Operation and Maintenance Management Plan

Former Schwartzwalder Mine Water Treatment Plant

Doc. No.: 25-US-0221_1101-0

Date: May 9, 2025

Prepared for:

COLORADO
Department of Natural Resources

Division of Reclamation Mining and Safety

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TABLE OF CONTENTS

TABLES

APPENDICES

1.0 INTRODUCTION

The purpose of this report is to outline the continued updated operational protocol performed by the operations team in preparation for the 2025 operating season when compared to the original Ensero Solutions INC O&M manual found in **Appendix A** (Water Treatment Plant Operations and Maintenance Manual Former Schwartzwalder Mine Golden, Colorado, November 2023). The Original O&M governs except where specified below. The Operations and Maintenance Management Plan (OMMP) is a living document and will continue to evolve, particularly as the Non-Guaranteed items are implemented during the upcoming operating season. The OMMP will be updated throughout the 2025 operating season, with a revised version provided after operations conclude to reflect current conditions.

2.0 2024 CHANGES

Operational changes from the original November 2023 Manual are as noted below:

Table 2-1 2024 Operational Changes from 2023 Manual

O&M Section	Page	Line(s)	Difference in Operational Protocol
2.2 - Anti-Scale and Cartridge Filters	17	11	The antiscalant that is used is Avista 5100. The dosage remains the same.
2.5 - Ion Exchange (IX) and Sodium Hydroxide	18	28	Vessels 1 and 2 were used for the entire season. Vessel 3 could not be on standby due to a leak in the IX piping
2.5 - Ion Exchange (IX) and Sodium Hydroxide	19	22	Programming was changed such that the primary control of the NaOH dose is targeting an effluent pH value. The NaOH dosing also has an interlock which will stop dosing if the flowrate stops
2.8 - Engineering Control and Webmaster Overview	21	5	IP address changed to 192.168.10.130
2.8 - Engineering Control and Webmaster Overview	21	5	IP address changed to 192.168.10.194
2.9 - In-Situ Treatment	21	14 - 28	The in-situ treatment was not performed
4.1 - WTP Start-up SOP	24	21 - 22	Typical operation saw the start-up of RO#2 first however, it was not a requirement. RO#1 was able to be started first. There was no rationale as to why RO#2 was required to be started before RO#1.
4.1.1 - RO #2 Start-up (Single RO Operation)	25	28	If the RO was in FILL and the pressure was below 48 psi, operations would slowly close the RED bypass valve such that all of the flow is going to the RO (step 16). If closing the valve did not result in a pressure of 48 psi, the VFD was slowly increase. If the RO was in FILL and the pressure was at or slightly above 48 psi, the VFD was slightly lowered. Once the pressure was stable and below 48 psi, RED bypass valve was slowly closed to target 48 psi.
4.1.2 - RO#1 Start-up (Double RO Operation)	26	17	Start up procedure for 2 RO operation was performed differently. If it was known that both ROs were to be operated, both ROs would be put into FILL with an inlet pH of 48 psi. The air would be bled from both ROs as described in 4.1.1. Once both ROs are bled of air, one RO was started while the other remained in fill. Once one RO was stable and online, the other RO was started (Step 9 onwards). The throttling valve of both ROs were adjusted together once they were both online.
4.3 - Anti-Scalant Refill SOP	27	40	Operations will set the Mine pump into HAND on the Discharge Webmaster → VFD Power (R7). This will ensure that the plant will not shutdown. Once finished making the new batch of antiscalant, the pump was put back in AUTO.

O&M Section	Page	Line(s)	Difference in Operational Protocol
4.4 - Barium Chloride Refill SOP	28	28	Permeate was added to the drum in 2 ways over the season. If 2 operators are present, they would use the same hose set up as the antiscalant. Before doing so they would put the mine pump into HAND. While filling they will communicate regularly to ensure the drum does not overfill. Once finished, the pump would be put back in auto. If 1 operator is present, the operator would fill 5 gal buckets with permeate and slowly fill the drum to the 50-gal mark.
4.7 - Membrane Preservation SOP	30	42	RO membranes were preserved with a solution of permeate and Avista Safeguard 100
4.10 - Mine Pool Elevation Monitoring	32	10	For the majority of the 2024 season, depth to water readings were taken of MW-18 since the transducer in the mine pool was broken. A new transducer was installed in October 2024. Since the reading with the new transducer has yet to happen at the date that this memo has been issue, an SOP on how to take mine pool elevation readings with the new transducer will need to be drafted at a later date.
4.12 - Daily Operational Logs	33	32 - 33	pH was logged daily and sampled at Outfall 001A, not at the discharge tank
5.2 - Generator	34	15	The generator was not used during the 2024 season. It is unclear the last time maintenance was performed on the generator.
5.4 - Pumps	35	11 - 14	The underground injection pumps were not used

3.0 2025 ANTICIPATED CHANGES

Operations for the 2025 season will start based on the conditions in place at the end of 2024, as described in section 2. However, several upgrades and changes related to the Non-Guaranteed items are expected to be made before the season. While the planned updates are outlined below, their full effect on operations won't be fully understood until the plant is running. The OMMP will be updated as needed to reflect these changes and to stay current with actual operating conditions. The Non-Guaranteed items are as follows:

- Item B237 – Antiscalant Pump and Dosing Plumbing Upgrade
  - The addition of another pump with two individual lines to the feed of the ROs affects how the ROs are fed and how they run. This modifies Section 4.1.1 RO#2 Start-up (Single RO Operation) (Page 24). The upgrades will allow for better, more accurate dosing of the ROs that can be better controlled.
- Item B28 – Install Surge Protector on Existing Transformer
  - There were numerous power outages last year that damaged PLC boards and other components, so a Surge Protector is being installed on the Existing Transformer to prevent future electrical events. This item is not anticipated to significantly affect the operations; the transformer will still function as current.
- Item B29 – Repair PVC Leak in IX Vessel #3
  - Repairing the PVC leak will not affect/change the operations.
- Item B29.1 – Repair Valve Handle in the IX System
  - Repairing the handle will not affect/change current operations.
- Item B29.2 – Add a Drain Valve in the IX System Discharge PVC Line for Winterization
  - This change will change section 5.5 Winterization of the original O&M (Page 35) "make sure all lines that can or will be exposed throughout the winter have adequate insulation and heat trace these lines are exposed and have experienced freezing/breaking in the previous years – by adding the drain valve we can ensure proper drainage in that area to avoid freezing/breaking.
- Item B30 – Repair PVC Leak in Intake Sample Port Valve
  - Repairing the Leak will not affect/change operations.
- Item B31 – Install Sample Port between RO and IX Circuits
  - Adding a sample port will not modify operations as documented in the O&M significantly but will make it easier to obtain samples between the Circuits. The method and procedures for collecting the samples is as documented.
- Item B32 – Install TDS Autosampler
  - An autosampler will allow for easier samples in the TDS which will report to the PLC, following the procedures for PLC reporting as documented.
- Item B33 – Install Remote Monitoring Control System
  - Modified O&M section 2.8 Engineering Control and Webmaster Overview (Page 20)
- Item B34 – Install Hardwired Electrical and Data Connections to Mine Pool Transducer PLC

  - The electrical and PLC upgrades will improve the way the plant operates and the ability to report the data will be demonstrated and appear in the updated O&M once completed. Though the upgrades are almost complete, the impact and difference to the Operations is not yet known until the PLC is operational.
- Item B36 – Installation of a ORP Sensor at Influent Pipe.
  - An ORP Sensor will allow for automated readings which will report to the PLC, following the procedures for PLC reporting as documented.
- Item B37 – Repair PVC Piping and Valve in Exterior Effluent Valve Box
  - Repairing the Piping/Valve will not affect or change operations as documented.
- Item B38 – Install 600’ Mine Pool Transducer Cable
  - Modified Section 4.10 Mine Pool Elevation Monitoring (Page 32). A 500’ transducer is currently installed but is not providing reliable reading on the pool. Adding another 100’ of cable will not affect how the operations progress as documented, only improve the readings/results. The procedures will be the same.

The remainder of the Operational and Maintenance Procedures are as found in the O&M in Appendix A.

APPENDIX A

WATER TREATMENT PLANT OPERATIONS AND MAINTENANCE MANUAL FORMER SCHWARTZWALDER MINE GOLDEN, COLORADO, NOVEMBER 2023

WATER TREATMENT PLANT
OPERATIONS AND MAINTENANCE MANUAL
FORMER SCHWARTZWALDER MINE
GOLDEN, COLORADO

NOVEMBER 2023

COLORADO LEGACY LAND

PREPARED BY:

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WATER TREATMENT PLANT
OPERATIONS AND MAINTENANCE MANUAL
FORMER SCHWARTZWALDER MINE,
GOLDEN, COLORADO
NOVEMBER 2023

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Table of Contents

List of Tables

List of Figures

Acronyms and Abbreviations

AUTO	Automatic Operation (see HAND)
AC	Alternating Current
BPL	Below Property Line
CDO	Cease and Desist Order
CDRMS	Colorado Department of Public Health & Environment
CIP	Clean-in-Place
CLL	Colorado Legacy Land, LLC
COC	Chain of Custody
DMR	Discharge Monitoring Report
DRMS	Colorado Division of Reclamation, Mining & Safety
EDD	Electronic Data Deliverable
EDTA	**E**thylene**d**iamine**t**etra**a**cetic Acid
GPM	Gallons per Minute
HAND	Manual Operation (see AUTO)
HASP	Health & Safety Plan
HDPE	High Density Polyethylene
HMI	Human Machine Interface
HSE	Health, Safety, & Environment
NOV	Notice of Violation
OSHA	Occupational Safety & Health Administration
PDF	Portable Document Format
PPE	Personal Protective Equipment
QA	Quality Assurance
QC	Quality Control
SOP	Standard Operating Procedure
VFD	Variable Frequency Drive
WTP	Water Treatment Plant

1 INTRODUCTION

This WTP Operations and Maintenance (O&M) Manual provides the necessary information for the operation, maintenance, and troubleshooting of the WTP to ensure the plant operates to the design standards and criteria. It is important that all operators, technicians, and maintenance personnel understand and follow the guidelines and procedures outlined in this O&M manual.

Safety information can be found within the site-specific *Health and Safety Plan* (HASP). The treatment plant system will be operated and monitored in compliance with the Occupational Safety and Health Administration (OSHA) guidelines. This O&M Manual will be updated along with any changes to the current water treatment plant system. Any changes must be noted, and notification given to either the Project Manager or Site Manager for review and approval.

O&M Manual revisions will be generated as necessary to address any additional activities or changes in site conditions that may occur during field operations. Once generated, newer revisions will supplant older revisions and will be reviewed/acknowledged by operator and maintenance personnel. A copy of this manual, as well as any applicable supplements, shall always be maintained on site and available for review.

1.1 BACKGROUND AND SITE DESCRIPTION

The Former Schwartzwalder Mine is a not yet reclaimed underground uranium mine located in Jefferson County near Golden Colorado. Figure 1-1 shows the general location of Schwartzwalder Mine. The property encompasses approximately 87% (559.204 acres) of Section 25, T2S, R71W, of which 72.24 acres are permitted for reclamation under Colorado Mine Land Reclamation Permit M-1977-300 (Figure 1-2). This permit is administered by the Colorado Division of Reclamation, Mining, and Safety (DRMS). The mine was operated by Cotter Corporation N.S.L. from 1966 until May 2000, when mining operations ceased, dewatering pumps were shut off, and the mine was allowed to flood.

In March of 2018, Colorado Legacy Land, LLC (CLL), purchased the Former Schwartzwalder Mine from Cotter Corporation. In the transaction, CLL acquired the title to 559.204 acres of real property, all underlying mineral rights, certain water rights, and regulatory responsibility for ongoing environmental compliance and closure.

1.2 REGULATORY REQUIREMENTS

The primary regulatory requirements for WTP operations onsite are:

- In accordance with *the CDRMS Modification of Fact, Conclusions of Law and Order* (September 2012) mine pool elevation is required to be 150-feet below the Steve Adit elevation. This is monitored continuously via pressure transducer directly in the mine shaft through an adjacent ventilation shaft and discussed in greater detail in this document.

- In accordance with Colorado Discharge Permit #CO-0001244, the WTP discharge rate must be less than 200 gpm (averaged over the month). This is visually monitored by the onsite operator and recorded on the operator's logs. In accordance with Colorado Discharge Permit #CO-0001244, the WTP discharge pH must be between 6.5 and 9.0. pH is continuously monitored with a probe that is suspended inside a temporary holding tank. This measurement is verified daily by the onsite operator with a pH probe and documented on the operator logs.

- In accordance with Colorado Discharge Permit #CO-0001244, the WTP effluent (discharge) is sampled and analyzed for constituents listed in the Permit. The discharge concentration limits, and reporting requirements are discussed in the project's *Sampling and Analysis Plan*.

1.3 HEALTH AND SAFETY

It is the policy of Ensero Solutions Inc. ("Ensero") to provide a safe and healthy work environment for all its employees. Ensero considers no phase of operations or administration is of greater importance than injury and illness prevention. Safety takes precedence over expediency or shortcuts. At Ensero, we will take every reasonable step to reduce the possibility of injury, illness, or accident on the job site. Ensero has in place a corporate wide *Health, Safety and Environmental Policy Statement*. This statement guides all Ensero activities and operating business units in our collective responsibilities for the health and safety of our employees and contractors. Additionally, the Schwartzwalder Project has a site-specific *Health and Safety Plan*. Prior to onsite work all Ensero employees must read, sign, and consent to both the Ensero *Health, Safety and Environmental Policy Statement* and the site-specific *Health and Safety Plan.* Health and safety requirements for visitors, subcontractors, and vendors are presented in the *Health and Safety Plan*.

The site-specific Health and Safety Plan is saved to the project SharePoint site under Task 3300 Health and Safety.

The practices and procedures presented in this O&M Manual and any supplemental documents associated with it are binding on all Ensero employees while engaged in site operation. In addition, all site visitors, and subcontractors under Ensero direction shall abide by and follow these procedures as the minimum acceptable standard for the work site. Operational changes to this manual and supplements that could affect the health or safety of personnel, the community, or the environment will not be made without prior approval of the Site Manager and the HSE Officer (Holli).

1.4 OPERATIONS MANUAL - SCOPE AND OBJECTIVES

The primary objectives of the WTP O&M Manual for the Former Schwartzwalder Mine are:

- Describe the water treatment technologies and flow processes in use at the Former Schwartzwalder Mine Site.

- This is a practical "how-to" manual that documents site-specific procedures and protocols directly related to the water treatment process and responsibilities of the onsite operator.

The scope of this WTP O&M Manual is limited to onsite operations and use. Additional information regarding onsite sampling can be found in the *Sampling and Analysis Plan*. Additional information regarding onsite sampling can be found in the *Health and Safety Plan*.

1.5 PROJECT ORGANIZATION CHART

Figure 1-3 shows the organization chart for operations, environmental compliance, and reclamation work. Table 1-1 lists the responsibilities of each project role in the project organization chart and their contact information.

TABLE 1-1: PERSONNEL RESPONSIBILITIES AND CONTACT INFORMATION

Name	Title / Role	Organizational Affiliation	Responsibilities	Phone Number	Email Address
Jim Harrington	Site Owner / Managing Director	Colorado Legacy Land, LLC	• Responsible for communication and coordination with Site Manager, Project Manager, project stakeholders, and regulatory staff. • Programmatic oversight and direction. • Point of contact for permits, deliverables, and regulatory documents.	970-632-2239	Jim@ColoradoLegacy.Land
Liz Busby	Senior Project Manager	Ensero Solutions Inc.	• Responsible for overall project execution and coordination with project team, site owners, project stakeholders, and regulatory staff. • Programmatic management, scheduling, direction, and oversight; and • Point of contact for contractual, programmatic, and regulatory issues,	970-222-0404 (Cell) 970-632-2240 (Office)	ebusby@ensero.com
Holli Merchant	Health and Safety Officer		• Responsible for the development of the Site-Specific Health and Safety Plan. • Responsible for site-specific health and safety training for new employees, visitors, etc. • Maintain health and safety training records and documentation; and • Conduct health and safety inspections, audits, sound surveys on an as-needed basis.	303-668-0589	hmerchant@ensero.com
Nate Lambert	Operator of Responsible Charge		• Review, approve, and submit monthly Discharge Monitoring Report and results.	303-862-3929 (Office) 315-414-6986 (Cell)	nlambert@ensero.com
Ainsly Stewart	Analytical Database Manager		• Ensure COC, EDD, and PDF report are saved to project files. • Ensure EDDs are uploaded to project's analytical database. • Ensure quality and integrity of data tables / database outputs for project reports, analysis, and communication. • Prepare monthly NOV/CDO report and Discharge Monitoring Report. • Responsible for defining analytical requirements.	719-204-7046 (office) 719-281-7594 (cell)	cbethea@ensero.com

TABLE 1-1: PERSONNEL RESPONSIBILITIES AND CONTACT INFORMATION					
Name	**Title / Role**	**Organizational Affiliation**	**Responsibilities**	**Phone Number**	**Email Address**
			• Responsible for resolution of laboratory QC issues with Project Manager. • Provides program level QA/QC guidance to team. • Review analytical data results for completeness and compliance with regulatory requirements; and • Manage subcontracting laboratory, ensure timely reporting and accurate invoicing.		
Tyler Fasenmyer	Onsite Operator / Engineer		• Daily operation and management of onsite water treatment plan. • Monitoring operation actives to ensure compliance with regulatory requirements. • Identifies non-conformities and through review of operational data and recommends corrective actions. • Prepare discharge monitoring report. • Communicate with Site Manager and Project Manager. • Ensure the HASP is followed. • Conduct discharge sampling and monthly surface water sampling. • Ensure daily field forms are uploaded to project files. • Ensure filed parameters are entered into MonitorPro and • Contractor oversight. • Prepare quarterly DRMS report, • Communicate with Site Manager and Project Manager, • Ensure the HASP is followed, • Conduct quarterly groundwater and surface water sampling, • Ensure daily field forms are uploaded to project files. • Ensure filed parameters are entered into MonitorPro.	720-388-1537 (office) 303-668-6017 (Cell)	tfasenmyer@ensero.com
Greg Ching				303-862-3929 (office)	gching@ensero.com
Randy Whicker	Radiation Safety Officer	Environmental Restoration Group	• Develop, submit, and maintain Radioactive Materials License, • Ensures all equipment meets release criteria prior to leaving site. • Oversee the transportation / shipment of any listed materials to a proper disposal facility. • Responsible for workspace and employee dose monitoring and communicating results to employees.	970-556-1174 (cell)	randywhicker@ergoffice.com
Bryan Erdman	Alternate Radiation Safety Officer			505-797-1405 (cell)	bryanerdmann@ergoffice.com

TABLE 1-1: PERSONNEL RESPONSIBILITIES AND CONTACT INFORMATION					
Name	**Title / Role**	**Organizational Affiliation**	**Responsibilities**	**Phone Number**	**Email Address**
			• Responsible for site-specific radiation safety training for new employees, visitors, etc. • Maintain radiation safety training records.		
Max Janicek	Project Manager	ACZ Labs	• Responsible for QC and oversight of laboratory operations; and • Responsible for adhering to contractual and SOP requirements.	(970) 879-6590 ext. 128 (Office) (720) 480-4432 (Cell)	maxj@acz.com
Tessa Hunt-Woodland	Laboratory Manager	SeaCrest Laboratories		303-866-3567 x8116	labmanager@ seacrestgroup.com
Calvin Kessler	Reclamation Subcontractor	Kessler Reclamation	• Construction contractor for demolition, earthwork, construction, and reclamation work onsite.	719-371-0476	kesslerreclamation@ yahoo.com
Michael Cunningham	Regulatory Oversight	Colorado Division of Reclamation and Mining Safety	• Regulatory oversight of Mine Land Reclamation Permit No. M-1977-300	303-8663567 x 8116	michaela.cunningham@state.co.us
Eric Mink	Regulatory Oversight	Colorado Department of Public Health and Environment, Water Quality Control Division	• Regulatory oversight Colorado Discharge Permit #CO-0001244.	303-692-2312	eric.mink@state.co.us
Dan Arnold	Project Stakeholders	Denver Water Attorney	• N/A. Project stakeholder.	303-628-6469	daniel.arnold@ denverwater.org
Bill Robie	Project Stakeholders	Bear Tooth Ranch Homeowners Association	• Manages access through Bear Tooth Ranch	303-278-2862	billrobie@prodigy.net

Notes:

EDD = Electronic Data Deliverable
N/A = Not Applicable
COC = Chain of Custody

QA = Quality Assurance
QC = Quality Control

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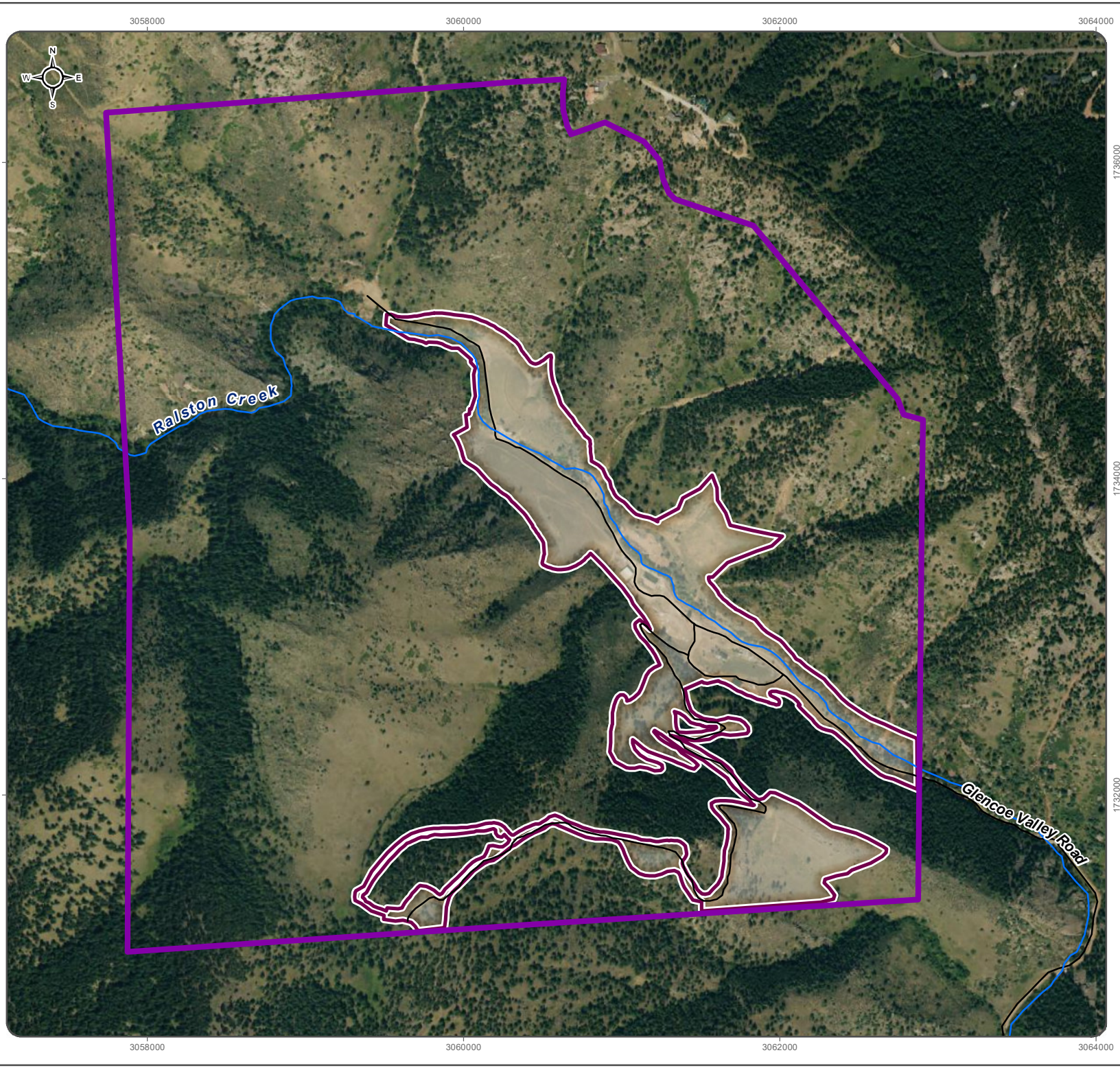
SCHWARTZWALDER MINE

FIGURE 1-1
PROJECT LOCATION

MAY 2018

D:\Project\All Projects\CLL\Schwartzwalder\Map\01-Overview\01-Location\Project_Location_20180516.mxd (*Last edited by: amallashevska; 18/05/2018/14:50 PM*)



COLORADO LEGACY LAND SCHWARTZWALDER MINE

FIGURE 1-2

SCHWARTZWALDER MINE SITE MAP

JANUARY 2020

COLORADO LEGACY LAND

- CLL Property Boundary (559.204 acres)
- Permitted Boundary, Schwartzwalder Mine M-1977-300 (72.24 acres)
- Glencoe Valley Road
- Ralston Creek

1:10,000 ***when printed on 8x11 inch paper***

0 250 500 750 1,000 Feet

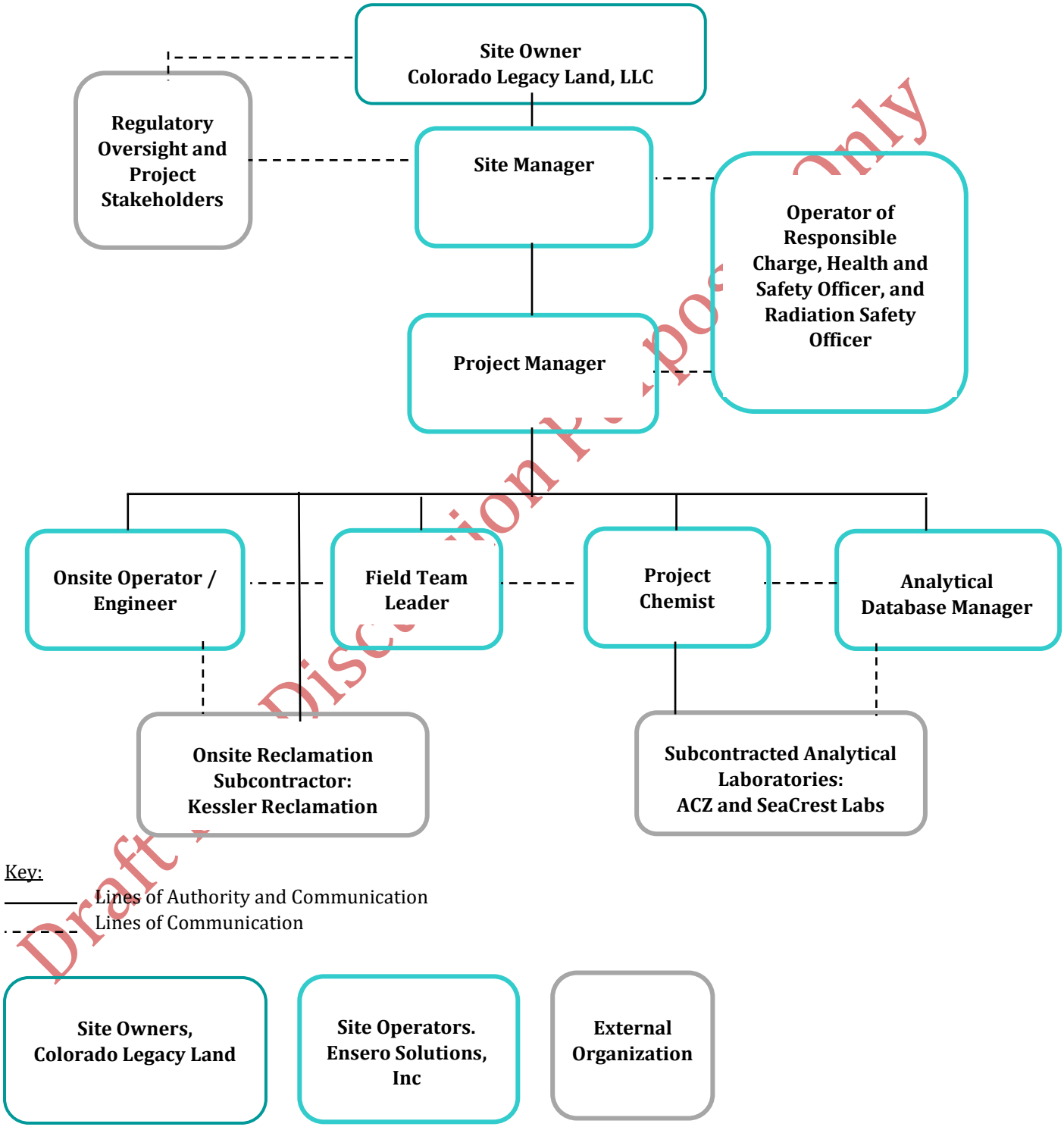
ENSERO solutions

Satelite imagery obtained from ArcGIS on services.arcgisonline.com on January 2020

Datum: NAD 1983 (CORS96) StatePlane Colorado Central FIPS 0502 (US Feet)

D:\Project\AllProjects\Schwartzwalder\Map\01-Overview\04-Special_Topics\Land_Tenure\Land_Use_Map_20200124.mxd

FIGURE 1-3. PROJECT ORGANIZATION CHART



2 WATER TREATMENT PLANT PROCESS DESCRIPTION

The Schwartzwalder WTP key processes to treat water include pre-filtering, followed by reverse osmosis (RO), and a finishing polish of the water via ion exchange (IX). Three reagents are utilized during the process. First, an anti-scale is injected into the raw mine influent just prior to the pre-filters to help reduce scaling of the RO membranes. A second reagent, barium chloride, is injected into the concentrate stream coming from the RO's to precipitate radium after it is injected underground. And finally, sodium hydroxide is injected into the discharge water to adjust the water pH to within the permit-defined range of 6.5 – 9.0 before it can flow to Ralston Creek. Figure 2-2 is the process flow diagram for the treatment process.

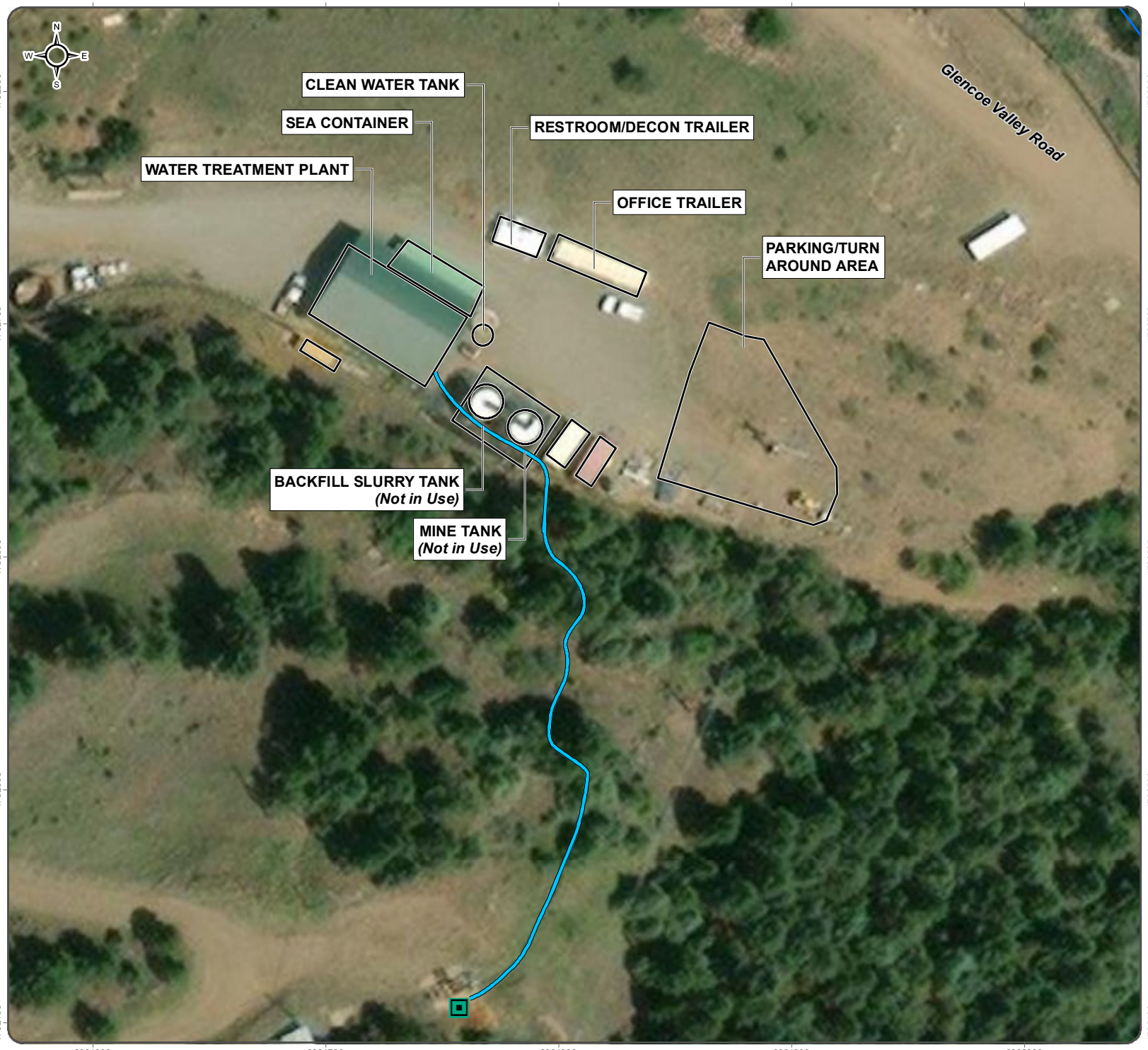
The WTP is enclosed within a pre-engineered insulated steel building allowing for year-round operation. However, the aim is to only operate in the more seasonal months and to have the WTP in standby during the colder winter months. The WTP layout is shown in Figure 2-1. When navigating the following sections of this document, refer to Figures 2.1 – 2.7 for any required clarity.

2.1 60HP MINE PUMP

Water treatment conducted at the Schwartzwalder WTP begins with water being pumped from the mine workings to the surface. Installed in 2019, the 60hp Gould's Model 7CSL mine pump (60hp) was inserted at a much greater depth than that of previous, and now obsolete, mine pumps. The 60hp was installed into the Jeffery vent shaft, as shown on Figure 2-6, to an elevation of 6,202'. The Jeffrey shaft location sits approximately 140' above the Steve Adit elevation, the pump approximately 400' below Steve Adit elevation – Steve Level, at an elevation of 6,602' above mean sea level (msl), is the baseline for permitting at the Schwartzwalder site and is used as the vertical reference datum.

The 60hp is controlled via a variable frequency drive (VFD) located above the floor sump inside the WTP. Once the VFD has been set to the desired frequency the pumped water begins to flow from the mine pool up through a 4" HDPE pipe. As the water approaches the surface it forces the column of air out through an air relief valve before flowing in a double walled pipe to the secondary containment area (**Error! Bookmark not defined.**). At the top of the Jeffrey shaft are structural components that were used to insert the pump, and which remain in place for potential future maintenance and to keep the pump held in static equilibrium. A 4" gate valve exists here to adjust flowrate manually, if required, though it is currently in the fully open position and has not required any adjustment at the time this document was prepared. See section 2.7 for full description of secondary containment.

Once the mine water has reached the secondary containment area there are two possible paths it can take, both of which are manually controlled. Typically, the valving is such that the water makes a 90° turn flowing through an open 4" ball valve and through a 2" diameter orifice plate (see next paragraph for description) prior to entering the WTP. The other possible flow direction is directly into the adjacent 20,000 gallon "mine" tank. To accommodate water into the mine tank the butterfly valve on this section of pipe must be open and the 4" ball valve must be closed; though, pushing mine water directly into the mine tank is a rarely required flow configuration. The mine tank is used to divert mine water from the plant during start up after a prolonged shutdown when excess solids or air is believed to be in the line. See Figure 2.4 for visual representation of components.



COLORADO LEGACY LAND SCHWARTZWALDER MINE

FIGURE 2-1

MESA WATER TREATMENT PLANT BUILDING LAYOUT

SEPTEMBER 2023

COLORADO LEGACY LAND

- Wench and Cable Housing for Dewatering Pump
- Site Feature
- Pipeline
- Watercourse

1 inch = 58 feet

1:700 *when printed on 8x11 inch paper*

0 25 50 75

Feet

ENSERO solutions

Satelite imagery obtained from ArcGIS on services.arcgisonline.com on September 2023

Datum: NAD 1983 (CORS96) StatePlane Colorado Central FIPS 0502 (US Feet)

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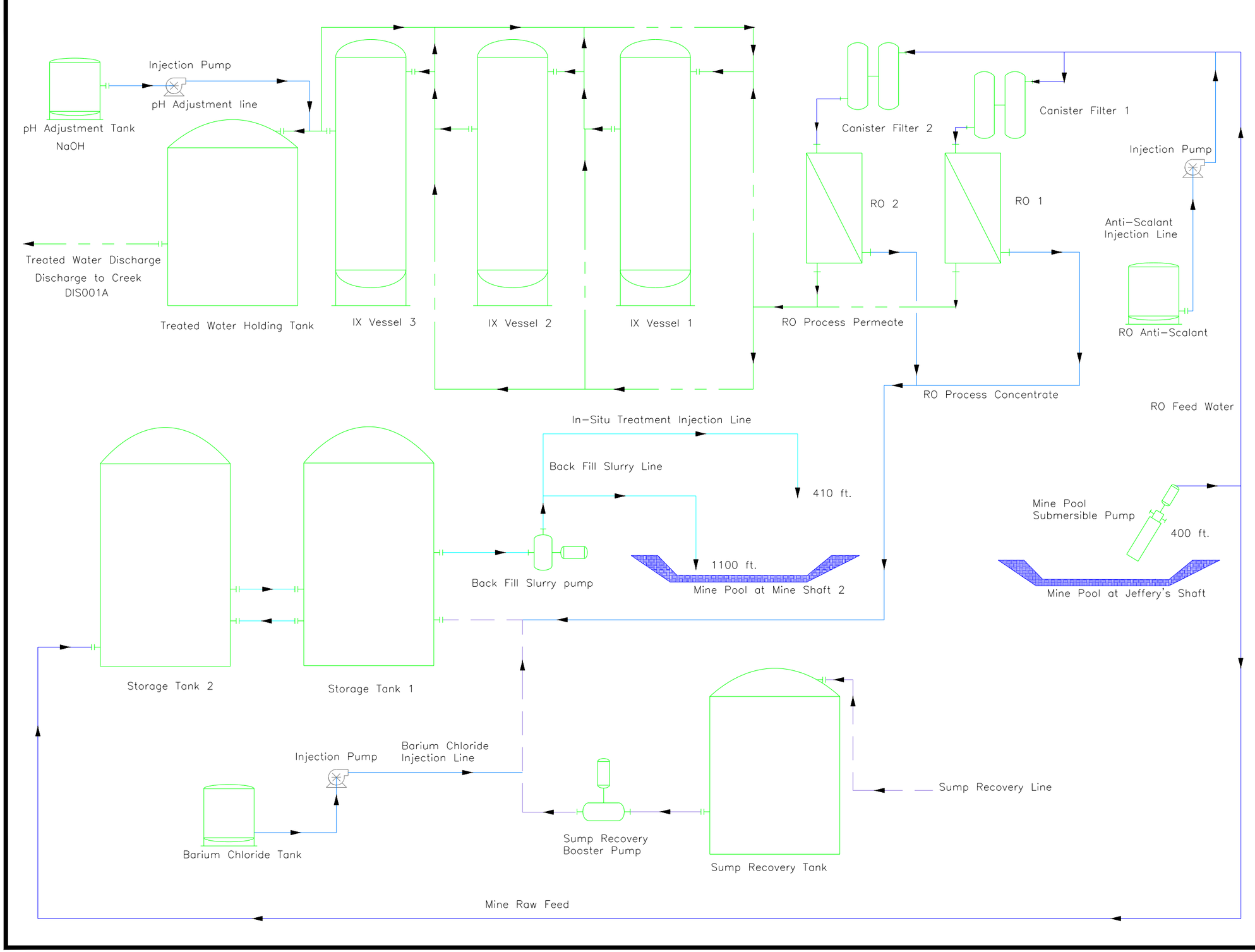


STAMP/SEAL

REVISION HISTORY

REV	ISSUE/REVISION	DATE	APP
A	As Built Revision	2/10/20	TF

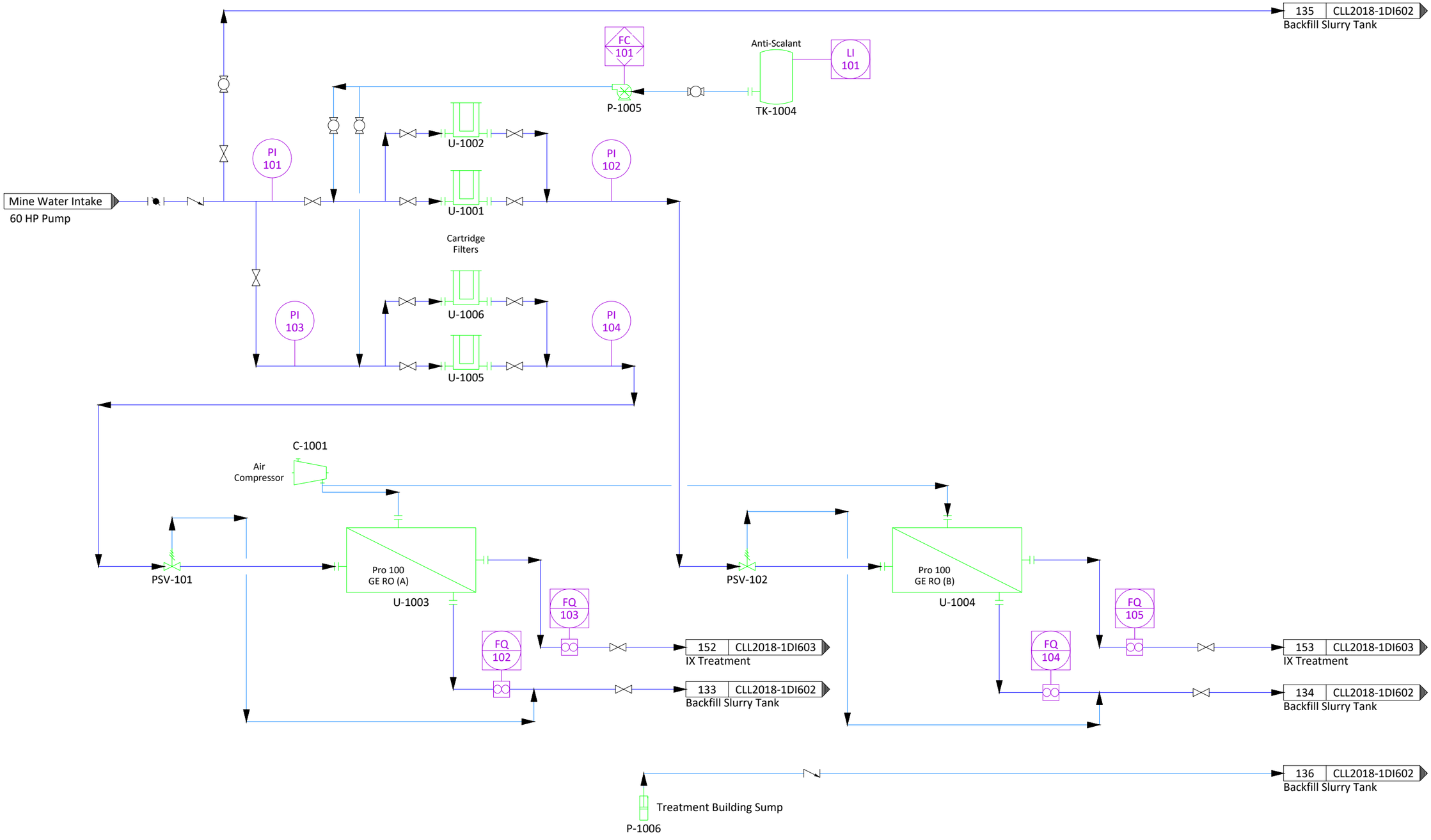
ALEXCO WATER & ENVIRONMENT

PROJECT NO.	DESIGNED BY	DRAWN BY	DATE
CLL-2020	TF	NL	2/10/20

Schwartzwalder WTP Existing Conditions

Figure 2-2
Process Flow Diagram

DRAWING NO.	REVISION
CLL-2020-D604	A



DATE	ISSUE/REVISION	REV No.	DRW.	APP.
2020-02-13	As Built	B	NL	--
2018-12-07	Issued for Review	A	KAB	--

ENSERO solutions

Schwartzwalder WWTP
Existing Conditions
Drawing No.: CLL2018-1DI601

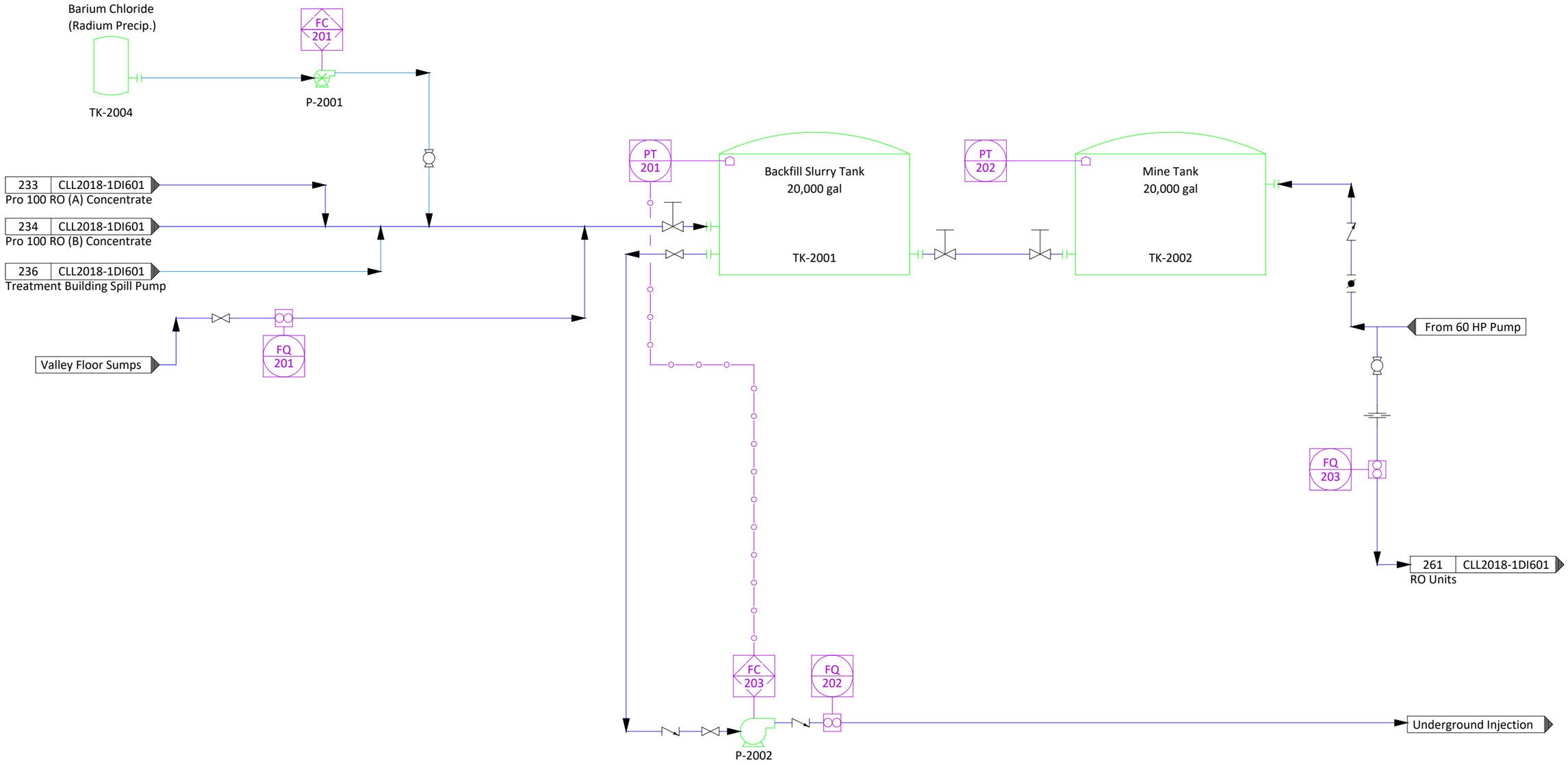
Figure 2-3

Reverse Osmosis

Piping & Instrumentation Diagram

REVISION B	2020-02-13	PROJECT No.: CLL-2020
DRAWN BY: NL	DESIGNED BY: PD	REVIEWED BY: JW

C:\Users\NateLambert\Documents\projects\Schwartzwalder WTP\PID DWG\CLL2018-1DI601.dwg [last edited by: NateLambert; 2020/03/20 - 3:00 PM



DATE	ISSUE/REVISION	REV No.	DRW.	APP.
2020-02-13	As Built	B	NL	--
2018-12-07	Issued for Review	A	KAB	--

ENSERO solutions

Schwartzwalder WWTP
Existing Conditions
Drawing No.: CLL2018-1DI602

Figure 2-4

Storage Tanks and Mine Injection

Piping & Instrumentation Diagram

REVISION B	2020-02-13	PROJECT No.: CLL-2020
DRAWN BY: NL	DESIGNED BY: PD	REVIEWED BY: JW

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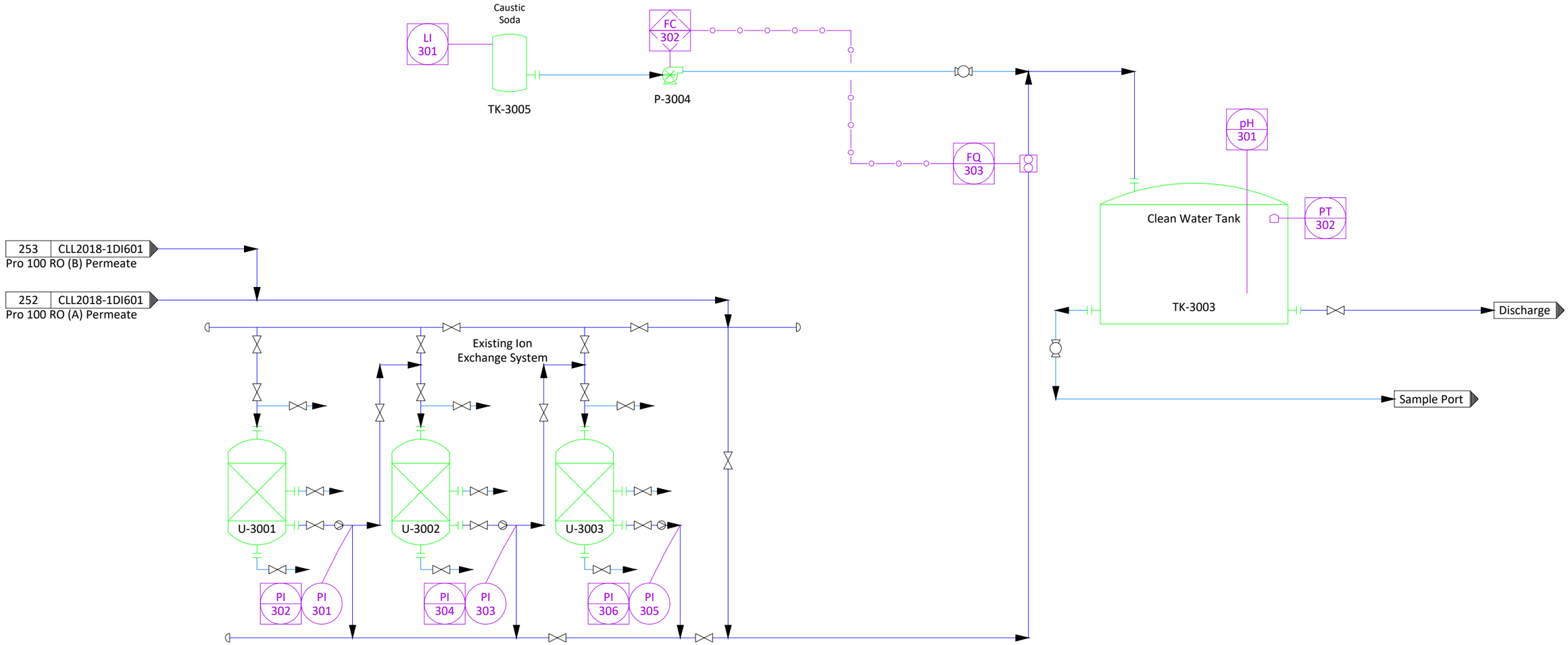

DATE	ISSUE/REVISION	REV No.	DRW.	APP.
2020-02-13	As Built	B	NL	--
2018-12-07	Issued for Review	A	KAB	--

ENSERO solutions

Schwartzwalder WWTP
Existing Conditions
Drawing No.: CLL2018-1DI603

Figure 2-5

Ion Exchange and Discharge

Piping & Instrumentation Diagram

REVISION B	2020-02-13	PROJECT No.: CLL-2020
DRAWN BY: NL	DESIGNED BY: PD	REVIEWED BY: JW

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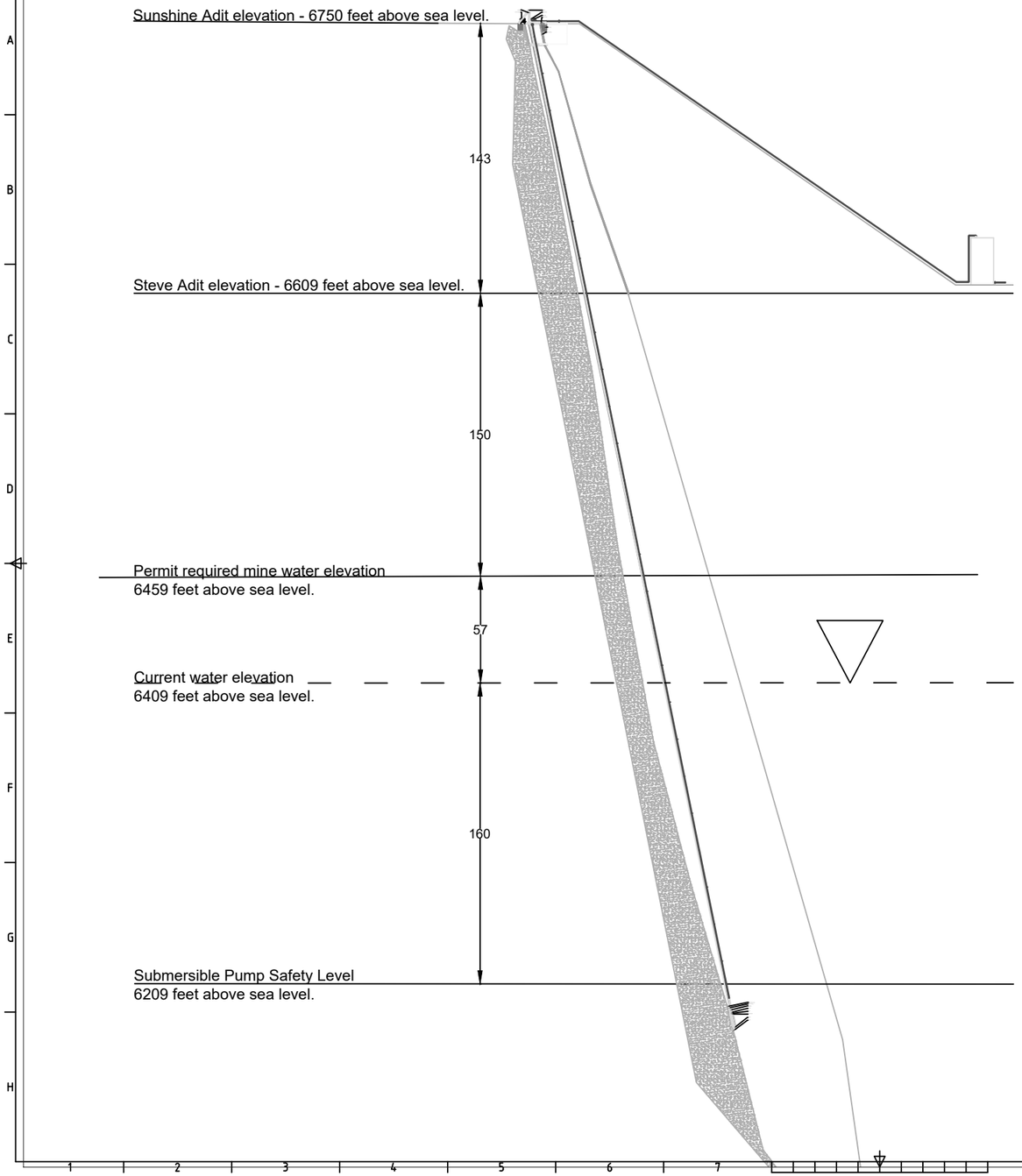
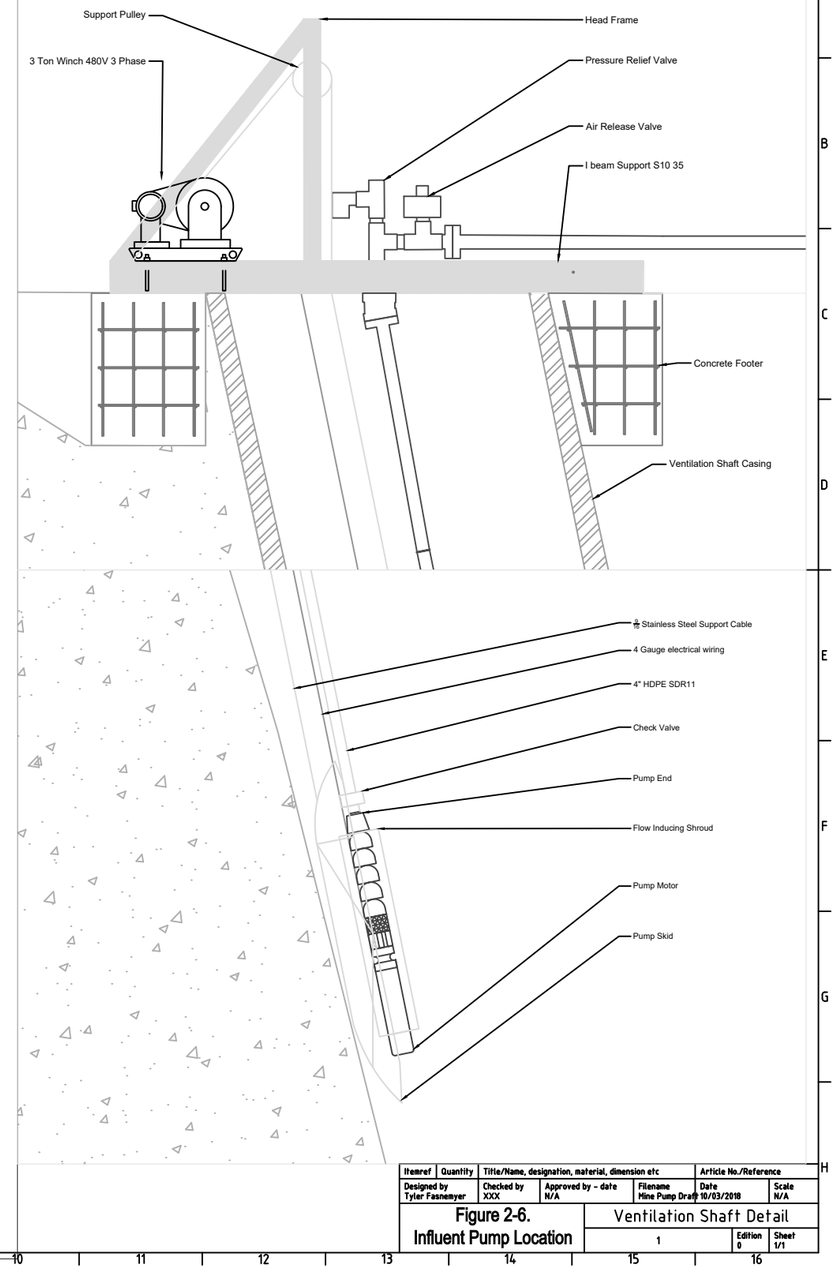
RevNo	Revision note	Date	Signature	Checked





Itemref	Quantity	Title/Name, designation, material, dimension etc			Article No./Reference
Designed by: Tyler Fasnemyer		Checked by: XXX	Approved by – date: N/A	Filename: Mine Pump Draft	Date: 10/03/2018	Scale: N/A
Figure 2-6. Influent Pump Location		Ventilation Shaft Detail			
		1		Edition: 0	Sheet: 1/1

The orifice plate is a 3/8" thick stainless-steel plate that reduces the diameter of the pipe enough to put sufficient backpressure on the water. If the plate is not present, as was found upon commissioning of the 60hp, the water traveling down the hill creates both air voids and vacuum scenarios within the pipe. Some of this air can build up within the canister filter housings causing a host of problems for operations. There exists both 1" and 2" diameter plates with the latter currently in place.

2.2 ANTI-SCALE AND CARTRIDGE FILTERS

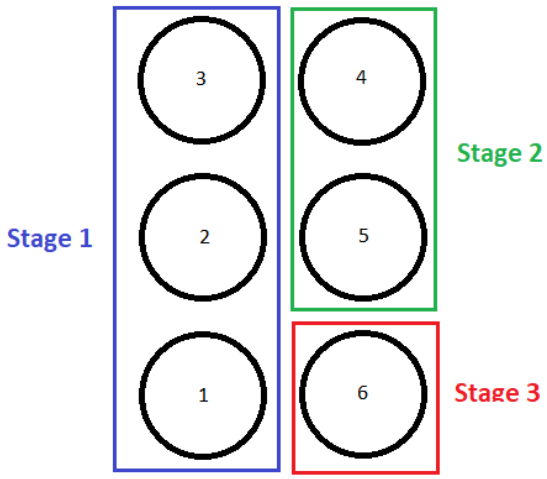
Once the mine water is pumped to the WTP it is dosed within the pipe with anti-scale to help protect and preserve the RO membranes from scaling. The dosing is automated via a PeriFlo PulsaFeeder pump which draws from a 1000-gallon poly tank located next to the RO units. When operating continually, as is often the case, the anti-scale tank must be filled manually, approximately every 4 days at a chemical-to-permeate ratio of 1:100 gallons. The provider of the anti-scalant, RO 1302 from Mid South Chemical, recommends a dosage of 2-6 ppm in the feedwater. The dosed water can then begin the pre-filtering process through the cartridge filters.

The cartridge filters consist of two pressure vessels working in parallel (on each RO skid) each of which contain 12 vertical 1µm (0.000001 meter, or 1 micron) filters. The water enters the canister and is forced via system pressure from the outside of the filter inward. Normally, the pressure differential across this threshold is around 1 – 2psi. A good sign that it is time to change these filters is when the pressure differential begins to increase beyond 2psi. The pressure differential is the difference in pressure going into the canisters (the mine feed pressure) and leaving the canisters (the RO inlet pressure, discussed below).

2.3 REVERSE OSMOSIS

Just like the canister/cartridge filters, the RO process also works in parallel and can thus be operated independently if required (i.e., one RO skid or the other). The pre-filtered mine water can now begin the reverse osmosis process. As the water leaves the canisters it is routed to the RO pumps. Each identical RO skid is equipped with a 40hp motor and subsequent staged stainless-steel pump. At this point, the water is handed off from the 60hp mine pump at a pressure of 25 – 50psi – the RO inlet pressure – and is ramped up via the onboard motor/pump combination to the high pressures required (150 – 330psi, depending on conditions) to achieve reverse osmosis.

Each RO skid is equipped with six membrane-containing pressure vessels having a diameter of 8" and a length of 16'. Each of these vessels are numbered 1-6 accordingly and are arranged in a three-stage array. Stage 1 is comprised of vessels 1, 2, & 3; stage 2 vessels 4 & 5; and stage 3 vessel 6 (3:2:1). The image below demonstrates the RO array used on both RO skids.



Each stage's vessels (except Stage 3 since it is a single vessel) work in parallel, i.e., vessels 1, 2, & 3 are in parallel and thus accept water equally. In addition, the three stages work in series, hence the "stage" naming convention. After the water is ramped up to high pressure through the pump, it passes into the first stage. The high pressures are required to overcome osmotic pressure and force the clean water from the outside of the membrane to its hollow center. Any water that has passed through the membrane wall to the hollow center is now referred to as permeate (or purified water) and is collected and routed to the IX process (described in section 2.5). Water that does not pass through the membrane wall in stage 1 will attempt the same process as it is subsequently routed to stage 2, and finally stage 3. The fluid that has passed through stage 3 and never passed through the membrane wall is no longer considered water but referred to as concentrate.

In reverse osmosis, the pore size of the filter media (membrane) is quite small. Compared to the cartridge pre-filter pore size of 1µm, RO's can operate at a pore size that is four orders of magnitude smaller at 0.1 nm (nanometers). Theoretically, this pore size is large enough to allow a water molecule (H_2O) to pass through yet small enough to halt the passage of a salt compound (NaCl, for example). This means that RO machines can turn saltwater into fresh water.

2.4 CONCENTRATE AND BARIUM CHLORIDE

The RO system achieves relatively high rates of return at around 60 – 80%. The 20 – 40% of fluid that is leftover is called concentrate. This concentrate is routed over the membranes and through a separate pipe. The Concentrate from both RO systems is collected in a single pipeline and directed back underground to the mine pool. The concentrate out flow is dosed with barium chloride ($BaCl_2$) via diaphragm pump as it is conveyed to the mine pool. The $BaCl_2$ helps to precipitate radium from the water as it is reinjected into the mine pool. This backend process aids in future treatment of the water in that it contains less of the radionuclide.

2.5 ION EXCHANGE (IX) AND SODIUM HYDROXIDE

Once the water has passed through the reverse osmosis system, it still requires further treatment to remove as much remaining uranium (in ionic form) as possible prior to discharge; the ion exchange vessels provide this. Loaded with charged resin beads and working in series, the process water enters the top of the IX vessel and percolates through the resin, stripping it of much of the remaining undesirable ions and ionic compounds. Typically, two of the three vessels are operational with the third on standby. The valving is setup to accommodate any water flow configuration through, or around, the vessels.

Resin is the term used to describe the very small, charged beads that are loaded into the IX vessels. Because the IX step in the water treatment process follows the RO process, the resin rarely needs to be changed as it collects impurities at a very slow rate. However, if a change of resin is required on a given vessel, that vessel is taken offline and isolated from the rest of the system. The resin is emptied into totes and must be recycled or disposed of properly at a facility licensed to accept radioactive materials. Several totes exist within the WTP that contain recycled, clean resin to fully refill an empty vessel, if required.

If the IX vessels experience a high-pressure event, above 25-30 psi, for a prolonged period, there is a risk of damaging the internal components of the IX vessels. This could result in mobilizing the resin beads through the effluent plumbing. Each vessel is equipped with a cone filter at the exit of the vessel. In the event of internal damage of the IX vessel components the filter can become clogged with resin. The build-up of resin will increase the IX operating pressure and decrease discharge flow. The pipe is transparent at the location of the cone filter, to allow for inspection of the cone filters. If there is significant resin build up and discharge rates have been reduced and/or IX pressures have increased 4 – 6psi, the cone filter needs to be removed, cleaned, and reinstalled. This cleaning process can only be completed when the WTP is shutdown, or that specific vessel is isolated and locked out from the rest of the system.

After the final polish through the IX vessels, the pH of the water is increased to the permitted discharge range of 6.5 – 9.0. This is accomplished with a dosing of Sodium Hydroxide (NaOH) via diaphragm pump. NaOH is injected into the pipe prior to the treated water entering the top of the discharge tank. The permeate water is allowed to freefall into the tank after the dose is applied to aid in the thorough mixing of water and NaOH reagent. This completes the water treatment process as the water is now fed via gravity from the discharge tank to the creek.

The NaOH dose amount is based on the discharge flowrate which is monitored via programmable logic controller (PLC). Since the pH of the water discharged is a regulatory requirement, the pH is monitored both through PLC's and readings taken manually by the operator and recorded daily in operational logs. These daily logs are submitted to the State of Colorado at the end of each month to demonstrate permit compliance.

2.6 SUMPS

There is a floor sump located within the WTP right below the 60hp VFD. This sump operates on a float switch to automatically pump collected fluids to the concentrate line. This sump should be checked periodically to ensure proper function of the pump and to clear any larger debris that has collected.

2.6.1 Bypass Pipeline and Seasonal Overflow

Because much of the Schwartzwalder site is known to be contaminated, measures have been taken to reduce the amount of contamination leaving the site. To help accomplish this, an 18" HDPE bypass pipeline intercepts Ralston Creek and conveys it through the site. For much of the year, all water flowing in Ralston Creek is carried through the pipeline until it rejoins the creek near surface water sample location BPL.

However, during a certain time of the year, the flows of Ralston Creek are too much for the 18" bypass to handle alone. Therefore, a 42" overflow gate exists that, when opened, will allow excess surface water to pass through the site as nature intended. The overflow gate is a manually controlled valve that must be opened when heavy spring runoff occurs to avoid potential flooding issues on site. The two flow paths are used in tandem during seasonal runoff.

Seasonal runoff typically occurs around mid-May and can run through the end of June, though, all surface water flow changes rely heavily on the operator to observe such changes visually and react accordingly. The 18" bypass can fill with debris during this time. Flushing the pipe by opening and closing the valves can clear the debris. If the 42" overflow gate is open, the 18" bypass should already be flowing at full capacity, observable at the outfall.

2.7 STORAGE TANKS

There are currently two tanks the sit adjacent to each other within a secondary containment area. The two tanks are no longer used for any processes at the site and will remain in the current position until the tanks can be properly disposed of. The secondary containment that the tanks are in was designed to catch any water that may leak from the tanks and/or any adjacent plumbing that may be going to or coming from the tanks. Since two 20,000-gallon tanks sit in the containment area, and the latter of the above two options is greater, a secondary containment of at least 20,000 gallons is required. If excess fluid is in the containment area it can be removed with a pump and the discharge hose directed to the floor sump in the WTP. Any dirt, rocks, snow, ice, or other debris must be removed through mechanical processes (hand shovel).

2.8 ENGINEERING CONTROL AND WEBMASTER OVERVIEW

Currently, two separate PLC systems are used to collect data and control certain features of the WTP system: the RO, and Discharge PLC's. Much of the operational and engineering controls in place are done so with this system. The entire system is referred to as the Webmaster, though, the individual units can also be called out by their individual locations, e.g., the "Discharge Webmaster." Until familiarity with the Webmaster system is attained via training, much of the systems' usage is for observational and trending information.

As familiarity with operations increases, the extended functionality of the Webmaster becomes apparent. All level-sensing hardware, flow meters, pressure transducers, etc. are connected directly to these units to aid in operations. Though certainly not an all-encompassing list, the Webmaster can and is used to:

- Continuously report reagent tank levels.
- Report pressure transducer readings within pipes.
- Report flow totals and flowrates of fluids within pipes.
- Create redundant settings that will shutdown all systems if a certain parameter isn't stable and/or at its set value.
- and report water parameters like pH and temperature.

Login information is required to access any of the Webmaster functionality through a web browser and is the preferred method. There exists a Wi-Fi enabled tablet on site to add both Webmaster access flexibility and operator mobility within the WTP. The login credentials for the Webmaster units (Discharge and RO) are identical:

- Name (login): schwartz
- Password: 2013

The Webmaster can be accessed both on-site with a using the local connection IP addresses and off-site through the Walchem web-based data collection tool called Fluent. The on-site Ethernet IP Address for any of the given controllers can be found in the Communications menu in the Webmaster. Upon drafting this manual, the local set of IP addresses are:

- Discharge Webmaster: 192.168.10.129
- RO Webmaster: 192.168.10.111

When one of the above IP's is entered into a browser, the following login page should appear, and the previously stated credentials will allow proper access.

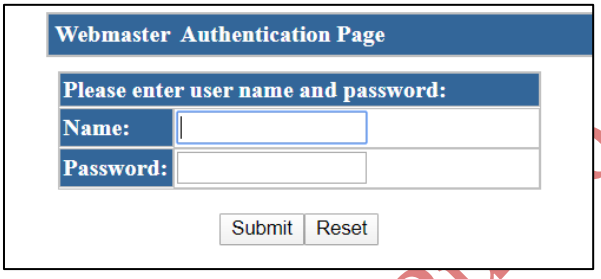


FIGURE 2-7. WEBMASTER AUTHENTICATION PAGE

It should be noted that because of the ease and simplicity with which one can adjust a setting in the Webmaster, great care must be taken that one doesn't inadvertently change the wrong setting as catastrophic failure could occur. Contact the project manager or another engineer if uncertain about changing any parameter.

2.9 IN-SITU TREATMENT

Due to the complexity of the entire in-situ process, the following is only a very short synopsis of the process. Although further information is not essential to the operation of the WTP, the Operations Management Plan describes the in-situ process much more completely.

Approximately once a year an in-situ treatment of the mine pool is performed. This process typically takes place right after a seasonal shutdown of the WTP (when the mine pool is at a lower-than-normal elevation) and occurs late in the year. The entire process is a very collaborative effort and typically encompasses several days and many man-hours. During an in-situ treatment, molasses (or other high sugar fluid) and a strong acid are introduced at a certain level within the mine. This is followed up by an alcohol injection, typically at a different level in the mine. The chemistry of these ingredients aid in the precipitation of certain metals in the mine pool water and act as a mine water treatment prior to water treatment operations in the WTP performed at the surface.

These injections purposely alter the water chemistry of the mine water. Upon initial start up in the spring, extra precautions need to be taken to monitor for excessive solids building up on the canister filters and high sulfur levels in the clean water tank, which can create dangerous working conditions.

3 RO-IX CONSUMABLES

Table 3-1 summarizes the six primary chemical reagents used in the water treatment process at the Site. PPE for handing each chemical is outlined in the site-specific *Health and Safety Plan*.

TABLE 3-1. WTP CHEMICAL SUMMARY TABLE

CHEMICAL NAME	WHY WE USE IT?	HOW TO USE?	WHEN TO USE?	WHEN TO REORDER?	HOW TO STORE IT?	NOTES
Sodium Hydroxide (NaOH)	As a pH adjustment on discharge and for CIP washes	Using proper PPE, measure amount needed in graduated 5-gal bucket	pH adjustment is automated. Mixed with permeate for CIP	When three full totes remain in WTP	Stored inside WTP in 250 gal totes.	Keep from freezing. Thoroughly wash/clean used totes with permeate
Barium Chloride	To treat concentrate	Mix 1 bag into 50 gal permeate	When ~10 gallons remain in drum	When 5-10 bags remain	50lb bags on pallet in WTP	Toxic dust. Use proper PPE.
Hydrochloric Acid	Concentrate line wash; To clean RO membranes during CIP	Follow SOP's – extreme hazard	When Concentrate line pressure increases and during CIP	When approximately25 gallons remain	In tote elevated on pallets inside WTP	DANGER. Extremely corrosive
RO Anti- Scale (RO 1302)	To keep RO membranes from scaling	Pour 1-gal into 100-gal running permeate into tank	Constant dose during operations. Refill as needed.	When approximately50 gallons remain	In tote elevated on pallets inside WTP	Avoid spills
Citric Acid	To clean RO membranes during CIP	Add half bag to heated CIP acid tote; mix.	During CIP	When 4-5 bags remain	On pallet in WTP	Dust hazard
EDTA	To clean RO membranes	Draw from drum required amount	During CIP	When approximately10 gallons remain	In drum in WTP	

Notes:

CIP = Clean-in-place
gal = gallon
lb = U.S. pound
RO = Reverse Osmosis
SOP = Standard Operating Procedure
PPE = Personal Protective Equipment
WTP = Water Treatment Plant

3.1 ORDERING CONSUMABLES

All consumables are delivered directly to site via semi-trailer. Because of this, having a plan well in advance of consumables required for delivery is necessary as road conditions must be free of snow and ice as well as in good condition thus timing is key to delivery success in winter months.

3.1.1 Purchase Order / New Vendor

Purchase orders (PO's) need to be created for any expense in excess of $1,500. Contact the accounting team (ap@ensero.com) to request the PO through an approved vendor.

3.1.2 Vendors Contact Information

Contact information for vendors for the Schwartzwalder Project is saved to the project SharePoint Site, Task 5200 RO-IX Consumables Folder.

3.1.3 Receipt / Unloading

The on-site operator/engineer must be available at the site to receive any chemical deliveries. In addition, heavy machinery (the Bobcat will *not* lift totes of chemicals) is often required to aid in unloading chemicals from the trailer and moving them into the WTP. Therefore, the operator must plan to use the Hyster forklift or plans must be made well in advance with Calvin Kessler to coordinate use of his time, assistance, and heavy machinery. The CLL-owned Hyster forklift may only be used by those that have forklift certification (Holli, the HSE Manager, can set this up) as well as tasked specifically by someone who knows how to operate the Hyster lift. This machine will easily lift and manage heavy chemical totes.

4 STANDARD OPERATING PROCEDURES

4.1 WTP START-UP SOP

RO system should be brought on-line one RO unit at a time. Operators should start by putting RO #2 on-line first, followed by RO #1. The instructions below will describe the steps to complete the RO system start-up.

4.1.1 RO #2 Start-up (Single RO Operation)

1. Open the manual valve connected to the outlet of the combination valve, located at the mine pump head frame.
2. Fully open the **RED** Bypass valve located above the WTP floor sump. **Note**: The Bypass valve controls how much influent mine water is being directed to the RO's and how much is being directed into the mine recirculation line.
3. Turn Mine pump into HAND on Discharge Webmaster → **VFD Power (R7)**.
    a. Prior to starting the pump confirm that the VFD frequency in Hertz (Hz) is set to the correct setting.

The frequency required will fluctuate depending on the work required to pump the water. This will vary as the level of the mine pool changes through the treatment season. Startup, at the beginning of the season, will require less work to move the water and a lower settling can be used.

i. During initial start up, the Frequency should be set to 38 Hz and slowly increased as water enters the WTP section of the pipeline. This method will reduce the potential for water hammer.

ii. Altering Hz can only be done directly on the VFD itself. Typically, the VFD will operate in a range of approximately:

1. 52 – 59 Hz for two RO systems
2. 42 – 49 Hz for a single RO system.

4. After allowing several minutes for the mine water to reach the WTP, slowly increase the VFD Hz until RO inlet pressures reach ~48 psi (**NOTE:** *48 psi will ensure that the combination valve at the head frame is sealed and will not introduce air into the pump system*). Ok
   Higher pressures will decrease the time to remove air from the system while the filling of the RO units.
   a. This pressure reading is displayed in 2 locations:
      i. Local location: An analog gage on the inlet piping of the RO.
      ii. Remote location: A digital gauge that is displayed on the Schwartzwalder Discharge Webmaster - **RO #1 Pressure (AI_2)** and **RO #2 Pressure (AI_3)**.
5. For one RO unit, set the RO system into **FILL** mode using the RO Human Machine Interface (HMI) and open all 6 bleed valves located on the permeate manifolds, connected to the ends of the RO pressure vessels.
   a. Login in credentials:
      i. **Username: master**
      ii. **Password: control**
6. After the RO is put into **FILL** the overall system pressure will decrease. Do not adjust the VFD, this is an acceptable pressure drop for start up.
7. Open the air purge valves located on the top of the cannister filters to aid in bleeding the air from the influent water line.
8. Allow the air to be purged from RO #2. Verify this by witnessing full streams of water out of each of the 6 air purge valves.
   It is best practice to bleed air in sequence with RO stages.
9. On RO #2 Close the 6 air purge valves once full streams attained. Confirm that air has been bled from the two sets of two canister filters via valve located on the top of each.
10. Bleed air from the RO on-board canister (There is one on each skid)
11. Press the **HAND** button located on the RO HMI display.
12. Once the RO motor/pump *begins to* audibly ramp up (5 – 25 seconds after setting RO unit into **HAND** mode, this can vary) the frequency should be increased to ~46 Hz, as soon as possible, to maintain operational pressure.
    a. **NOTE:** The 46 Hz value may vary and is typical during start up. It may need to be increased depending on Mine Pool level.
    b. **NOTE**: It is possible that the RO systems can over-pressurize (this happens at ~60 psi) causing the RO units to shut down. If the pump is not increased the RO systems can shutdown due to low inlet pressure (~15psi). If this happens, first turn off the mine pump then follow the SOP "WTP Shutdown" and return to step 1 of this SOP.
13. Verify that RO #2 is at a pressure of approximately 48 psi (the higher the pressure, the slower the discharge and vice versa). Minimum and maximum operating pressures are 28 psi and 48 psi, respectively.
14. Check all points of air relief to confirm that air has been removed from the system.

15. Close the manual valve connected to the outlet of the combination valve, located at the mine pump head frame.
16. Close the **RED** bypass valve by slowly moving it down.
    a. Monitor the system pressures as the valve is closed.
    b. Maintain an overall pressure of approximately 28 to 48 psi.
    c. As the valve is closed, the VFD Hz will need to be adjusted to reduce the system pressure.
17. The RO pressures (and thus flow) can be adjusted via the red gate valve located near the bottom center of the skid, if necessary. Opening these valves will decrease RO inlet pressure, increase IX pressure, and increase discharge. Closing these valves will have the opposite effect. Each skid should be within ~2psi of each other.
18. Ensure that the VFD power relay is set up properly on the Discharge Webmaster, with the IX pressure set point 1-2 psi below the actual IX pressure and a dead band of 4-6 psi. Set the Mine pump into AUTO on the Discharge Webmaster → **VFD Power (R7)**.
19. Verify that the Sodium Hydroxide (aka NaOH, Caustic) pump is dosing such that pH is within permit range of 6.5 – 9.0.
20. Verify that the Barium Chloride pump is dosing.

4.1.2 RO #1 Start-up (Double RO Operation)

1. Ensure that the VFD power relay is set on the Discharge Webmaster. Set the Mine pump into **HAND** on the Discharge Webmaster → **VFD Power (R7)**.
    a. Setting to **HAND** will deactivate the safety controls and allow the pressures to fluctuate without turning off the pump.
2. Set feed pressure to approximately 42psi.
    a. Set the VFD to the speed appropriate for the pressure.
    b. Typical setting – 46 Hz.
3. Set the RO #1 to **FILL** mode using the RO HMI and open all 6 bleed valves located on the permeate manifolds, connected to the ends of the RO pressure vessels.
    a. Login in credentials:
        i. **Username: master**
        ii. **Password: control**
4. After the RO is put into **FILL** the overall system pressure will decrease. Do not adjust the VFD, this is an acceptable pressure drop for start up.
5. Open the air purge valves located on the top of the cannister filters to aid in bleeding the air from the influent water line.
6. Allow the air to be purged from RO #1. Verify this by witnessing full streams of water out of each of the 6 air purge valves.
   It is best practice to bleed air in sequence with RO stages.
7. On RO #1 Close the 6 air purge valves once full streams attained. Confirm that air has been bled from the two sets of two canister filters via valve located on the top of each.
8. Bleed air from the RO on-board canister (There is one on each skid)
9. Press the **HAND** button located on the RO HMI display.
10. Once the RO motor/pump *begins to* audibly ramp up (5 – 25 seconds after setting RO unit into **HAND** mode, this can vary) the frequency should be increased to ~56 Hz, as soon as possible, to maintain operational pressure.
    a. **NOTE:** The 56 Hz value may vary and is typical when both RO systems are online. It may need to be increased depending on Mine Pool level.

b. **NOTE**: It is possible that the RO systems can over-pressurize (this happens at ~60 psi) causing the RO units to shut down. If the pump is not increased the RO systems can shutdown due to low inlet pressure (~15psi). If this happens, first turn off the mine pump then follow the SOP "WTP Shutdown" and return to step 1 of this SOP.

11. Verify that RO #1 is at a pressure of approximately 48 psi (the higher the pressure, the slower the discharge and vice versa). Minimum and maximum operating pressures are 28 psi and 48 psi, respectively.
12. Check all points of air relief to confirm that air has been removed from the system.
13. Adjust the throttling valves on both RO system to balance the pressures and flows to match the desired discharge rate.
    a. The RO pressures (and thus flow) can be adjusted via the red gate valve located near the bottom center of the skid, if necessary. Opening these valves will decrease RO inlet pressure, increase IX pressure, and increase discharge. Closing these valves will have the opposite effect. Each skid should be within ~2psi of each other.
14. Ensure that the VFD power relay is set up properly on the Discharge Webmaster, with the IX pressure set point 1-2 psi below the actual IX pressure and a dead band of 4-6 psi. Set the Mine pump into **AUTO** on the Discharge Webmaster → **VFD Power (R7)**.
15. Verify that the Sodium Hydroxide (aka NaOH, Caustic) pump is dosing such that pH is within permit range of 6.5 – 9.0.
16. Verify that the Barium Chloride pump is dosing.

4.2 WTP SHUTDOWN SOP

1. Turn off the 60hp Mine Pump via Discharge Webmaster → **VFD Power (R7)** → Off.
    a. This will stop the influent flow of water.
    b. The loss of water flow will decrease the RO feed pressure and cause an automated shutdown at the RO systems.
2. Once the RO pumps power down automatically, put RO units from **HAND** into **OFF**.
3. Verify that Anti-scale pump reads zero on readout (is no longer dosing).
4. Verify Sodium Hydroxide pump is not dosing (off).
5. Verify Barium Chloride pump is not dosing (off).

4.3 ANTI-SCALANT REFILL SOP

The anti-scalant dosing solution needs to be refilled twice a week during continuous operation. The plant must be running to divert sufficient volume of permeate for mixing with RO-1302. One full 900-gallon tank can last approximately4-5 days.

1. When the anti-scalant tank has reached approximately 200-300 gallons, it is time to refill the tank.
2. Calculate the quantity of RO-1302 needed. The ratio of RO-1302 to permeate is 1:100. For example, if the tank needs approximately600 gallons, use 6 gallons of RO-1302 and 600 gallons of permeate.
3. Don proper PPE: hard hat, safety glasses, nitrile gloves, sleeved shirt, and steel-toed boots.
4. Attach the female end of a 2-inch barracuda hose from the Permeate Outlet on either RO skid. Attach the male end of the 2-inch barracuda hose to the top of the Anti-scalant tank.
5. Use the tablet to monitor the IX pressure. The plant shut-down relay is "VFD Power" (Relay 7) on the Discharge WebMaster. If the IX pressure drops below the difference between the Set Point and Dead Band, the mine pump will shut off, triggering the RO's to also shutdown.
6. Very slowly open the permeate outlet valve on the chosen RO skid. By opening this valve, the IX pressure will drop immediately once permeate begins to flow through the hose. Monitor the IX

pressure closely and watch for permeate entering the anti-scale tank. Ensure that the IX Pressure does not drop below the difference of the Set Point and the Dead Band by opening the valve very slowly in small increments and giving time for the system to react to each incremental opening.

7. Once the permeate is flowing into the tank, discharge will drop approximately15 gpm, IX pressure will drop by approximately3 to 4 psi, and there should still be a buffer of 3 to 4 psi between the IX pressure and the difference between the Set Point and the Dead Band.
8. While the tank is filling with permeate, attach a cam-lock spigot to the RO-1302 tote.
9. Remove lid of Anti-scalant tank and place step stool next to the tank. Clear path from tank to tote to avoid tripping.
10. Fill a 5-gallon bucket in 2 to 2.5-gallon increments of RO-1302. Pour RO-1302 into stream of permeate to ensure good mixing. Repeat until the required volume of RO-1302 is added.
11. Replace tank lid and level indicator.
12. Clean the bucket, spigot, and outlet on RO1302 tote with permeate.
13. Wait for the tank to fill to desired level. This will take approximately 10 to 15 minutes. DO NOT allow the tank to overflow. If the tank overflows, it will drain into the sump, but the solution will be diluted.
14. Once the tank has reached the desired level, shut the permeate outlet valve on the RO Skid and detach hose. The plant should return to the same operating condition as prior to filling the tank.

4.4 BARIUM CHLORIDE REFILL SOP

A 55-gallon drum holds the barium chloride solution, made by mixing one (1) 50-pound bag of Barium Chloride Dihydrate crystals with 50 gallons of permeate (1-lb powder: 1-gallon permeate). The drum needs to be refilled approximately every 2 weeks. The drum should be refilled when 25 gallons remains.

1. When the drum has reached 25 gallons, it needs to be refilled with 25 gallons of permeate and one half of a 50-lb bag of $BaCl_2$.
2. Don proper PPE: hard hat, safety glasses, nitrile gloves, elbow length gloves, sleeved shirt, face shield, and steel-toed boots. Minimize airborne dust by handling the powder slowly and carefully.
3. Carry one bag of barium chloride to the drum. Cut open threaded seal.
4. Scoop approximately half of one 50-lb bag of barium chloride into the barrel. Return bag to storage.
5. Extend one of the hoses on the permeate manifold at the end of RO Skid 2 using a hose stored in the totes by the fridge. Put the end in the drum.
6. Open the valve on the permeate manifold slowly, while monitoring the IX pressure. This technique is unlikely to drop the IX pressure more than 2 psi, so there is little risk to triggering a shutdown from low IX pressure. Close the valve once the drum is full.
7. Insert the paint mixer into the drum. Mix 3 – 5 minutes.
8. Unplug the paint mixer, wash it with permeate, and return it to its storage location behind RO1.

4.5 CAUSTIC REFILL SOP

Caustic usage rates vary due to dosing requirements. The dedicated dosing tote needs to be refilled approximately every week. It is it crucial that the caustic tote does not run empty while the plant is operating to prevent discharging water with a pH lower than 6.5.

1. Don proper PPE: hard hat, face shield, safety glasses, nitrile gloves, elbow length gloves, sleeved shirt, and steel-toed boots.
2. Use pallet jack to move new caustic tote next to the dedicated tote.
3. Open top of tote with large pipe wrench.

4. Insert a small submersible pump into caustic tote and direct hose to dedicated tote. Secure the hose with a heavy object such as a large wrench to minimize possibility of splashing.
5. Tie the cable to tote and plug into power outlet to start the flow.
6. Monitor the filling to ensure there is no spilling. Keep the pump always submerged. Make sure the dedicated tote does not overfill.
7. Once full, unplug the power cable to stop the flow. With the hose still in the dedicated tote, lift the pump out of the caustic to allow it to drain back into the caustic tote.
8. Carefully remove the pump and hose. Place both into a 5-gallon bucket with a couple gallons permeate.
9. Bring the pump in the bucket to the floor sump. Circulate permeate through the pump into the floor sump for at least 5 minutes.
10. Rinse gloves with permeate and remove PPE.

4.6 WTP CIP (CLEAN-IN-PLACE) WASH OF RO MEMBRANES SOP

A CIP wash is typically conducted approximately once a quarter (for aging membranes) or as needed. If conductivities in each pressure vessel have recently become more elevated, it is probably time to do a CIP. Other contributing factors requiring CIP include reduced performance (i.e., lower discharge, less salt rejection) and growing pressure differential between stages.

When conducting a CIP wash, there is a chance of elevated Hydrogen Sulfide (H_2S) levels in the plant, especially during the acid addition. Always carry a H_2S gas meter when inside of the plant during a CIP wash, keep the plant well ventilated, and evacuate the building immediately if meter alerts user to elevated levels.

When conducting a CIP wash, it is best to have one RO operating such that sufficient permeate can be used to flush the cleaned RO unit.

1. Preparation of acidic CIP solution
    a. At least a full day in advance of CIP, fill both CIP totes with 250 gallons of permeate and place bucket heater into both the acid tote and caustic tote such that water temperature can increase for at least 24 hours. The ideal water temperature for CIP is 100°F.
    b. Once sufficient temperature is attained, remove heater from acid tote and pour 25lbs (half a bag) of citric acid into top opening; run paint mixer in tote for ~5 minutes.
    c. Remove mixer from acid tote and, after following all critical PPE requirements for handling hydrochloric acid (see below), slowly pour 2 gallons of HCl into the top opening of acid tote; run paint mixer for ~5 minutes. pH should now be between 1.5 and 2.0.
        i. **Alert all other staff to NOT enter the WTP facility whilst HCl is being handled.**
        ii. **Be sure that at least one other person is aware that handling extremely corrosive HCl will commence.**
        iii. **Always use elbow-length chemical gloves, chemical apron, respirator, goggles, and face shield when pouring, measuring, and/or mixing HCl.**
    d. Add 2 gallons of EDTA; run paint mixer for ~5 minutes.
    e. The acid solution preparation is now complete.
2. Preparation of caustic CIP solution
    a. Once sufficient water temperature is attained (~100°F), remove bucket heater from tote.

   b. Using proper PPE, pour 4 gallons of NaOH (in two separate trips) into the top opening of caustic tote; run paint mixer for ~5 minutes.
   c. The caustic solution preparation is now complete. A pH of approximately 12 is ideal.
3. Attach the required plumbing that places each tote as well as the CIP pump in series.
4. Attach effluent hose of pump to desired RO unit inlet.
5. Close cartridge filter valve on this side of the RO such that no mine water comes from the canisters and so that no CIP cleaning agents enters the canisters.
6. Attach 2" hose from permeate outlet and direct to the WTP floor sump; open permeate valve.
   a. Note: each RO is double valved here and the permeate valving must be set up such that no permeate can route to the IX process. Due to the CIP pump pressure and the nature of the chemicals being used, some chemicals in the acid tote can indeed pass through the membrane walls. The end of this SOP reveals how all chemicals will be cleansed from the unit after the wash is complete.
7. Open valve on the acid tote.
8. Open valve on the CIP pump.
9. Set RO unit to be cleaned into FILL mode.
10. Open RO inlet to allow a full path from the acid tote, through the CIP pump, into the RO inlet, and eventually out of the RO permeate outlet.
11. Plug in the CIP pump and pump half of the tote into the RO; once half of the tote has been pumped, unplug the CIP pump and immediately close the CIP pump valve so that fluid flow doesn't reverse direction into the acid or caustic totes.
12. Let solution sit in RO for at least 30 minutes. This is a bare minimum. The longer the solution can sit stagnated the better.
13. Open the CIP pump valve and plug in the pump again to pump the remaining acid solution (sans air) into the RO unit.
14. Unplug the pump, close pump valve, and allow solution to stagnate again for at least 30 minutes.
15. Switch the CIP tote valving such that the caustic tote can now be pumped into the RO.
16. Repeat all above steps for the caustic tote.
17. Close the RO inlet valve.
18. Carefully remove the CIP pump outlet hose from the RO inlet (as caustic solution will be present)
19. Attach a 2" hose from the running RO unit permeate outlet and route to the CIP RO inlet.
20. Open the CIP RO inlet valve.
21. Very slowly open the permeate outlet valve on the running RO to allow permeate to flow.
22. Check the conductivity of the 2" hose outlet at the floor sump every 10 minutes until the conductivity of the effluent is less than 50 µS/cm. Achieving this conductivity can take up to an hour. This process will cleanse any remaining chemicals from the cleaned RO. The CIP process is now complete.
23. Set the cleaned RO from FILL to OFF.
24. Replace any valving to its original orientation and refill the two CIP totes with fresh permeate.

4.7 MEMBRANE PRESERVATION SOP

At the end of each operating season, both RO's need to be Cleaned-in-Place (CIP). The Clean-in-Place SOP is in section 4.6. Following the completion of a CIP, the membranes on each RO skid will then need to be preserved with a sodium (meta)bisulfate solution. The following SOP describes the steps required to conduct this preservation process.

1. Fill a clean tote with 200 gallons of permeate (this is required for each skid)
    a. Add 6 gallons sodium bisulfate solution and mix for ~5 minutes with paint mixer.
2. Setup the RO skid as you would for a CIP except direct a hose from each effluent port (concentrate and permeate) back to the tote for recirculation.
3. Using the CIP pump, pump the solution into the skid and recirculate for 30 minutes.
4. After 30 minutes, slowly close the concentrate effluent valve such that flow is directed through the membranes.
    a. While the fluid is recirculating through the membranes, open each of the six individual vessel air relief valves to evacuate all air from the RO vessels.
    b. Once all air has been purged (this is evident by seeing full, laminar streams from each vessel), slowly close the permeate effluent valve and Select the OFF button on the RO HMI screen. This will close the primary inlet valve and seal the RO with preservative and without air.
        i. While the valve is closing, monitor the inlet pressure from the CIP pump. Open the lower bleed valve on the integral canister filter to eliminate the build up of excessive pressure that could lead to pump damage.
    c. Now the CIP pump can be turned off and its valve closed.
5. Disconnect hoses, drain tote to floor sump, rinse, refill, and repeat procedure with the second RO skid.

At the beginning of each operating season, proper cleansing of this solution is necessary prior to discharge. Typically, recycling (i.e., not discharging but otherwise operating normally) for 8 – 16 hours prior to the official start of the operating season will remove any remaining preservative from the system.

4.8 WTP IX BACKWASH SOP

IX backwashing is conducted at the onset of long-term shutdown, if required. Typically, it is necessary to backwash the vessels to "churn up" the resin to reveal new or unused surface areas of the resin beads and prevent a caking effect. However, the IX resin at Schwartzwalder is loaded at a very slow pace due to the nature of the water after the RO process.

1. IX vessel being backwashed must be offline and isolated via valving.
2. Connect hose from top vessel connection to the floor sump and affix a bag filter to end of hose at sump.
3. Connect permeate outlet from operating RO unit to the lower IX vessel connection
4. Slowly run water in a reverse direction through the vessel being careful to keep pressure ~15psi
5. After running for 30 minutes, the wash is complete
6. Disconnect hoses and return any valving to its original state

4.9 SCHWARTZWALDER OPERATIONAL SAMPLING

There are two types of operational samples collected at the Site:

- Aqueous samples collected from individual IX's or RO's and analyzed for total uranium by ACZ labs to determine performance of individual components. These samples are collected on an as-needed basis.

- Cartridge filters and RO membranes are sampled prior to replacement to determine the concentration of accumulated uranium. The concentration of uranium in the filter or membranes is required documentation for disposal.

These samples are for internal discussion only, they are not shared with regulatory agencies unless requested. Data from these samples are used to optimize performance of the WTP systems. Additional information on operational sampling is discussed in the Sampling and Analysis Plan. Refer to that document in Task 4200 on SharePoint.

4.10 MINE POOL ELEVATION MONITORING

When to do it: Monitoring of the mine pool elevation should be tracked in the O&M Log here.

Why we do it: The mine pool elevation is constantly monitored so that we stay in compliance with the discharge permit and to compile reports. The mine pool elevation can be projected using historical refill trends, mass balance data, and mine void volumes. These projections can be used to make long-term goals for dewatering and ensure a 6-month operating period.

The mine pool elevation is monitored using a submersible pressure transducer housed in a PVC sleeve and routed into the Jeffery vent shaft, adjacent to the mine pump discharge pipeline. The wiring of the transducer is connected at the surface through a PLC or Webmaster interface stored at the head frame. The Webmaster uses a 4-20mA signal from the transducer to display the water column that is above the transducer. This value can be used to determine the mine pool depth by subtracting the water column from the total length of the transducer wire from the deck of the head frame.

Below is the procedure to collect the mine pool water level.

1. Plug in PLC into electrical power source and turn on Webmaster.
   NOTE: *There is no electrical at the head frame to power the Webmaster, the only power source is from a small generator or extension cords connected to a receptacle at the plant. Proper electrical connection will need to be determined and completed to turn on the Webmaster.*
2. Allow Electrical system to sit for a minimum of 30 minutes.
3. Record readings after 30 minutes.
4. Use equation 1 below to determine water level from the elevation of the head frame.
   NOTE: *The shaft was constructed at a 12° angle to connect with the main section of the mine. Operations staff must correct for this angle to determine actual depth or length from the surface. Use equation 2 to determine accurate depth.*

1. $Water\ Level = 410\ feet - (PLC\ Read\ out)$

2. $Distance\ from\ surface\ (Adjacent) = Length\ of\ wire(Hypotenuse)\ \times COS(12°)$

4.11 LONG TERM SHUT DOWN

Use the Shut Down check list (Appendix A) as a walkthrough guide to assist in long term shut down. All process systems must be properly protected against damage that can occur from both freezing conditions and chemical/corrosive exposure. All systems should be drained and stored without water or chemicals, if possible.

4.11.1 Shut Down Preparation

1. Backwash Ion Exchange vessels (if needed)
2. CIP wash Reverse Osmosis membranes in unit 1 and unit 2.

As an optional step it may be beneficial to store process water in the discharge tank. This can be achieved by closing the discharge valve on the tank prior to taking the system offline. This will allow the operator to store 5,000 gallons of water. In addition, filling pre-cleaned totes (2-4 is ideal) with permeate to keep inside the plant has long been in practice.

4.11.2 System Shut Down

3. Conduct short term shut down as outlined in the previous section (Section 4.2)
4. Drain water from unit 1 and unit 2.
5. Remove filter elements from cannister filter 1 and 2.
6. Drain Booster pumps into WTP building sump.
7. Drain IX vessels into WTP building sump.
8. Disconnect hose in the discharge line to fully drain.

4.11.2.1 Check Components

To protect against freezing conditions, it is critical that all pipelines are drained of water. If piping is drained of water and is equipped with heat trace, the heat trace must be unplugged and deenergized. If piping is not drained it must have insulation and functioning heat trace elements. Upon system shut down confirm that insulation is in place and heat trace is functional.

Confirm that all pump motors are disconnected at the circuit breaker panel to protect against power surge or accidental operation.

4.12 DAILY OPERATIONAL LOGS

Each workday that the WTP is discharging the onsite operator shall prepare a daily report. These daily reports are electronic. A link to this log is saved in the 5100 Task folder on SharePoint here and a hard copy is included in Appendix A.

The daily operations log captures the following WTP parameters to demonstrate compliance with the discharge permit:

- pH at DIS001A (this is the discharge tank sample port located on the outside of the clean water tank, approximately18 inches off the ground, near the discharge line.)
- the discharge flowrate in GPM (can be taken either from the Webmaster or inside the WTP)

- whether or not an oil sheen was observed in the discharge water (visual inspection)
- the time and date parameters were collected.

Additional notes on the daily operations log are used to schedule maintenance activities, order reagents, and facilitate management of the plant. The ORC reviews the daily logs to ensure operations consistent with the discharge permit.

4.13 MONTHLY OPERATIONS REPORT

At the conclusion of each calendar month an operations report is compiled by the operator and submitted to the Project Manager for review and approval before being posted to SharePoint. This is an internal report stating the various goings on at the site, operational challenges faced or anticipated, sampling activities, future activities, and any other information the operator feels the need to convey to internal personnel.

5 MAINTENANCE

5.1 PREVENTATIVE MAINTENANCE SCHEDULE

WTP maintenance has mostly been covered thus far. However, a few preventive measures can and should still be taken and are listed appropriately in the O&M log located in the 5100 Task folder on SharePoint here.

5.2 GENERATOR

If there is a power outage at the site one of the first things to happen is an almost immediate shutdown of the plant (if operating). This is an acceptable outcome and should be expected to occur a few times a year, especially during thunderstorms in the spring and summer. However, there are many other working systems relying on power that are required to remain active (especially during winter) during a power loss like fluid tank heaters and building heaters. For the purpose of supplying power to those systems during site power loss, a large diesel generator resides just south (approximately10 feet) of the WTP. When power is lost, the generator receives a signal to start up (from a transfer switch) and resupply the needed power. Operations cannot resume and/or commence until full line power is restored via United Power (see Sec. 6.3.1).

To ensure the generator is operational and/or in standby and is in good working order, a yearly maintenance check is completed. This maintenance check looks at things like air filters, adequate fuel reserves, anti-freeze levels, oil levels, filters, etc., and is typically scheduled in mid-late fall via project manager and on-site operator collaboration.

As an additional reminder to its existence and to keep all pertinent fluids from stagnating for long periods of time, an auto-run feature is set to run a weekly test on Tuesday mornings at around 10-11am, depending on daylight savings. Without interrupting power to the rest of the site, the generator will fire up and run for 30 minutes each week around that time. However, it is also good practice for the operator to physically look at, in, and around the generator every couple of weeks being sure to note any flashing lights on the digital readout, tripped breakers, or other anomalies which could signal to an impending problem. Any problems witnessed should be reported to the project manager.

5.3 CIRCUIT BREAKERS

The two main circuit breakers, a high amperage panel and a low amperage panel (labeled HA and LA, respectively) are both located in the southwest corner of the WTP and control most of the power on site. There is also a main breaker located near the Steve adit which would cut power to the entire site, if required. All panels are labeled and up to date.

5.4 PUMPS

There are five pumps (two of which are identical) that are extremely important to the overall operation of the WTP and site. They are listed below with a quick synopsis and any required maintenance:

- The 60hp pump (2.1) is the WTP influent mine feed. No maintenance is required for this staged, submersible pump because it lives inside the mine.

- The underground injection pump (section 2.6) is the reinjection pump. Grease motor housing 2 times a year or approximately every 1,100 operating hours with 19 pumps of Exxon Mobil Polyrex EM. No other maintenance should be performed by the operator. If pump fails for some reason, it should be taken to Arvada Pump (on the Vendor List) for repair and operations adjusted accordingly.

- The master sump pump requires no maintenance other than visual checks to ensure the float is free from obstructions. If pump fails for some reason, it should be taken to Arvada Pump (on the Vendor List) for repair and operations adjusted accordingly.

- (2) RO TonkaFlo pumps and 40hp GE motor – oil should be checked (visually) weekly and changed every 6 months on bearing housing (oil can be topped off while RO's are operating – fill *very* slowly). Motor housings should be greased once every 4 years with 27 pumps of Exxon Mobil Polyrex EM. according to the equipment manual located in task 5100 on SharePoint here. The wet end of the pump has a proprietary screen at the discharge interface and must be in place to prevent damage to the RO membranes. See TonkaFlo manual located here for more detailed information.

5.5 WINTERIZATION

The most pressing of the winterization tasks to be performed in early fall (or late summer) is to make sure all lines that can or will be exposed throughout the winter have adequate insulation and functioning heat trace if they are to hold and/or move water. In theory, all lines were insulated/heat traced properly the prior year, but systems are ever dynamic at Schwartzwalder and must be checked each season. A complete winterization/maintenance list is located in task 5100 on SharePoint here.

5.6 SITE TRUCK

The white site truck is used for any on-site activities. It is also used to make quick runs to town for fuel can refills, refilling fuel in the truck itself, or making parts runs. Be sure that seatbelts are always worn and if leaving site, CLL Licensee placards are posted in the front and back windows.

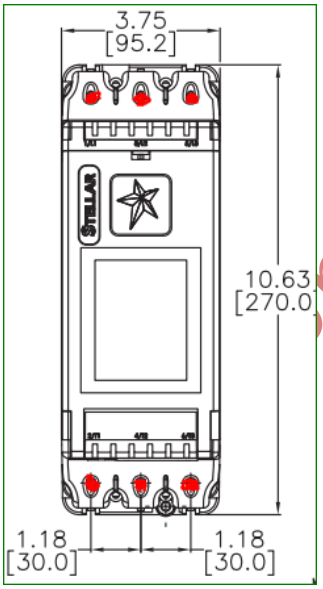
Occasionally, the truck will need simple repairs and/or maintenance (e.g., oil changes). Simply take the truck into any Jiffy Lube location and let them know an account exists ("Ensero") and all work will be charged through accounting appropriately.

5.7 SOFT STARTS

Note: Each soft starter must be separated from the incoming power source *and allowed to de-energize for a minimum of 15 minutes* prior to any maintenance or servicing performed, including the following procedure.

Soft starters are devices used to slowly (10 – 30 seconds) ramp up larger motors from 0 Hz to 60 Hz. Without these devices, full power would be supplied almost instantaneously causing premature wear on the motor due to the instant torque applied to the motor shaft under load. Each RO unit motor is powered identically as follows: 3 phase 460V line power into the WTP high amperage (HA) panel, then from the HA panel to the soft starter, and then from the soft starter to the 40 hp motor.

The Figure 5-1 below shows a picture of a soft start. The location of the electrical connections is indicated by the six red dots in the figure. Each soft start has a total of 6 connections. Each connection is completed using a hex-head lug bolt located on the top and bottom of the soft start. The 3 connections located on the top of the soft start are the incoming power from the circuit breaker panel. The 3 connections located on the bottom of the soft start are the outgoing power to the motor. Due to significant vibration throughout the water treatment season these 6 lugs (on each RO skid; thus 12 total for the two skids) must be checked and tightened to a specified torque such that they don't become loose during operation; a loose lug on these soft starters will quickly cause irreparable equipment damage to the soft start and can also pose a fire and/or electrical shock risk. This procedure should be conducted at the beginning of the treatment season, mid-season, and at the end of the season. The proper torque specification and other details can be found in the equipment manual section "Wire Sizes and Torques" on SharePoint here. The specific model of soft starts used at the Schwartzwalder WTP are SR55-077 and are purchased through Automation Direct.



To tighten the lugs, the following steps will need to be completed:

1. Remove power from the soft start at the High Amp (HA) breaker panel. Select the circuit breaker that is labeled with the equipment that is being serviced, e.g., RO1. Once the breaker is off, lockout and tag out (LOTO) the breaker switch according to Ensero LOTO protocol.

2. Once the breaker has been locked/tagged out, allow at least 15 minutes to elapse for the soft start to de-energize. After at least 15 minutes, use a voltmeter to check all legs for any residual AC voltage; a reading less than 1V is optimal.

3. Tighten each of the 6 lugs to 80 in-lb using a calibrated/certified torque wrench and 5/32" straight hex bit. To convert between in-lb and ft-lb, divide by 12, i.e., 80/12 = 6.67 ft-lb.

4. Securely close soft start cabinet and resupply power to the unit at the breaker.

FIGURE 5-1 SOFT START DIAGRAM

6 SITE MANAGEMENT

Most, if not all, site management tasks and duties fall to the on-site operator/engineer. However, help with anything site-related is just a phone call away to other Ensero employees that also support the site. Outside support is often required, and always expected, over the course of an operating season.

6.1 SITE ACCESS

Site is accessed by first passing through the service gate entrance (via input gate code) into Bear Tooth Ranch and following Glencoe Valley Road until the site is reached. The official address is 8300 Glencoe Valley Road, Golden, CO, 80401. Most vendors coming to site have their own dedicated gate codes. If a vendor does not have a code, the operator must meet them at the gate and allow access. The Project Manager can assign codes for new vendors who will need access on a routine basis. No code is needed to leave Bear Tooth Ranch, only to enter.

Most of the road is unpaved and must be navigated cautiously so that any accidents are avoided. Be sure proper placards (CLL Licensee) are placed in both the front and rear windows of any vehicle travelling to site.

From time to time the service road will need to be re-graded. Kessler Reclamation supplies this service a couple times each year. In addition, Kessler's will aid in snow removal around the site and down the road to a certain point if and when required.

6.2 ONSITE SIGN-IN LOGS

Anyone arriving to site, Ensero employees or otherwise, must sign in and sign out. One of the sign-in logs is specifically for Ensero employed individuals (like the operator or project manager) and the other is for everyone else (e.g., Kessler's or Jeffco personnel). At the close of each calendar month it is the operator's responsibility to scan each of these logs and post them to SharePoint in the 5100 Task folder here.

6.3 UTILITIES

The Schwartzwalder site doesn't consistently have all the utilities one would come to expect, but it does have most. All the forward thinking and advanced planning in the world sometimes just isn't enough to keep (specifically) potable water on site. Below are those utilities listed and/or vendor related utilities. All pertinent contact information can be found in the vendor list located in Task 5200 here.

6.3.1 Power, United Power

Electrical power is supplied through United Power and can be contacted directly if any issues arise.

6.3.2 Trash, Waste Management

Trash service is provided by Waste Management and are scheduled up to site every other Thursday, typically arriving prior to noon. Do note that the roads must be in relatively good condition (free of most ice/snow) before they will venture up to the site. Due to this, sometimes trash can pile up a bit.

6.3.3 Septic Tank, Columbia Sanitary

The lab/bathroom trailer is equipped with an in-ground (just west of trailer) 1200-gallon septic tank. Because of the size of the potable water tank (see next section) it must be emptied every-other water delivery. Columbia Sanitary provides this service and, as with most all other vendors, the roads must be in relatively good condition.

6.3.4 Potable Water, A1 Water

Potable water is delivered to site via A1 Water who refills two 500-gallon tanks just outside (to the north) the lab trailer. Heaters are placed in the tanks, such that the water doesn't freeze in winter, and must be checked often for proper operation.

6.3.5 Internet, Mountain Broadband

Internet service is provided by Mountain Broadband and is quite reliable. If an issue arises with service, first call Toby Arrowsmith (IT dept.) and he will give any direction needed. The site router is located inside the RO Webmaster control box in the southwest corner of the WTP.

6.3.6 Phone (landline), Century Link

Century Link provides landline phone service. Because the site is a bit remote and cell service is spotty at best, a landline and internet phone line both exist on site. If any issue arises with phone service, call/email Toby Arrowsmith who will in turn contact Century Link for resolution. Power surges on-site have damaged many cordless phones. The best type of phone is a corded phone with no power needs.

6.4 HOUSEKEEPING

Because of the high-profile reputation the Schwartzwalder site enjoys, it is necessary to keep the entire site, not just the WTP, in a very presentable manner. This includes (but is certainly not limited to) keeping all garbage picked up around the site, putting away all equipment and/or tools after use, keeping the office, lab, and bathroom in tidy order, sweeping, mopping, and so on. It is often helpful to post on a white board in the office trailer of an impending visit from Waste Management such that everyone who is regularly on site is aware. It is the operator's job to clean the toilet.

6.5 TOOLS AND EQUIPMENT

Tools are plentiful on site and are mostly all located in the Conex/Sea container that sits directly adjacent (to the north) to the WTP (formerly and informally known as the Green Goblin). If a tool is needed and can't be located by the operator, Calvin Kessler is a great on-site resource for these kinds of things.

The Bobcat Skid steer (forklift/bucket) on site is free for use by the operator. It can be very helpful at times to lift heavy objects or to plow snow. Do be aware that, because of its size, it ***cannot*** lift full totes regardless of what fluid is inside. It is best to use good, sound, and safe judgement when operating this machine and to not do anything that feels uncomfortable and/or feels reckless.

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APPENDIX A. FORMS AND CHECKLISTS