS
NH4	AMMONIA GAS
NO	NITRIC OXIDE
NO2	NITROGEN DIOXIDE NITRATE NO3
O2	OXYGEN
ORP	OXIDATION REDUCTION POTENTIAL
OUR	OXYGEN UPTAKE RATE
pH	pH
PO4	PHOSPHORUS
SO2	SULPHUR DIOXIDE
SS	SUSPENDED SOLIDS (DENSITY)
TSS	TOTAL SUSPENDED SOLIDS
TURB	TURBITY
VIB	VIBRATION

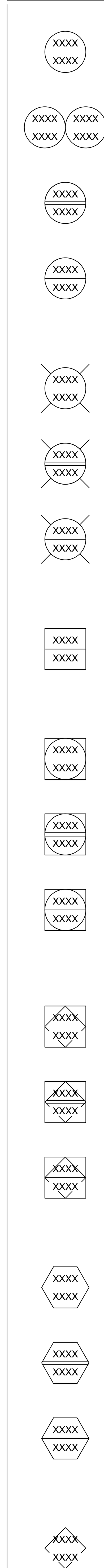
SWITCHING FUNCTIONS

ACK	ACKNOWLEDGE (ALARM)
ALOH	AUTO-LOCAL-OFF-HAND
A/M	AUTO/MANUAL
CLS	CLOSE
COB	COMPUTER-OFF-BYPASS
COH	COMPUTER-OFF-HAND
ESD	EMERGENCY SHUTDOWN DEVICE
F/S	FAST-SLOW SELECTION
FOR	FORWARD-OFF-REVERSE
FWD	FORWARD SELECTION
HA	HAND-AUTO SELECTION
HOA	HAND-OFF-AUTO SELECTION
L/L	LEAD-LAG SELECTION
LOR	LOCAL-OFF-REMOTE
LOS	LOCK-OFF-STOP
L/R	LOCAL-REMOTE SELECTION
M/A	MANUAL-AUTO SELECTION
MAN	MANUAL REG.
O/C	OPEN/CLOSE
O/O	ON-OFF SELECTION
OCA	OPEN-CLOSE-AUTO SELECTION
OPN	OPEN
OSC	OPEN-STOP-CLOSE SELECTION
OVR	INTERLOCK OVERRIDE SWITCH
P/M	POSITIONER/MANUAL
P/R	PANEL/REMOTE
POT	POTENTIOMETER
R/B	RUN/BYPASS
R/L	RAISE-LOWER
REV	REVERSE SELECTION
RST	RESET
SEL	SELECTOR SWITCH
S/S	START-STOP
SP	SET POINT

GENERAL

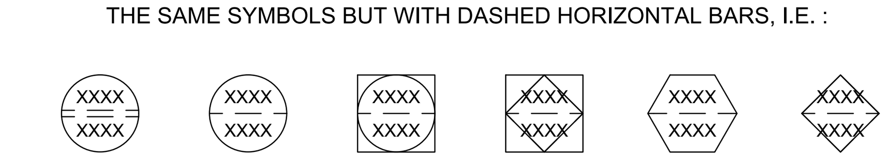
AI	ANALOG INPUT
AO	ANALOG OUTPUT
CCTV	CLOSED CIRCUIT TELEVISION
DB	DEVICE BUS
DCS	DISTRIBUTED CONTROL SYSTEM
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
D/P	DIFFERENTIAL PRESSURE
ES	ELECTRICAL SERVICE
FB	FIELDBUS
HMI	HUMAN MACHINE INTERFACE
I/I	CURRENT TO CURRENT
I/O	INPUT/OUTPUT
I/P	CURRENT TO PRESSURE
IBD	INBOARD BEARING
LEAK	LEAKAGE
LCP	LOCAL CONTROL PANEL
MCC	MOTOR CONTROL CENTRE
OBD	OUTBOARD BEARING
O/L	OVERLOAD
PLC	PROGRAMMABLE LOGIC CONTROLLER
RTD	RESISTIVE TEMPERATURE DEVICE
SOL	SOLENOID
T/C	THERMOCOUPLE
TOR	TORQUE
WDG	WINDING

INSTRUMENT & FUNCTION SYMBOLS

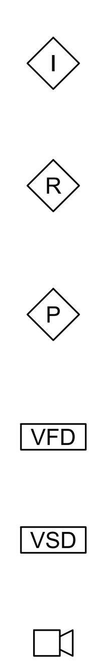


- DISCRETE INSTRUMENTS FIELD OR LOCALLY MOUNTED NOT PANEL OR CABINET MOUNTED NORMALLY ACCESSIBLE TO AN OPERATOR
- DISCRETE INSTRUMENTS SHARING COMMON HOUSING
- DISCRETE INSTRUMENTS SECONDARY OR LOCAL CONTROL ROOM FIELD OR LOCAL CONTROL PANEL MOUNTED NORMALLY ACCESSIBLE TO AN OPERATOR
- DISCRETE INSTRUMENTS CENTRAL OR MAIN CONTROL ROOM FRONT OF MAIN PANEL MOUNTED NORMALLY ACCESSIBLE TO AN OPERATOR
- ANNUNCIATOR POINT FIELD OR LOCALLY MOUNTED NOT PANEL OR CABINET MOUNTED NORMALLY ACCESSIBLE TO AN OPERATOR
- ANNUNCIATOR POINT FIELD OR LOCAL CONTROL PANEL PANEL MOUNTED NORMALLY ACCESSIBLE TO AN OPERATOR
- ANNUNCIATOR POINT CENTRAL OR MAIN CONTROL ROOM MAIN PANEL MOUNTED NORMALLY ACCESSIBLE TO AN OPERATOR
- CDACS (COMPUTER DATA ACQUISITION & CONTROL SYSTEM) INPUT, OUTPUT, OR FUNCTION ACCESSIBLE EG. DCS OR SCADA
- SHARED DISPLAY OR CONTROL DEDICATED SINGLE FUNCTION DEVICE FIELD OR LOCALLY MOUNTED NORMALLY ACCESSIBLE TO THE OPERATOR AT DEVICE
- SHARED DISPLAY OR CONTROL SECONDARY OR LOCAL CONSOLE FIELD OR LOCAL CONTROL PANEL VISIBLE ON VIDEO DISPLAY NORMALLY ACCESSIBLE TO AN OPERATOR AT CONSOLE
- SHARED DISPLAY OR CONTROL CENTRAL OR MAIN CONSOLE VISIBLE ON VIDEO DISPLAY NORMALLY ACCESSIBLE TO AN OPERATOR AT CONSOLE
- PROGRAMMABLE LOGIC CONTROL FIELD OR LOCALLY MOUNTED NOT PANEL OR CABINET MOUNTED NORMALLY ACCESSIBLE TO AN OPERATOR AT DEVICE
- PROGRAMMABLE LOGIC CONTROL SECONDARY OR LOCAL CONSOLE FIELD OR LOCAL CONTROL PANEL VISIBLE ON VIDEO DISPLAY ACCESSIBLE TO AN OPERATOR AT CONSOLE
- PROGRAMMABLE LOGIC CONTROL CENTRAL OR MAIN CONSOLE VISIBLE ON VIDEO DISPLAY NORMALLY ACCESSIBLE TO AN OPERATOR AT CONSOLE
- COMPUTER FUNCTIONS FIELD OR LOCALLY MOUNTED
- COMPUTER FUNCTIONS SECONDARY OR LOCAL COMPUTER VISIBLE ON VIDEO DISPLAY NORMALLY ACCESSIBLE TO AN OPERATOR AT TERMINAL
- COMPUTER FUNCTIONS CENTRAL OR MAIN COMPUTER VISIBLE ON VIDEO DISPLAY NORMALLY ACCESSIBLE TO AN OPERATOR AT TERMINAL
- COMMUNICATION INTERFACE COMMUNICATES TO AN ADDRESSABLE DEVICE (i.e. DB=DEVICEBUS, MB=MODBUS, E=ETHERNET IY=CURRENT-FIELDBUS, FB=FIELDBUS, PB=PROFIBUS)

NOTE: INSTRUMENTS & DEVICES NOT NORMALLY ACCESSIBLE TO THE OPERATOR OR BEHIND-THE-PANEL DEVICES OR FUNCTIONS MAY BE DEPICTED BY USING THE SAME SYMBOLS BUT WITH DASHED HORIZONTAL BARS, I.E. :

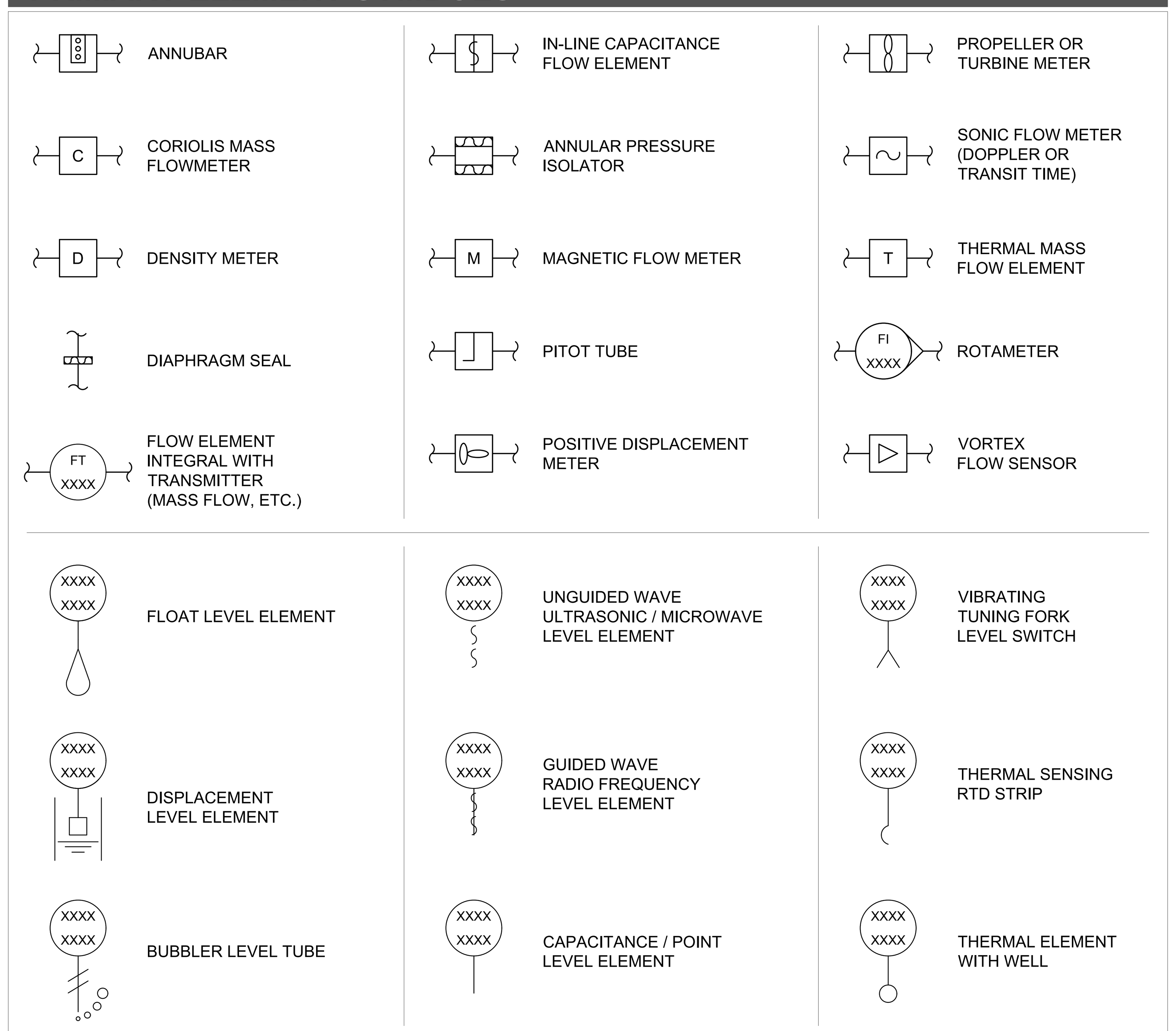


MISCELLANEOUS SYMBOLS

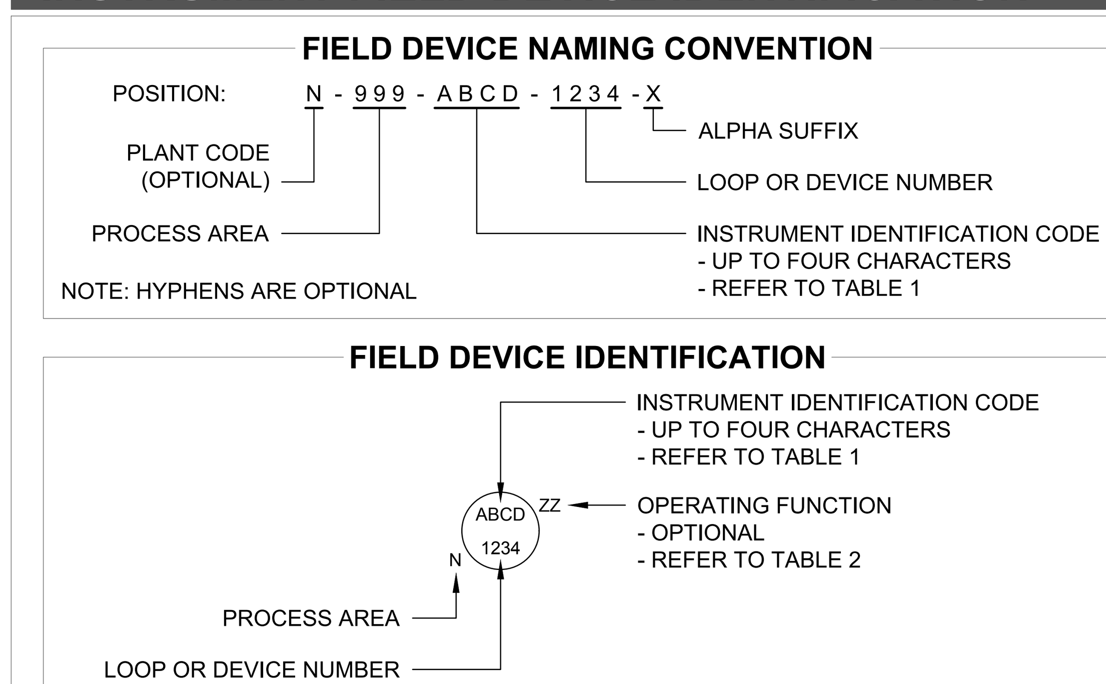


- INTERLOCK REFER TO CONTROL DESCRIPTION STRATEGY
- RESET FOR LATCH-TYPE OPERATOR
- PURGE CONNECTION OR FLUSHING DEVICE
- VARIABLE FREQUENCY DRIVE
- VARIABLE SPEED DRIVE
- ANNUNCIATOR HORN

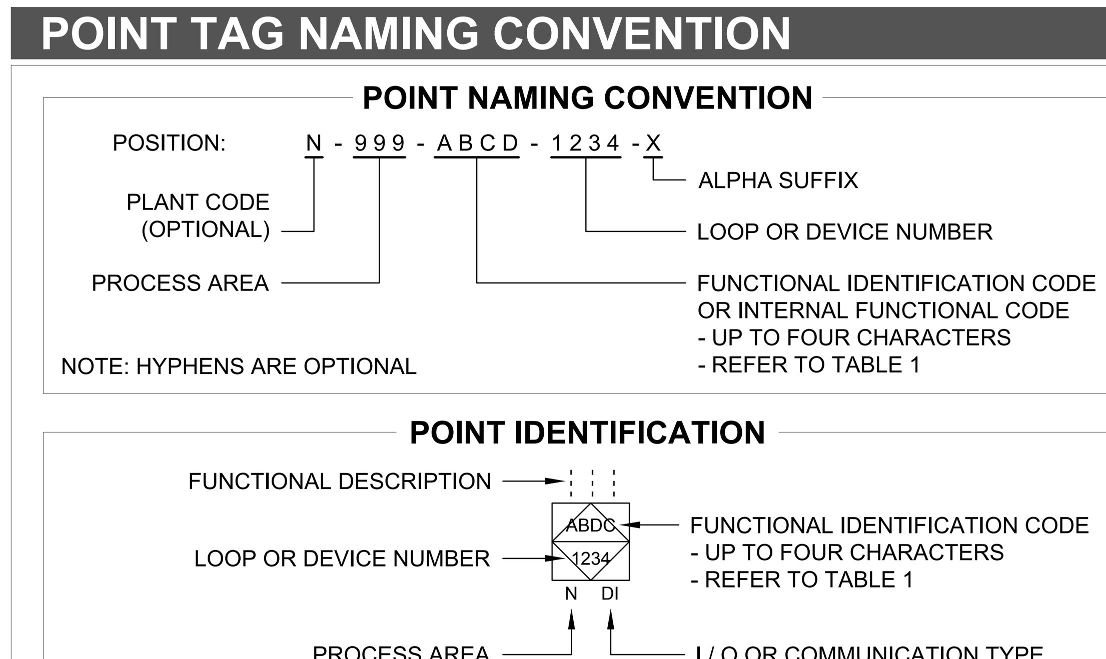
PRIMARY ELEMENT SYMBOLS



INSTRUMENT FIELD DEVICE IDENTIFICATION



POINT TAG NAMING CONVENTION



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Date: 2016-11-04

ISSUE/REVISION

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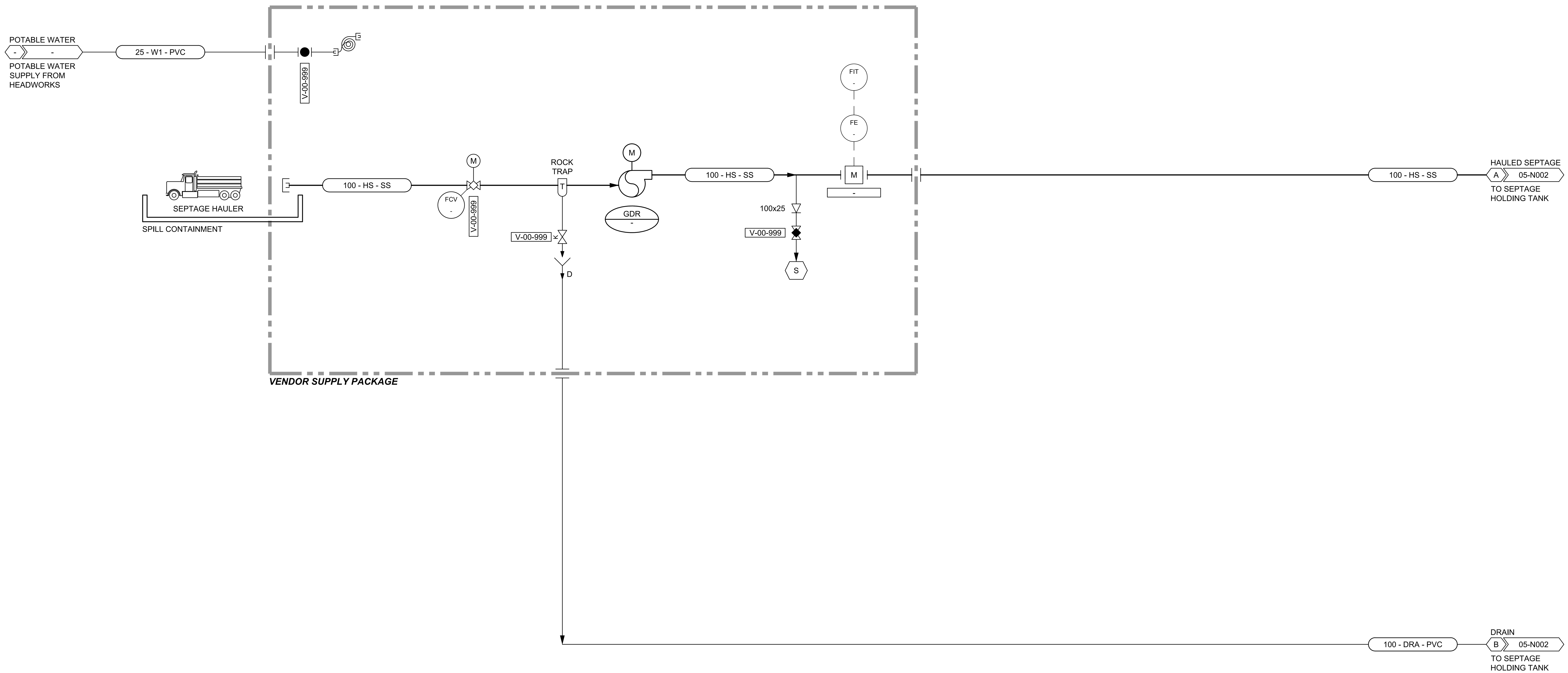
PROJECT NUMBER
60430450

SHEET TITLE
DIAGRAMS & SCHEMATICS
PROCESS MECHANICAL
INSTRUMENTATION
LEGEND & ABBREVIATIONS

SHEET NUMBER
00-N002

ANSI D 864mm x 559mm

Project Management Initials: Designer: ____ Checked: ____ Approved: ____



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SHEET TITLE

DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
SEPTAGE RECEIVER
DIAGRAM

SHEET NUMBER

05-N001

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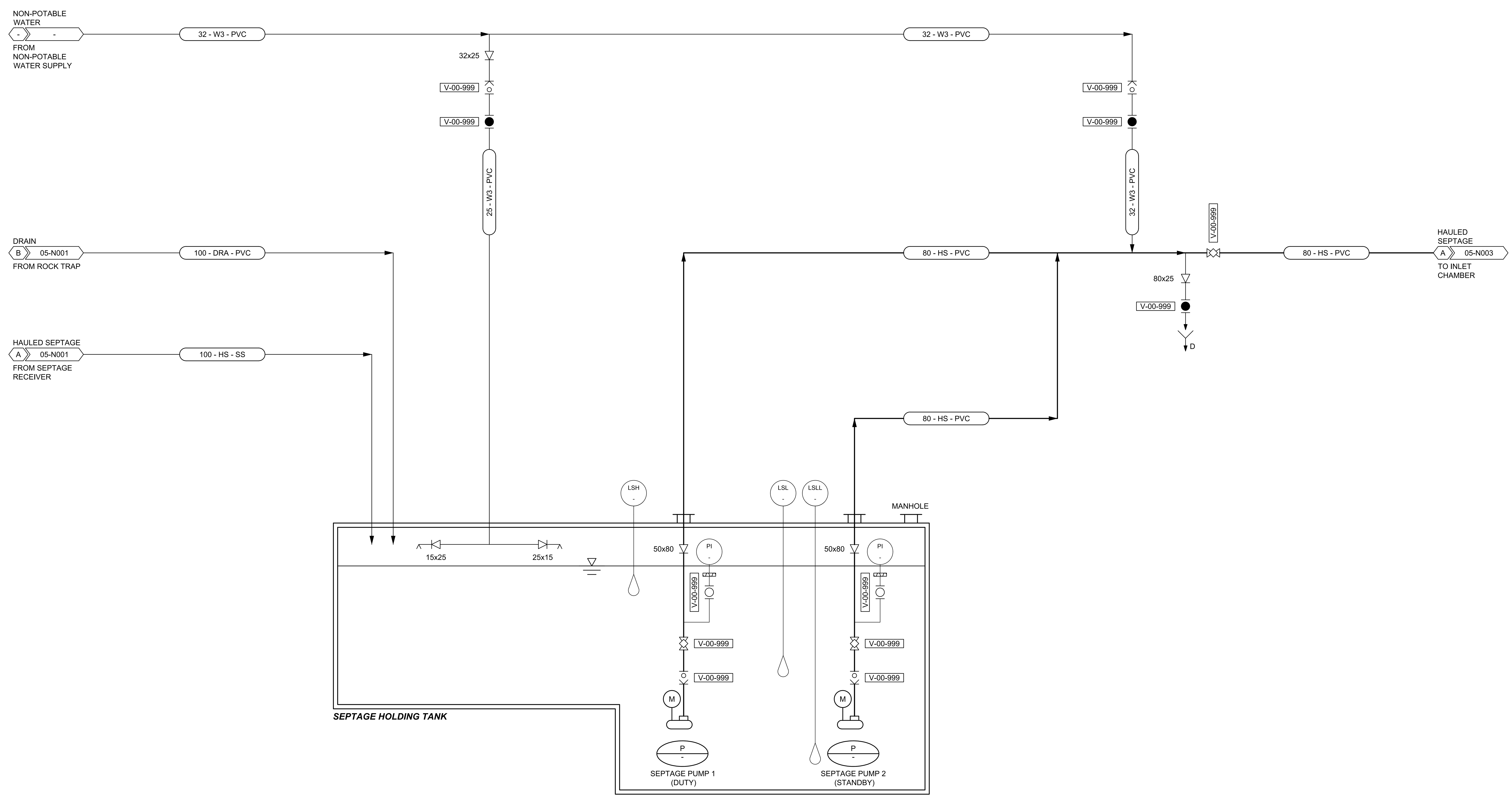

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PROJECT NUMBER

60430450

SHEET TITLE

DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
SEPTAGE TANK &
PUMPS DIAGRAM

SHEET NUMBER

05-N002

Project Management Initials: Designer: Checked: Approved: ANSI D 864mm x 559mm

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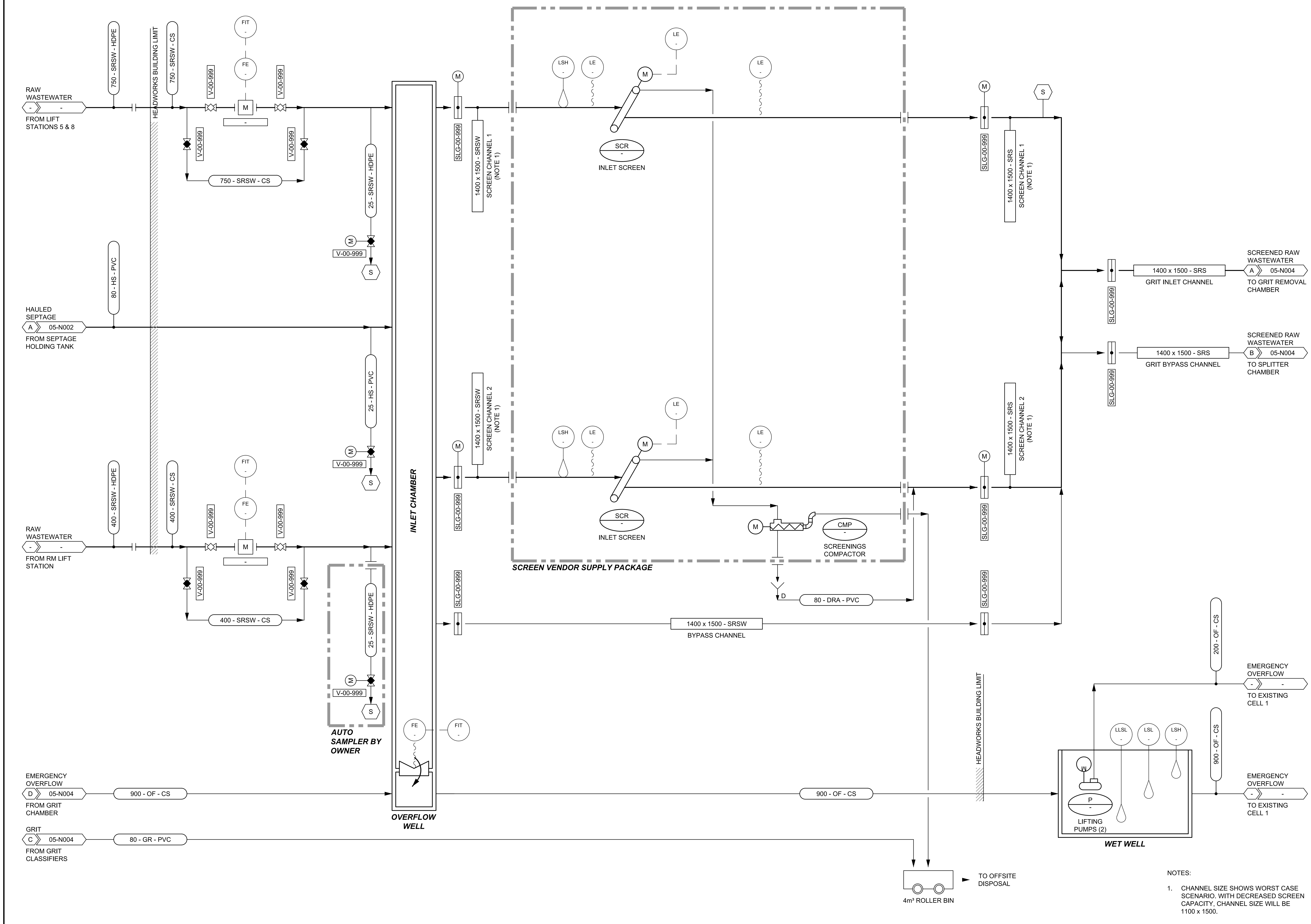

NOTES:

1. CHANNEL SIZE SHOWS WORST CASE SCENARIO. WITH DECREASED SCREEN CAPACITY, CHANNEL SIZE WILL BE 1100 x 1500.

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SHEET TITLE

DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
SCREENING
DIAGRAM

SHEET NUMBER

05-N003

ANSI D 864mm x 559mm
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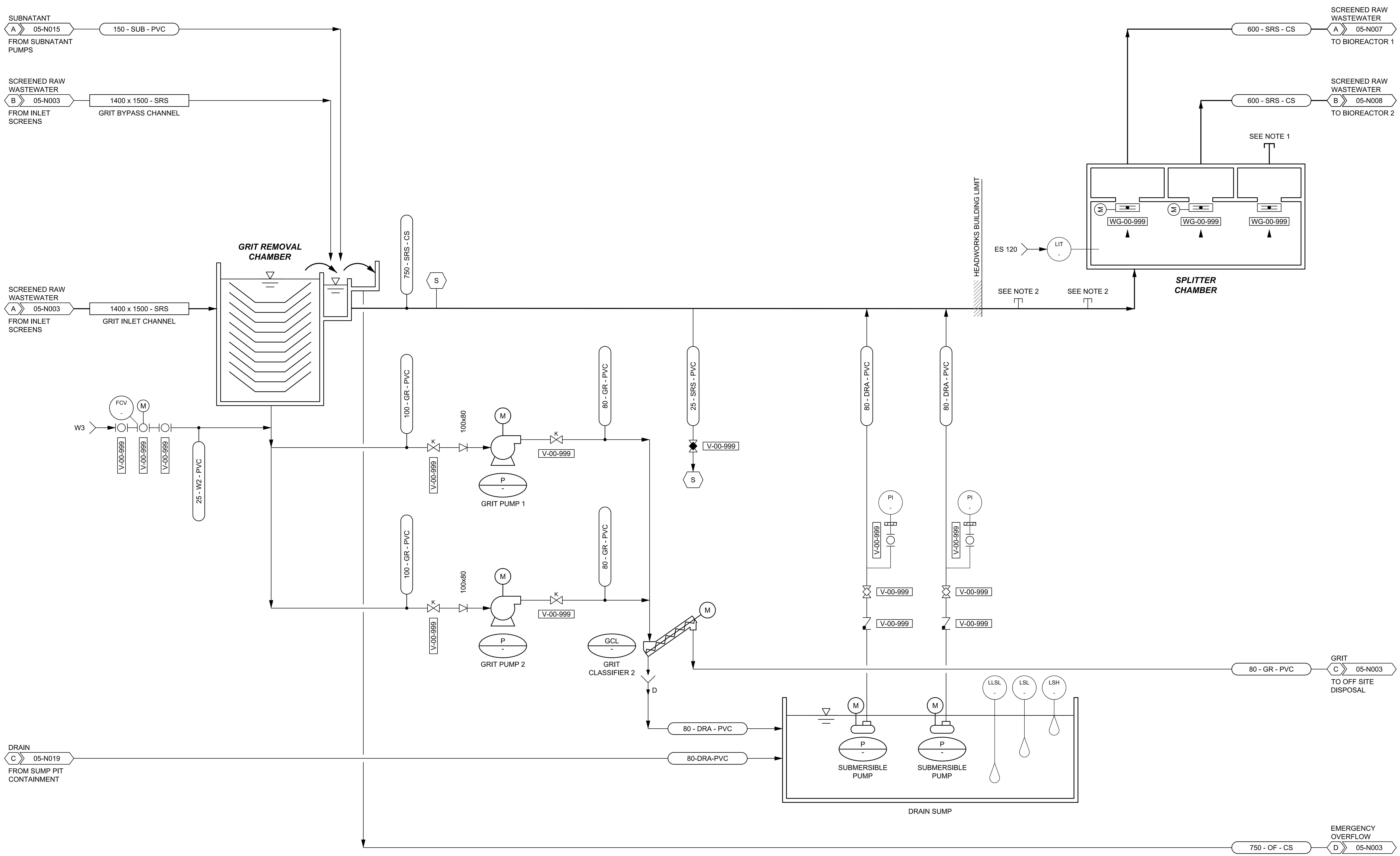

NOTES:

1. 600Ø CAP FOR FUTURE EXPANSION.
2. 750Ø CAPPED CONNECTIONS FOR FUTURE PRIMARY CLARIFIERS. SEE DRAWING 05-N005.

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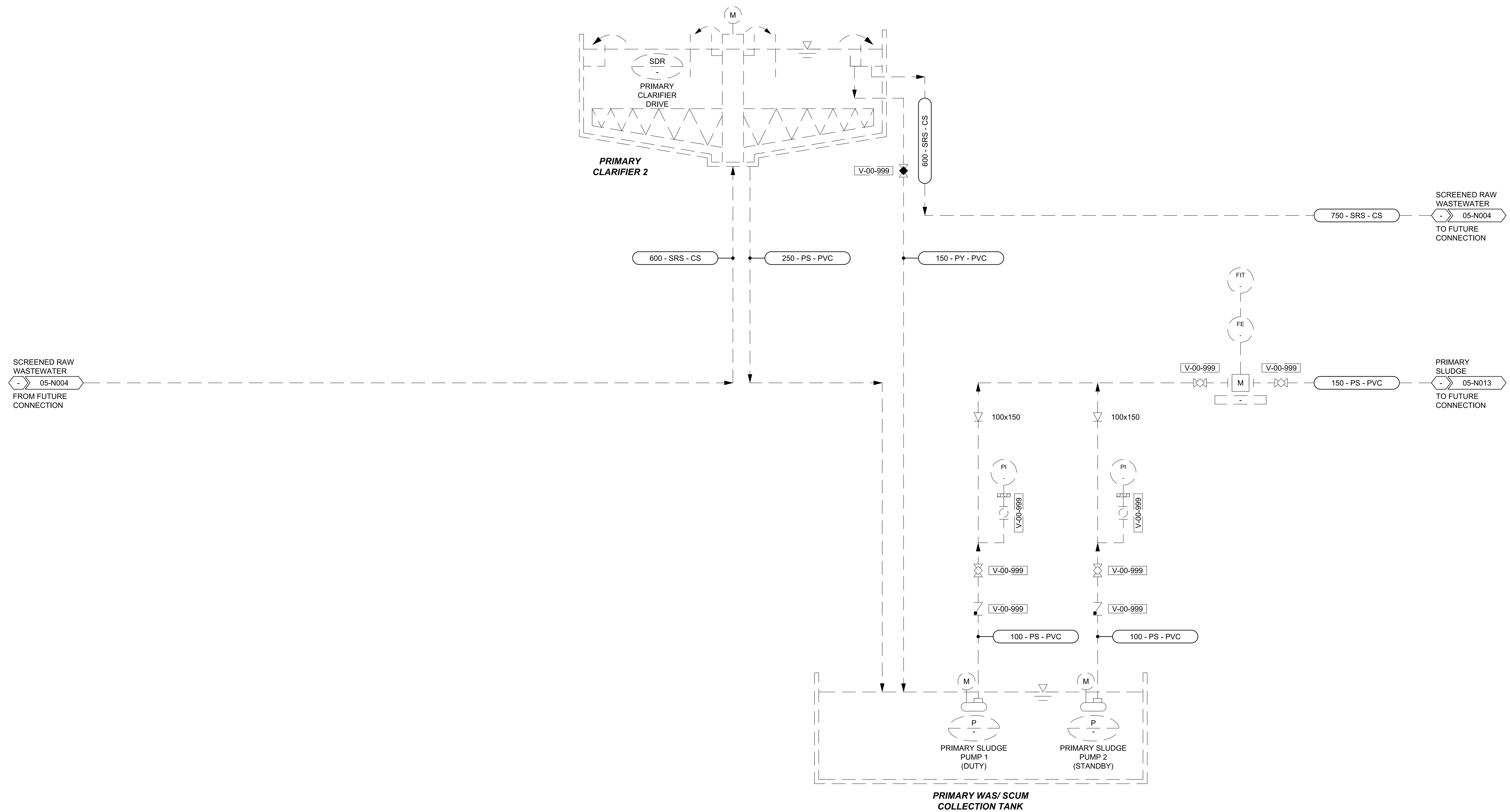
SHEET TITLE

DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
GRIT REMOVAL & SPLITTER DIAGRAM

SHEET NUMBER

05-N004



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60430450

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DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
FUTURE PRIMARY CLARIFIERS
DIAGRAM

SHEET NUMBER

05-N005

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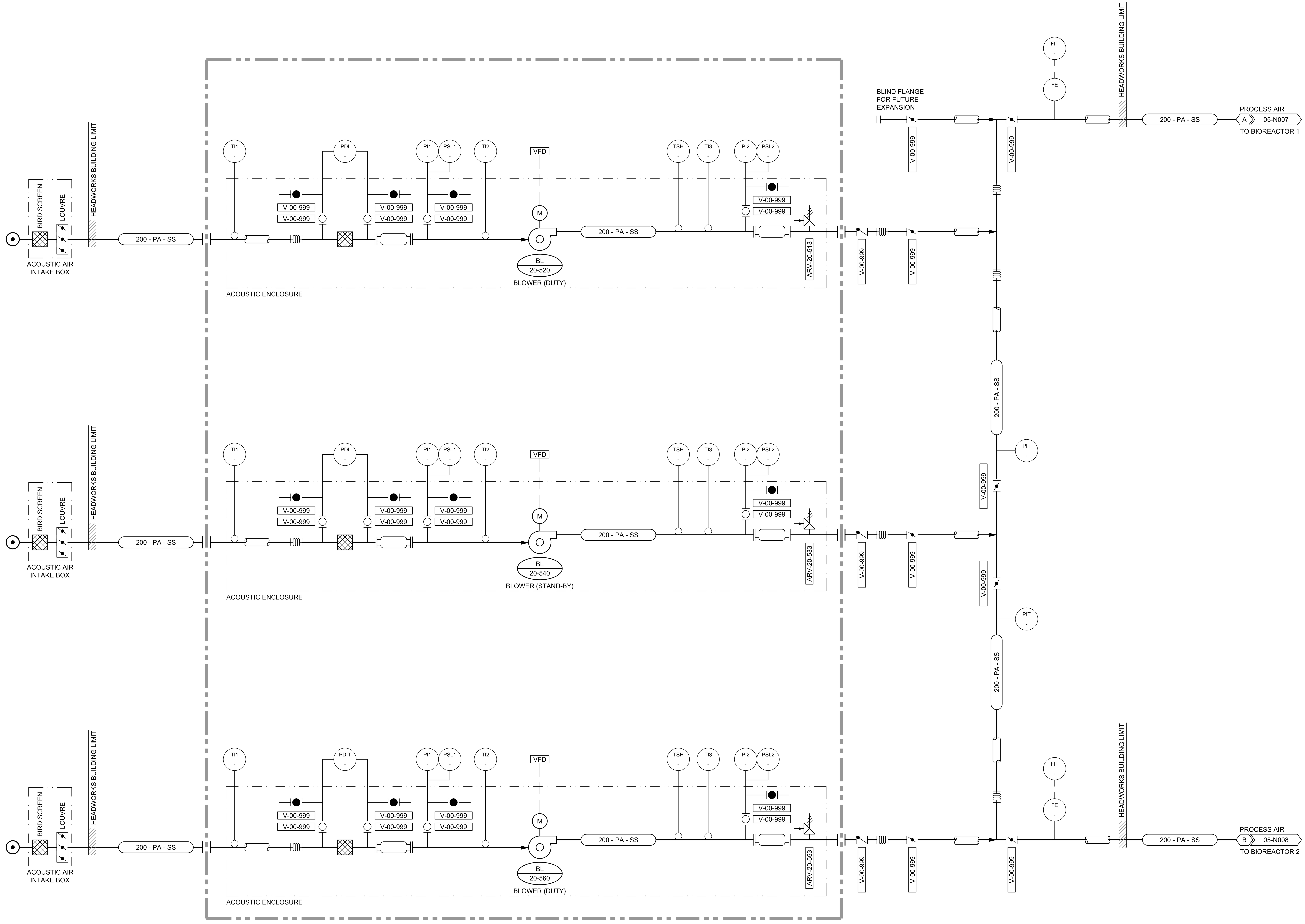

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SHEET TITLE

DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
BIOREACTOR BLOWERS
DIAGRAM

SHEET NUMBER

05-N006

Project Management Initials: Designer: Checked: Approved: ANSI D 864mm x 559mm

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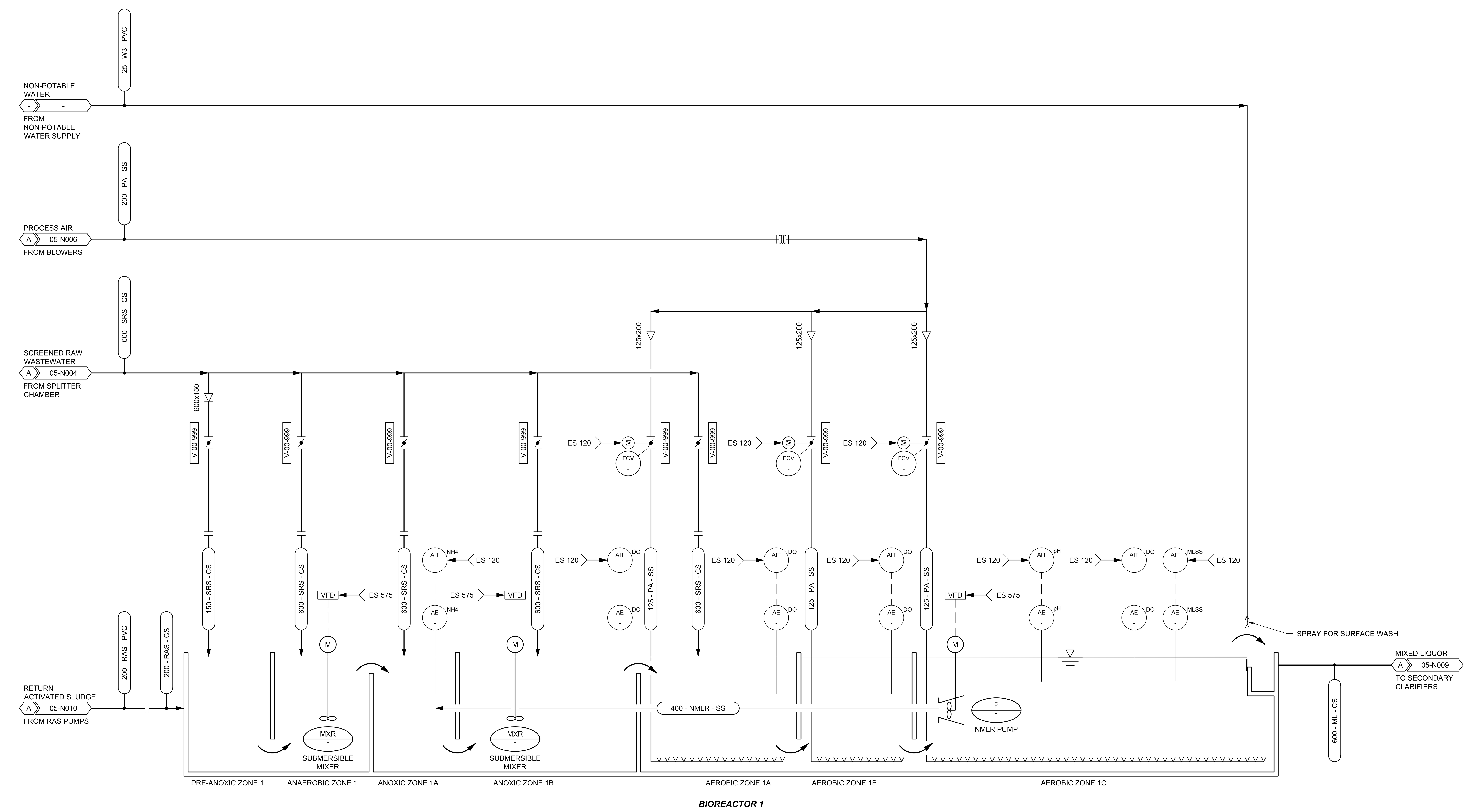

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PROJECT NUMBER

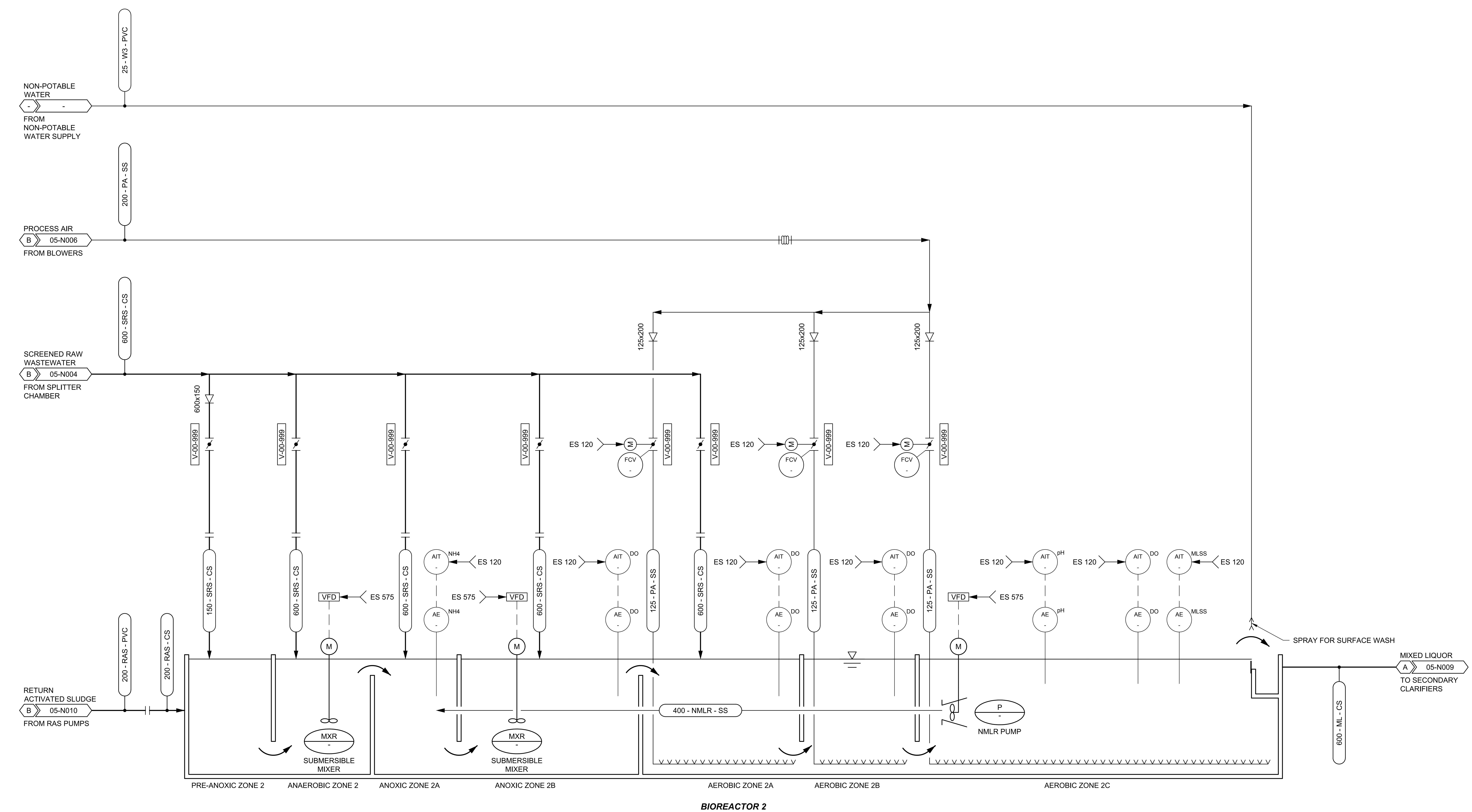
60430450

SHEET TITLE

DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
BIOREACTOR 1
DIAGRAM

SHEET NUMBER

05-N007



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PROJECT NUMBER

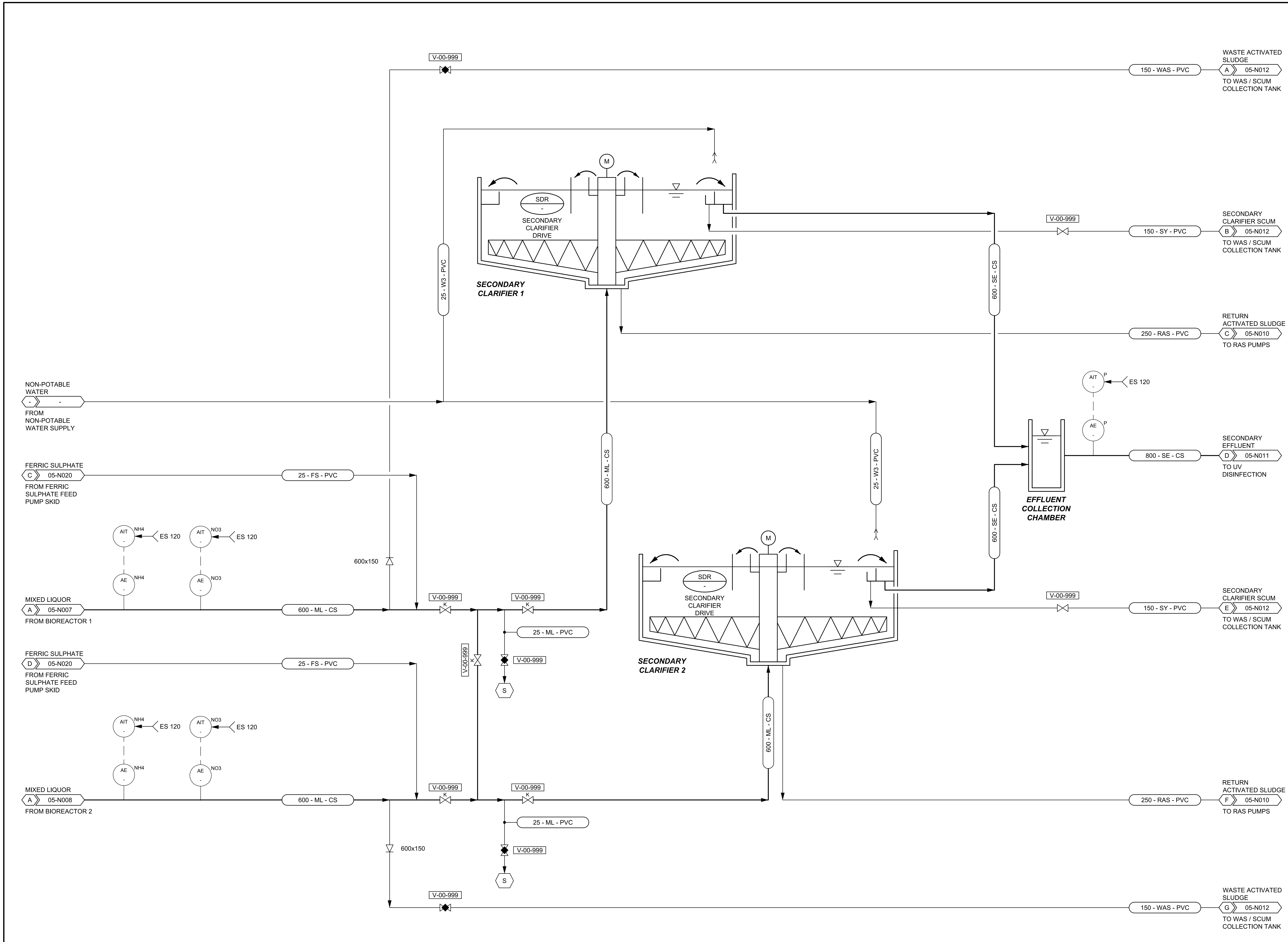
60430450

SHEET TITLE

DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
BIOREACTOR 2
DIAGRAM

SHEET NUMBER

05-N008



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60430450

SHEET TITLE

DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
SECONDARY CLARIFIERS
DIAGRAM

SHEET NUMBER

05-N009

ANSI D 864mm x 559mm
Project Management Initials: Designer: Checked: Approved:

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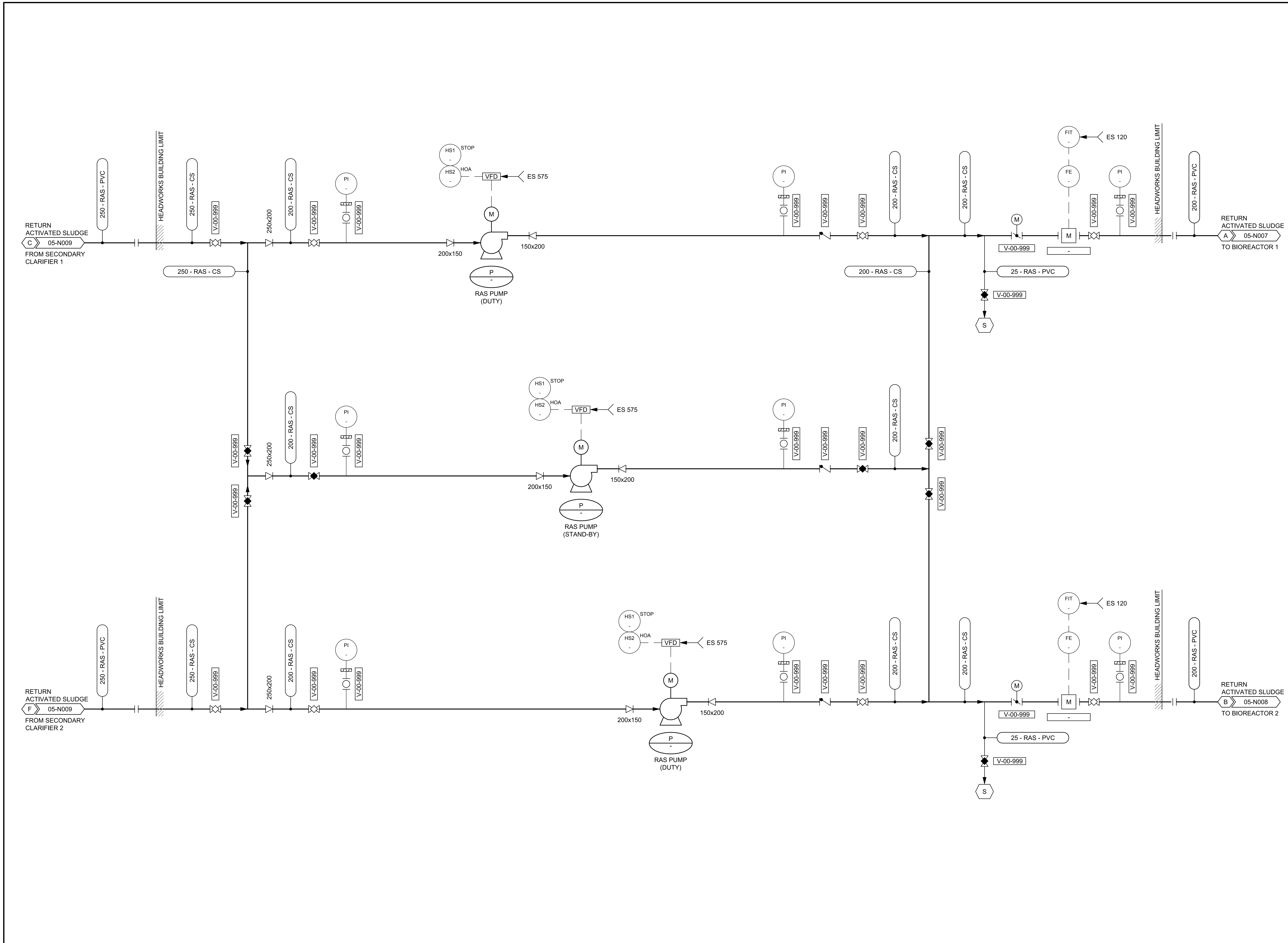

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PROJECT NUMBER

60430450

SHEET TITLE

DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
RAS PUMPS
DIAGRAM

SHEET NUMBER

05-N010

Project Management Initials: Designer: Checked: Approved: ANSI D 864mm x 559mm

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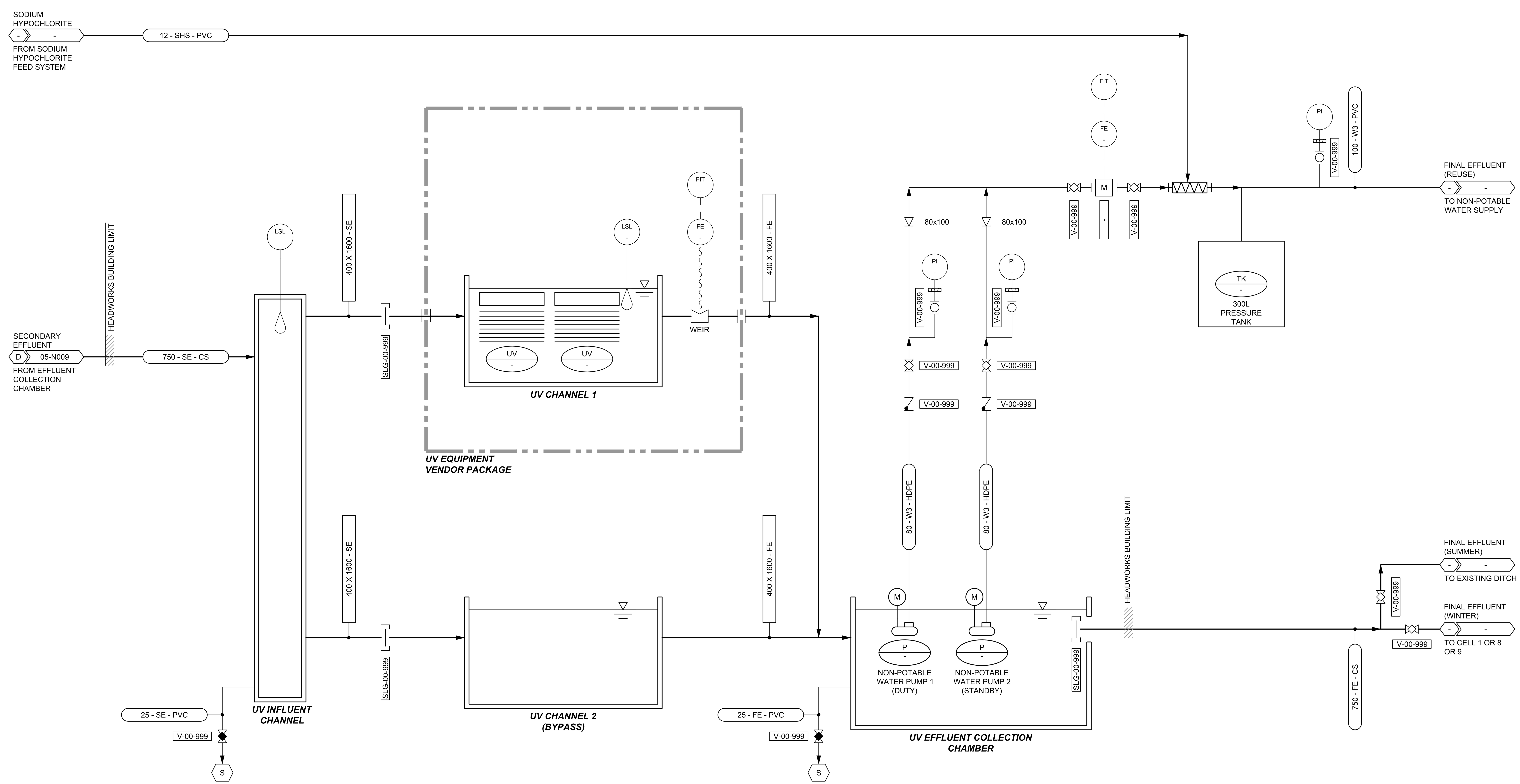

ANSI D 864mm x 559mm

Project Management Initials: ____ Designer: ____ Checked: ____ Approved: ____

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PROJECT NUMBER

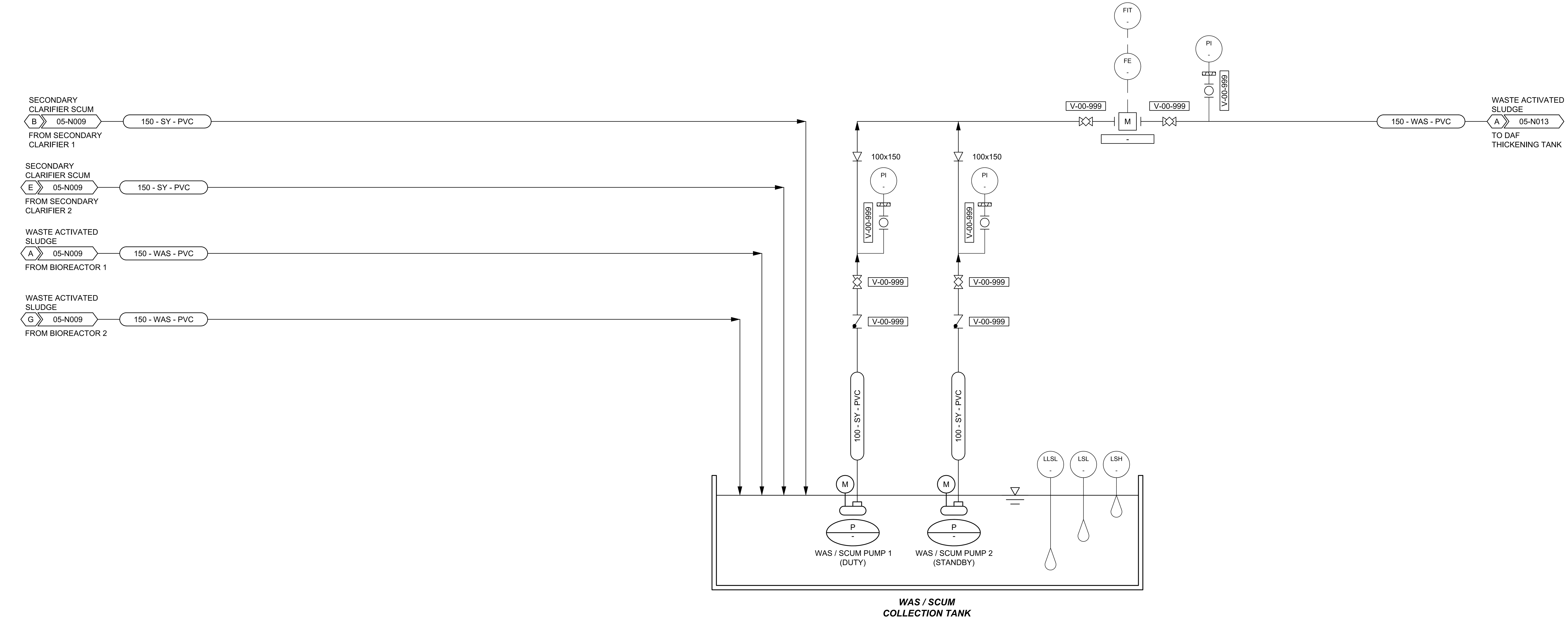
60430450

SHEET TITLE

DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
UV DISINFECTION
DIAGRAM

SHEET NUMBER

05-N011



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60430450

SHEET TITLE

DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
WAS / SCUM COLLECTION
DIAGRAM

SHEET NUMBER

05-N012

Project Management Initials: Designer: Checked: Approved: ANSI D 864mm x 559mm

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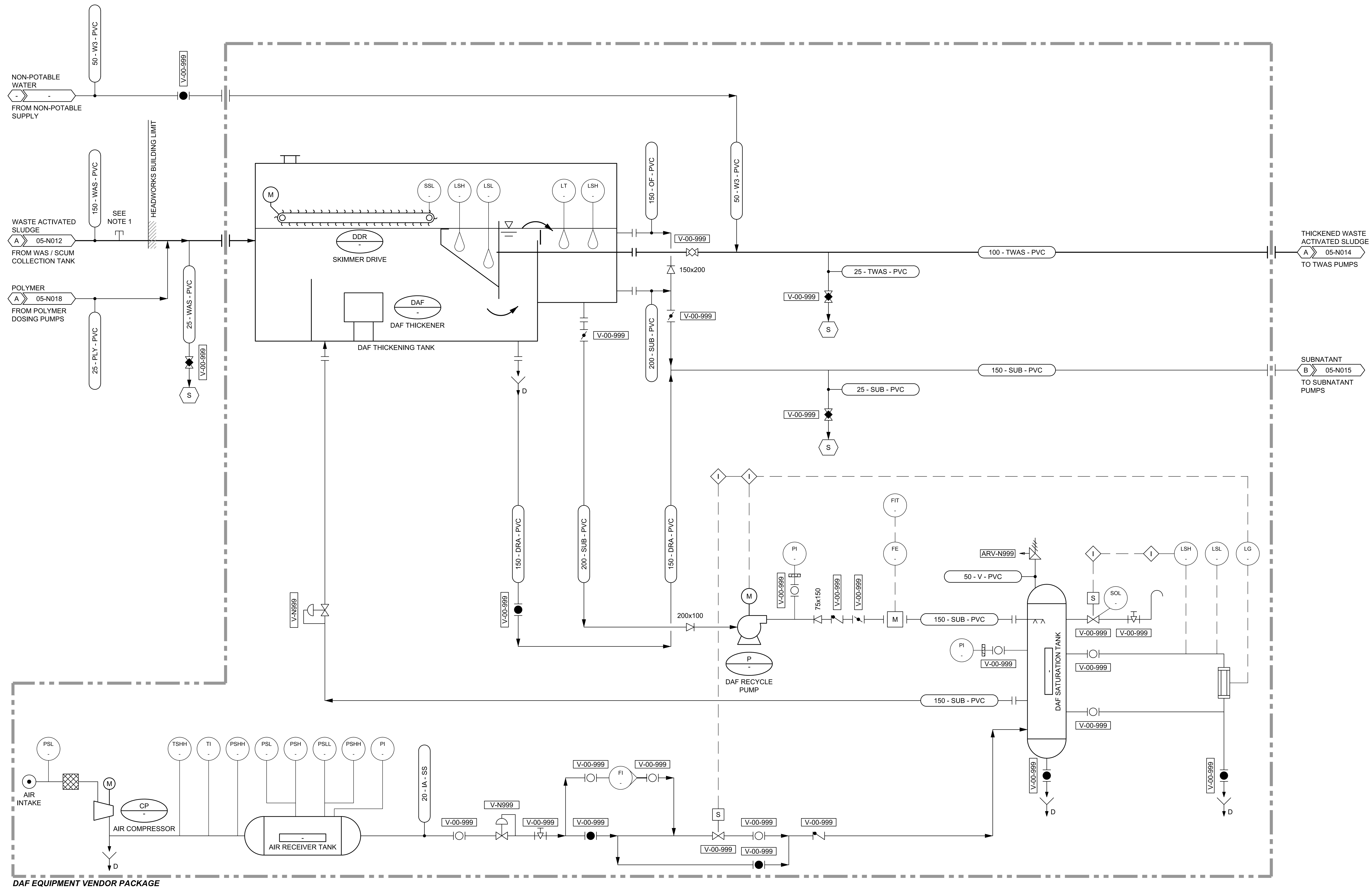

NOTES:

1. 150Ø CAPPED CONNECTIONS FOR FUTURE PRIMARY CLARIFIERS. SEE DRAWING 05-N005.

Project Management Initials: ____ Designer: ____ Checked: ____ Approved: ____ ANSI D 864mm x 559mm

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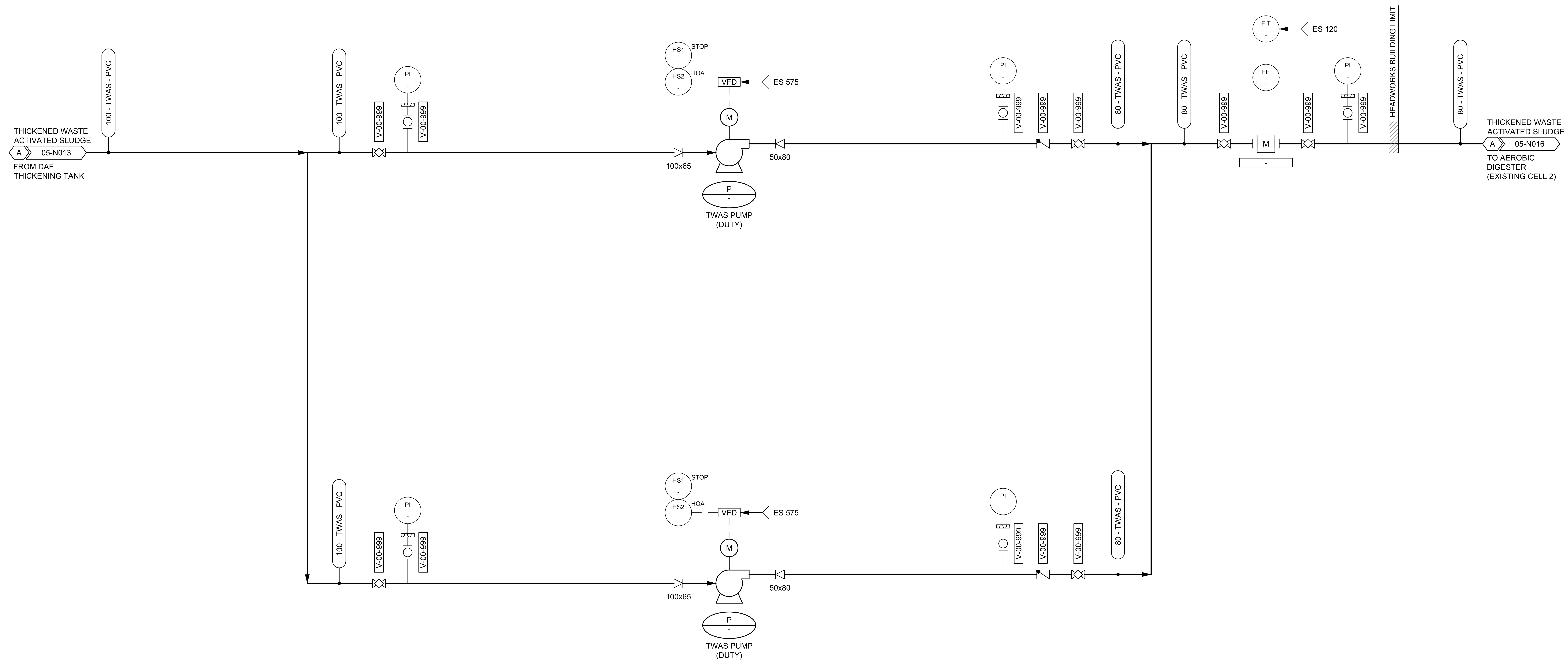
SHEET TITLE

DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
DAF THICKENING
DIAGRAM

SHEET NUMBER

05-N013



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SHEET TITLE

DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
TWAS PUMPS
DIAGRAM

SHEET NUMBER

05-N014

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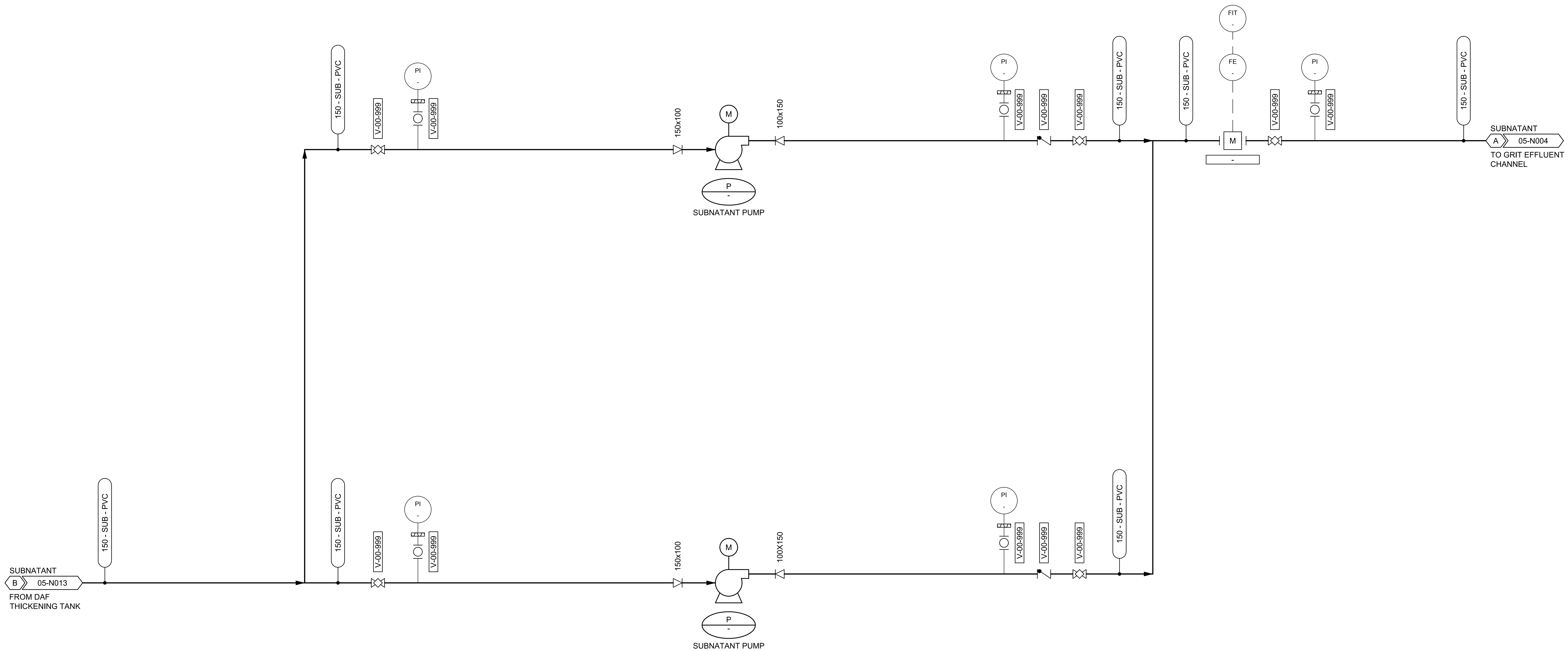

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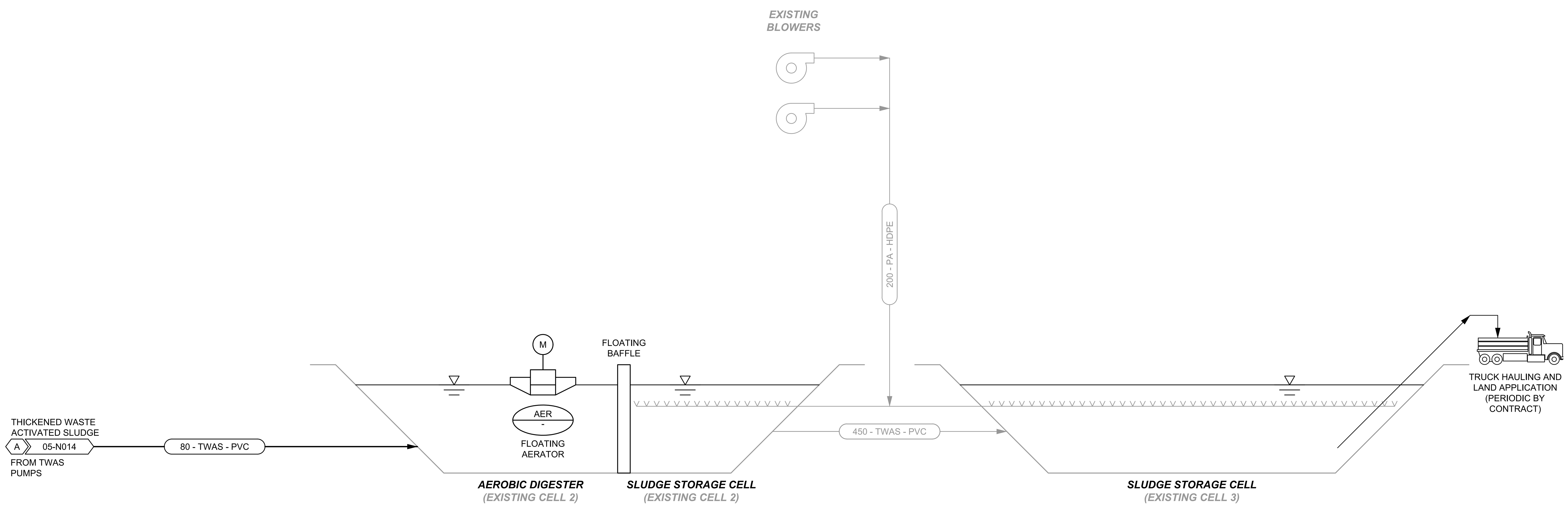
DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
SUBNATANT PUMPS
DIAGRAM

SHEET NUMBER

05-N015



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SHEET TITLE

DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
AEROBIC DIGESTERS
DIAGRAM

SHEET NUMBER

05-N016

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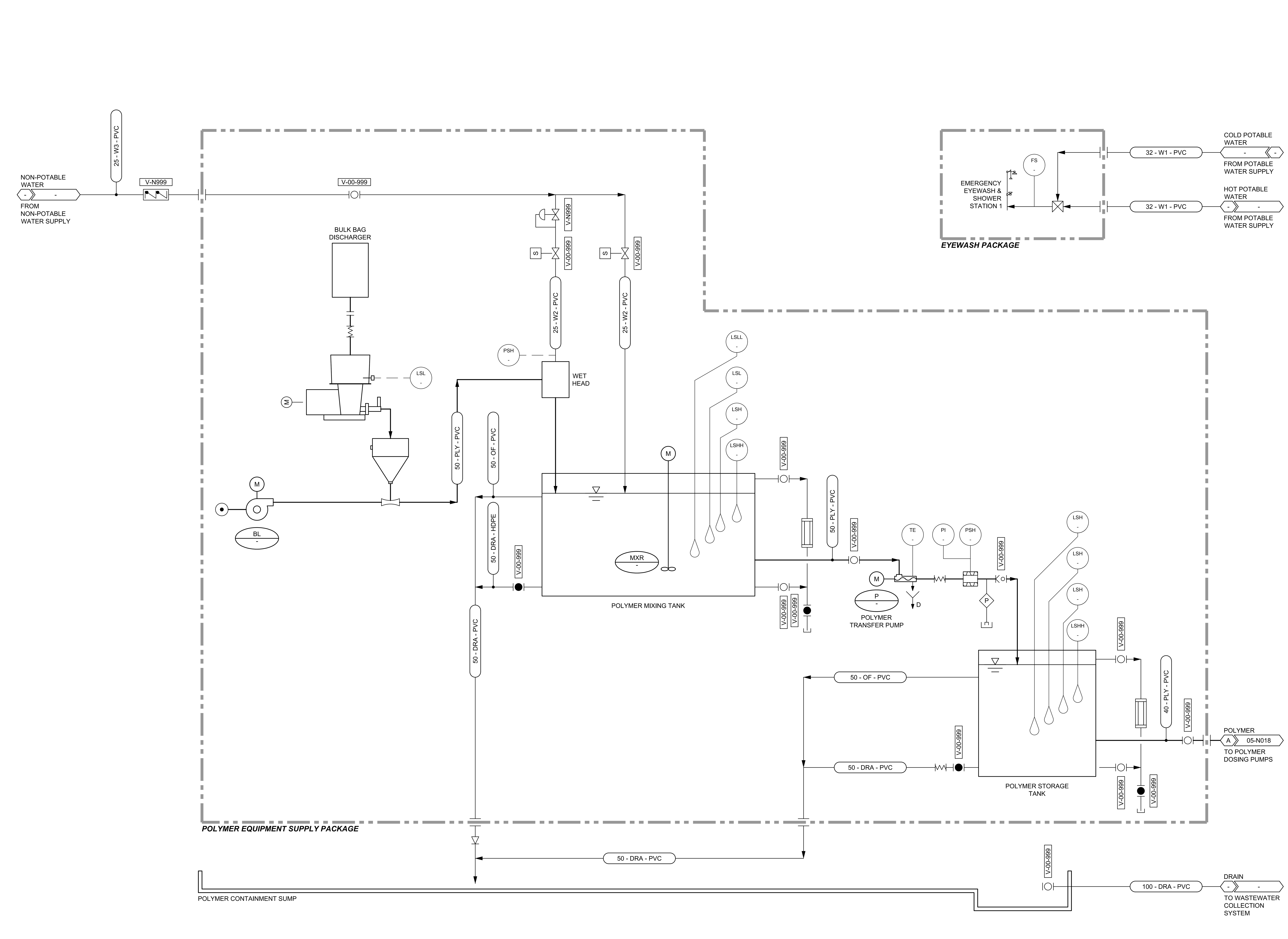

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SHEET TITLE

DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
POLYMER STORAGE
SYSTEM DIAGRAM

SHEET NUMBER

05-N017

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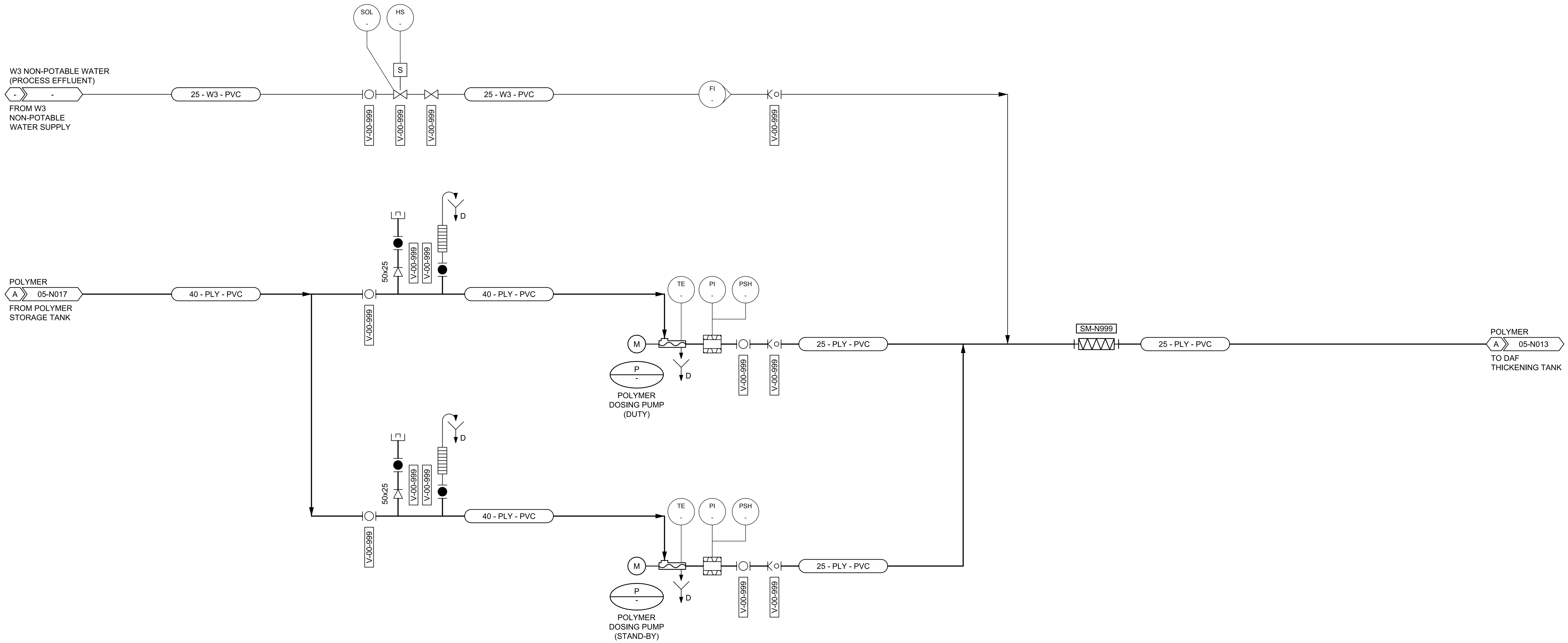

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60430450

SHEET TITLE

DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
POLYMER DOSING PUMPS
DIAGRAM

SHEET NUMBER

05-N018

Project Management Initials: Designer: Checked: Approved: ANSI D 864mm x 559mm

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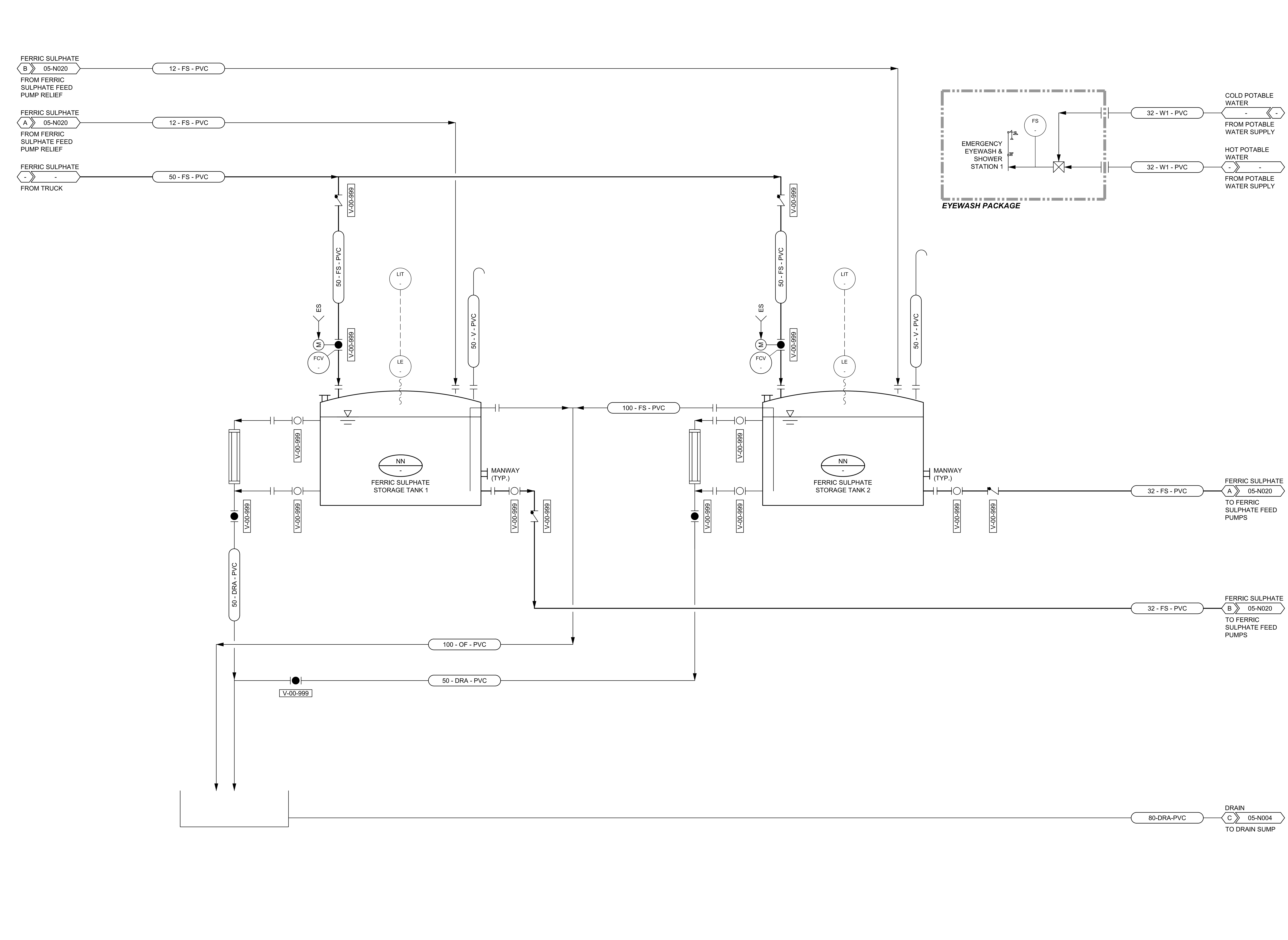

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DIAGRAMS & SCHEMATICS
PROCESS & INSTRUMENTATION
FERRIC SULPHATE STORAGE
DIAGRAM

SHEET NUMBER

05-N019

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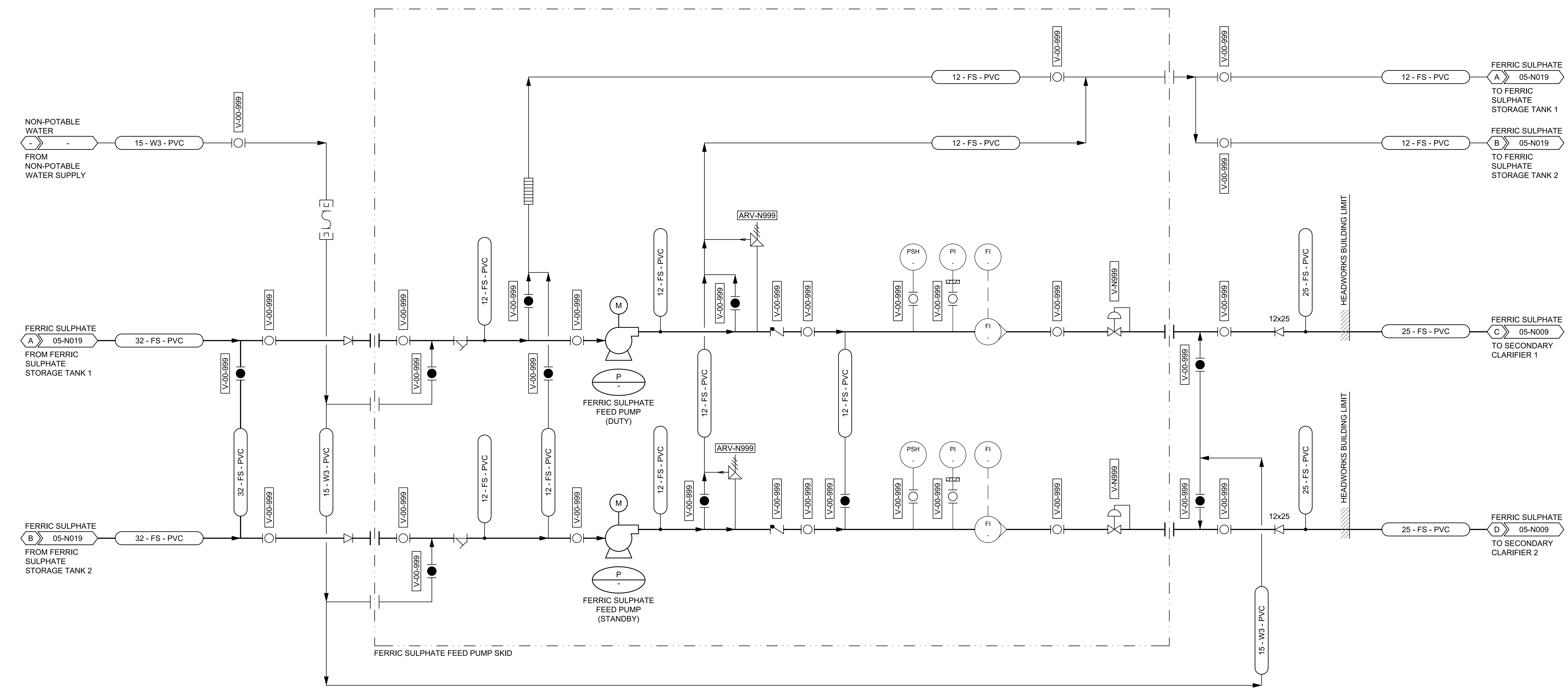

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DIAGRAM & SCHEMATICS
PROCESS & INSTRUMENTATION
CHEMICAL FEED PUMPS
DIAGRAM

SHEET NUMBER

05-N020

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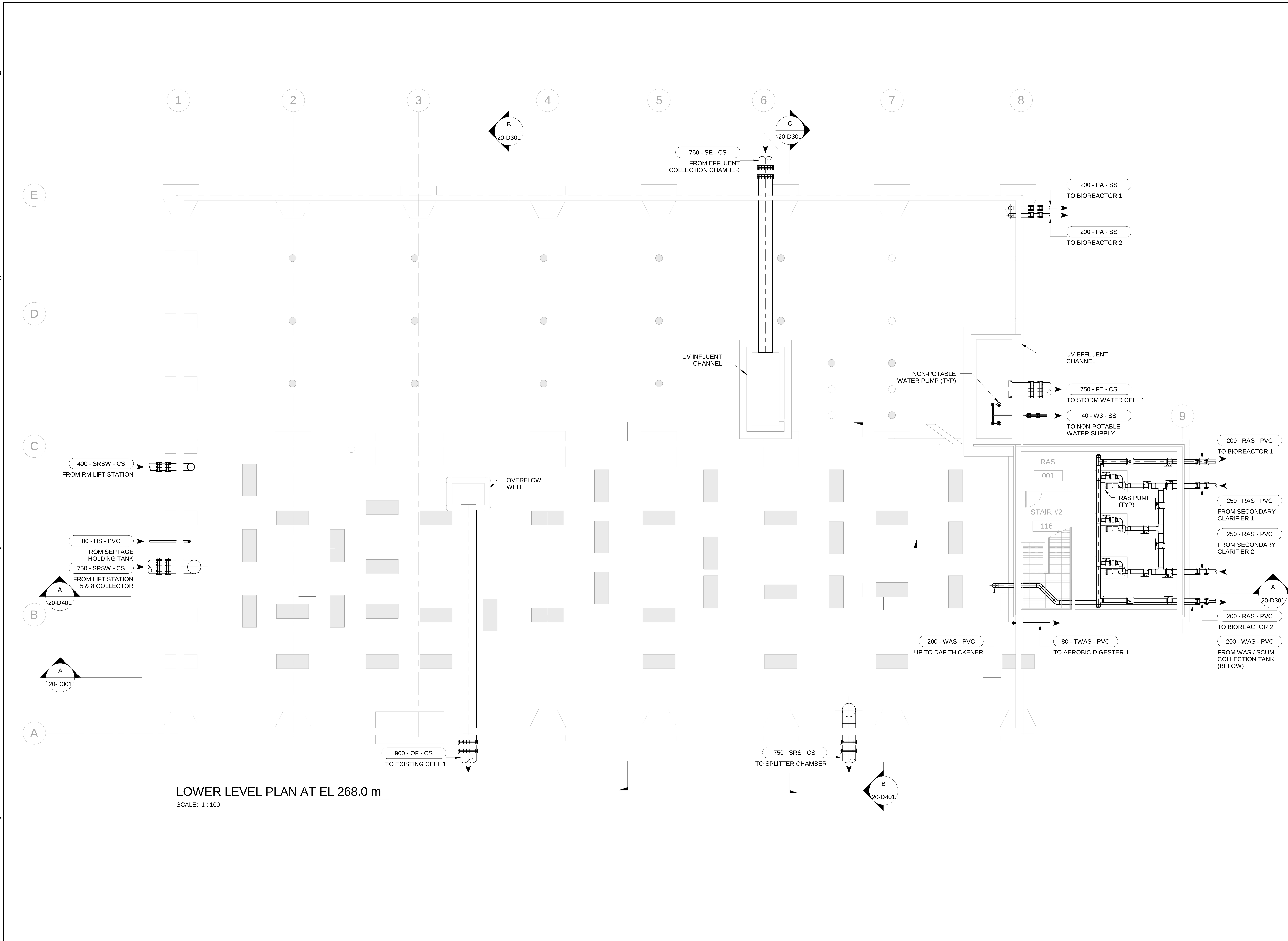

LOWER LEVEL PLAN AT EL 268.0 m

SCALE: 1 : 100

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60430450

SHEET TITLE

HEADWORKS BUILDING PROCESS MECHANICAL OVERALL LOWER LEVEL PLAN

SHEET NUMBER

20-D101

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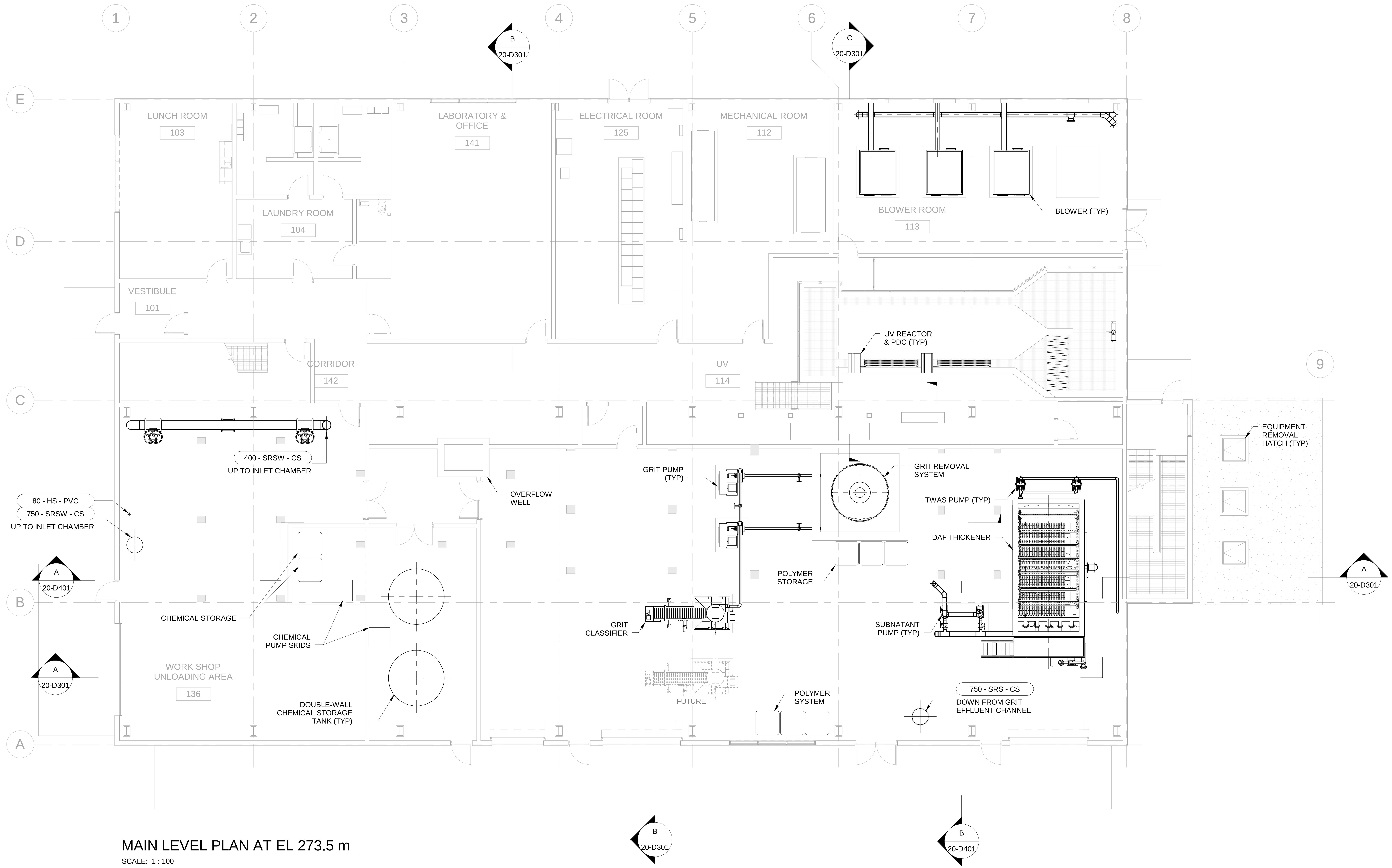

MAIN LEVEL PLAN AT EL 273.5 m

SCALE: 1 : 100

PROJECT

WASTEWATER TREATMENT PLANT UPGRADE PROJECT

CLIENT

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PROJECT NUMBER

60430450

SHEET TITLE

HEADWORKS BUILDING PROCESS MECHANICAL OVERALL MAIN LEVEL PLAN

SHEET NUMBER

20-D102

Project Management Initials: Designer: Designer Checked: Checker Approved: Approver ANSI D 559mm x 864mm

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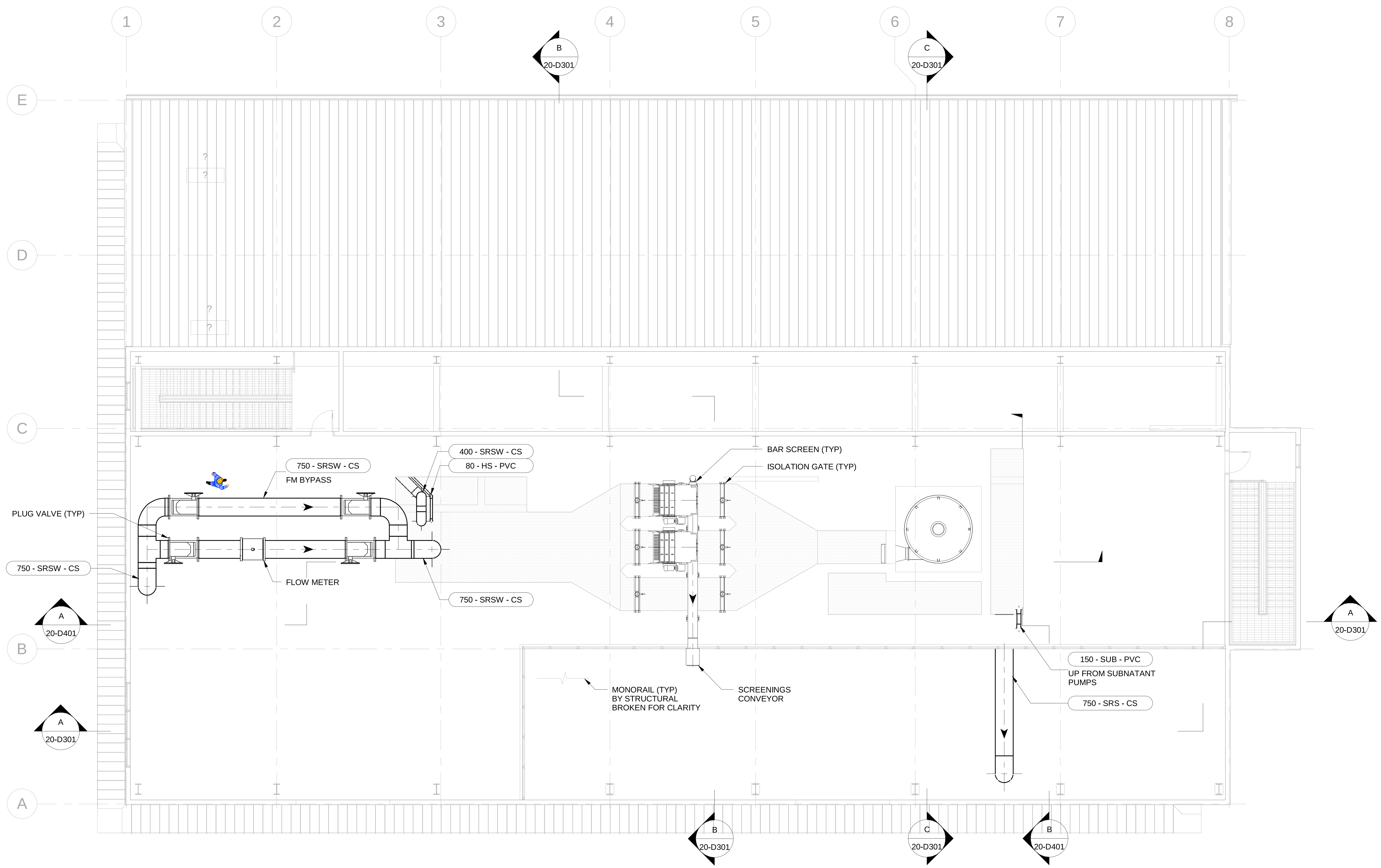

UPPER LEVEL PLAN AT EL 282.0 m

SCALE: 1 : 100

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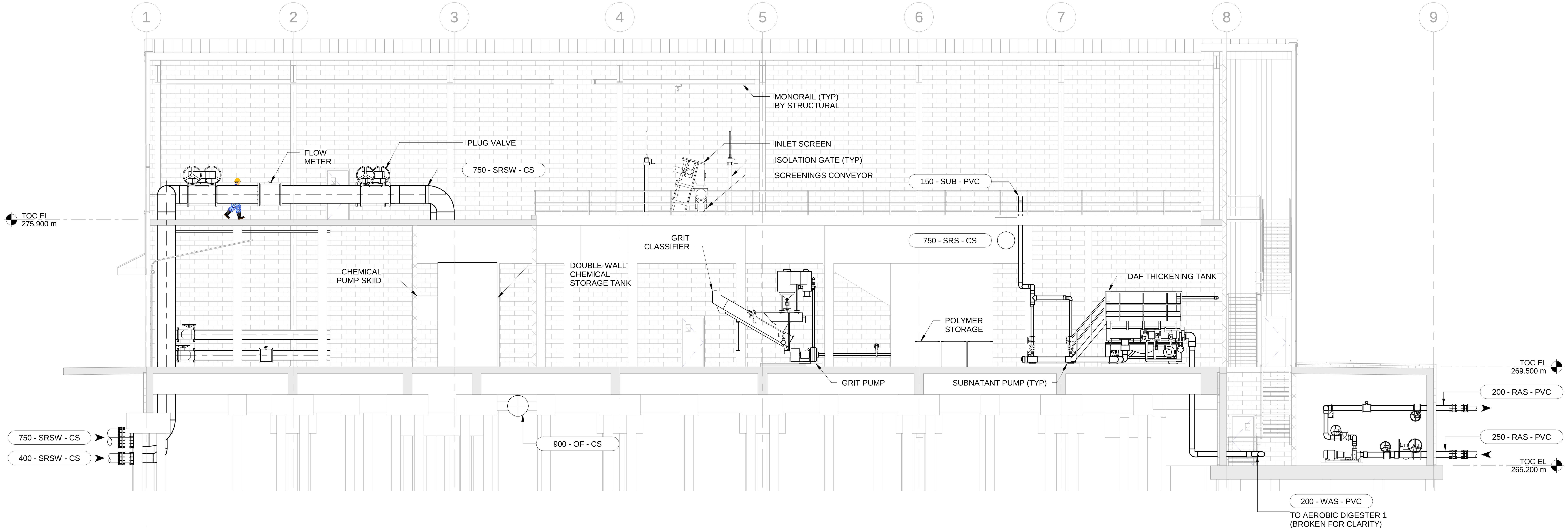
60430450

SHEET TITLE

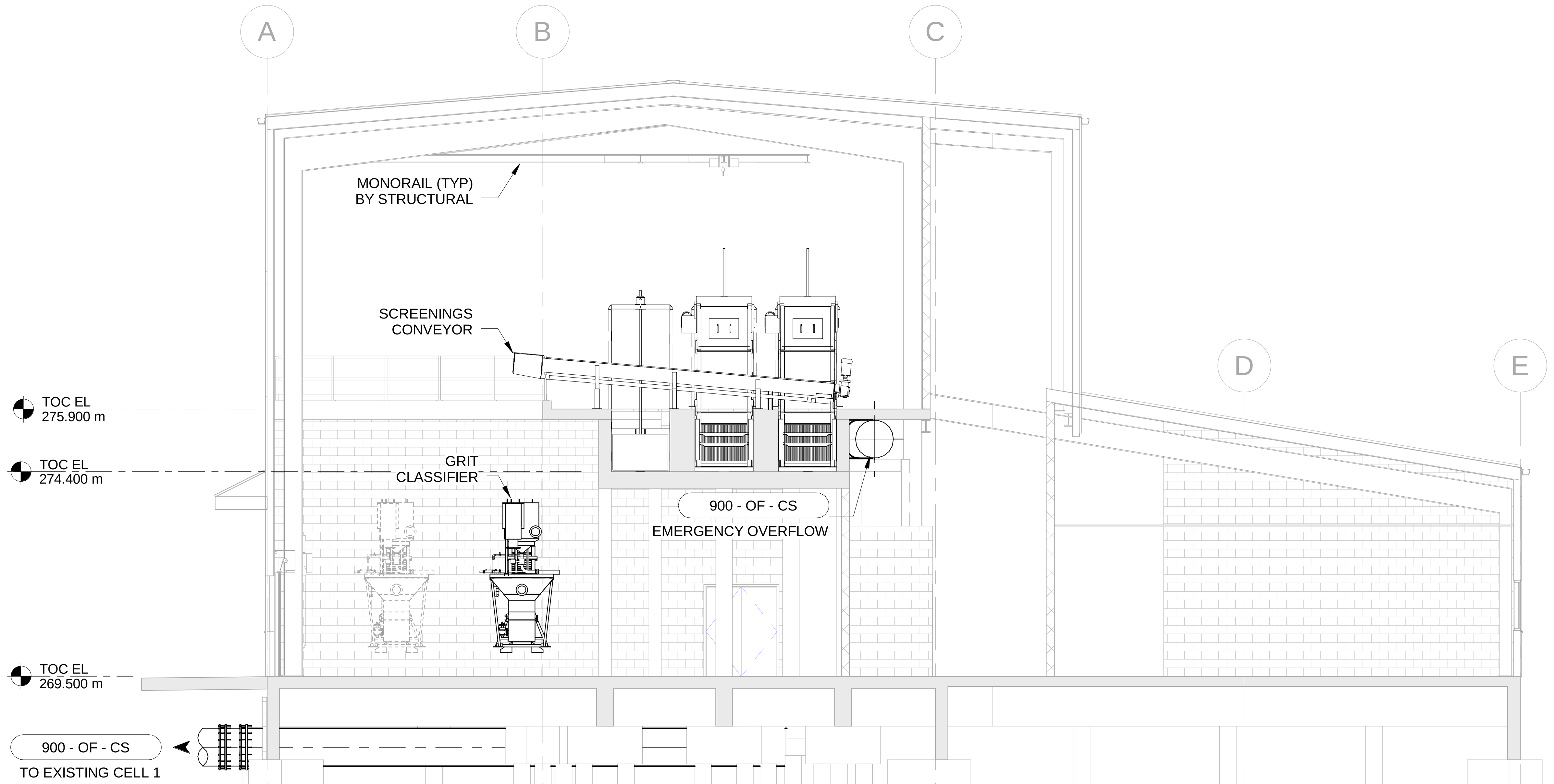
HEADWORKS BUILDING PROCESS MECHANICAL OVERALL UPPER LEVEL PLAN

SHEET NUMBER

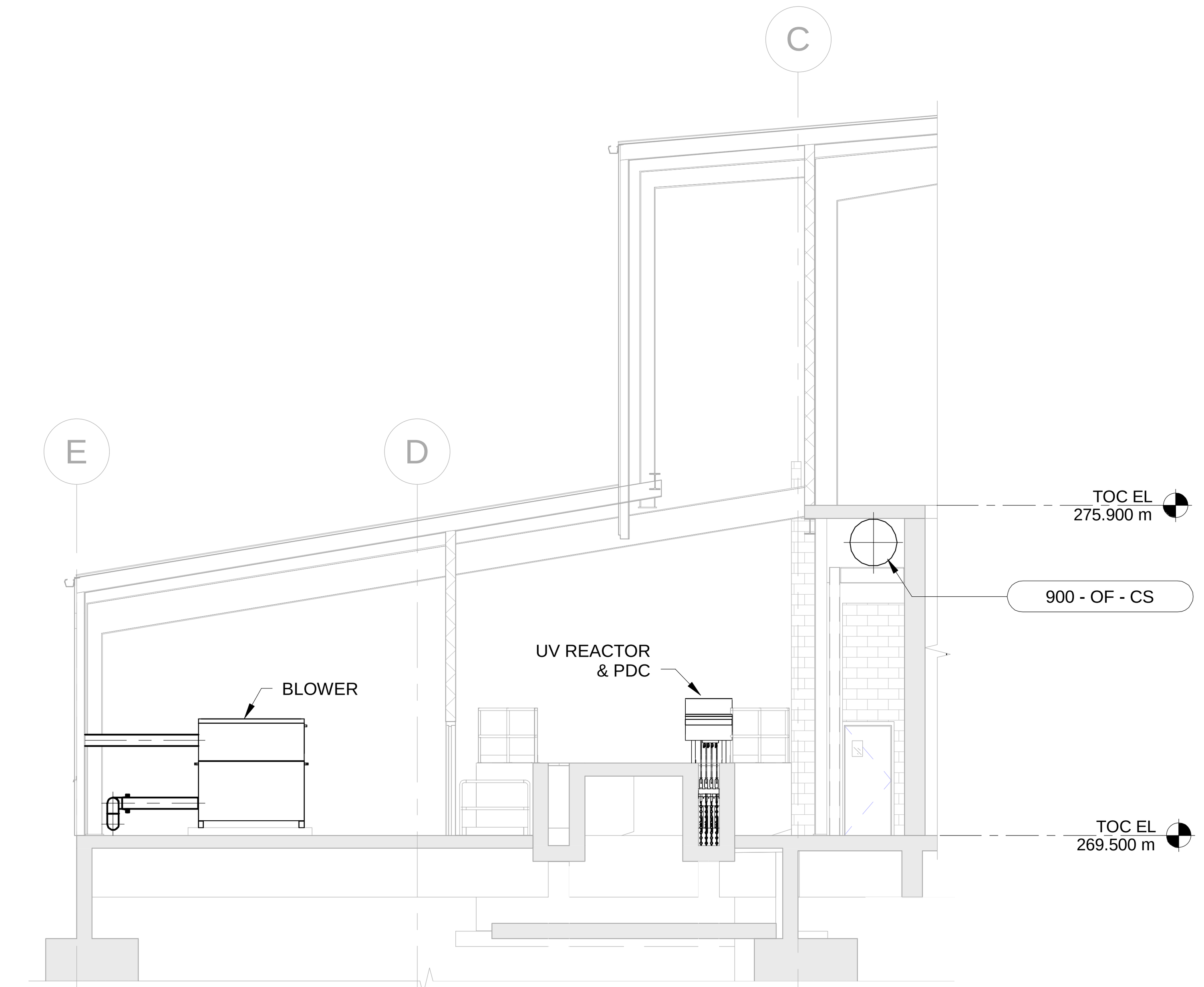
20-D103



A SECTION
20-D101 SCALE: 1 : 100



B SECTION
20-D101 SCALE: 1 : 100



C SECTION
20-D101 SCALE: 1 : 100

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SHEET TITLE

HEADWORKS BUILDING
PROCESS MECHANICAL
OVERALL SECTIONS

SHEET NUMBER

20-D301

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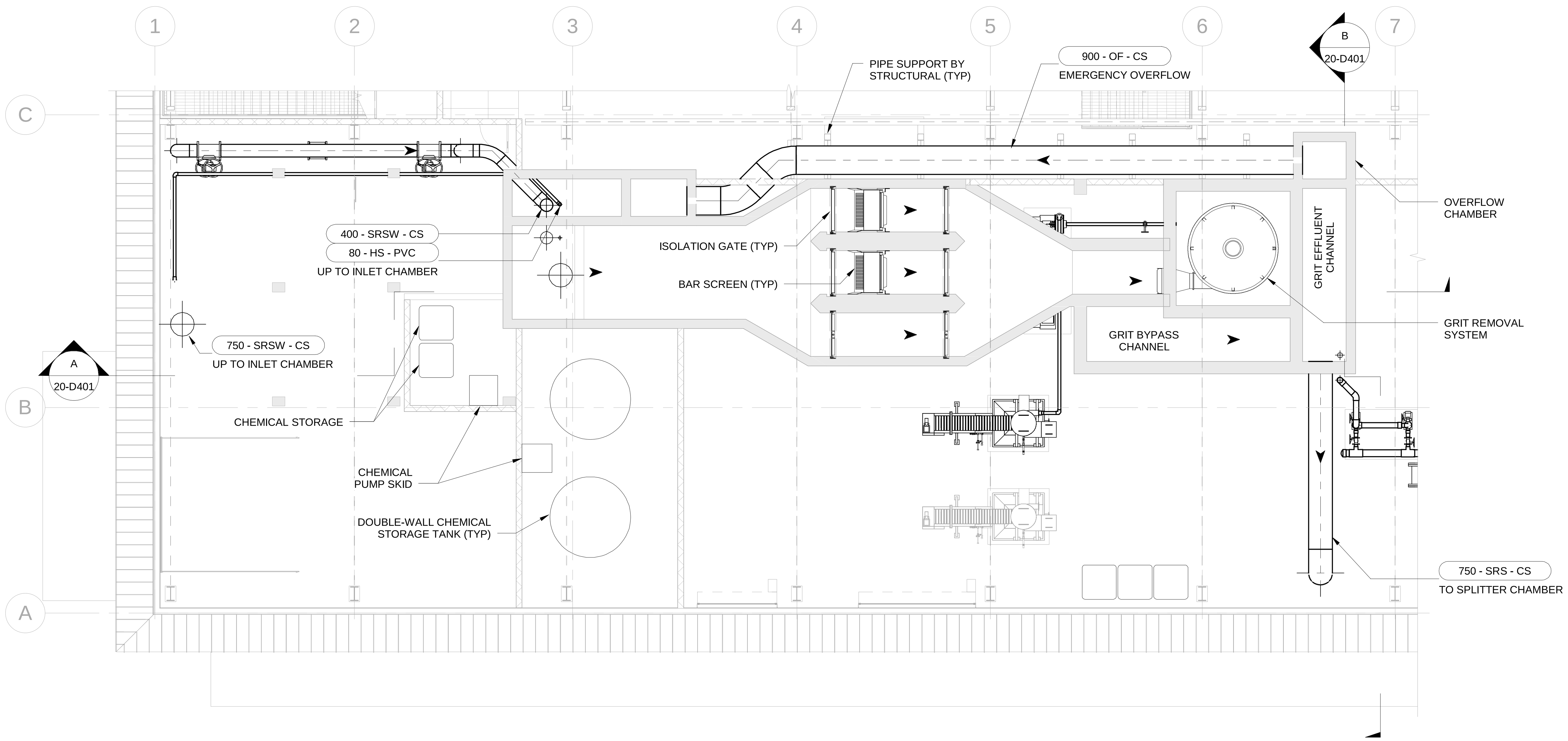
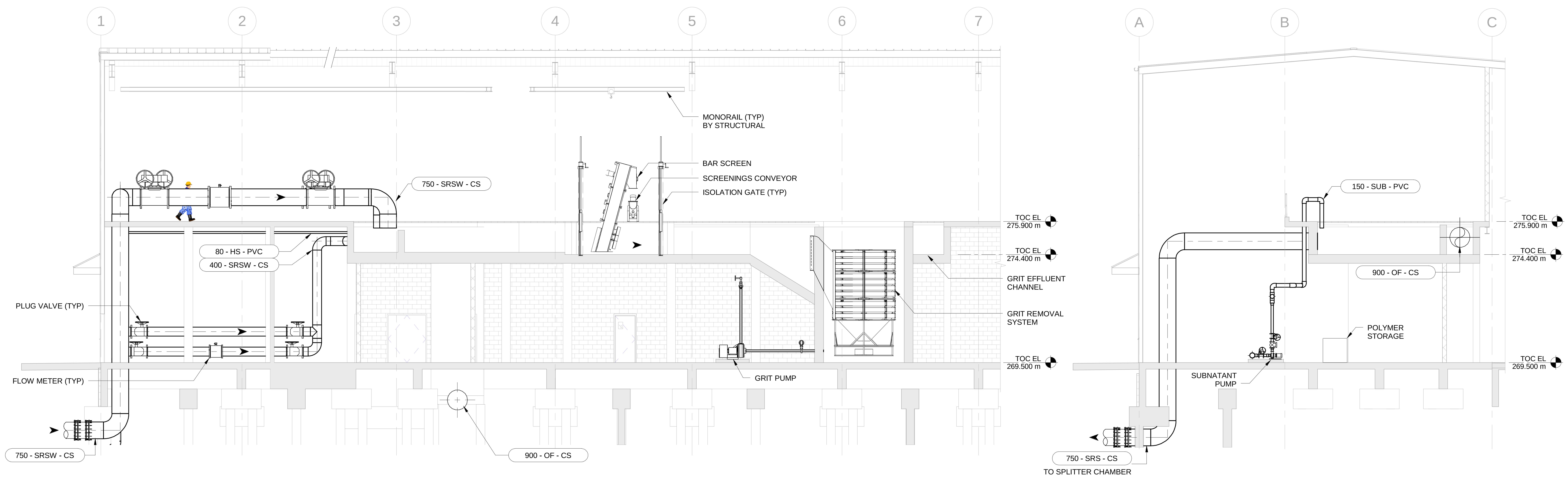


CHANNEL PLAN AT EL 276.6 m

SCALE: 1 : 100



A | SECTION
20-D101 | SCALE: 1 : 100

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SHEET TITLE

HEADWORKS BUILDING
PROCESS MECHANICAL
CHANNEL DETAILS

SHEET NUMBER

20-D401

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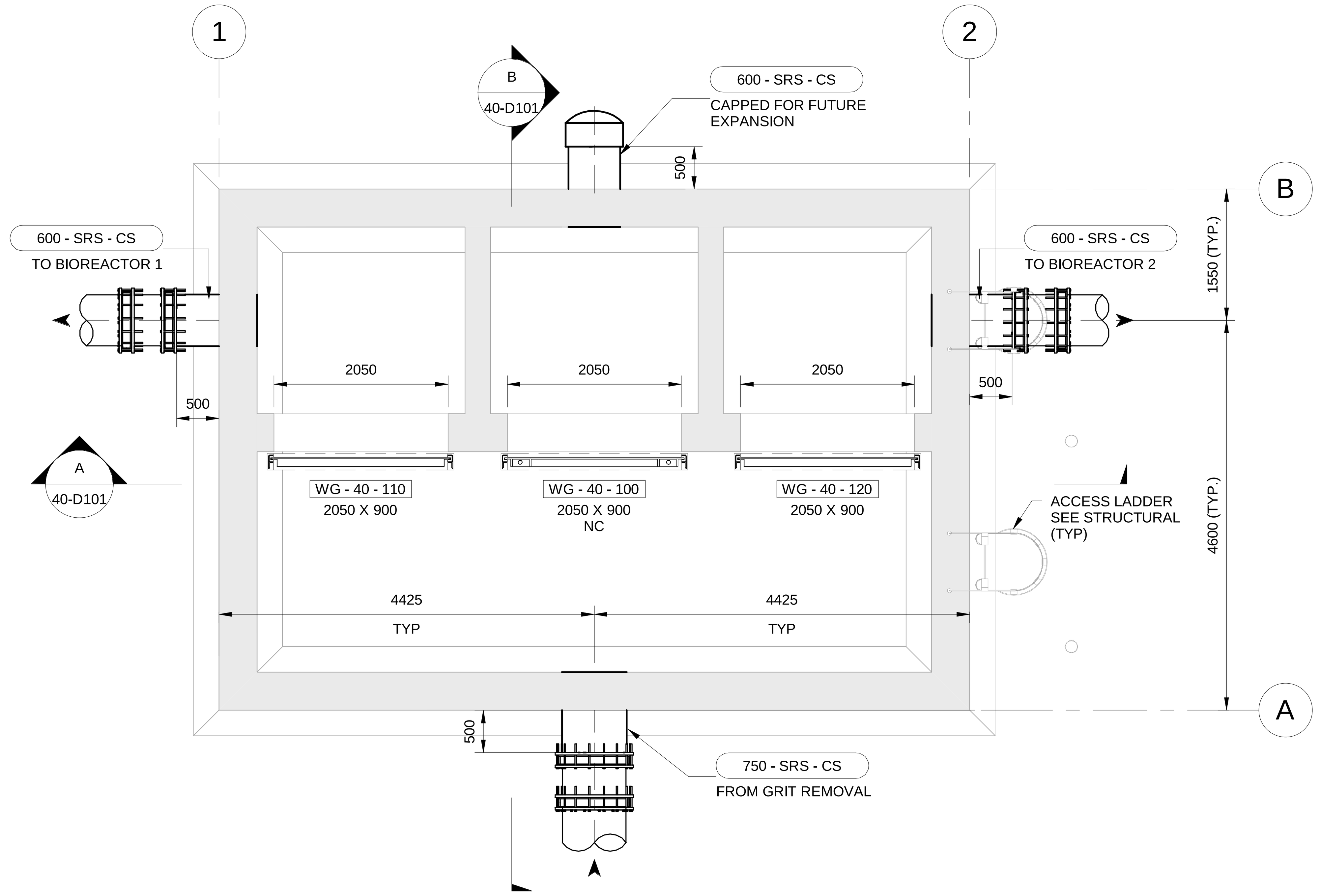
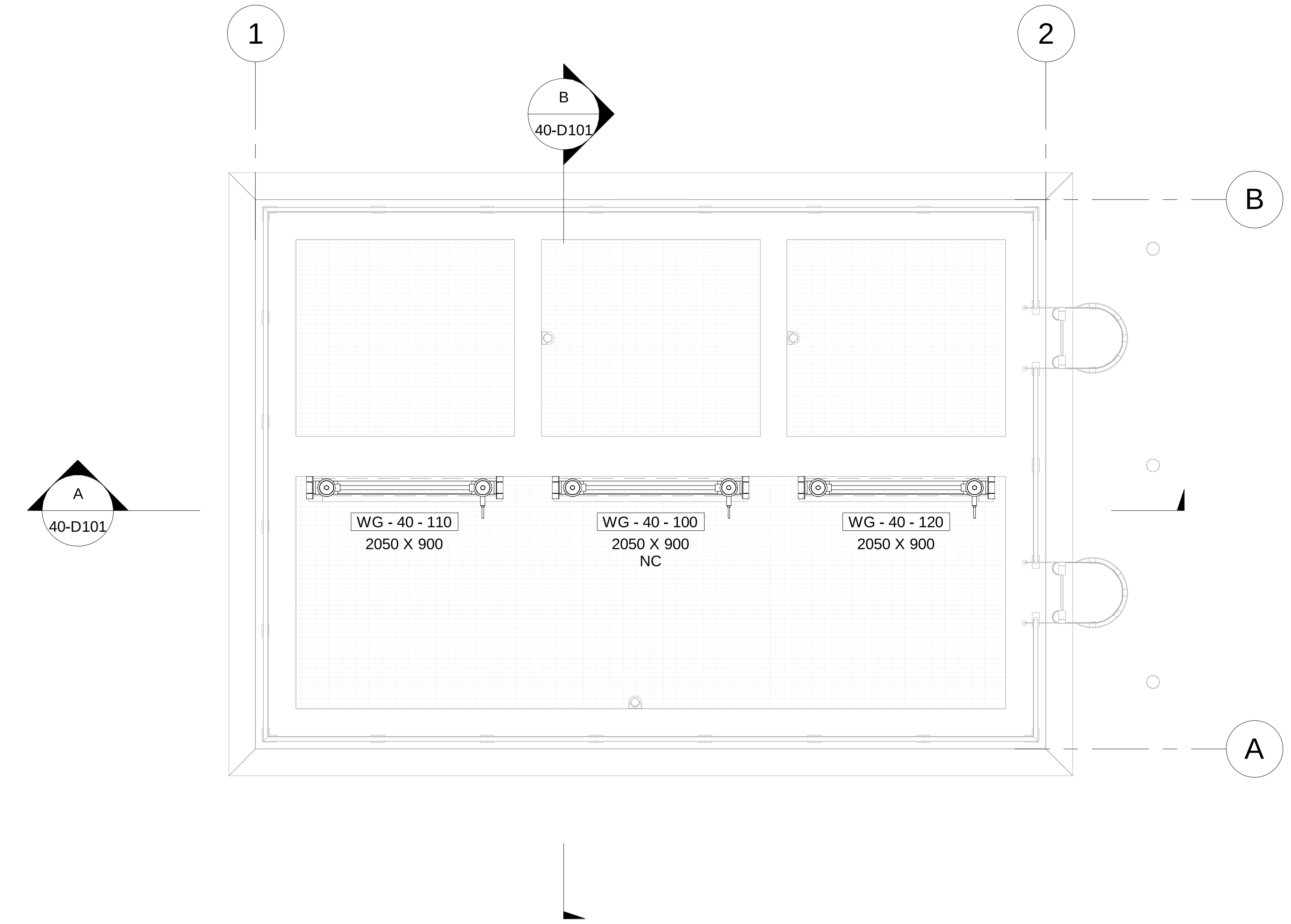
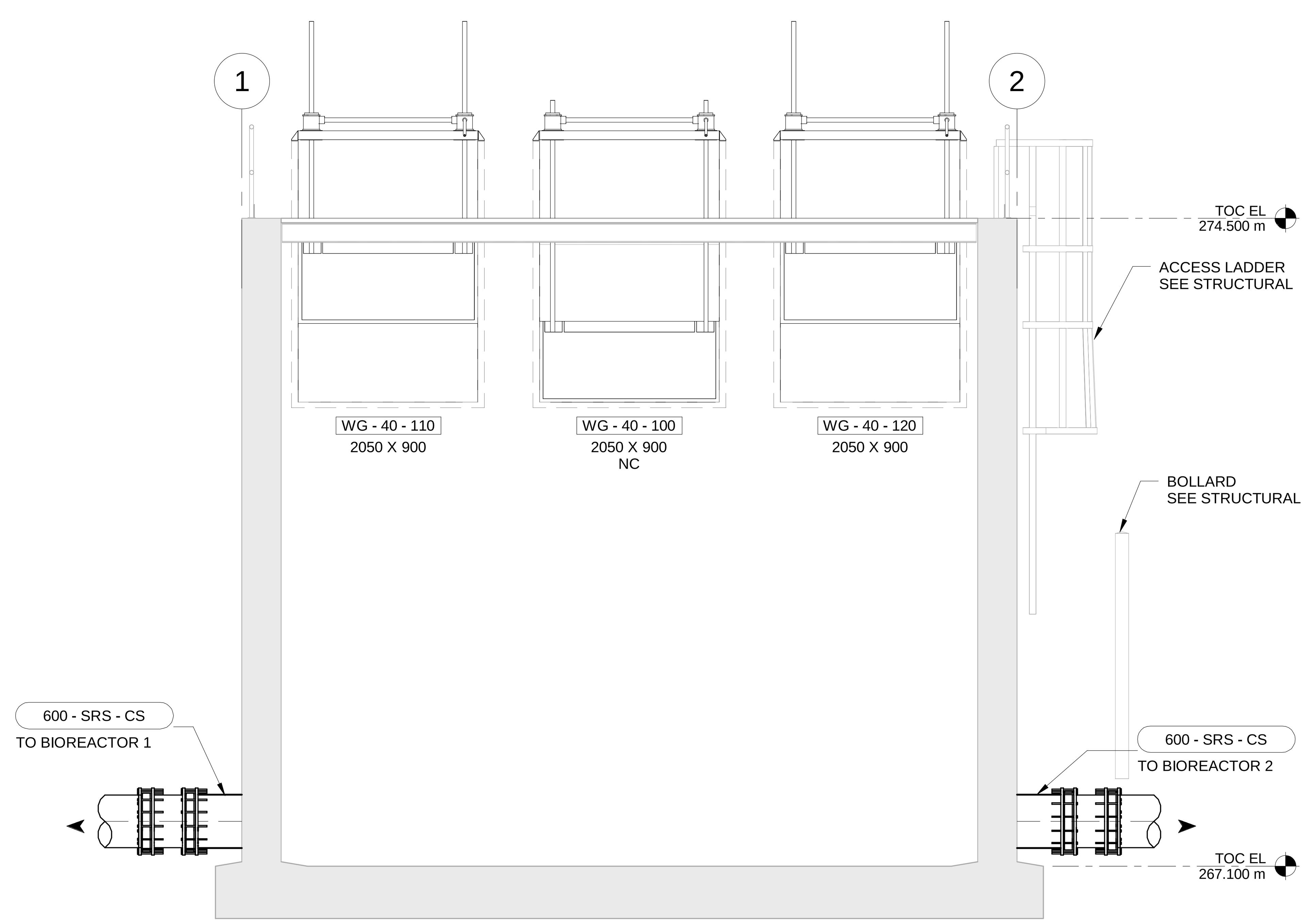


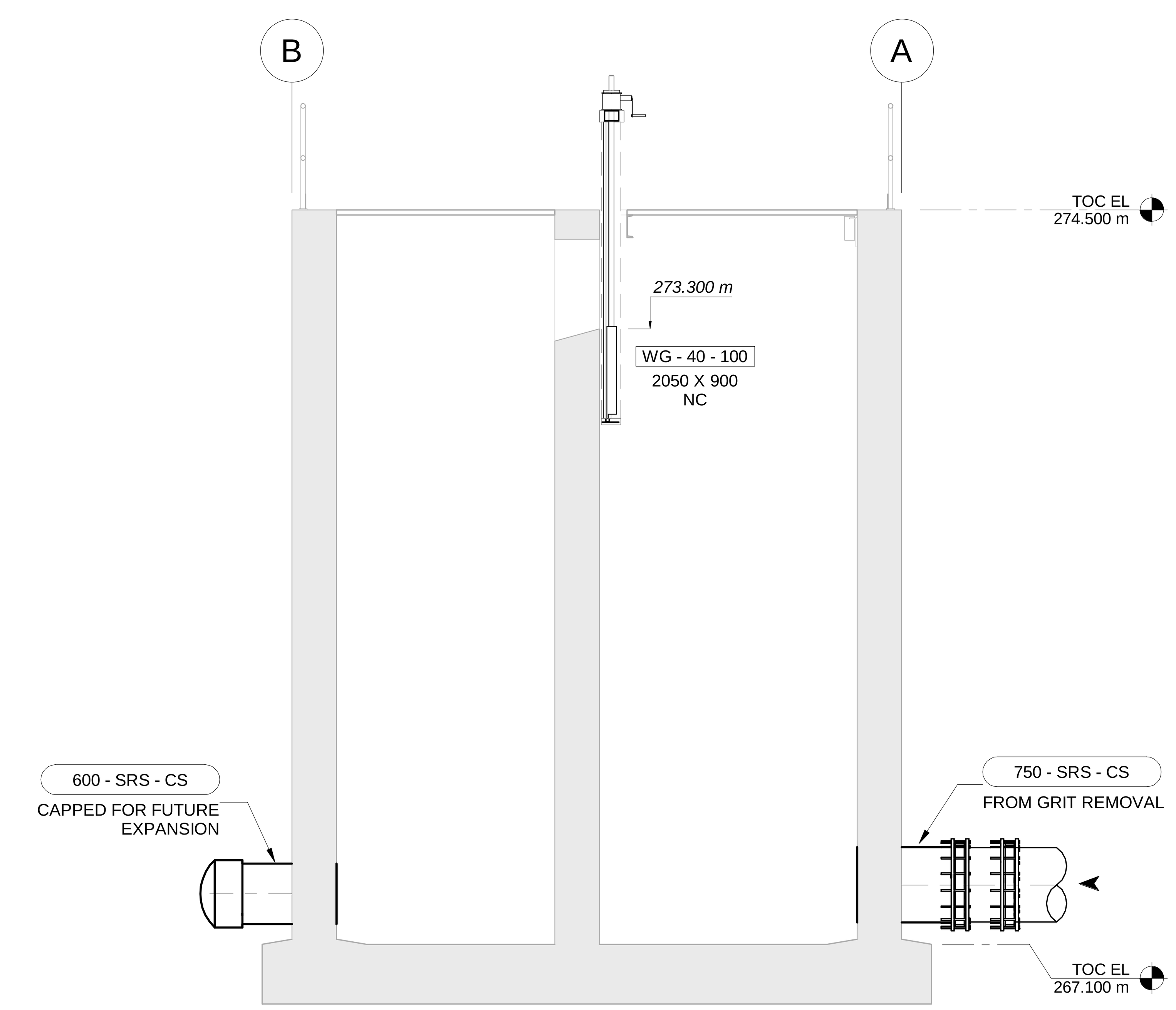
PLAN AT EL 272.300m
SCALE: 1 : 50



PLAN AT EL 277.000m
SCALE: 1 : 50



A | SECTION
40-D101 | SCALE: 1 : 50



B | SECTION
40-D101 | SCALE: 1 : 50

AECOM

PROJECT

WASTEWATER TREATMENT PLANT UPGRADE PROJECT

CLIENT

City of Winkler

185 Main Street
Winkler, Manitoba
R6W 1B4

CONSULTANT

AECOM
99 Commerce Drive
Winnipeg, Manitoba R3P 0Y7
204.477.5381 tel 204.284.2040 fax
www.aecom.com

REGISTRATION

PRELIMINARY
NOT FOR CONSTRUCTION
Date: 2016.11.04

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	2016.11.04	FUNCTIONAL DESIGN

PROJECT NUMBER

60430450

SHEET TITLE

SPLITTER CHAMBER
PROCESS MECHANICAL
PLANS & SECTIONS

SHEET NUMBER

40-D101

Project Management Initials: Designer: A FARROKHI Checked: P BARSALOU Approved: P BARSALOU ANSI D 559mm x 864mm

Last Plotted: 11/4/2016 7:52:42 AM
Filename: P:\60430450\900-Work\910-CAD\05-MODELS\D\00 Design Files_Susanne Local Files\60430450-MOD-00-0040-D_Elliotts.rvt

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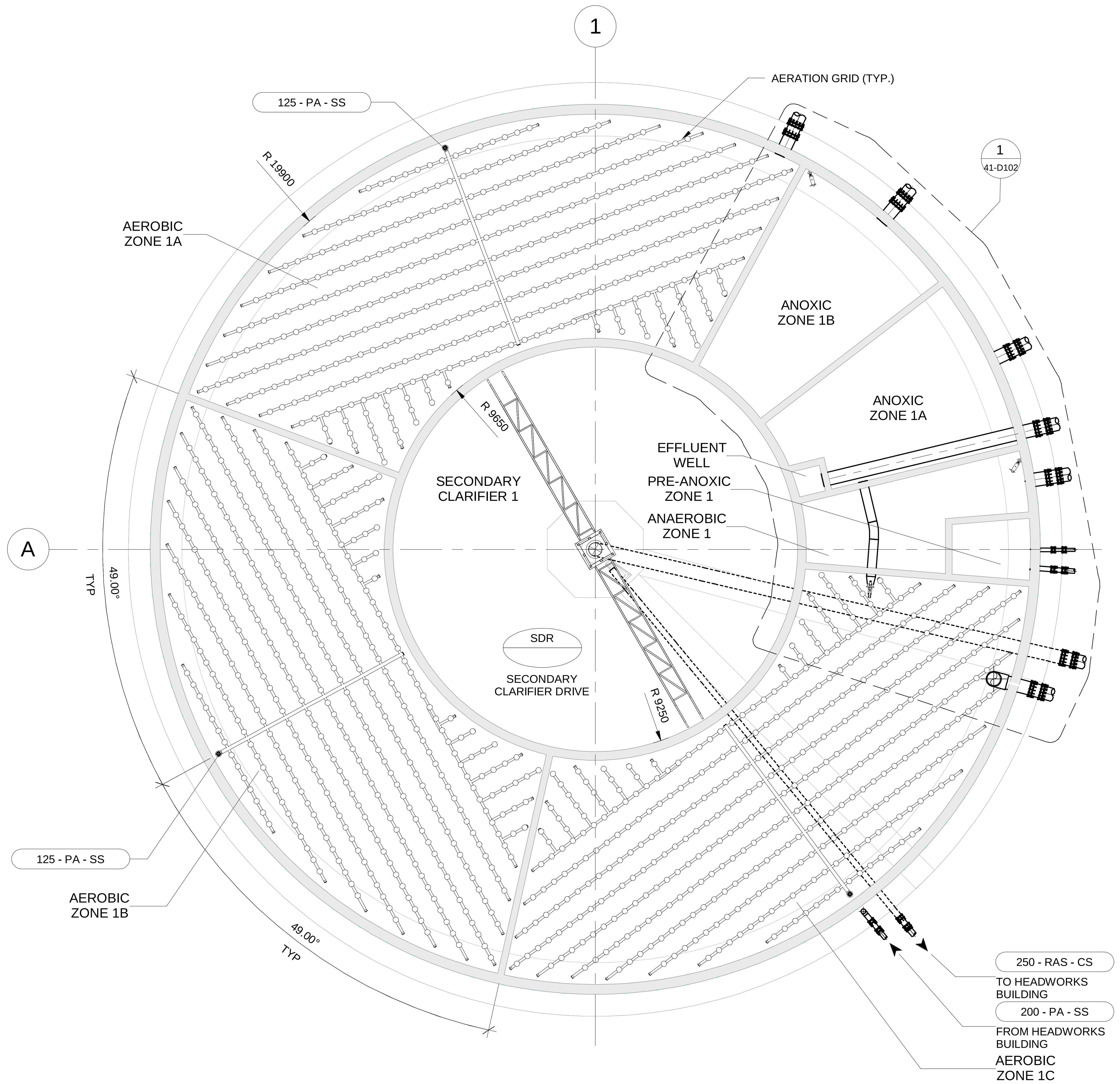
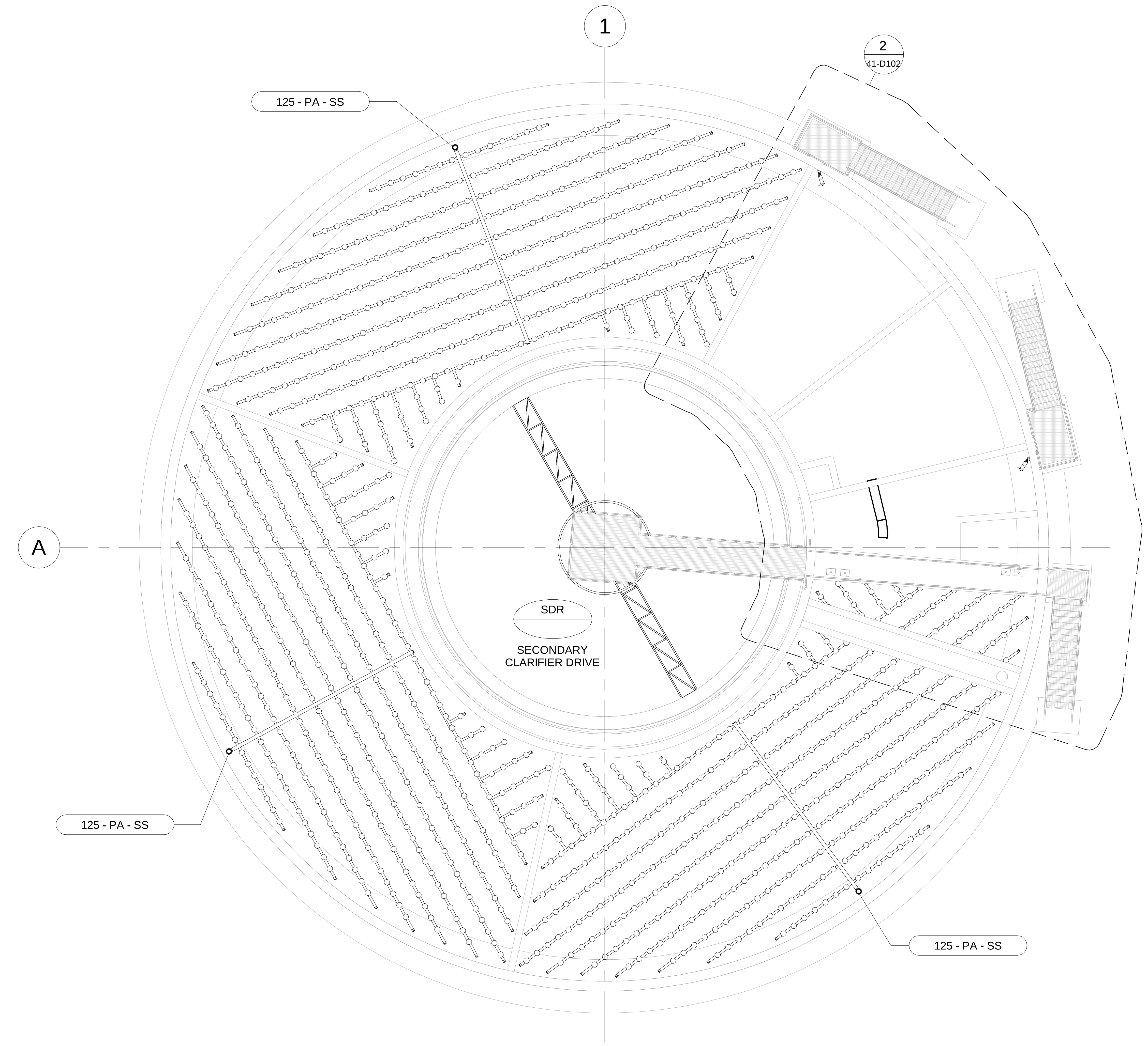


OVERALL LOWER LEVEL PLAN AT EL 268.500m

SCALE: 1 : 150



OVERALL UPPER LEVEL PLAN AT EL 275.000m

SCALE: 1 : 150

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PROJECT

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City of Winkler

185 Main Street
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A	2016.11.04	FUNCTIONAL DESIGN

PROJECT NUMBER

60430450

SHEET TITLE

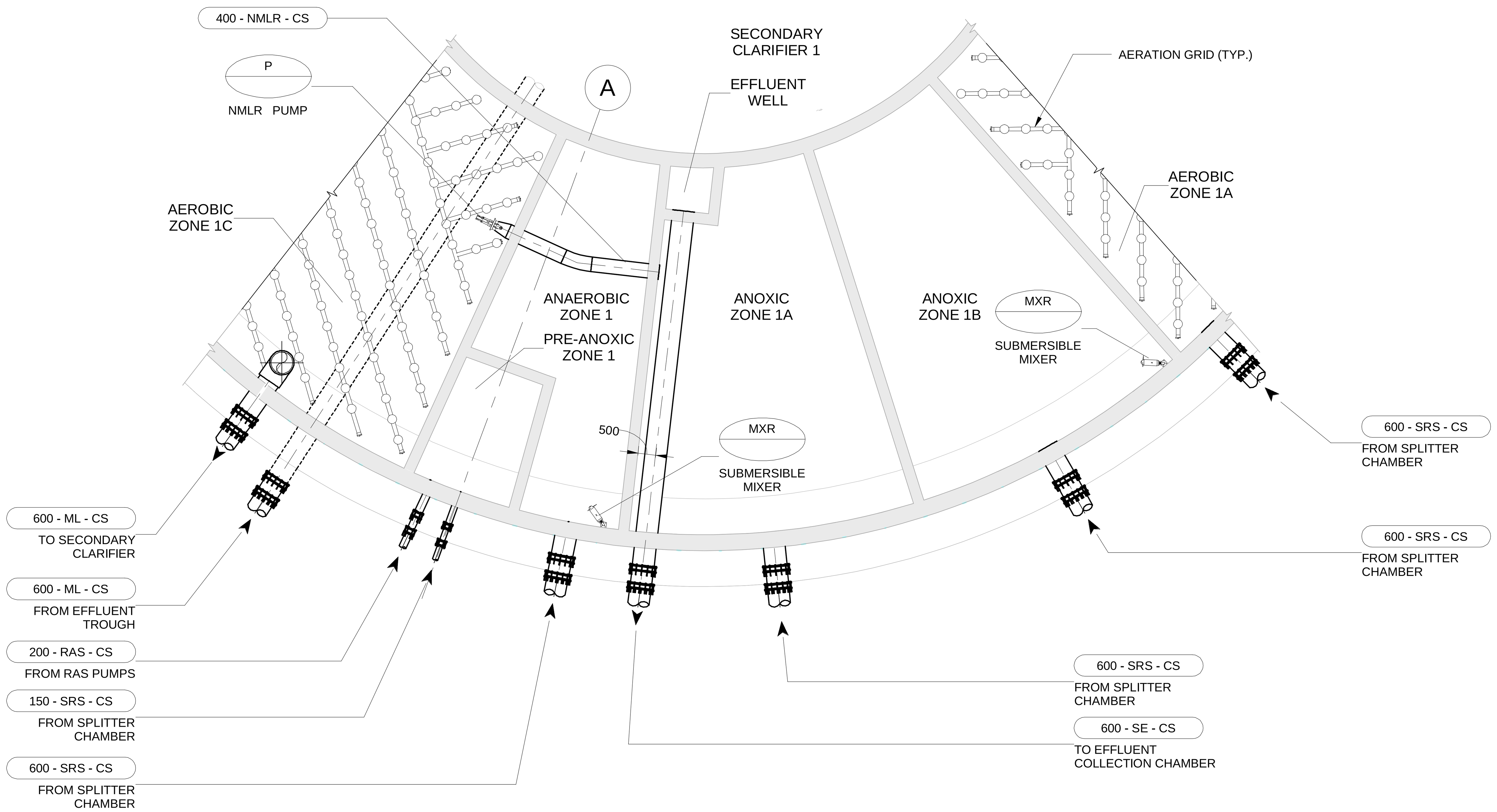
SECONDARY TREATMENT UNIT 1
PROCESS MECHANICAL
OVERALL PLANS

SHEET NUMBER

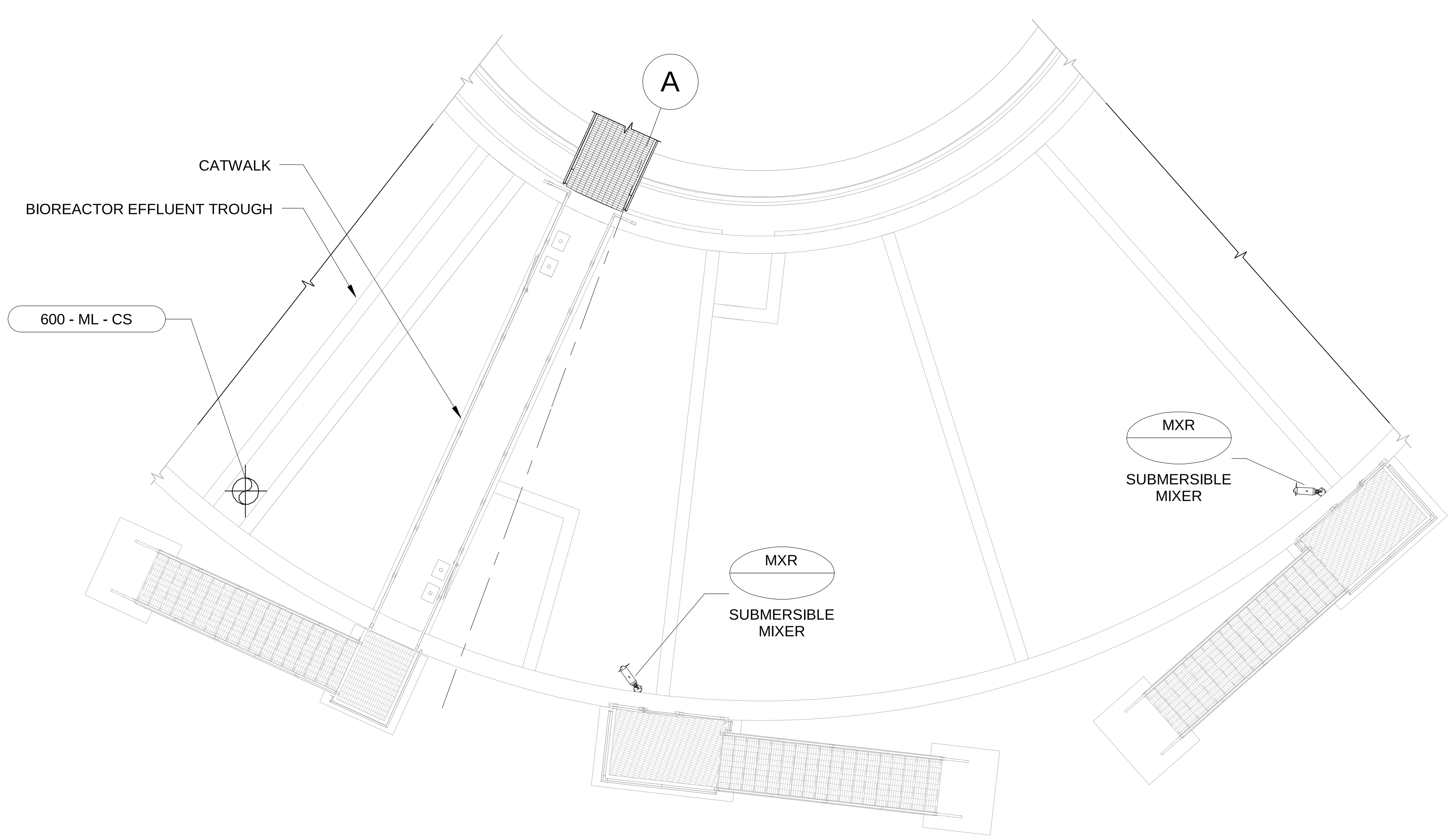
41-D101

Project Management Initials: Designer: A FARROKHI Checked: P BARSALOU Approved: P BARSALOU ANSI D 559mm x 864mm

Last Plotted: 11/4/2016 7:55:45 AM
Filename: P:\60430450\900-Work\910-CAD\05-MODELS\D\00 Design Files_Susanne Local Files\60430450-MOD-00-0041-D_Elliotts.rvt



1 | ENLARGED PLAN AT EL 268.500m
41-D102 | SCALE: 1 : 100



2 | ENLARGED PLAN AT EL 275.000m
41-D102 | SCALE: 1 : 100

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I/R	DATE	DESCRIPTION
A	2016.11.04	FUNCTIONAL DESIGN

PROJECT NUMBER

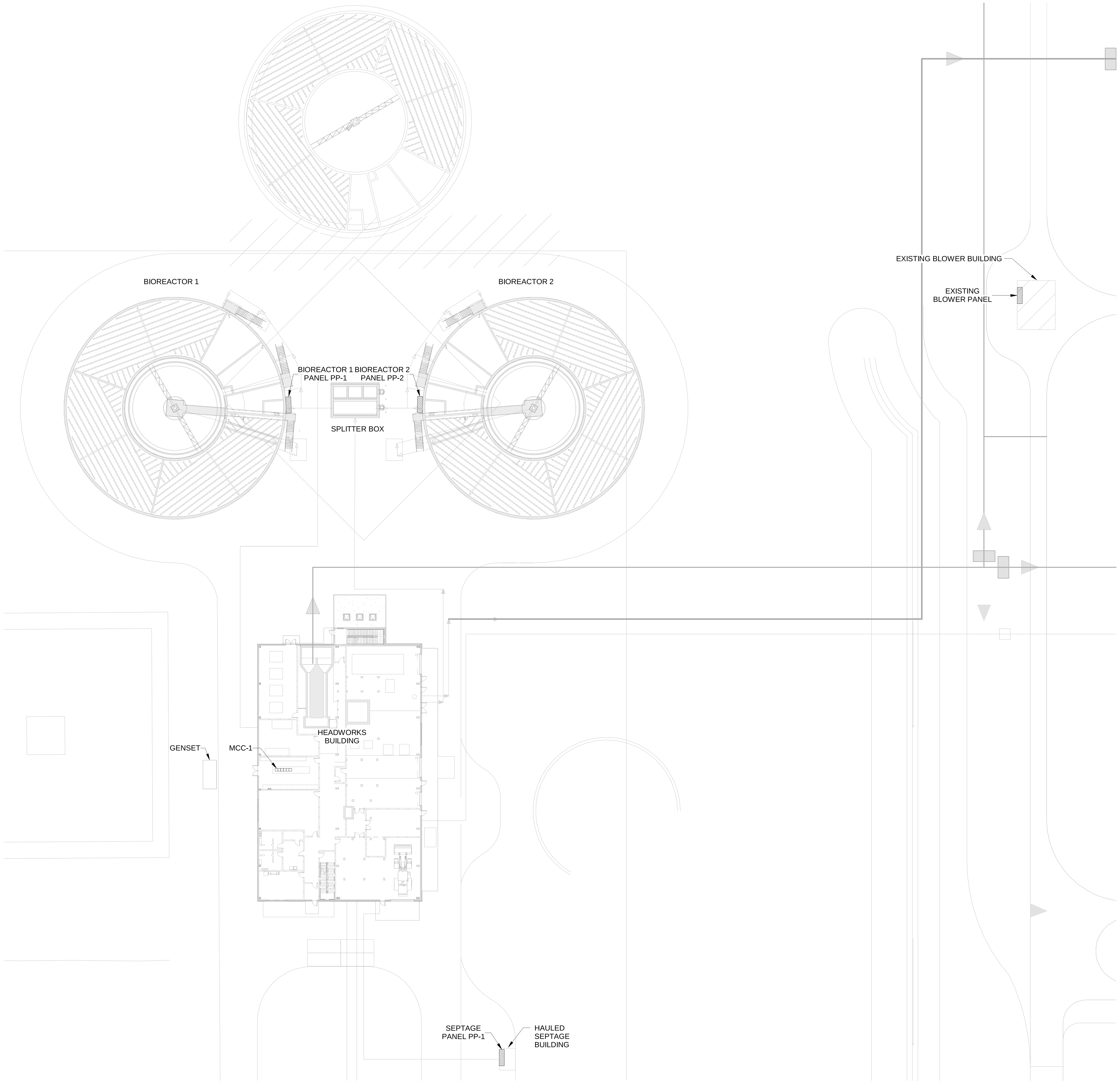
60430450

SHEET TITLE

SECONDARY TREATMENT UNIT 1
PROCESS MECHANICAL
ENLARGED PLANS

SHEET NUMBER

41-D102



1 ELECTRICAL SITE PLAN
00-E101
SCALE: 1 : 400

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185 Main Street
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I/R	DATE	DESCRIPTION
A	11.04.2016	FUNCTIONAL DESIGN

PROJECT NUMBER

60430450

SHEET TITLE

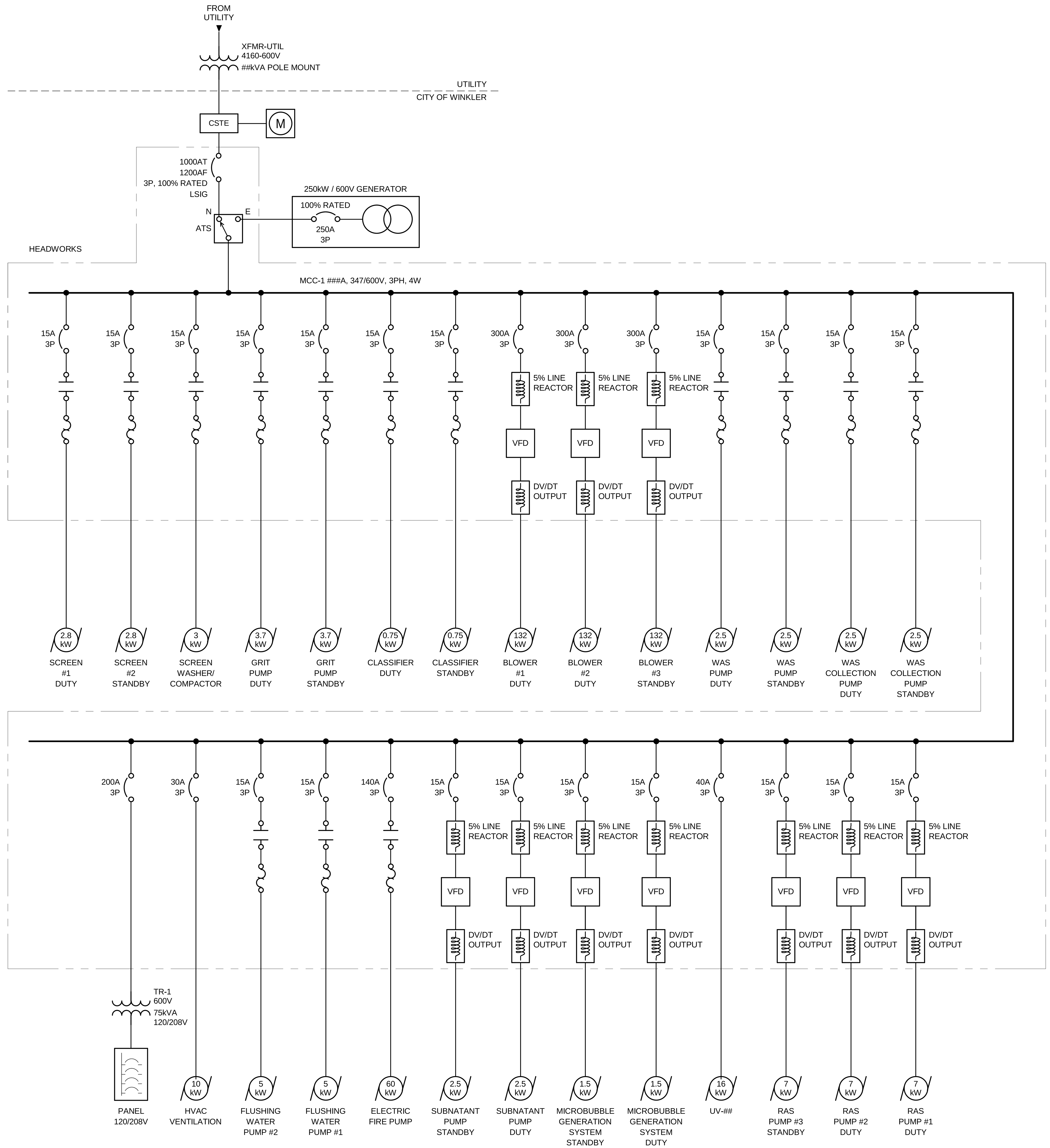
GENERAL & SITEWORKS ELECTRICAL SITE PLAN

SHEET NUMBER

00-E101

Project Management Initials: Designer: Designer Checked: Checker Approved: Approver ANSI D 559mm x 864mm

Last Plotted: 11/7/2016 7:21:20 AM
Filename: P:\60430450\900-Work\910-CAD\05-MODELS\D\00 Design Files_Susanne Local Files\60430450-MOD-00-0020-E_v14_Central_Elliotts.rvt



1 HEADWORKS SINGLE LINE DIAGRAM

05-E601 SCALE: N.T.S.

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185 Main Street
Winkler, Manitoba
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A	11.04.2016	FUNCTIONAL DESIGN

PROJECT NUMBER

60430450

SHEET TITLE

DIAGRAMS & SCHEMATICS
ELECTRICAL
HEADWORKS
SINGLE LINE DIAGRAM

SHEET NUMBER

05-E601

Project Management Initials: Designer: Designer Checked: Checker Approved: Approver ANSI D 559mm x 864mm

Last Plotted: 11/7/2016 7:21:21 AM
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C

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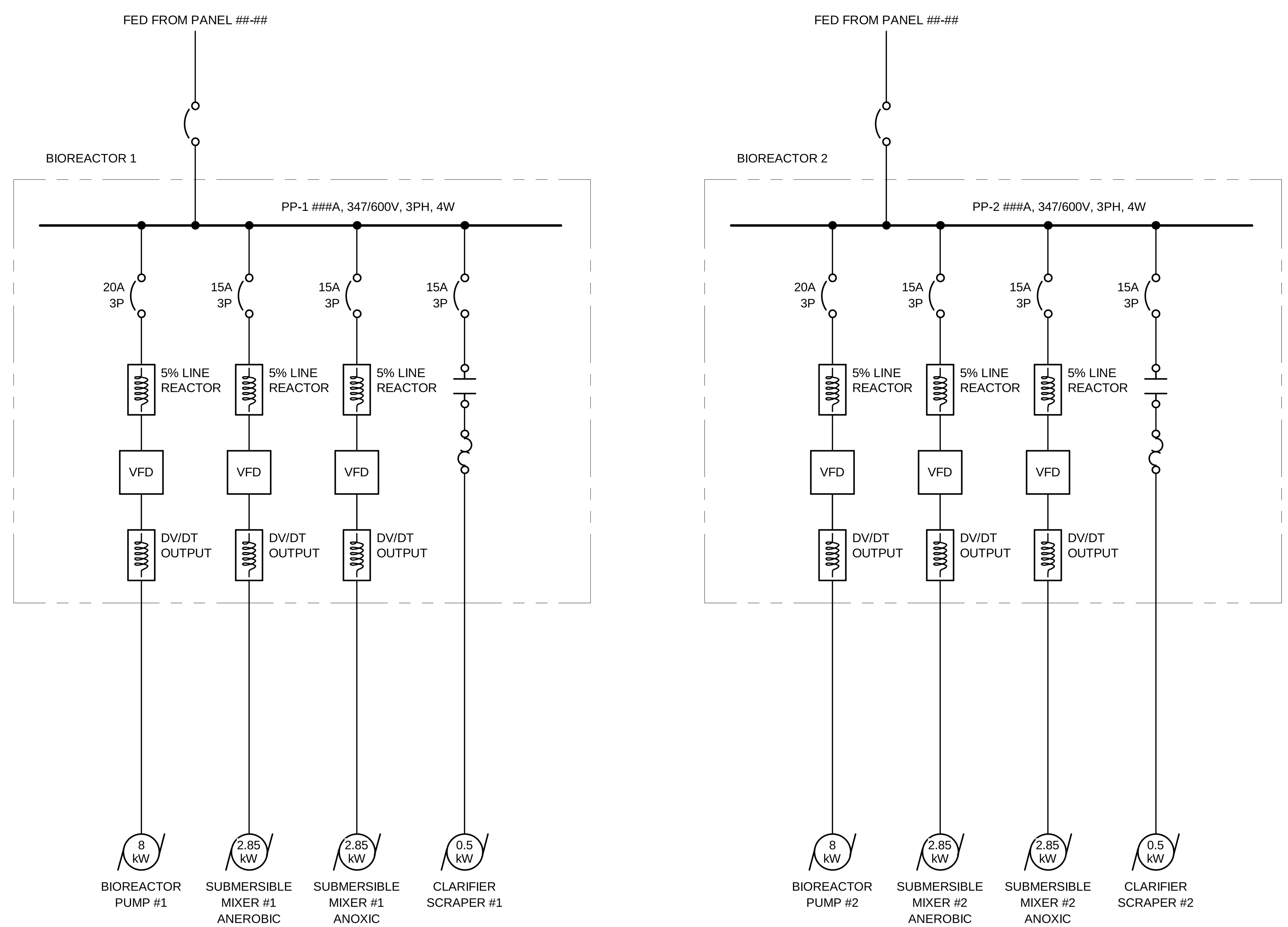
A



1 BIOREACTOR 1 & 2 SINGLE LINE DIAGRAM

05-E602 SCALE: N.T.S.

5 4 3 2 1

Project Management Initials: Designer: Designer Checked: Checker Approved: Approver ANSI D 559mm x 864mm

Last Plotted: 11/7/2016 7:21:22 AM
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I/R	DATE	DESCRIPTION
A	11.04.2016	FUNCTIONAL DESIGN

PROJECT NUMBER

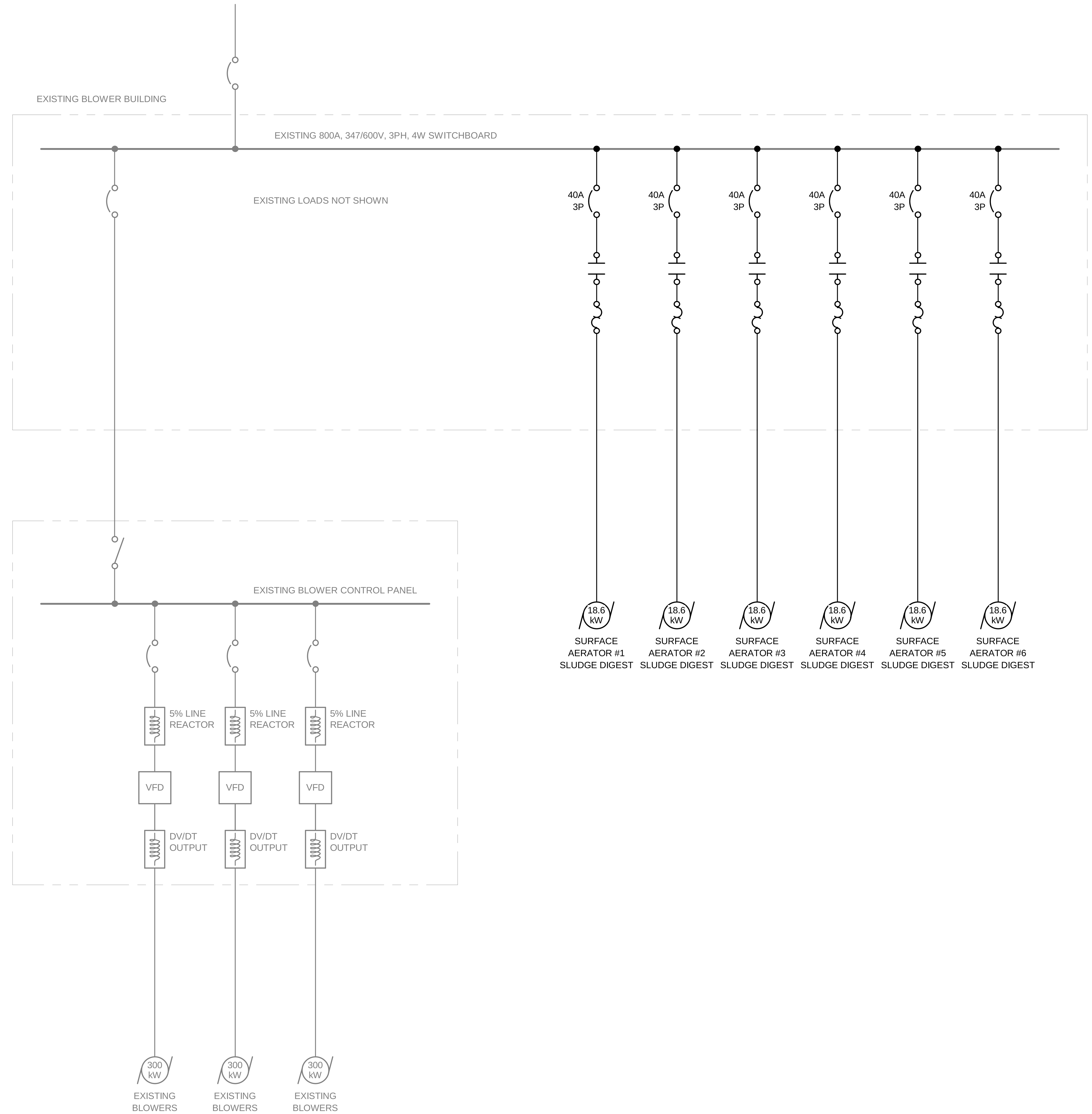
60430450

SHEET TITLE

DIAGRAMS & SCHEMATICS
ELECTRICAL
BIOREACTOR 1 & 2
SINGLE LINE DIAGRAM

SHEET NUMBER

05-E602



1 EXISTING BLOWER BUILDING SINGLE LINE DIAGRAM

05-E603 SCALE: N.T.S.

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PROJECT

WASTEWATER TREATMENT PLANT UPGRADE PROJECT

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185 Main Street
Winkler, Manitoba
R6W 1B4

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Date: 2016.11.04

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	11.04.2016	FUNCTIONAL DESIGN

PROJECT NUMBER

60430450

SHEET TITLE

DIAGRAMS & SCHEMATICS
ELECTRICAL
EXISTING BLOWER BUILDING
SINGLE LINE DIAGRAM

SHEET NUMBER

05-E603

Project Management Initials: Designer: Designer Checked: Checker Approved: Approver ANSI D 559mm x 864mm

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Branch Panel: HEADWORKS...

Location: ELECTRICAL ROOM 125 | **Volts:** 120/208 Wye | **A.I.C. Rating:**
Supply From: | **Phases:** 3 | **Mains Type:**
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 100 A
Enclosure: | | **MCB Rating:** 100 A

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	FERRIC SULPHATE DOSING PUMP	15 A	1	0 VA	0 VA					1	15 A	POLYMER DOSING PUMP	2
3							0 VA			1	15 A	POLYMER MIXER	4
5													6
7													8
9													10
11													12
13													14
15													16
17													18
19													20
21													22
23													24
25													26
27													28
29													30
31													32
33													34
35													36
37													38
39													40
41													42
			Total Load:	0 VA		0 VA		0 VA					
			Total Amps:	0 A		0 A		0 A					

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
				Total Conn. Load:	0 VA
				Total Est. Demand:	0 VA
				Total Conn.:	0 A
				Total Est. Demand:	0 A

Notes:

Branch Panel: SEPTAGE...

Location: | **Volts:** 120/208 Wye | **A.I.C. Rating:**
Supply From: | **Phases:** 3 | **Mains Type:**
Mounting: Recessed | **Wires:** 4 | **Mains Rating:** 100 A
Enclosure: Type 1 | | **MCB Rating:** 225 A

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	SEPTAGE GRINDER	15 A	3	0 VA	0 VA					3	15 A	SEPTAGE PUMP DUTY	2
3	--	--	--			0 VA	0 VA			--	--	--	4
5	--	--	--					0 VA	0 VA	--	--	--	6
7	UNIT HEATERS	30 A	3	0 VA	0 VA					3	15 A	SEPTAGE PUMP STANDBY	8
9	--	--	--			0 VA	0 VA			--	--	--	10
11	--	--	--					0 VA	0 VA	--	--	--	12
13													14
15													16
17													18
19													20
21													22
23													24
25													26
27													28
29													30
31													32
33													34
35													36
37													38
39													40
41													42
			Total Load:	0 VA		0 VA		0 VA					
			Total Amps:	0 A		0 A		0 A					

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
				Total Conn. Load:	0 VA
				Total Est. Demand:	0 VA
				Total Conn.:	0 A
				Total Est. Demand:	0 A

Notes:

AECOM

PROJECT

WASTEWATER TREATMENT PLANT UPGRADE PROJECT

CLIENT

City of Winkler

185 Main Street
Winkler, Manitoba
R6W 1B4

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Date: 2016.11.04

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	11.04.2016	FUNCTIONAL DESIGN

PROJECT NUMBER

60430450

SHEET TITLE

DIAGRAMS & SCHEMATICS
ELECTRICAL
PANEL SCHEDULES

SHEET NUMBER

05-E604

Project Management Initials: Designer: Designer Checked: Checker Approved: Approver ANSI D 559mm x 864mm
Last Plotted: 11/7/2016 7:21:23 AM
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AECOM is built to deliver a better world. With 85,000 employees, we design, build, finance and operate infrastructure assets for governments, businesses and organizations in more than 150 countries.

As a fully integrated firm, we connect knowledge and experience across our global network of experts to help clients solve their most complex challenges.

From high-performance buildings and infrastructure, to resilient communities and environments, to stable and secure nations, our work is transformative, differentiated and vital. A Fortune 500 firm, AECOM companies had revenue of $18 billion during the 12 months ended September 30, 2015.

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Appendix B

2016 Treatment Process Summary Table from the Functional Design Report

2016 Treatment Process Summary Table from the Functional Design Report

Section	Chapter in Functional Design Report	Current Report is Functionally the Same as 2014 [1]	Functionally the Same as 2014 Submission but Additional Information Added [2]	Items That are Substantially Different from 2014 Submission [3]	Additional Items of Design not Previously Noted [4]
1	**Introduction**				
1.1	Background	**X**			
1.2	Existing Treatment Plant	**X**			
1.3	Existing Sludge Inventory			**X**	
1.4	Sludge Inventory Management			**X**	
2	**Basis of Design**				
2.1	Population		**X**		
2.2	Wastewater Sources	**X**			
2.3	Wastewater Flow Projections		**X**		
2.4	Design Wastewater Loads		**X**		
2.5	Effluent Discharge Standards	**X**			
3	**Treatment Process Design**				
3.1	Design Philosophy		**X**		
3.2	Discharge to Receiving Stream		**X**		
3.3	Biological Nutrient Removal		**X**		
3.4	Septage Receiving				**X**
3.5	Influent Channel and Overflow		**X**		
3.6	Screening and Washer/Compactor		**X**		
3.7	Grit Removal		**X**		
3.8	Primary Clarifier and Fermenter (Future Expansion Only)				**X**
3.9	Bioreactor		**X**		
3.10	Secondary Clarifiers		**X**		
3.11	Clarifier Cover		**X**		
3.12	Chemical Dosing – Ferric Sulphate		**X**		
3.13	Disinfection		**X**		
3.14	Sludge and Scum Handling and Disposal				**X**
3.14.1	Sludge Thickening (DAF)				**X**
3.14.2	Sludge Stabilization				**X**
3.14.3	Land Application for Future Biosolids				**X**
3.14.4	Disposal of Cell 1 Sludge		**X**		
3.15	Overflow/Storm Water Handling		**X**		
3.16	Water Usage on Site				**X**
3.16.1	Potable Water System				**X**
3.16.2	Utility or Flushing Water System				**X**
3.16.3	Fire Fighting Pond				**X**
3.17	Odour Control				**X**
3.18	Process Flow Summary				**X**
4	**Civil Design**				
4.1	Plant Elevation		**X**		
4.2	Access Roads and Internal Roads		**X**		
4.3	Site Grading, Drainage		**X**		
5	**Electrical**				

Section	Chapter in Functional Design Report	Current Report is Functionally the Same as 2014 [1]	Functionally the Same as 2014 Submission but Additional Information Added [2]	Items That are Substantially Different from 2014 Submission [3]	Additional Items of Design not Previously Noted [4]
5.1	Electrical Service		**X**		
5.2	Backup Power				**X**
6	**Heating and Ventilation**		**X**		
7	**Schedule**		**X**		
8	**Construction Sequencing and Tie-ins**		**X**		
9	**Facility Discharge Monitoring and Testing**			**X**	
10	**Costing**			**X**	
10.1	Capital Costs			**X**	
10.2	Operating Costs			**X**	

Note:

1. *The content is the same as the 2014 EAP submission.*
2. *The NOA has the same content as the 2014 EAP submission but some additional information has been included.*
3. *Components which are new and/or different for the 2014 EAP submission.*
4. *Many of these items were noted in the TAC comments.*

Appendix C

Sludge Analysis Results

City of Winkler
ATTN: TIM WIEBE
185 Main Street
Winkler MB R6W 1B4

Date Received: 20-OCT-16
Report Date: 31-OCT-16 14:08 (MT)
Version: FINAL

Client Phone: 204-325-9524

Certificate of Analysis

Lab Work Order #: L1845996
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Hua Wo
Chemistry Laboratory Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1845996-1 BLACK LIQUID IN TROUT PAIL							
Sampled By: CLIENT							
Matrix:							
Miscellaneous Parameters							
Mercury (Hg)	0.252		0.010	mg/kg	26-OCT-16	27-OCT-16	R3582417
Total Solids and Total Volatile Solids							
Total Solids	37.4		0.10	%	28-OCT-16	28-OCT-16	R3582327
Total Volatile Solids (dry basis)	14.6		0.10	%	28-OCT-16	28-OCT-16	R3582327
pH and EC (1:2 Soil:Water Extraction)							
Conductivity (1:2)	2.27		0.050	dS m-1	29-OCT-16	29-OCT-16	R3582955
pH (1:2 soil:water)	7.91		0.10	pH	29-OCT-16	29-OCT-16	R3582955
Nitrate, Nitrite and Nitrate+Nitrite-N							
Nitrite-N	1.46	DLR	0.80	mg/kg	29-OCT-16	29-OCT-16	R3583059
Nitrate+Nitrite-N	17.6	DLR	2.0	mg/kg	29-OCT-16	29-OCT-16	R3583059
Nitrate-N	16.2	DLR	2.0	mg/kg	29-OCT-16	29-OCT-16	R3583059
Metals							
Aluminum (Al)	9290		5.0	mg/kg	26-OCT-16	26-OCT-16	R3580733
Antimony (Sb)	0.54		0.10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Arsenic (As)	11.0		0.10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Barium (Ba)	236		0.50	mg/kg	26-OCT-16	26-OCT-16	R3580733
Beryllium (Be)	0.37		0.10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Bismuth (Bi)	3.69		0.020	mg/kg	26-OCT-16	26-OCT-16	R3580733
Boron (B)	18		10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Cadmium (Cd)	0.842		0.020	mg/kg	26-OCT-16	26-OCT-16	R3580733
Calcium (Ca)	161000		100	mg/kg	26-OCT-16	26-OCT-16	R3580733
Chromium (Cr)	21.1		1.0	mg/kg	26-OCT-16	26-OCT-16	R3580733
Cobalt (Co)	4.24		0.020	mg/kg	26-OCT-16	26-OCT-16	R3580733
Copper (Cu)	94.2		1.0	mg/kg	26-OCT-16	26-OCT-16	R3580733
Iron (Fe)	12800		25	mg/kg	26-OCT-16	26-OCT-16	R3580733
Lead (Pb)	28.4		0.20	mg/kg	26-OCT-16	26-OCT-16	R3580733
Magnesium (Mg)	9720		10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Manganese (Mn)	570		0.50	mg/kg	26-OCT-16	26-OCT-16	R3580733
Molybdenum (Mo)	14.5		0.020	mg/kg	26-OCT-16	26-OCT-16	R3580733
Nickel (Ni)	15.0		0.50	mg/kg	26-OCT-16	26-OCT-16	R3580733
Phosphorus (P)	7680		100	mg/kg	26-OCT-16	26-OCT-16	R3580733
Potassium (K)	1750		25	mg/kg	26-OCT-16	26-OCT-16	R3580733
Selenium (Se)	5.67		0.50	mg/kg	26-OCT-16	26-OCT-16	R3580733
Silver (Ag)	15.4		0.10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Sodium (Na)	899		10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Strontium (Sr)	476		0.10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Thallium (Tl)	0.15		0.10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Tin (Sn)	11.4		5.0	mg/kg	26-OCT-16	26-OCT-16	R3580733
Titanium (Ti)	51.2		0.50	mg/kg	26-OCT-16	26-OCT-16	R3580733
Uranium (U)	36.7		0.020	mg/kg	26-OCT-16	26-OCT-16	R3580733
Vanadium (V)	27.3		0.50	mg/kg	26-OCT-16	26-OCT-16	R3580733
Zinc (Zn)	235		10	mg/kg	26-OCT-16	26-OCT-16	R3580733
Total Organic Nitrogen - Soil							
Available Ammonium-N							
Available Ammonium-N	111	NSSM	12	mg/kg	28-OCT-16	28-OCT-16	R3583874
Note: Done as received and cacluated to dry							
Nitrogen, Total Organic - calculation							
Total Organic Nitrogen	0.520		0.020	%		31-OCT-16	
Total Kjeldahl Nitrogen							
Total Kjeldahl Nitrogen	0.53	DLHC	0.10	%	28-OCT-16	29-OCT-16	R3583034

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLR	Detection Limit Raised due to required dilution, limited sample amount, and/or high moisture content (soil samples)
NSSM	Non-standard sample matrix. Modified methods were used for sample processing and analysis.
NSSM	Non-standard sample matrix. Modified methods were used for sample processing and analysis.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ETL-N-TOTORG-CALC-SK	Soil	Nitrogen, Total Organic - calculation	APHA 4500 Norg-Calculated as TKN - NH3-N
HG-200.2-CVAF-WP	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

ALS Test Code	Matrix	Test Description	Method Reference**
MET-200.2-MS-WP	Soil	Metals	EPA 200.2/6020A

Samples for analysis are homogenized, dried at 60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve, and a representative subsample of the dry material is weighed. The sample is then digested by block digester (EPA 200.2). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may become "environmentally available." By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

ALS Test Code	Matrix	Test Description	Method Reference**
N-TOTKJ-COL-SK	Soil	Total Kjeldahl Nitrogen	CSSS (2008) 22.2.3

The soil is digested with sulfuric acid in the presence of CuSO4 and K2SO4 catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.

ALS Test Code	Matrix	Test Description	Method Reference**
N2/N3-AVAIL-SK	Soil	Nitrate, Nitrite and Nitrate+Nitrite-N	APHA 4500 NO3F

Available Nitrate and Nitrite are extracted from the soil using a dilute calcium chloride solution. Nitrate plus Nitrite is quantitatively reduced to nitrite by passage of the sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. The resulting water soluble dye has a magenta color which is measured at colorimetrically at 520nm. Nitrite is determined on the same extract by following the same instrumental procedure without a cadmium column.
Reference: Recommended Methods of Soil Analysis for Canadian Prairie Agricultural Soils. Alberta Agriculture (1988) p. 19 and 28

ALS Test Code	Matrix	Test Description	Method Reference**
NH4-AVAIL-SK	Soil	Available Ammonium-N	CSSS(1993) 4.2/COMM SOIL SCI 19(6)

Ammonium (NH4-N) is extracted from the soil using 2 N KCl. Ammonium in the extract is mixed with hypochlorite and salicylate to form indophenol blue, which is determined colorimetrically by auto analysis at 660 nm.

ALS Test Code	Matrix	Test Description	Method Reference**
PH,EC-1:2-SK	Soil	pH and EC (1:2 Soil:Water Extraction)	AB Ag (1988) p.7

1 part dry soil and 2 parts de-ionized water (by volume) is mixed. The slurry is allowed to stand with occasional stirring for 30 - 60 minutes. After equilibration, pH of the slurry is measured using a pH meter. Conductivity of the filtered extract is measured by a conductivity meter.

ALS Test Code	Matrix	Test Description	Method Reference**
SOLIDS-TOT/TOTVOL-SK	Manure	Total Solids and Total Volatile Solids	APHA 2540G

A well-mixed sample is evaporated in a weighed dish and dried to constant weight in an oven at 103-105”C. The increase in weight over that of the empty dish represents the Total Solids. The crucible is then ignited at 550”–10”C for 1 hour. The remaining solids represent the Total Fixed Solids, while the weight lost on ignition represents the Total Volatile Solids.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

GREYHOUND CDA TRANS CORP

GST NO. 891646655RT1 WAYBILL NO. 51777109834

WINNIPEG MB	PIECE NUMBER 1
PREPAID CHARGE	TOTAL PIECES 1
RECIPIENT 400648	19Oct16 5:19 PM CDT Billing Weight 17.0 lb Declared Value 100
A L S LABORATORY GROUP UNIT 12, 1329 NIAKWA RD E WINNIPEG MB R2J3T4 204-255-9720	EXPRESS $15.41 FUEL S/C $1.00 TAXES $0.82
SHIPPER 427872 CITY OF WINKLER 185 MAIN ST WINKLER MB R6W1B4 204-325-9524	TOTAL $17.23
PO/Ref #:	

DOOR TO DOOR

LABEL / LOT SHIPMENT

05051777109834

COC #:

Page #:

Work Order #:

L1845996-COFC

Please note the following observations that prevent your a[...] ALS is attempting to contact you for furthe[...] If our attempts fail, please contact us as soon as possible to ensure your analytical needs are met.

	Observation	Details
☐	Temperature < freezing point	actual temp. (breakdown by cooler):
☐	Temperature ≥ 10 Celsius	actual temp. (breakdown by cooler):
☐	Containers broken in transit	details:
☐	Sample integrity compromised	details:
☐	Regulatory non-compliance	details:
☐	No COC with shipment	details:
☐	Discrepancy between COC and label	details:
☐	COC incomplete or unclear	details:
☐	Container incompatible with test	details:
☐	Volume is insufficient for test	details:
☐	Preservation incompatible with test	details:
☐	No preservation	details:
☐	Other observation	details:

Additional information (list all affected sample portions):

No COC, one pail contaning about 1/4 of the pail (Black liquid enclosed).

16 Oct
8:00-

City of Winkler
ATTN: TIM WIEBE
185 Main Street
Winkler MB R6W 1B4

Date Received: 24-SEP-15
Report Date: 09-OCT-15 15:08 (MT)
Version: FINAL

Client Phone: 204-325-9524

Certificate of Analysis

Lab Work Order #: L1678243

Project P.O. #: NOT SUBMITTED
Job Reference: C1505
C of C Numbers:
Legal Site Desc:

Chantal Bouchard
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1678243-1 C3-01 - C3-05 COMP CELL 3							
Sampled By: CLIENT on 23-SEP-15 @ 09:00							
Matrix: SLUDGE							
Miscellaneous Parameters							
Ammonia, Total (as N)	62		50	mg/L		01-OCT-15	R3281129
Conductivity	1980		1.0	umhos/cm		30-SEP-15	R3279705
Mercury (Hg)-Total	<0.020	DLM	0.020	mg/L	29-SEP-15	29-SEP-15	R3279192
Phosphorus (P)-Total	408		2.0	mg/L		30-SEP-15	R3279277
Total Kjeldahl Nitrogen	91	DLA	10	mg/L		04-OCT-15	R3282082
Total Suspended Solids	24600		5.0	mg/L		30-SEP-15	R3285311
pH	7.66		0.10	pH units		30-SEP-15	R3279705
Total Solids and Total Volatile Solids							
Total Solids	1.17		0.10	%	09-OCT-15	09-OCT-15	R3286851
Total Volatile Solids (dry basis)	20.5		0.10	%	09-OCT-15	09-OCT-15	R3286851
Total Metals by ICP-MS							
Arsenic (As)-Total	1.14	DLM	0.10	mg/L	29-SEP-15	29-SEP-15	R3279108
Cadmium (Cd)-Total	0.057	DLM	0.020	mg/L	29-SEP-15	29-SEP-15	R3279108
Chromium (Cr)-Total	1.88	DLM	0.20	mg/L	29-SEP-15	29-SEP-15	R3279108
Copper (Cu)-Total	9.97	DLM	0.20	mg/L	29-SEP-15	29-SEP-15	R3279108
Lead (Pb)-Total	0.96	DLM	0.10	mg/L	29-SEP-15	29-SEP-15	R3279108
Nickel (Ni)-Total	1.49	DLM	0.20	mg/L	29-SEP-15	29-SEP-15	R3279108
Potassium (K)-Total	242	DLM	10	mg/L	29-SEP-15	29-SEP-15	R3279108
Zinc (Zn)-Total	20.4	DLM	2.0	mg/L	29-SEP-15	29-SEP-15	R3279108
Nitrogen Total							
Nitrate in Water by IC							
Nitrate (as N)	<0.20	HTD	0.20	mg/L		29-SEP-15	R3279571
Nitrate+Nitrite							
Nitrate and Nitrite as N	0.55		0.22	mg/L		30-SEP-15	
Nitrite in Water by IC							
Nitrite (as N)	0.55	HTD	0.10	mg/L		29-SEP-15	R3279571
Total Nitrogen Calculated							
Total Nitrogen	91		10	mg/L		08-OCT-15	
L1678243-2 C2-01 - C3-05 COMP CELL 2							
Sampled By: CLIENT on 23-SEP-15 @ 09:00							
Matrix: SLUDGE							
Miscellaneous Parameters							
Mercury (Hg)	0.160		0.050	mg/kg	02-OCT-15	02-OCT-15	R3283627
Total Kjeldahl Nitrogen	0.820		0.020	%	03-OCT-15	04-OCT-15	R3282145
Total Solids and Total Volatile Solids							
Total Solids	15.1		0.10	%	03-OCT-15	03-OCT-15	R3281552
Total Volatile Solids (dry basis)	20.1		0.10	%	03-OCT-15	03-OCT-15	R3281552
pH and EC (1:2 Soil:Water Extraction)							
Conductivity (1:2)	4.45		0.050	dS m-1	03-OCT-15	03-OCT-15	R3281944
pH (1:2 soil:water)	7.90		0.10	pH	03-OCT-15	03-OCT-15	R3281944
Nitrate, Nitrite and Nitrate+Nitrite-N							
Nitrite-N	0.43		0.40	mg/kg	02-OCT-15	02-OCT-15	R3281979
Nitrate+Nitrite-N	<2.0		2.0	mg/kg	02-OCT-15	02-OCT-15	R3281979
Nitrate-N	<2.0		2.0	mg/kg	02-OCT-15	02-OCT-15	R3281979
Metals							
Aluminum (Al)	9820		5.0	mg/kg	02-OCT-15	02-OCT-15	R3282232
Antimony (Sb)	0.83		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Arsenic (As)	12.4		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Barium (Ba)	259		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Beryllium (Be)	0.38		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Bismuth (Bi)	5.39		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1678243-2 C2-01 - C3-05 COMP CELL 2							
Sampled By: CLIENT on 23-SEP-15 @ 09:00							
Matrix: SLUDGE							
Metals							
Boron (B)	19		10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Cadmium (Cd)	0.879		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Calcium (Ca)	80100		100	mg/kg	02-OCT-15	02-OCT-15	R3282232
Chromium (Cr)	22.8		1.0	mg/kg	02-OCT-15	02-OCT-15	R3282232
Cobalt (Co)	4.43		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Copper (Cu)	191		1.0	mg/kg	02-OCT-15	02-OCT-15	R3282232
Iron (Fe)	14400		25	mg/kg	02-OCT-15	02-OCT-15	R3282232
Lead (Pb)	13.2		0.20	mg/kg	02-OCT-15	02-OCT-15	R3282232
Magnesium (Mg)	14200		10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Manganese (Mn)	582		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Molybdenum (Mo)	27.9		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Nickel (Ni)	13.5		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Phosphorus (P)	6000		100	mg/kg	02-OCT-15	02-OCT-15	R3282232
Potassium (K)	1830		25	mg/kg	02-OCT-15	02-OCT-15	R3282232
Selenium (Se)	12.2		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Silver (Ag)	14.7		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Sodium (Na)	1430		10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Strontium (Sr)	262		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Thallium (Tl)	0.18		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Tin (Sn)	9.4		5.0	mg/kg	02-OCT-15	02-OCT-15	R3282232
Titanium (Ti)	50.8		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Uranium (U)	39.0		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Vanadium (V)	31.3		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Zinc (Zn)	236		10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Total Organic N-liquid manure -as rec'd							
Ammonium - N in Liquid Manure - as rec'd							
Ammonia, Total (as N)	2.2		1.0	lb/1000gal	02-OCT-15	02-OCT-15	R3281243
Nitrogen, Total Organic							
Total Organic Nitrogen	16.4		1.0	lb/1000gal		04-OCT-15	
Total N in Liquid Manure -as rec'd							
Total Nitrogen	18.7		1.0	lb/1000gal	02-OCT-15	02-OCT-15	R3281239
L1678243-3 C4/5-01 COMP CELL 4+5							
Sampled By: CLIENT on 23-SEP-15 @ 09:00							
Matrix: SLUDGE							
Miscellaneous Parameters							
Mercury (Hg)	0.83		0.10	mg/kg	02-OCT-15	02-OCT-15	R3283627
Total Kjeldahl Nitrogen	0.260		0.020	%	03-OCT-15	04-OCT-15	R3282145
Total Solids and Total Volatile Solids							
Total Solids	62.5		0.10	%	03-OCT-15	03-OCT-15	R3281552
Total Volatile Solids (dry basis)	5.67		0.10	%	03-OCT-15	03-OCT-15	R3281552
pH and EC (1:2 Soil:Water Extraction)							
Conductivity (1:2)	2.27		0.050	dS m-1	03-OCT-15	03-OCT-15	R3281944
pH (1:2 soil:water)	8.41		0.10	pH	03-OCT-15	03-OCT-15	R3281944
Nitrate, Nitrite and Nitrate+Nitrite-N							
Nitrite-N	3.30		0.40	mg/kg	02-OCT-15	02-OCT-15	R3281979
Nitrate+Nitrite-N	17.8		2.0	mg/kg	02-OCT-15	02-OCT-15	R3281979
Nitrate-N	14.5		2.0	mg/kg	02-OCT-15	02-OCT-15	R3281979
Metals							
Aluminum (Al)	5300		5.0	mg/kg	02-OCT-15	02-OCT-15	R3282232
Antimony (Sb)	0.23		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Arsenic (As)	3.29		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1678243-3 C4/5-01 COMP CELL 4+5							
Sampled By: CLIENT on 23-SEP-15 @ 09:00							
Matrix: SLUDGE							
Metals							
Barium (Ba)	76.7		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Beryllium (Be)	0.22		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Bismuth (Bi)	0.768		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Boron (B)	15		10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Cadmium (Cd)	0.271		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Calcium (Ca)	43700		100	mg/kg	02-OCT-15	02-OCT-15	R3282232
Chromium (Cr)	11.7		1.0	mg/kg	02-OCT-15	02-OCT-15	R3282232
Cobalt (Co)	3.62		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Copper (Cu)	28.1		1.0	mg/kg	02-OCT-15	02-OCT-15	R3282232
Iron (Fe)	8520		25	mg/kg	02-OCT-15	02-OCT-15	R3282232
Lead (Pb)	17.5		0.20	mg/kg	02-OCT-15	02-OCT-15	R3282232
Magnesium (Mg)	9290		10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Manganese (Mn)	342		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Molybdenum (Mo)	1.51		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Nickel (Ni)	7.62		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Phosphorus (P)	2840		100	mg/kg	02-OCT-15	02-OCT-15	R3282232
Potassium (K)	1200		25	mg/kg	02-OCT-15	02-OCT-15	R3282232
Selenium (Se)	1.30		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Silver (Ag)	2.01		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Sodium (Na)	692		10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Strontium (Sr)	119		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Thallium (Tl)	<0.10		0.10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Tin (Sn)	<5.0		5.0	mg/kg	02-OCT-15	02-OCT-15	R3282232
Titanium (Ti)	104		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Uranium (U)	6.72		0.020	mg/kg	02-OCT-15	02-OCT-15	R3282232
Vanadium (V)	19.9		0.50	mg/kg	02-OCT-15	02-OCT-15	R3282232
Zinc (Zn)	60		10	mg/kg	02-OCT-15	02-OCT-15	R3282232
Total Organic N-liquid manure -as rec'd							
Ammonium - N in Liquid Manure - as rec'd							
Ammonia, Total (as N)	1.3		1.0	lb/1000gal	02-OCT-15	02-OCT-15	R3281243
Nitrogen, Total Organic							
Total Organic Nitrogen	15.7		1.0	lb/1000gal		04-OCT-15	
Total N in Liquid Manure -as rec'd							
Total Nitrogen	17.0		1.0	lb/1000gal	02-OCT-15	02-OCT-15	R3281239

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DLM	Detection Limit Adjusted due to sample matrix effects.
HTD	Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
EC-WP	Water	Conductivity	APHA 2510B

Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.

ALS Test Code	Matrix	Test Description	Method Reference**
ETL-N-TOT-ANY-WP	Water	Total Nitrogen Calculated	Calculated
ETL-N-TOTORG-AGL-SK	Manure	Nitrogen, Total Organic	APHA 4500 Norg-Calculated as TKN - NH3-N
HG-200.2-CVAF-WP	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

ALS Test Code	Matrix	Test Description	Method Reference**
HG-T-CVAF-WP	Water	Mercury Total	EPA245.7 V2.0

Mercury in filtered and unfiltered waters is oxidized with Bromine monochloride and analyzed by cold-vapour atomic fluorescence spectrometry.

ALS Test Code	Matrix	Test Description	Method Reference**
MET-200.2-MS-WP	Soil	Metals	EPA 200.2/6020A

Samples for analysis are homogenized, dried at 60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve, and a representative subsample of the dry material is weighed. The sample is then digested by block digester (EPA 200.2). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may become "environmentally available." By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

ALS Test Code	Matrix	Test Description	Method Reference**
MET-T-MS-WP	Water	Total Metals by ICP-MS	APHA 3030E/EPA 6020A-T

This analysis involves preliminary sample treatment by hotblock acid digestion (APHA 3030E). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

ALS Test Code	Matrix	Test Description	Method Reference**
N-TOT-LECO-AGL-SK	Manure	Total N in Liquid Manure -as rec'd	RMMA A3769 3.3

The sample is introduced into a quartz tube where it undergoes combustion at 900 C in the presence of oxygen.
Combustion gases are first carried through a catalyst bed in the bottom of the combustion tube, where oxidation is completed and then carried through a reducing agent (copper), where the nitrogen oxides are reduced to elemental nitrogen.
This mixture of N2, CO2, and H2O is then passed through an absorber column containing magnesium perchlorate to remove water. N2 and CO2 gases are then separated in a gas chromatographic column and detected by thermal conductivity.

Reference:
Reference: Wolf, A., Watson, M. and Nancy Wolf. 2005. In: John Peters(ed.) Recommended Methods for Manure Analysis. Method 3.3

ALS Test Code	Matrix	Test Description	Method Reference**
N-TOTKJ-COL-SK	Soil	Total Kjeldahl Nitrogen	CSSS (1993) 22.2.3

The soil is digested with sulfuric acid in the presence of CuSO4 and K2SO4 catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.

ALS Test Code	Matrix	Test Description	Method Reference**
N2/N3-AVAIL-SK	Soil	Nitrate, Nitrite and Nitrate+Nitrite-N	APHA 4500 NO3F

Available Nitrate and Nitrite are extracted from the soil using a dilute calcium chloride solution. Nitrate plus Nitrite is quantitatively reduced to nitrite by passage of the sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. The resulting water soluble dye has a magenta color which is measured at colorimetrically at 520nm. Nitrite is determined on the same extract by following the same instrumental procedure without a cadmium column.
Reference: Recommended Methods of Soil Analysis for Canadian Prairie Agricultural Soils. Alberta Agriculture (1988) p. 19 and 28

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
NH3-COL-WP	Water	Ammonia by colour	APHA 4500 NH3 F

Ammonia in water samples forms indophenol when reacted with hypochlorite and phenol. The intensity is amplified by the addition of sodium nitroprusside and measured colourmetrically.

ALS Test Code	Matrix	Test Description	Method Reference**
NH4-AGL-SK	Manure	Ammonium - N in Liquid Manure - as rec'd	RMMA A3769 4.1

Ammonium is determined by steam distillation into boric acid followed by titration with standard acid.

Reference: Wolf, A., Watson, M. and Nancy Wolf. 2005. In: John Peters(ed.) Recommended Methods for Manure Analysis. Method 4.1

ALS Test Code	Matrix	Test Description	Method Reference**
NO2+NO3-CALC-WP	Water	Nitrate+Nitrite	CALCULATION
NO2-IC-N-WP	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
NO3-IC-N-WP	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
P-T-COL-WP	Water	Phosphorus, Total	APHA 4500 P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

ALS Test Code	Matrix	Test Description	Method Reference**
PH,EC-1:2-SK	Soil	pH and EC (1:2 Soil:Water Extraction)	CSSC 3.13/CSSS 18.3.1

1 part dry soil and 2 parts de-ionized water (by volume) is mixed. The slurry is allowed to stand with occasional stirring for 30 - 60 minutes. After equilibration, pH of the slurry is measured using a pH meter. Conductivity of the filtered extract is measured by a conductivity meter.

ALS Test Code	Matrix	Test Description	Method Reference**
PH-WP	Water	pH	APHA 4500H

The pH of a sample is the determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode.

ALS Test Code	Matrix	Test Description	Method Reference**
SOLIDS-TOT/TOTVOL-SK	Manure	Total Solids and Total Volatile Solids	APHA 2540G

A well-mixed sample is evaporated in a weighed dish and dried to constant weight in an oven at 103-105”C. The increase in weight over that of the empty dish represents the Total Solids. The crucible is then ignited at 550”–10”C for 1 hour. The remaining solids represent the Total Fixed Solids, while the weight lost on ignition represents the Total Volatile Solids.

ALS Test Code	Matrix	Test Description	Method Reference**
SOLIDS-TOTSUS-WP	Water	Total Suspended Solids	APHA 2540 D (modified)

Total suspended solids in aquesous matrices is determined gravimetrically after drying the residue at 103 105°C.

ALS Test Code	Matrix	Test Description	Method Reference**
TKN-F-CL	Water	Total Kjeldahl Nitrogen by Fluorescence	APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

CITY OF WINKLER
SLUDGE TESTING REQUIRMENTS
REFERENCE ALS COC 14-455314

L1678243-COFC

Sludge Testing Component

Component
Conductivity
pH
Total solids
Volatile solids
Nitrate nitrogen
Total Kjeldahl nitrogen
Ammonia Nitrogen
Total phosphorus
Total Lead
Total Mercury
Total Nickel
Total potassium
Total Cadmium
Total Copper
Total Zinc
Total Chromium
Total Arsenic
Metals to be tested after strong acid digestion

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1678243-COFC

COC Number: 14 - 455314

Page 1 of 1

Report To	
Company:	City of Winkler
Contact:	Tim Wiebe
Address:	185 Main St Winkler MB
Phone:	204-325-9524

Report Format / Distribution

Select Report Format: [x] PDF [ ] EXCEL [ ] EDD (DIGITAL)
Quality Control (QC) Report with Report [ ] Yes [ ] No
[ ] Criteria on Report - provide details below if box checked
Select Distribution: [x] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax: TWiebe@cityofwinkler.ca
Email 2

Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)

R [x] Regular (Standard TAT if received by 3pm)
P [ ] Priority (2-4 business days if received by 3pm)
E [ ] Emergency (1-2 business days if received by 3pm)
E2 [ ] Same day or weekend emergency if received by 10am – contact ALS for surcharge.
Specify Date Required for E2,E or P:

Invoice To: Same as Report To [x] Yes [ ] No
Copy of Invoice with Report [ ] Yes [ ] No
Company:
Contact:

Invoice Distribution

Select Invoice Distribution: [ ] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax
Email 2

Project Information

ALS Quote #:
Job #: C1505
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)

Approver ID: | Cost Center:
GL Account: | Routing Code:
Activity Code:
Location:

ALS Lab Work Order # (lab use only)
ALS Contact:
Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

See Attached Test Sheet

Number of Containers

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type
	C3-01 → C3-05 Comp. Cell 3	Sept 23	9:00 am	Sludge
	C2-01 → C3-05 Comp. Cell 2	Sept 23	9:00 am	Sludge
	C4/5-01 Comp. Cell 4+5	Sept 23	9:00 am	Sludge

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? [ ] Yes [x] No
Are samples for human drinking water use? [ ] Yes [x] No

Special Instructions / Specify Criteria to add on report (client Use)

Do Not send to MB Conservation

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No [ ]
Ice packs Yes [ ] No [ ] Custody seal intact Yes [ ] No [ ]
Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C | FINAL COOLER TEMPERATURES °C

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: [signature]	Date: Sept 23	Time:	Received by: CB	Date: 09/24/15	Time: 8:00	Received by:	Date:	Time:

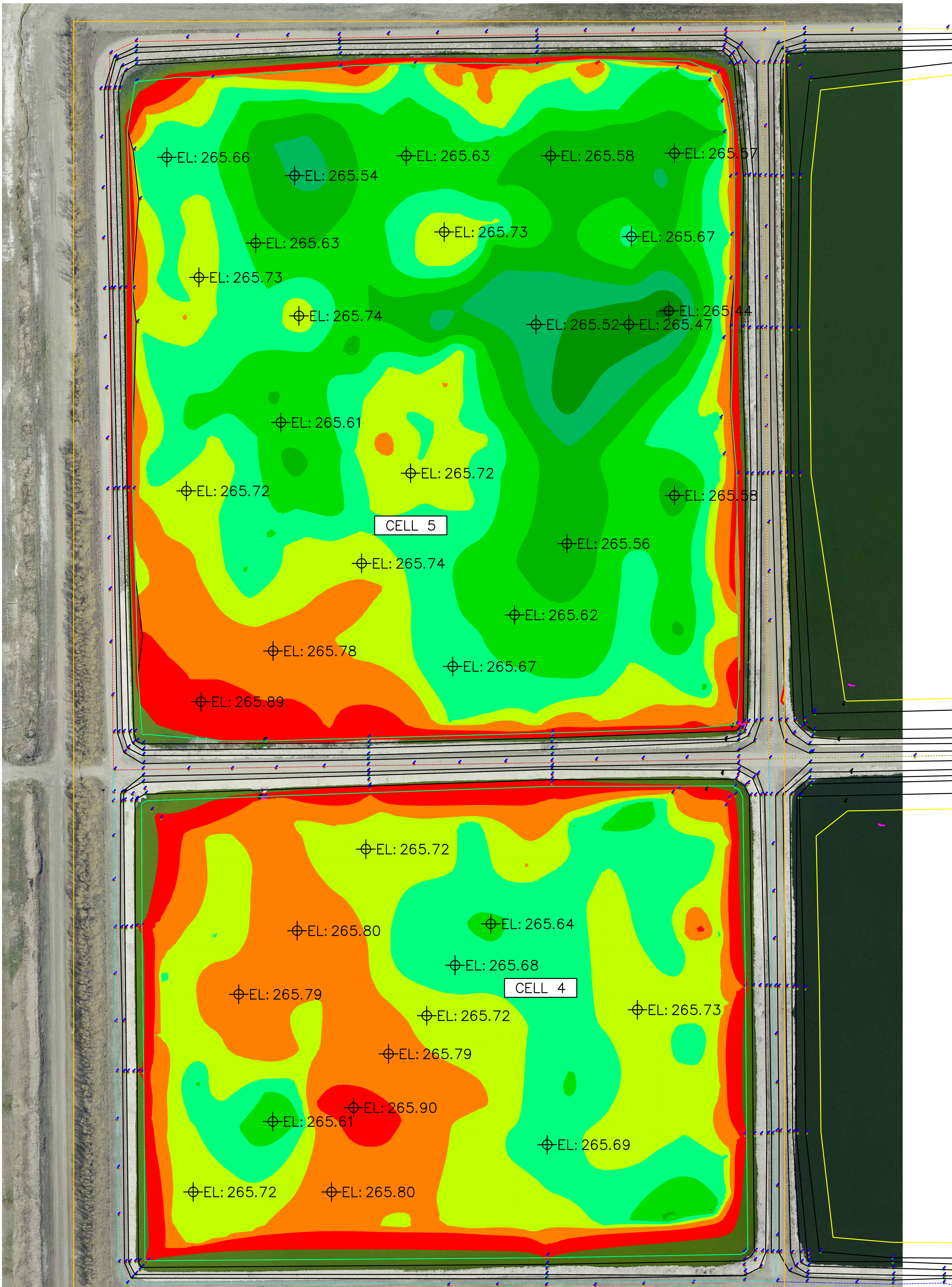
REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION   WHITE - LABORATORY COPY   YELLOW - CLIENT COPY

NA FM 0326e v06 Front/03 October 2013

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

2°C



Elevations Table

Number	Minimum Elevation	Maximum Elevation	Color
1	265.40	265.45	
2	265.45	265.50	
3	265.50	265.55	
4	265.55	265.60	
5	265.60	265.65	
6	265.65	265.70	
7	265.70	265.75	
8	265.75	265.85	
9	265.85	266.10	

Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
s4	**1.000**	**1.000**	58012.76sq.m	4223.86 Cu. M.	349.58 Cu. M.	3874.28 Cu. M.<Cut>
s5	**1.000**	**1.000**	82812.71sq.m	1902.22 Cu. M.	4378.97 Cu. M.	2476.75 Cu. M.<Fill>
Totals			140825.48sq.m	6126.08 Cu. M.	4728.55 Cu. M.	1397.52 Cu. M.<Cut>

About AECOM

AECOM (NYSE: ACM) is built to deliver a better world. We design, build, finance and operate infrastructure assets for governments, businesses and organizations in more than 150 countries.

As a fully integrated firm, we connect knowledge and experience across our global network of experts to help clients solve their most complex challenges.

From high-performance buildings and infrastructure, to resilient communities and environments, to stable and secure nations, our work is transformative, differentiated and vital. A Fortune 500 firm, AECOM companies had revenue of approximately US$19 billion during the 12 months ended June 30, 2015.

See how we deliver what others can only imagine at aecom.com and @AECOM.

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