Final Operations and Maintenance Data

Wyckoff Groundwater Treatment Plant

(Volume I)

Wyckoff/Eagle Harbor Superfund Site
Kitsap County, Washington

Prepared for

U.S. Army Corps of Engineers, Seattle District
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Abbreviations and Acronyms

ABS	acrylonitrile butadiene styrene
AFD	adjustable frequency drive
AHP	high-pressure process air
AI	instrument air
ALP	low pressure air
ASME	American Society of Mechanical Engineers
BWE	backwash effluent
BWR	backwash recycle
BWS	backwash source
BYP	bypass
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfm	cubic feet per minute
DAF	dissolved air flotation
DC	direct current
DE	DAF effluent
DI	DAF influent
DO	dissolved oxygen
DR	DAF recycle
DNAPL	dense non-aqueous-phase liquid
EPA	U.S. Environmental Protection Agency
EQ	equalization
EW	extraction well
^{o}F	degrees Fahrenheit
FE	filter effluent
FFE	forward flush effluent
FFS	forward flush supply
ft^2	square feet
FI	filter influent
FRE	froth effluent
FRI	froth influent
FRP	fiberglass-reinforced plastic
ft	feet
GAC	granular activated carbon
gph	gallons per hour
gpm	gallons per minute
GWTP	Groundwater Treatment Plant
HAZWOPER	Hazardous Waste Operations Emergency Response
HDBF	hydromation deep bed filter
HDPE	high-density polyethylene
HMI	human-machine interface
HP	horsepower

HVAC	heating, ventilation, and air conditioning
Hz	hertz
kW	kilowatts
LCS	local control station
LNAPL	light non-aqueous-phase liquid
LP	lighting panel
MDP	main distribution panel
MB	megabyte
mg/L	milligrams per liter
ml/min	milliliters per minute
mm	millimeter
MOV	metal oxide varistor
MSDS	material safety data sheet
NAPL	non-aqueous-phase liquids
NFPA	National Fire Protection Association
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NRC	National Response Center
NTU	nephelometric turbidity unit
O&G	oil and grease
O&M	operations and maintenance
OF	overflow
OIT	operator interface terminal
OSHA	Occupational Safety and Health Administration
OU	operable unit
P&ID	process and instrumentation diagram
PAH	polynuclear aromatic hydrocarbons
PCP	pentachlorophenol
PE	pressure gauge
PLC	programmable logic controller
PLE	plant effluent
PLI	plant Influent
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
PRG	preliminary remediation goal
psi	pounds per square inch
psid	pounds per square inch differential
psig	pounds per square inch gauge
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RCY	recycle
ROD	Record of Decision
RQ	Reportable Quantity
rpm	revolutions per minute
scfm	standard cubic feet per minute
SP	sampling port

SS	filter press feed tank solids
SSHP	Site Safety and Health Plan
STW	stormwater
TDH	total dynamic head
TDS	total dissolved solids
TEFC	totally enclosed fan-cooled
TSP	tri-sodium phosphate
TSS	total suspended solids
TVSS	transient voltage surge suppressor
µg/L	micrograms per liter
UL	Underwriters Laboratories
UPS	uninterrupted power supply
USACE	U.S. Army Corps of Engineers
V	volts
VSS	volatile suspended solids
W	watts
W2	non-potable water
WSDOT	Washington State Department of Transportation

1.0 Introduction

This *Operations and Maintenance Data* document for the Wyckoff Groundwater Treatment Plant, Wyckoff/Eagle Harbor Superfund Site, Kitsap County, Washington (Volumes I through XII), herein referred to as the Operations and Maintenance (O&M) Manual, is a combination of descriptions, tables, figures, and manufacturer's data for the operation, maintenance, repair and other operational activities associated with the Wyckoff/Eagle Harbor Superfund Site (Wyckoff) replacement Groundwater Treatment Plant (GWTP) constructed by ECC during 2007, 2008, and 2009 on Bainbridge Island, Washington.

This project was performed for the United States Army Corps of Engineers (USACE) Seattle District, under Contract Number W912DQ-04-D-0017, Task Order EC01 for the U.S. Environmental Protection Agency (EPA).

This O&M Manual was written to assist personnel in successfully operating the groundwater extraction, treatment, and discharge system at the Wyckoff GWTP. The manual serves as a resource for:

- Equipment information (one-stop for manufacturer-supplied catalog cut sheets and O&M manuals)
- Startup, operating, and shutdown procedures
- Inspections and maintenance
- Repairs
- Parts
- Recordkeeping

This O&M Manual is to be used in conjunction with the following companion documents prepared by CH2M HILL, the O&M contractor:

- Site Safety and Health Plan (SSHP) for O&M of the Wyckoff GWTP
- Quality Assurance Project Plan (QAPP) for O&M sampling of the Wyckoff GWTP (provided in Appendix G)

These documents are on file in the treatment plant office at all times. A set of construction record drawings is also on file in the treatment plant office.

1.1 Site History

Before 1904, the Wyckoff facility site was occupied by two mining operations and a brick mill. Wood treating operations at the site began in 1905 and continued until 1988 under several owners. The wood treatment operations included wood preservation; storage of treated and untreated wood; use and storage of fuel oil, creosote, pentachlorophenol (PCP), solvents, gasoline, antifreeze, waste oil, and lubricants; and management of process wastes. These chemicals were stored in aboveground storage tanks, conveyed through aboveground and belowground piping, disposed in sumps, spilled, and buried onsite. Wood preservative chemicals were delivered to the facility by barge and ship and stored in tanks on the property. Spills and leaks from tanks and piping entered the ground directly or through unlined sumps. The practice of storing treated pilings and timber in the water continued until the late 1940s.

The EPA began an investigation of the property in 1971. In August 1984, EPA issued an order under Section 3013 of the Resource Conservation and Recovery Act (RCRA) requiring the Wyckoff Company to conduct environmental investigation activities. Data collected at the time revealed the presence of significant soil and groundwater contamination.

The Wyckoff Site was proposed to be listed on the National Priority List (NPL) in September 1985 and the site was subsequently placed on the NPL in 1987. In 1988, the Wyckoff Company ceased all operations on the property. In 1989, a groundwater extraction and treatment system was installed and began operating in 1990. The treatment system continues to pump creosote product and process contaminated groundwater at the site. Groundwater is obtained from several extraction wells (EWs) located within the groundwater operable unit (OU). These EWs are screened in the shallow, unconfined aquifer, and the groundwater is treated at the existing onsite Wyckoff GWTP. Treated effluent from the existing GWTP is discharged via a single pipe outfall that extends in an easterly direction from the Wyckoff facility toward the entrance channel to Eagle Harbor. A physical barrier comprised of sheet piling was installed around the OU site boundary to provide containment of the contaminated groundwater and prevent the spread of contamination from the site into Eagle Harbor or Puget Sound. In 1993, the EPA assumed management of the soil and groundwater OUs.

1.2 Site Description

The Wyckoff Site is situated on the southeast side of Eagle Harbor on the eastern shore of Bainbridge Island, which is located in central Puget Sound, directly across and due west from Seattle, Washington. The Wyckoff Site location is shown on Figure 1-1. The existing layout of the Wyckoff Site is shown on Figure 1-2. The property is approximately 40 acres in size, which includes approximately 16 acres of generally flat and open terrain at the entrance to Eagle Harbor. This flat area comprises the soil and groundwater OUs defined in the Record of Decision (ROD) for the Superfund project. The average ground surface elevation is approximately 10 feet (ft) above mean sea level. The southern portion of the Wyckoff Site consists of a steep tree-covered slope. Offsite to the south, the topography rises toward the island’s interior and elevations exceeding 200 ft. Approximately 2,000 people live within 1 mile of the site. The nearest residence is located less than 1/4 mile to the south. Land use in the area is mostly residential and commercial. The harbor is used by recreational boaters, "live-aboards," and ferry transport to and from Seattle.

1.3 Nature and Extent of Contamination

The nature and extent of contamination present at the Wyckoff soil and groundwater OUs have been evaluated using data on nonaqueous phase liquids (NAPLs), soil, groundwater, and surface water collected during expedited response actions and site characterization, monitoring, and cleanup activities. The evaluation of the nature and extent of contamination focused on the presence of NAPL in soil and groundwater and on those chemicals detected in one or more environmental media at concentrations exceeding preliminary remediation goals (PRGs), which are established by the EPA to protect human health and the environment.

Chemicals detected in NAPL at the Wyckoff Site are consistent with the products historically used onsite (that is, creosote, PCP, and aromatic carrier oils). The light NAPL (LNAPL) and dense NAPL (DNAPL) at the site generally contain varying concentrations of polynuclear aromatic hydrocarbons (PAHs), PCP, other semivolatile organic compounds (SVOCs; dibenzofuran, 3,5-dimethylphenol, 2-methylnaphthalene, carbazole, and 1-methylnaphthalene), and volatile organic compounds (VOCs; methylene chloride, ethylbenzene, toluene, and xylenes). NAPL is primarily restricted to the marine sand and gravel units. The maximum thickness of mobile LNAPL and DNAPL is approximately 13 and 9 ft, respectively. Mobile NAPL is present in all units, including the glacial aquitard.

Site personnel potentially could come into contact with NAPL during performance monitoring at the extraction wells, sampling of the upper aquifer groundwater wells, maintenance activities (for wells, extraction system piping, and other equipment that comes into contact with the NAPL), trenching and excavation, and at the GWTP. The anticipated primary potential exposure routes for site personnel from NAPL are dermal contact, and possible inhalation of organic vapors from out-gassing of NAPL exposed to the atmosphere. In near-surface soil, detected contaminants exceeding PRGs include PCP, nine PAHs, two other SVOCs (carbazole and dibenzofuran), one VOC (styrene), one pesticide (dieldrin), and dioxin (as total 2,3,7,8-TCDD equivalents). The extent of contamination is generally represented by the approximate lateral extent of PAH contamination.

1.4 Discharge Requirements

The ROD requires treatment of the contaminated groundwater to meet the effluent limits presented in Table 1-1. The treated effluent from the Wyckoff GWTP is discharged to Eagle Harbor through the existing outfall. The effluent is treated to comply with the same substantive National Pollutant Discharge Elimination System (NPDES) standards presented in the ROD (Appendix A).

If effluent water quality exceeds the discharge criteria for one or more of the parameters in Table 1-1, then the EPA must be notified in writing within 24 hours of discovery of the exceedance. Actions to correct effluent quality exceedances and achieve the required effluent concentrations must be implemented immediately. If the required actions are considered to be outside the scope of work for plant operations, then the system will be shut down pending further direction from the EPA. The contact person at the EPA is Howard Orlean (206) 553-2851 If the main EPA contact is not available, then plant operators will contact other USACE personnel by phone or email. A contact list is provided in Table 1-2.

2.0 Health and Safety

The foremost priority in operating the Wyckoff GWTP is to ensure the health and safety of the operators, visitors, and nearby residents. CH2M HILL has developed an SSHP to be used in conjunction with this O&M Manual and other documents required for any CH2M HILL O&M operation. The SSHP is to be used by CH2M HILL staff only. A separate SSHP will need to be developed in the future if operating companies change.

A copy of the current SSHP must be kept in the Wyckoff GWTP office for reference. Operating the Wyckoff GWTP includes the following potential hazards:

- Contact with contaminated (untreated) groundwater
- Confined space entry
- Electrical hazards
- Hazards associated with rotating equipment (such as pump shafts and vent fans)
- Release of stored energy (mechanical and pressurized systems)
- Slip/trip/fall hazards
- Lifting heavy objects
- Heat and cold stress

The operators must be familiar with the SSHP and its requirements, including training (project orientation, Occupational Safety and Health Administration [OSHA], Hazardous Waste Operations Emergency Response [HAZWOPER], confined space entry, fall protection), medical monitoring, personal protective equipment (PPE), confined space entry procedures, fall protection measures (required for any activity having a potential fall greater than 6 feet), air monitoring, hazard communication, emergency response plan, hospital route, and the site control log. Plant operators provide safety briefings for visitors to the plant and well locations as part of their normal protocol. A sign-in sheet for visitors is posted at the treatment plant office.

Treatment plant operations may normally be conducted in Level D PPE, which includes nitrile gloves, protective footwear, coveralls, standard work clothing, hard hats, and protective eye wear (safety glasses). Noise monitoring was performed within all treatment building locations, and hearing protection requirements were evaluated and posted accordingly.

3.0 Description and Operation of Groundwater Treatment Plant System and Components

The purpose of this section is to familiarize plant operators with basic information regarding the various plant systems and components. Pertinent catalog information from the equipment manufacturers is provided in the attachments (Volume II through Volume XII) to this O&M Manual. A detailed table of contents is provided at the beginning of each volume to facilitate locating specific component information. Manufacturer information consists primarily of the manufacturer's typical O&M package, which includes but is not limited to product data, performance curves (for pumps), materials of construction, equipment operation, equipment maintenance, troubleshooting, and spare parts inventories. Major process equipment warranty information is provided in Appendix B. Individual associated product warranties are provided in Volumes II through XII. This section provides an overview of the manufacturer's information and of the system operation.

Except during initial startup of each individual process system (dissolved air flotation [DAF], hydromation deep bed filter [HDBF] and pumps), the operator will need to operate the system from the touch screen on control panel 50CP1001, also called the operator interface terminal (OIT) or the human-machine interface (HMI), located at the east end of the treatment plant. The touch screen is located next to the DAF control panel and the six adjustable frequency drives (AFDs) for the pumps (DAF feed, filter feed, and decant).

In addition to the DAF local control panel, local control panels for the HDBF, polymer system, and the switch and disconnects for the plant water pumps are located inside the treatment building process area. The rotary blower local control panel is located inside the treatment building mechanical room and the sump pumps control panel is located inside of the tank farm. If needed, the operator can use these local control panels for manual operation of specific equipment.

O&M sampling schedules detailing the sampling frequency and parameters at each sampling port are provided in the project QAPP (Appendix G).

3.1 Groundwater Treatment System Description

The Wyckoff GWTP is designed to treat contaminated groundwater extracted from beneath the site to levels specified by the ROD. Extracted groundwater is pumped into an equalization (EQ) tank, from which the water is drawn and processed through three separate treatment units arranged in series. The treatment units (in order) are the DAF system with polymer injection, the HDBF system, and the granular activated carbon (GAC) system. The DAF and HDBF systems are designed to remove oil and grease (O&G), total suspended solids (TSS), and PAHs. The GAC units are designed to remove PCP and PAHs.

The major process components of the treatment system are:

- Groundwater extraction and storage

- DAF system
- HDBF system
- GAC system
- Process pumps
- Effluent storage system
- Discharge to Eagle Harbor outfall

Additional side-stream components are:

- Solids processing system (digester, stormwater and dirty backwash water settling tanks)
- Filter press system (for sludge handling)
- Oil processing system (product and froth tank for separating and removing NAPL product)
- Containment area system

The treatment equipment, along with appurtenances such as flow meters, level sensors, valves, and pressure gauges, are located either inside the treatment building (41 ft by 127 ft) or within the tank farm containment area (33 ft by 119 ft), which is south of and adjacent to the treatment building (see Figure 1-2). The treatment system uses a programmable logic controller (PLC) to facilitate automated system operation for treating contaminated water. The treatment building PLC communicates with and controls the process equipment associated with treating contaminated water. The controls allow the system to be operated either automatically from the treatment building, or manually at local control stations (LCSs) located near specific equipment.

Figure 3-1 is a schematic diagram of the entire wastewater treatment process, including several "side streams" for process water recycling and waste removal and recovery. The side streams include product recovery from the EQ tank and the DAF system; backwash for the HDBF and GAC systems; solids recovery at the filter press from the backwash streams; stormwater, spill containment, and recycled water streams; polymer; water; and air. Figure 3-2 presents a simplified process flow diagram with flow directions showing both main and recycle streams. Figure 3-3 shows the layout of the treatment equipment and piping inside the treatment building and the adjacent outside tank farm. Figures 3-4 to 3-14 are discussed in the following unit process sections. Sheets 1 and 2 provide instrumentation and control (I&C) legends explaining the symbols, letters, and numbers used on these figures. Applicable treatment system as-built drawings are provided in Appendix C. Appendix D includes PLC screen captures that summarize each unit process operation. Manufacturer information for the process valves is provided in Volume VII – Attachment 7.4. The groundwater treatment system is primarily interconnected with fiberglass-reinforced plastic (FRP) piping located in the treatment building and tank farm. For details on FRP pipe replacement/installation procedures, refer to Volume VII – Attachment 7.12. In addition, the attachment includes instructions for Garlock viton gasket installation between FRP flanges and the FRP flange/valve interface.

Table 3-1 lists the sampling ports for the entire process system. Tables 3-2 and 3-3 list the flow meters and level sensors for the entire process system. (Tables 4-1 through 4-9 identify and list the valves for normal and backwash operations of individual process units. These valves are referenced under this Section 3.0 and should be cross-referenced with startup and shutdown procedures from Section 4.0.)

Each unit process described in subsections 3.2 through 3.11 focus on the following topics:

1. A system description
2. An operational description
3. I&C
4. Design criteria

In addition, references to troubleshooting procedures are provided for the DAF, HDBF, and GAC systems under Sections 3.3.5, 3.4.5, and 3.5.8, respectively. Optimization procedures for the DAF system are provided in Section 3.3.6.

Under design criteria, reference to manufacturer information manuals (Volumes II to XII) and corresponding figure numbers are provided. In addition, refer to Figure 3-3 for the location and layout of the specific process equipment discussed in Sections 3.2 to 3.11.

3.2 Groundwater Extraction and Storage

This section provides a system description, an operational description, a description of I&C, and the design criteria for the groundwater extraction and storage system. Manufacturer information references related to groundwater extraction and storage are provided in the design criteria in Section 3.2.4. Figure 3-3 illustrates the layout of the treatment system and shows groundwater extraction and storage located in the tank farm.

3.2.1 Groundwater Extraction and Storage System Description

The groundwater extraction and storage system includes the following major components:

- EWs and associated pumps
- EQ tank
- EQ skim sump

Groundwater extraction maintains hydraulic containment within the confines of the existing sheet pile wall and transfers contaminated groundwater to the GWTP. To verify that adequate hydraulic containment is being achieved, a groundwater monitoring system is required to be maintained as part of the O&M procedures. The monitoring system should measure groundwater levels and pumping flow rates. The groundwater levels are analyzed to determine the extent of hydraulic containment.

Influent water to the treatment plant is obtained from seven groundwater extraction wells (PW-1 through PW-9; PW-3 and PW-7 have been abandoned), and the pilot extraction wells EW-2 and EW-6, located within the Wyckoff facility boundary. Each extraction well’s capacity varies from location to location, but on average can produce from 4 to 15 gallons per minute (gpm) using progressive cavity pumps (former process area) and air-operated Hammerhead extraction pumps (pilot area). Flow from the individual groundwater extraction wells is monitored locally using a propeller-type flow meter for the progressive cavity pumps and an air-actuated stroke counter for the Hammerhead pumps. The water pumped from the extraction wells is combined in the piping collection system and directed to the GWTP.

Contaminants (free NAPL product) accumulate in the groundwater extraction wells within the Wyckoff facility boundary. Each extraction well is equipped with a product recovery pump and piping system to remove accumulated contaminants. Prior to pumping free product, all wells are probed to identify the location and amount of free product (LNAPL and DNAPL**)** collected in the wells. Probing is also used to identify the elevation of the liquid surface of the well. Recovered product is then pumped to the product recovery tank located at each extraction well and ultimately transferred to the product tank located in the treatment plant tank farm.

The extraction well pumps discharge contaminated groundwater into the EQ tank (40T1010) located within the tank farm through the 3-inch-diameter FRP pipeline labeled plant influent (PLI) (Figure 3-4). The design flow rate from the extraction well network is 53.6 gpm. The EQ tank provides equalization of flow and contaminant concentrations prior to discharge to the DAF system and also provides separation of non-aqueous phase oil and settleable solids as a result of long hydraulic retention time. The EQ tank is sized to provide 3 days of retention time at an influent flow of 11 gpm, which is the expected future peak flow rate after the site cap and upgradient hydraulic isolation wall are installed.

Separation of nonaqueous phase oil and suspended solids also occurs within the EQ tank. The tank has a vertical baffle to reduce short-circuiting between the water influent and effluent points, an overflow weir for removal of LNAPL, and a sloped floor to facilitate the removal of DNAPL and settled solids. Hoses are connected to the EQ tank to remove LNAPL and DNAPL, which are then discharged to the EQ skim sump. This sump allows for storage and handling of LNAPL, DNAPL, and water, which are manually removed using digester/skim pump 50P1120 (separately discussed under Section 3.9). The EQ tank and EQ skim sump are shown on Figure 3-4. The physical location of the EQ tank is shown in Sheet 49, with details shown in Sheets 55 and 65 in Volume I, Appendix C. The location of the EQ skim sump is also shown in Sheet 49.

3.2.2 Groundwater Extraction and Storage System Operational Description

Groundwater is pumped into the EQ tank from the Wyckoff extraction well network with valves PLI-01 and PLI-00 open. The total flow rate is monitored by plant influent flow meter FE/FIT-1009 (see Figure 3-4 and Table 3-2).

The liquid level in the EQ tank is monitored by level transmitter LE/LIT-1011 (see Figure 3-4 and Table 3-3), and will be maintained by the process control system at approximately one half of the tank capacity under normal operating conditions. This maintained liquid level will provide storage capacity in case treatment processes are temporarily shut down for maintenance or repair and pumping from the extraction wells must be maintained. The liquid level can be set by the operator by adjusting the level on the HMI screen.

Sampling port (SP) SP-0, flow meter 1009, and level transmitter 1011 are shown on Figure 3-4. Sampling port SP-0 (see Table 3-1) is located on the PLI pipeline between the extraction wells and EQ tank.

In addition to the influent flow from wells, the EQ tank receives recycle water from the following streams:

- Treated plant effluent (PLE) from carbon adsorbers, designated as PLE/RCY (recycle) (cross-reference with Figure 3-10) - associated valve PLE/RCY-01
- Backwash recycle water from dirty backwash tank, designated as BWR (cross-reference with Figure 3-11) - associated valve BWR/FI (filter influent)/RCY-01
- Recycle from DAF effluent (DE)/filter feed pumps, designated as FI/RCY (cross-reference with Figure 3-7) - associated valve BWR/FI/RCY-01
- Decant recycle from decant pumps/froth tank, designated as FRE (cross-reference with Figure 3-13) - associated valve FRE-07
- Recycle from the stormwater recycle pump, designated as STW (cross-reference with Figure 3-14) - associated valve STW-13

Contaminated water from the EQ tank is sent to the DAF system, which is described in Section 3.3.

3.2.2.1 Influent Piping from Wells to Equalization Tank

The 3-inch high-density polyethylene (HDPE) pipeline from the extraction well field is connected to a new 3-inch-diameter FRP PLI pipeline that directs contaminated water to the EQ tank in the tank farm. This new PLI pipeline can be isolated from the extraction well field water by closing the 3-inch plug valve (PLI-00) located in the exclusion zone. Valve PLI-01 isolates the flow of extracted well field water through the plant at the inlet of the EQ tank. (The PLI pipeline is shown on Figure 3-15.)

3.2.2.2 LNAPL Recovery from Equalization Tank

1. Periodically (anticipated frequency once per quarter), the water level in the EQ tank will be raised to the top of the working volume to decant floating oil (LNAPL) that accumulates on the water surface through the overflow weir.
2. Water level in the tank will be monitored, with the level indicated on LE/LIT-1011. This is done by adjusting the DAF feed pump flow or shutting down the plant and maintaining well pump flow into the EQ tank (refer to Section 4.7.3).
3. The LNAPL is removed by connecting a hose to the 2-inch FRP NAPL pipe that connects to the valve NAPL-01 on the LNAPL outlet.
4. Decanted LNAPL discharges by gravity flow to the EQ skim sump. Refer to Section 4.7.3 for the procedure to perform this task. Normal operations will include removing this product from the sump after it has been removed from the EQ tank.

3.2.2.3 DNAPL Recovery from Equalization Tank

The bottom of the EQ tank slopes toward a bottom outlet to facilitate removal of DNAPL and settled solids.

1. DNAPL and heavy solids will be drawn off periodically (anticipated frequency, once per quarter) by connecting a hose to the 2-inch FRP NAPL pipe that connects to the valve NAPL-02 on the DNAPL outlet.
2. DNAPL and heavy solids will discharge by gravity flow to the EQ skim sump, which allows gravity flow of both LNAPL and DNAPL, as well as visual verification that oil is being removed. Refer to Section 4.7.2 for the procedure to perform this task.

3.2.2.4 Extraction Well Probing

Probing, which is normally performed prior to recovering free product from the EWs, identifies the location and amount of free product (LNAPL and DNAPL) collected in the wells. Probing is also used to identify the elevation of the liquid surface of the well (the oil water separator probe that is used is capable of detecting both water and free product). When the probe is not submerged in water or free product, it is silent. When the probe is submerged in water, it emits an intermittent tone; when submerged in free product, it emits a constant tone. The probe is connected to a measuring tape that is connected to a totaling reel capable of raising and lowering the probe. All measurements are taken at the top edge of the well's casing, which has an established elevation. A Product Recovery Sheet is used to record findings.

Probing Procedure:

NOTE: All measurements are in FEET and TENTHS OF A FOOT.

- Adjust the handle to the USE position and press the ON button to activate the probe. Let out approximately 6 inches of measuring tape and open probe cover. Pull probe from probe cover.
- Slowly lower probe into well along the side of well casing.
- Stop when probe emits either an intermittent or constant beep.
- If the probe emits an intermittent beep, enter the measurement in the "Depth to Water" column on the Product Recovery Sheet for that particular well and continue to step 8.
- If the probe emits a constant beep, enter the measurement in the "Depth to LNAPL" column on the Product Recovery Sheet for that particular well.
- Lower the probe until it emits an intermittent beep. Enter the measurement in the "Depth to Water" Column on the Product Recovery Sheet.
- Subtract the "Depth to LNAPL" measurement from the "Depth of Water" measurement and enter the difference in the "LNAPL Thickness" Column on the Product Recovery Sheet.

- Lower the probe until either the bottom of the well is reached, or DNAPL is detected. If no DNAPL is detected, enter a zero in the “Depth to DNAPL” column on the Product Recovery Sheet.
- If DNAPL is detected, enter the measurement where it was detected in the "Depth to DNAPL" column on the Product Recovery Sheet.
- Subtract the "Depth to DNAPL" measurement from the depth of the well (in the “Total Well Depth” column). Enter the difference in the "DNAPL Thickness" column on the Product Recovery Sheet.
- At this time, wrap a double folded absorbent pad around the probe's measuring tape and slowly reel the probe to the surface, being careful to remove all product from the measuring tape. Hold the absorbent pad directly over the well opening to ensure that any product dripping off the probe will not make contact with the ground.
- When the probe is recovered from the well, it should also be carefully cleaned of all product and then returned to the probe protection cover.
- After all probing is completed, return the probe and reel assembly to its storage location.

3.2.2.5 Extraction Well NAPL pumping

These procedures are written exclusively for recovering free product from extraction wells 1 through 9. All wells will be probed before attempting to recover free product (see Section 3.2.2.3). The following procedures will be split into two sections; pumping of LNAPL, which is found on the surface of the well, and DNAPL, which is found at or near the bottom of the well. LNAPL and DNAPL will often be referred to as “product.”

Exclusion zone fencing has been installed around all extraction wells. When pumping product from these wells, the exclusion zone sign must be hung at the entrance of the exclusion zone. All personnel within this exclusion zone will wear appropriate PPE. The "buddy system" will be used at each well. All contaminated PPE and sorbent pads will be placed in the waste containers provided at each extraction well.

- LNAPL is removed when probing indicates a depth of (3 FEET or GREATER).
- DNAPL is removed when probing indicates a depth of (4 FEET or GREATER).

LNAPL

1. Lower the LNAPL suction piping into the well to a depth just above the water/LNAPL interface. This will prevent pumping excessive water with the LNAPL. For reference, the black HDPE suction pipe is 15 feet long. Be sure the winch line connecting the suction pipe is taught. This will prevent the suction piping from being pulled further into the well when pumping begins.
2. Open LNAPL suction valve PWV-1. Close DNAPL suction valve PWV-2.
3. Open product pump suction valve PWV-17 and open product tank inlet valve PWV-12. Close all other valves directly related to the product pump.
4. Remove the strap from the 150-gallon product tank and remove the lid.

5. Using the provided polyvinyl chloride (PVC) measuring device, measure the distance from the product surface level to the top edge of the tank. Using this measurement, move the measuring device to the outside of the tank and measure from the top edge of the tank down to the bottom of the measuring device. Note the location of the bottom of the measuring device in relation to the graduated marking on the side of the tank. This will indicate how many gallons of product are in the product tank prior to pumping.
6. Turn the product pump **ON** to the **HAND** position and observe the product entering the product tank. Continue to observe the product entering the tank until either water is noted, or the flow becomes intermittent, indicating that the pump is sucking air.
7. Turn the product pump to the **OFF** position.
8. Using the provided PVC measuring device, measure the distance from the product surface level to the top edge of the tank. Using this measurement, move the measuring device to the outside of the tank and measure from the top edge of the tank down to the bottom of the measuring device. Note the location of the bottom of the measuring device in relation to the graduated marking on the side of the tank. This measurement minus the previous measurement will indicate the amount of product pumped in gallons.
9. Replace the product tank lid and secure the strap.
10. Enter the amount of LNAPL recovered on the Product Recovery Sheet.
11. If no DNAPL is to be pumped, continue to step 10 under DNAPL.

DNAPL

1. Open DNAPL suction valve PWV-2 and close LNAPL suction valve PWV-1
2. Open product pump suction valve PWV-17. Open product tank inlet valve PWV-12 and close all other valves directly related to the product pump.
3. Remove the strap from the 150-gallon product tank and remove the lid.
4. Using the provided PVC measuring device, measure the distance from the product surface level to the top edge of the tank. Using this measurement, move the measuring device to the outside of the tank and measure from the top edge of the tank down to the bottom of the measuring device. Note the location of the bottom of the measuring device in relation to the graduated marking on the side of the tank. This will indicate how many gallons of product are in the product tank prior to pumping.
5. Turn the product pump **ON** to the **HAND** position and observe the product entering the product tank. Continue to observe the product entering the tank until either water is noted, or the product entering the tank takes on a frothy appearance.
6. Turn the product pump to the **OFF** position.
7. Using the provided PVC measuring device, measure the distance from the product surface level to the top edge of the tank. Using this measurement, move the measuring device to the outside of the tank and measure from the top edge of the tank down to the bottom of the measuring device. Note the location of the bottom of the measuring device

in relation to the graduated marking on the side of the tank. This measurement minus the previous measurement will indicate the amount of product pumped in gallons.

8. Replace the product tank lid and replace the strap securely.
9. Enter the amount of DNAPL recovered on the Product Recovery Sheet.
10. Upon completion of this task, PPE will be decontaminated at each well, if needed. If gloves or saranex are contaminated, remove and dispose in the PPE containers located at each well. Upon leaving the exclusion zone, remove the "exclusion zone" sign.

3.2.2.6 Drain Line Cleaning

The following is the standard operating procedure (SOP) for drain line cleaning:

- Determine whether there are reduced flows as a result of partial pipe blockages. This is done primarily by checking discharge pressures on the extraction water well pumps. Discharge pressures in excess of 30 pounds per square inch (psi) indicate that a blockage is somewhere down- stream of the pump. Check discharge pressures on other pumps to determine whether the blockage is confined to one section of pipe or whether it is a problem throughout the system. Generally, if one section is partially blocked it is a good idea to check the entire system as a proactive measure.
- First, try to dislodge any solids buildup by increasing flow rates. At the same time, hit the pipe with a rubber hammer to try to clear any blockages. Some- times this works temporarily; however, most often when increased pressures are observed, a jet rodder and vacuum truck are needed to clean the line.
- Contact Wyckoff's drain line cleaning service and schedule a time when the plant can be shut down. The cleaning service should bring all the necessary equipment, including a jet rodder with all appropriate nozzles, a vacuum truck, and their own PPE, including tyvek coveralls, rubber boots, hard hats, safety glasses, and face shields.
- All personnel working for the contractor must meet all health and safety criteria. A site safety briefing should be held before any work begins.
- Shut down the well field by turning the power off at the motor control center (MCC) panel, and notify the appropriate regulatory personnel.
- Isolate a section of the line to be cleaned either by closing valves or by installing blind flanges to isolate the section of pipe.
- Determine the length of the run to be cleaned.
- Position the jet rodder to feed into the pipe. Water for the jet rodder truck can be obtained onsite.
- Use an inexpensive children's non-inflatable swimming pool to collect water and solids purged from the line. Place it at a location along the line where a flange has been taken apart and the vacuum truck has been staged to vacuum the water and solids that have been generated by the jet rodder. It is vital that visual communication be maintained between the jet rodder operator and the vacuum truck operator so it can be determined

when to stop the jet rodder. It is also vital that the jet rodder operator know the length of the piping run to be cleaned so they know how much line to feed before it reaches the end of the pipe.

- The number of times a line is run is determined by the water quality of the purge water; normally, it takes approximately three to four runs until clear water is observed in the swimming pool.
- When a section of line is completed, return all blinds and valves to their normal operating positions.
- Clear the pipe runs for the entire drain field in a systematic manner using the method described above. The best method for running these lines is to work from outside of the site to the inside.
- Deposit all water and solids from the vacuum truck in the treatment pad sump, ahead of the hardware cloth screen to collect any solids that might be present.
- Once all the pipe runs have been cleaned and purged, confirm that all valves are in the correct position, and that all blinds and connections are tightened to normal tolerances.
- Verify the valving position by two independent inspections before putting the system online again.
- Energize the system at the MCC and note the discharge pressures on each water well pump.
- Do not release the vacuum truck and jet rodder until it is confirmed that discharge pressures are in the normal range (10 to 15 psi).
- The normal decontamination and health and safety rules apply to all equipment before it is allowed to leave the site.

3.2.3 Groundwater Extraction and Storage System I&C

Piping and instrumentation for the groundwater extraction and storage system are depicted schematically on Figure 3-4. This figure also should be cross-referenced with Figures 3-7, 3-10, 3-11, 3-13, and 3-14 for recycle streams (stream descriptions are in Section 3.2.2) entering the EQ tank in addition to the influent from the extraction wells. The groundwater extraction system layout drawing is shown in Figure 3-16. A typical arrangement for the groundwater extraction wells in the former process area is shown in Figure 3-17

The following are the instrumentation and controls for this system (refer to PLC screen captures titled “Plant Influent” in Appendix D):

1. The extracted groundwater flow rate into the EQ tank is measured by the plant influent flow meter (FE/FIT-1009). The flow rate value is transmitted by the PLC and is displayed on the HMI.
2. The liquid level in the EQ tank is measured by the EQ tank level transmitter (LE/LIT-1011). This level value is transmitted to the PLC and is displayed on the HMI. There are **LO-LO**, **LO**, **HI-HI** and **HI** alarms associated with the EQ tank. The **LO** and

HI alarms will be displayed on the HMI alarm screen. The **HI-HI** alarm will be displayed on the HMI alarm screen and will also signal the phone dialer system for an emergency operator call-out. The **LO-LO** alarm will be displayed on the HMI alarm screen and is interlocked with operation of the DAF feed pumps (described in Section 3.3).

3. The DAF feed pumps described in subsection 3.3 pump water out of the EQ tank. Under normal operating conditions, the DAF feed pump speed is controlled to maintain a constant level in the EQ tank at about half-depth (that is, half of the water working volume). Alternately, the operator can set the DAF feed pump speed manually.

4. Decanting LNAPL and DNAPL from the EQ tank is performed manually. The operator manually opens and closes valves on the LNAPL (NAPL-01) and DNAPL (NAPL-02) outlets to draw off oil. When decanting NAPL, the operator visually inspects the discharge continuously at the EQ skim sump to determine when to close the valve to avoid decanting water.

3.2.4 Groundwater Extraction and Storage System Design Criteria

The major components of the groundwater extraction and storage system are provided in this section along with their specifications, manufacturer, and location within the Wyckoff GWTP.

Equalization Tank (40T1010) – Figure 3-4

- Capacity: 51,400 gallons
- Dimensions: 18 ft diameter x 27 ft high
- Anticipated contents: groundwater contaminated with PCPs, PAHs, TSS and O&G, and total dissolved solids (TDS)
- Material of Construction: FRP
- Manufacturer: Ershigs
- Location: Tank farm
- Manufacturer Information and As-built Drawing: Volume VI of this O&M Manual

Equalization Skim Sump – Figure 3-4

- Dimensions: 5 ft long x 5 ft wide x 5 ft deep
- Capacity: 935 gallons
- Location: Tank farm

Plant Influent Flow Meter (FE-1009) – Figure 3-4

- Model: Optiflux 4000 Series
- Capacity/Characteristics: Optiflux Mag Inductive Flow Meter, operating range of 0 to 100 gpm
- Manufacturer: Krohne
- Location: Tank farm
- Manufacturer information: Volume VIII – Attachment 8.1.

Level Transmitter Equalization Tank (LE/LIT-1011) – Figure 3-4

- Model: Hydroranger 200

- Characteristics: Calibrated at 0 to 40 ft of water with the level element XPS-15 and 10-meter (m) cable
- Manufacturer: Miltronics
- Location: Tank farm
- Manufacturer information: Volume VIII – Attachment 8.1.

Groundwater Extraction Well System – Figure 3-17

- Groundwater Pump Manufacturer/Model: Moyno A2ESSF3S-BP-B
- Product Pump Manufacturer/Model: Moyno A1DSSF3S-BP-B
- Groundwater Pump Motor Manufacturer/Model: Baldor 2HP 1800RPM 3/60/230-460 Severe Duty
- Product Pump Motor Manufacturer/Model: Baldor 1.5HP 1800RPM 3/60/230-460 Severe Duty
- Variable Speed Drive Manufacturer/Model: Sumitomo GHHBJN2AG20Y4
- Flow Meter Manufacturer/Model: G2 Industrial Flow Meter G2S10N09GMA
- Location: Well field

3.3 Dissolved Air Flotation System

This section provides a system description, an operational description, a description of I&C for the DAF, the design criteria for the DAF and polymer systems, troubleshooting procedures, and optimization procedures. Detailed information related to DAF equipment is provided under Section 3.3.4. Figure 3-3 illustrates the layout of the treatment system and shows the DAF system, which is located in the treatment building process area. Information related to a detailed description of the DAF components, installation instructions for the DAF system, safety instructions, torque control, and maintenance and emergency procedures can be found under Volume III of Westech's manufacturer's manual– Attachment 3.1.1.

3.3.1 Dissolved Air Flotation System Description

The DAF system follows the groundwater extraction and storage system and precedes the HDBF system at the Wyckoff GWTP. The DAF system (M1121) removes suspended solids and nonaqueous-phase oil (LNAPL and DNAPL) from the groundwater. The principal removal mechanism in the DAF unit and its air saturation system is flotation of oil and settleable solids, removed as sludge. A polymer is injected into the DAF influent to improve oil removal efficiency.

- DAF system components include the following:
- DAF unit (M1121)
- Supplemental components of DAF system consisting of skimmer, auger, mixer, recirculation pump, air saturation tank, and DAF control panel
- DAF polymer system
- DAF feed pumps (2)

The DAF system consists of a flotation chamber, a motor-driven float drag skimmer (M1121C) and a float collection chamber, an effluent chamber, a motor-driven sludge auger (M1121B), a recycle pressurization system (recirculation pump 50P1135, air saturation tank 50T1138), a Mixer (M1121A), and a local control panel (50LCP1121). The DAF unit is protected from corrosion with 18 zinc anodes placed on the walls. In addition, the air saturation tank has 2 zinc anodes mounted on the inner tank wall and the recirculation piping. A 4-inch rupture disc is located in the north side of the DAF unit. The DAF polymer system consists of a neat polymer pump (50P1611), polymer mixer, an in-line mixer, a polymer blend tank (40T1620), and a polymer feed pump (50P1640).

The DAF process is effective in separating nonaqueous phase oil from the wastewater, which is critical for preventing fouling and allowing proper operation and performance of the HDBF and GAC processes.

The DAF polymer system prepares a polymer solution and injects it into the DAF influent (DI) prior to the DAF system, which improves the oil and solids removal performance of the DAF system. Polymer is obtained from the manufacturer in drum quantities. Non-potable water (W2) is supplied from the plant water storage tank (50T1570). Polymer and water are mixed in the polyblend system and the solution is stored in the polymer blend tank (40T1620). Polymer solution is injected into DI piping by the polymer feed pump (50P1640). The DAF system, polymer system, and DAF effluent are shown on Figures 3-4, 3-5, 3-6 and 3-7 (Equalization Tank and Skim Sump, Dissolved Air Flotation, Polymer System and DAF Effluent). The physical location of the DAF unit is shown in Sheet 48 with details shown in Sheets 51 and 62 under Appendix C "Applicable Project Drawings" of Volume I. The physical location of the polymer system is shown in Sheet 48 with details in Sheet 61. The location of the DAF feed pumps is also shown in Sheet 48.

3.3.2 Dissolved Air Flotation System Operational Description

1. Water to be treated for NAPL and solids removal is pumped via pipeline labeled DI from the EQ tank (40T1010) to the DAF system using one of the two DAF feed pumps (50P1101 or 50P1102). Valves DI-02 and DI-04 must be open to operate DAF feed pump 50P1101, and valves DI-05 and DI-07 must be open to operate DAF feed pump 50P1102. If these valves are closed when attempting to operate the pumps, piping could rupture, resulting in a significant safety issue. The second pump is installed as redundant, which increases the lifespan of each pump because their use should be cycled (refer to Figures 3-4 and 3-5). The DAF feed pumps are placed in **AUTO** by selecting the "Plant Influent" screen (Appendix D) from the HMI, and then selecting the proportional-integral-derivative (PID) tuning icon and then **AUTO**. The set point is selected, which is the level in the EQ tank and is typically 14 feet. The DAF feed pumps can also be operated manually by selecting the PID tuning icon from the "Plant Influent" screen (Appendix D) and pressing **AUTO** until it changes to **MANUAL**. The output (0-100) pump speed is selected in manual mode. If operating the DAF feed pump in manual, the operator will need to closely watch the changing level in the EQ tank.

2. Flow rate from the EQ tank is measured using DAF influent flow meter FE/FIT-1110 as illustrated in Figure 3-4.

3. The froth and effluent levels are measured using Level transmitters LE/LIT-1131 (for froth) and LE/LIT-1211 (for DAF effluent), respectively (see Figure 3-5). Both these level transmitters are located inside the DAF unit.

4. DAF influent water enters a flocculation zone where water is mixed with an AFD mixer for polymer conditioning and then exits the compartment to a main flotation area. This polymer-conditioned contaminated wastewater and the pressurized recycle flow is mixed in the first section of the DAF system near the flocculation zone of the tank.

5. The skimmer system has two strands of chain running above the liquid surface over two sets of sprockets, and evenly spaced flights to convey floated material over the dewatering beach and into the float hopper. Settled solids are removed from the bottom of the tank and the remaining effluent flows over an adjustable weir. A portion of the DAF effluent water is withdrawn from the effluent end of the flotation compartment by the DAF recirculation pump (50P1135).

6. Manual control by the operator maintains the flow to the saturation system (see Figure 3-5) at a flow rate of 75 gpm measured by the DAF air saturation tank flow meter (FE/FIT-1137). The flow rate can be adjusted by varying the manual valve (also called a break-out valve) designated as DR-03. This valve controls the pressure on the air saturation tank as well as the recirculation pump discharge pressure.

7. A portion of this flow is recycled back to the DAF unit by operating pressure sustaining valve DR-04 (also labeled as PSV1134). This valve only functions as a relief valve; that is, flow through DR-04 only occurs when the recirculation pump pressure exceeds the DR-03 valve pressure setting.

8. High-pressure process air (AHP), operated through valves AHP-09 through AHP-14 and piped to the air flow meter (FI-1133), is injected into the discharge of the recirculation pump directly ahead of the saturation system at a flowrate of approximately 3.5 cubic feet per minute (cfm). In the air saturation tank, air is dissolved into the liquid at approximately 60 to 80 psi. Excess air is expelled from the saturation system through an air bleed valve (DR-V01) from the top of the tank and recycled back to the DAF unit.

9. The air-saturated liquid exits the saturation system and is directed toward break-out valve DR-03. Flow from the recirculation pump to the air saturation tank is monitored using flow meter 1137. The recirculation pump should be set to run at 90 to 100 psi.

10. As water passes into the flotation chamber and the pressure is released, minute gas bubbles form and rise to the surface, carrying suspended solids and oil droplets that adhere to the bubble surfaces. This material forms a “float” or froth at the liquid surface, which is removed by the skimmer by means of traveling up the dewatering beach and discharging into the float collection chamber.

11. Polymer (refer to Figure 3-6) is injected into the DAF influent water to enhance oil flotation performance. Heavy materials such as dense oil and solids settle out in the V-bottom section of the DAF, with the sludge auger rotating in one direction only. The V-bottom is fabricated of right-hand screws on one half and left hand screws on the other half. As the auger rotates, it draws sludge from the two ends toward the 2-inch solids suction connection located at the center of the DAF unit.

12. Treated water flows under a baffle and over a level-control weir into a collection launder, and discharges through the DAF effluent (pipeline labeled as DE). DAF effluent water discharges by gravity flow to the DAF effluent chamber (DE tank).
13. The DE tank has over/under baffles to facilitate oil retention and minimize the amount of oil pumped to the HDBF unit. The DAF effluent water is pumped to the HDBF unit by the filter feed pumps. Valve DE-01 must be open to transfer water to the HDBF (refer to Figure 3-7).
14. A portion of the DAF effluent (see Figure 3-7) is checked for turbidity using an online turbidimeter (AE/AIT-1245) by opening the valves FI/SA-01 and FI/SA-02. The turbidity meter continually monitors the turbidity of the DAF effluent and digitally displays a real time value, which is monitored by the PLC. These values are used to both warn the operator of water quality, and to optimize the performance of the DAF. This DAF effluent from the turbidimeter is discharged to a drain in the building that eventually goes to the decontamination pad sump and ultimately to the containment sump in the tank farm.

Sampling port SP-1 (see Figure 3-4 and Table 3-1) is located immediately upstream from the DAF feed pumps and is used to sample the influent to the DAF unit before the polymer is injected into the DAF influent flow stream. Sampling port SP-2 (see Figure 3-5 and Table 3-1) is located downstream of the DAF unit to sample processed water from the DAF effluent chamber. All DAF sampling ports, flow meters, valves and level transmitters are shown on Figures 3-4, 3-5, and 3-6.

In addition to the DAF system process stream, the system receives recycle water from the following process streams:

- Vent from the HDBF system (cross-reference with Figure 3-8)
- Vent from the air saturation system through valve DR-V01

Flow from the DAF system goes to the HDBF system, which is described in Section 3.4.

3.3.3 Dissolved Air Flotation System I&C

The local control panel (50LCP1121) of the DAF unit monitors the following information, which is transmitted to the main process control panel (50CP1001):

- ON/OFF, alarm, and speed status for mixer 1121A
- ON/OFF and run status for auger 1121B
- ON/OFF, alarm, and speed status for skimmer 1121C
- ON/OFF and run status for recirculation pump 50P1135

The local control panel (50LCP1601) of the polymer system monitors the following information, which is transmitted to the main process control panel (50CP1001):

- ON/OFF/AUTO status of the polymer mixer (M1601)
- ON/OFF and run status of the polymer feed pump (50P1640)

Piping and instrumentation for the DAF system, polymer system, and DAF effluent system are depicted schematically on Figures 3-5, 3-6, and 3-7, respectively. The following are the instrumentation and control steps (refer to PLC screen captures “Plant Influent,” “DAF System,” “DAF Effluent Pumping” and “DAF Polymer System” in Appendix D.

1. DI-01 (FCV-1021 – see Figure 3-4) is a pneumatic valve located on the EQ tank outlet that relays to the HMI showing **OPEN/CLOSE** status. This valve is a **FAIL CLOSE** valve and is designed to isolate the EQ tank. This valve can also be operated in the manual mode by first closing the instrument air supply to the valve, setting the slot handle into the slot, and opening the valve manually. If the valve needs to be operated from the HMI again, first close the valve, set the slot in its upright position, ensure availability of instrument air, and then open the valve from the HMI.
2. The DI flow (FE/FIT-1110) is monitored by the PLC, which is used to set the DAF polymer feed rate.
3. The DAF unit has a dedicated local control panel (50LCP1121), and the DAF polymer system has dedicated I&C. Recirculation flows are monitored by the PLC. DAF polymer system operation (polymer feed rate) is controlled by the PLC.
4. The froth level (LE/LIT-1131) in the float collection chamber of the DAF unit is monitored and alarmed at the PLC. The **HI** level alarm is connected to the phone dialer system. The **LO-LO** alarm will cause the PLC to shut down the froth pumps. The froth pumps (described under Section 3.9) are operated manually, either locally or remotely, at the HMI based on a set timer.
5. The water level in the DAF effluent (DE) tank is monitored using LT-1211 and alarmed for high and low level by the PLC. The **LO-LO** level alarm will cause the PLC system to shut down the filter feed pumps. A **HI** level alarm will cause the PLC system to shut down the DAF feed pumps. One of the two adjustable speed filter feed pumps (described in Section 3.4) is controlled to maintain a constant level in the DE tank.
6. An online turbidimeter (AE/AIT 1235) is positioned to monitor turbidity of the DAF effluent water, as an indicator of TSS. The turbidity meter value is displayed on the HMI. The turbidimeter has a **HI** level alarm if the DE turbidity reaches 100 nephelometric turbidity units (NTUs) (operator-adjustable set point). This alarm will display on the HMI alarm screen. It is also connected to the operator phone dialer system.
7. Polymer feed rate is controlled by the PLC based on the DAF influent feed flow rate. The operator selects the desired polymer dosage rate on the HMI (“DAF Dosage,” in parts per million [ppm]). The PLC adjusts the stroke speed of the polymer feed pump (50P1640) in order to maintain this polymer dosage rate. The polymer feed pump should be maintained at 60 percent stroke for the correct PLC stroke speed adjustment. The operator can manually adjust the polymer concentration in the polymer blend tank as a secondary method of controlling the polymer feed amount. The adjusted polymer concentration in the blend tank will need to be entered onto the HMI screen (“Blend Tank Concentration in %). If a new type of polymer is used, the operator should also enter the specific gravity of the pure polymer product on the HMI screen (“Neat Specific Gravity”).

If the equipment is placed in manual operation, no PLC system controls are available. During this period the DAF feed pumps are started by placing the AFD in local mode and changing the frequency to meet the flow rate of the pumps. The DAF can be started from the local control panel on local mode. Manual operation of equipment should always be closely monitored by the operations personnel.

3.3.4 Dissolved Air Flotation System and Polymer Design Criteria

The following chart lists the DAF performance criteria.

DAF Performance Criteria

Parameter	Design Influent Concentration	Design Effluent Concentration
TSS (mg/L)	28	14
O&G (mg/L)	20	10
PCP (µg/L)	405	360
PAH (µg/L)	17,955	8,977
NOTES: mg/L = milligram per liter µg/L = micrograms per liter		

The major components of the DAF system and polymer system are provided in this section, along with their specifications, manufacturer, and location within the Wyckoff GWTP.

Dissolved Air Flotation Unit (M1121) – Figure 3-5

- Model: DAFR6S/618-2
- Capacity: 8,500 gallons (approximate)
- Dimensions: 18 ft long and 6 ft wide
- Anticipated contents: PCPs, PAHs, O&G and TSS
- Design Flow Rate: 11 to 90 gpm
- Material of Construction: stainless steel 316SS (main body)
- Manufacturer: Westech Inc.
- Location: treatment building process area
- Manufacturer Information and As-built drawings: Volume III (Attachment 3.1) of this O&M Manual. As-built drawings for the DAF system are provided under Attachment 3.1.7.

Supplemental Components for Dissolved Air Flotation System

a) Skimmer Drive (M1121C) – Figure 3-5

  – Model: SK32100-AZB-56C-71L/4

- Capacity: 0.5 horsepower (hp) with inverter duty alternate frequency drive and 1750 revolutions per minute (rpm)
- Manufacturer: Nord UNICASE

b) Auger Drive (M1121B) – Figure 3-5

- Model: CNH-M03-6125DBY-AV-1003
- Capacity: 0.33 hp and 1750 rpm
- Manufacturer: Nord UNICASE

c) Flotation Mixer (M1121A) – Figure 3-5

- Model: SK20282NB/AZBN56C
- Capacity: 0.5 hp with inverter duty alternate frequency drive and 1750 rpm
- Manufacturer: Nord UNICASE

d) ASME Air Saturation Tank (50T1138) – Figure 3-5

- Capacity: 2.5 standard cubic feet per minute (scfm) at 140 pounds per square inch gauge (psig)
- Manufacturer: Westech/Van Aire Incorporated

e) Effluent Chamber/Tank (Part of DAF unit Figure 3-5)

- Capacity: 400 gallons
- Manufacturer: Westech Inc.

f) DAF Control Panel (50LCP1121) – Figure 3-5

- Manufacturer: Westech

g) Recirculation Pump (50P1135) – Figure 3-5

- Model: 12-1
- Capacity: 15-hp motor
- Manufacturer: Sulzer Pump and Reliance Motor
- Location (Items a to g): treatment building process area
- Manufacturer Information (Items a to f): Volume III (Attachment 3.1) of this O&M Manual
- Manufacturer Information (Item g): Volume II (Attachment 2.10) of this O&M Manual

Dissolved Air Flotation Polymer System (Figure 3-6)

a) Neat Polymer Solution Supply Tank

- Capacity: 100 gallons

b) Polymer Blend Tank (40T1620)

- Dimensions: 6-inch diameter by 21.75 inches tall
- Manufacturer: US Filter

c) Static In-line Mixer:

- Dimensions: 1.5-inch diameter
- Manufacturer: Koflo Corporation

d) Neat Polymer Pump (50P1611)

- Capacity: 1 hp, 1,725 rpm, 90 volts (V), 3-phase
- Manufacturer: GE

e) Polymer Feed Pump (50P1640)

- Capacity: 8 gallons per hour (gph) flow, 60 psi max discharge pressure
  Manufacturer: LMI Milton Roy

f) Polymer System Control Panel (50LCP1601)

- Manufacturer: Ashland Chemical
- Location (all items above): treatment building process area
- Manufacturer Information (Items a through f): Volume III (Attachment 3.2) of this O&M Manual

Dissolved Air Flotation Feed Pumps (50P1101 and 50P1102) and AFDs (50AFD1101 and 50AFD1102) (Figure 3-4)

- Model: Pump – NM053SY01L07V, Motor – 00318ST3QIE182T
- Capacity/Characteristics:
  - 80 gpm at 5 ft head (260 rpm)
  - Motor: 3 hp, 460V, 3-phase, 1.15 square feet (ft2), 1,800 rpm
- Manufacturer: Netzsch Inc./Weg
- Location: treatment building process area
- Manufacturer Information: Volume II of this O&M Manual (Attachment 2.8)
- AFDs: 50AFD1101/1102
- AFD Model: ACH550PC-06A9-4, 3 hp, 480V
- Manufacturer: ABB
- Location: treatment building process area
- Manufacturer Information: Volume VIII of this O&M Manual (Attachment 8.2)

Dissolved Air Flotation Influent Flow Meter (FE-1110) – Figure 3-4

- Model: Optiflux 4000 Series
- Capacity/Characteristics: Optiflux Mag Inductive Flow Meter measures the flow from EQ tank with 2-inch Teflon lining and an operating range of 0 to 100 gpm.
- Manufacturer: Krohne
- Location: treatment building process area
- Manufacturer information: Volume VIII – Attachment 8.1.

Dissolved Air Flotation Air Saturation Tank Flow Meter (FE-1137) – Figure 3-5

- Model: S0723016
- Capacity/Characteristics: Optiflux Mag Inductive Flow Meter measures the flow at the recirculation system and an operating range of 0 to 130 gpm.

- Manufacturer: Krohne
- Location: treatment building process area
- Manufacturer information: Volume III – Attachment 3.1.

Turbidimeter (AE/AIT-1245) – Figure 3-7

- Model: Unit – 7121000, Flow Meter – 4028400
- Capacity:
  - Turbidimeter range - 0 to 9,999 NTUs
  - Flow meter range - 100-1,600 milliliters per minute (ml/min)
- Location: treatment building process area
- Manufacturer information: Volume VIII – Attachment 8.3.

Level Transmitters DAF System (LE/LIT-1211for DAF effluent and LE/LIT-1131 for DAF froth) – Figure 3-5

- Model: Multiranger 200
- Characteristics: Calibrated at 0 to 40 ft of water with the level element XPS-15 and 10- meter cable
- Manufacturer: Miltronics
- Location: treatment building
- Manufacturer information: Volume III – Attachment 3.1.

3.3.5 Dissolved Air Flotation System Troubleshooting

For troubleshooting DAF components, refer to Volume III – Attachment 3.1.1 under Maintenance and Parts.

3.3.6 Dissolved Air Flotation Optimization

1. During O&M, adjustments may be necessary for break-out valve DR-03 to allow optimization of the system by changing the recycle flow rate and pressure of the pressurization system. The higher the flow rate, the more air will be required in the system. The higher the pressure, the smaller the bubble size.
2. The rotational speed of the skimmer drive is also a point of optimization. The speed should be high enough to remove the solids after they reach the surface of the water in order to keep the effluent as clean as possible.

3.4 Hydromation Deep Bed Filtration System

This section of the O&M Manual provides a system description, operational description, a description of I&C for the HDBF system, the design criteria for the HDBF system, and troubleshooting procedures. Specific information related to the HDBF system is provided under Section 3.4.4. Figure 3-3 provides the layout of the treatment system and shows the HDBF system located in the treatment building process area. Manufacturer information for the HDBF system is provided under Volume IV of this manual.

3.4.1 Hydromation Deep Bed Filtration System Description

The HDBF system follows the DAF system in the Wyckoff GWTP and precedes the carbon adsorption system. The principal function of the filtration system is to remove suspended solids from DAF system effluent to protect the carbon beds from fouling. Although this filter is designed to remove solids, the system also removes some nonaqueous phase oil (LNAPL and DNAPL) that is not removed by the DAF system. If removal of nonaqueous phase oil becomes excessive, then fouling of the filter is possible. An automatic backwash cycle is incorporated into the HDBF system to remove the buildup of solids in the filter media. The HDBF system and backwash cycle are shown on Figure 3-8 (HDBF System).

HDBF system components include the following:

- Deep bed filter
- Filter feed pumps (2)
- Backwash pumps (2)

Backwash supply water is provided from the effluent tank and is transferred to the filter for backwashing. After completing the backwashing procedure, the cleaned media filter is placed on-line for regular filtration.

The physical location of the HDBF unit is shown in Sheet 48 with details shown in Sheet 54 under Appendix C "Applicable Project Drawings" of Volume I. The locations of the DAF feed pumps and backwash pumps are also shown under Sheet 48.

3.4.2 Hydromation Deep Bed Filtration System Operational Description

The operational description for the HDBF System is as follows:

1. DAF effluent water is pumped through the filter system by filter feed pumps (50P1241 and 50P1242) by opening valves DE-02, 04, 05 and 07 (see Figure 3-7). The second pump 50P1242 (associated valves DE-05 and 07) is installed as redundant, which increases the lifespan of each pump because their use should be cycled. The designation of DE changes to filter influent (pipeline labeled as FI) after the two filter feed pumps (see Figure 3-7).

2. The HDBF operates in five different cycles that are automatically initiated by the PLC system. The sequential order of the cycles following HDBF startup is:

   a. Recirculation cycle
   b. Filtration cycle (with periodic venting)
   c. Backwash cycle
   d. Agitation cycle (part of backwash cycle)
   e. Delay cycle

   After the delay cycle, the filter will return to the recirculation cycle. Each of these cycles is explained in greater detail later in this section.

3. After HDBF startup, the filter should always begin in the recirculation cycle. Verify that the RECIRC cycle indicator light is illuminated on the local control panel or the HMI screen. If the filter does not start in the recirculation cycle, the filter should be immediately shut down and restarted following the steps described later in this section.

4. During the recirculation cycle, filter influent valve AV-1261 and recirculation valve AV-1265 will open. Process water will flow from the top to the bottom of the filter and the filter effluent water will discharge to the dirty backwash tank. After the recirculation cycle times out, the filter will automatically switch to the filtration cycle.

5. During the filtration cycle, filter influent valve AV-1261 remains open and the filter discharge valve (AV-1262) will open. Recirculation valve AV-1265 will close. The process water continues to enter the top of the filter vessel, flows through the media, and discharges from the vessel as filter effluent (pipeline labeled as FE) to carbon adsorbers (see Figure 3-8). The HDBF will operate in the filtration cycle most of the time.

6. After the filter operates in filtration mode for several minutes, the filter vent valve (AV-1266) will open. The filter vent valve cycles open and closed (5 minutes every hour) throughout the rest of the filtration cycle. The vent valve prevents the buildup of air or gas in the vessel. Filter vent valve discharge is directed back to the DAF unit.

7. The filter requires backwashing on a frequent basis. The filter backwash sequence is initiated when the pressure differential level reaches a predetermined pressure setting. The current differential pressure setting across the HDBF that initiates a backwash cycle is 20 psi. In addition to the pressure differential backwash set point, the filtration cycle duration is operator- adjustable and is currently set for a 24-hour cycle before it automatically switches to the backwash cycle mode. From the HDBF screen on the HMI, the operator can adjust the filtration cycle duration. The HDBF screen also provides the operator with the current hours/minutes remaining before the “Next Backwash;” therefore, the operator can predict when the next automatic backwash cycle will initiate. The source for backwashing flow is the effluent tank (Section 3.6) using backwash pumps. As part of initial pre-startup, the discharge valves BWS-04 or BWS-07 associated with the backwash pumps are manually set (throttled) so they provide 75 to 80 gpm flows for backwash operation of the HDBF unit. This valve position will remain constant during normal operation, with the exception of the higher flow requirement for GAC backwash (Section 4.4.4). As the solids loading increases, the resistance to flow also increases. The backwash sequence is initiated by one of the three predetermined events, whichever occurs first: filter reaches the differential pressure set point (20 psi), the filtration timer times out (after 24 hours), or the operator presses the manual backwash button, located on the HDBF local control and the HMI screen.

    a. Once the backwash sequence is initiated, the filter will continue to operate in the filtration cycle configuration for a few minutes. The backwash cycle indicator light will flash on the HDBF local control panel and HMI screen. Filter vent valve AV-1266 will open and will vent the bed for 5 minutes prior to beginning the backwash. After 5 minutes, vent valve AV-1266, filter influent valve AV-1261, and filter effluent valve AV-1262 will close. The filter feed pump will automatically turn off.

    b. The first cycle in the backwash sequence is the agitation cycle. The preset time for the agitation cycle is 1 minute. During the agitation cycle, the backwash pump turns on. The PLC will automatically select either backwash pump 1 or backwash pump 2 based on what pump is selected as the lead pump on the “Plant Effluent” HMI screen. Then backwash supply valve AV-1263 opens while all other valves are closed. The media agitator starts and fully agitates the media bed, turning the vessel volume into a homogeneous slurry. The agitation cycle continues for the preset time to assure that the media bed is fluidized and the captured oil and solids are separated from the media.

c. Once the agitation timer has timed out, the filter continues the backwash cycle for 10 minutes. The agitator continues to agitate and scrub the media and to rotate the backwash scrubber basket. The backwash discharge valve (AV-1264) and the backflow valve (AV-1267) open. During the backwash cycle, liquid flows into the filter vessel through both the filter influent supply valve (AV-1261) and the backflow valve (AV-1267).

d. The process water, which flows through the backflow valve (AV-1267), flows up through the clean discharge screens. The concentrated dirty liquid in the vessel flows out through the slots in the rotating wedge wire scrubber basket and out through the backwash discharge valve (AV-1264). The oil and solids captured in the media bed during the filtration cycle are carried out with the backwash liquid. The backwash flow rate is controlled by the backwash discharge orifice (RO-102) (see Figure 3-8). The backwash discharge orifice creates a back pressure on the filter. The wedge wire slots in the media scrubber basket allow the oil and solids to pass through the backwash screen and out the backwash discharge orifice. The wedge wire slots are sized to prevent the walnut shell media from escaping the closed loop. The process water required during the backwash cycle is filtered water from the effluent tank following the filter and carbon adsorption processes. No dirty backwash water is used.

e. When the backwash cycle timer times out, the delay cycle begins. The backwash supply valve (AV-1263) and the backflow valve (AV-1267) close. The backwash pump turns off. The agitator continues to operate for a period of time after the backwash supply valve (AV-1263) has closed. The backwash scrubber basket must continue to rotate whenever the backwash valve (AV-1263) is open. When the agitator has stopped, the filter media will settle and cover the clean wedge wire discharge plenum. Without this delay, the media would be pulled into the wedge wire slots with sufficient velocity to cause the clean discharge screens to plug.

In summary, the backwash operation steps include the following:

- Backwash source (BWS) from backwash pumps (50P1351 and 50P1352)
- Backwash pump valves throttled to 75 to 80 gpm flow
- BWS enters the bottom of the HBDF unit
- Dirty backwash water comes out of the top of the HBDF unit and enters the dirty backwash tank (Figure 3-11) as backwash effluent (BWE).
  - After the delay cycle has timed out, the recirculation cycle starts again. During the recirculation cycle, the recirculation valve (AV-1265) opens, as does the filter influent supply valve (AV-1261). Filter feed pump 1 or filter feed pump 2, whichever is selected as lead pump on the “DAF Effluent Pumping” HMI screen, will automatically start and water will flow through the filter media bed. The filter bed is set or compressed and any residual dirty liquid in the media bed is transferred back to the dirty backwash tank (40T1440). When the recirculation timer has timed out

after 3 minutes, the recirculation valve (AV-1265) closes, and the clean discharge valve (AV-1262) opens. The filter is again ready for filtration. During this period the backwash effluent valves for the carbon absorbers need to be closed (BWE/FFS-01 to -06).

In addition to the influent flow from the DAF unit, the HDBF unit can receive recycle water from the bypass (BYP) filter influent recycle line from GAC #1, designated as FI/RCY/BYP (cross-reference with Figure 3-9). This line can be used to bypass the carbon bed system and recycle water back to the HDBF influent if needed.

Sampling port SP-3 (V-106 from Filtra Systems manual) is positioned to sample contaminated water from the DAF system prior to entering the HDBF System (see Figure 3-8 and Table 3-1). Sampling port SP-4 (V-105 from Filtra Systems manual) is positioned to sample filtered water from the filter system prior to entering the GAC system (see Figure 3-8 and Table 3-1). Sampling port SP-15 is positioned on the backwash effluent side to determine the clarity of backwash water (see Figure 3-8 and Table 3-1). Figure 3-8 shows the details of the components inside the system.

Filtered effluent water from the HDBF system goes to the GAC system, which is described in Section 3.5.

The following steps provide the detailed sequence necessary to operate the HDBF system. All operation cycles for the HDBF system are automatic and are run by the PLC. Once the operator completes the pre-start procedures, the remaining functions of the HDBF filter are fully automatic.

1) Pre-Start

- **a.** Check that instrument air to the system (85 psi) is on (all valves are closed at this point). All valves are closed when solenoids are de-activated.
- **b.** Place the agitator 217SS selector switch in the AUTO position; otherwise, the filter will not run.
- **c.** The operator verifies whether the HDBF panel disconnect is in the ON position
- **d.** Pull out the master stop button and press master start/fault reset push button 215PB-2 to energize the following:
  - **i.** Master control relay
  - **ii.** Manual controls
  - **iii.** Sensors
  - **iv.** Power on pilot light 216LT is on
- **e.** Clear any faults by pressing the master start/fault reset push button 215PB-2.

The filter will not start if any faults are present.

2) Startup and Run

- **a.** When the agitator 217SS selector switch is in the **AUTO** position:
  - **i.** Filter feed (influent) pump is energized.

ii. Initial recirculation cycle timer (T1).

iii. Filter supply (influent) valve solenoid FV1261 energizes. Filter supply (influent) valve AV1261 opens.

iv. Recirculation (forward flush effluent) valve solenoid FV1265 energizes. Recirculation (forward flush effluent) valve AV1265 opens.

v. Filter running pilot light 264LT is on.

vi. Recirculation cycle pilot light 269LT is on.

b. Initial recirculation cycle timer (T1) times out:

i. Recirculation (forward flush effluent) valve solenoid FV1265 de-energizes

ii. Recirculation (forward flush effluent) valve AV1265 closes.

iii. Recirculation cycle pilot light 269LT de-energizes.

iv. The following are energized:

(1) Filtration cycle minute counter (C1) begins counting minutes.

(2) Filtration vent minute counter (C2) begins counting minutes.

(3) Clean discharge (effluent) valve solenoid FV1262 energizes. Clean discharge (effluent) valve AV1262 opens.

(4) Filter cycle pilot light 265LT is on.

v. All backwash sequence timers are reset.

At this point the filter is now in operation. Filtration continues until a backwash sequence is initiated or the filter is halted for reasons described in Step 8. The filtration flow rate and the recirculation flow rate are to be controlled by the system flow control valve (manual valve). Separate valve set points are to be used when switching between recirculation and filtration. The filtration minute counter (C1) is to be adjustable.

3) Filtration Cycle

a. Filtration vent minute counter (C2) counts out:

i. Vent valve solenoid (FV1266) is energized. Vent valve (AV1266) opens.

ii. Re-vent timer (T2) begins timing.

iii. Filtration vent minute counter (C2) is reset.

b. Re-vent timer (T9) times out:

i. Filtration vent minute counter (C2) begins counting minutes.

ii. Vent valve solenoid (FV1266) is de-energized. Vent valve (AV1266) closes.

The vent valve should be open only during the filtration cycle or the filtration with vent cycle. If the vent valve is open in any other cycle, it is a fault and the unit will shut down until the fault is cleared.

4) Backwash Cycle

a. The filter remains in filtration cycle until one of the following occurs:

i. The differential pressure indicating transmitter (1281) across the filter media bed reaches 20 psi (differential).

ii. The filtration cycle minute counter (C1) counts out.

iii. The operator presses the manual backwash push button (351PB).

b. The filtration with vent cycle is as follows:

i. Filtration cycle pilot light (265LT) energizes.

ii. Filter vent valve solenoid (FV1266) energizes.

(1) Filter vent valve (AV1266) opens.

(2) Backwash cycle pilot light (267LT) flashes during venting.

iii. Filtration with vent delay timer (T2) begins timing.

iv. Filtration with vent delay timer (T2) times out.

v. The filter clean discharge (effluent) valve solenoid (FV1262) is de-energized. The filter clean discharge (effluent) valve (AV1262) closes.

vi. The filter supply (influent) valve solenoid (FV1261) is de-energized.

vii. The filter supply (influent) valve solenoid (AV1261) closes

viii. The filter vent valve solenoid (FV1266) is de-energized.
The filter vent valve (AV1266) closes.

ix. Delay One, filter clean discharge (effluent) valve closed delay timer (T5), starts and times out.

x. Delay cycle pilot light (268LT) is energized.

xi. Backwash cycle pilot light (267LT) energizes.

xii. Filter supply (influent) pump is de-energized and backwash supply is energized.

xiii. Backwash supply valve solenoid (V1263) is energized. Backwash supply valve (AV1263) opens.

During filtration with vent, the filter remains in filtration, processing liquid. The filter discharge (effluent) valve (AV-1262) and the process inlet (influent) valve (AV-1261) remain open and the filter feed (influent) pump remains on.

c. Agitation Cycle

i. Agitation cycle timer (T3) begins timing.

ii. Filtration cycle minute counter (C1) is reset.

iii. Filtration vent minute counter (C2) is reset.

(1) The following are energized:

- **iv.** Agitator motor (M1260) is energized.
- **v.** Delay cycle pilot light (268LT) is de-energized.
- **vi.** Agitation cycle pilot light (266LT) is on.
- **vii.** Agitation cycle timer (T3) times out.

d. Backwash Cycle

- **i.** Backwash cycle timer (T4) begins timing.
- **ii.** Agitation cycle pilot light (266LT) is de-energized.
- **iii.** The following are energized:
  - **(1)** The backflow valve solenoid (FV1267).
  - **(2)** The backflow valve (AV1267) opens.
  - **(3)** The backwash cycle pilot light (267LT).
  - **(4)** Backwash discharge (effluent) valve solenoid (FV1264). Backwash discharge (effluent) valve (AV1264) opens.
- **iv.** Backwash cycle timer (T4) times out.

e. Delay Cycle

- **i.** Delay Two cycle timer (T6) begins timing.
- **ii.** Delay cycle pilot light (268LT) is energized.
- **iii.** Agitator stop delay timer (T7) begins timing.
- **iv.** The following are de-energized:
  - **(1)** Backwash discharge (effluent) valve solenoid (FV1264). Backwash discharge (effluent) valve (AV1264) closes.
  - **(2)** Backwash cycle pilot light (267LT)
  - **(3)** Backflow valve solenoid (FV1267). Backflow valve (AV1267) closes.
- **v.** Agitator stop delay timer (T7, 15 seconds) times out.
- **vi.** Agitator motor (M1260) is de-energized.
- **vii.** Backwash supply valve solenoid (FV1263) is de-energized. The backwash supply valve (AV1263) closes.
- **viii.** Backwash supply pump is de-energized and filter supply is energized.
- **ix.** Delay three cycle timer (T6, 45 seconds) times out.

f. Recirculation Cycle

- **i.** Recirculation cycle timer (T8) begins timing.
- **ii.** Delay cycle pilot light (268LT) is de-energized.
- **iii.** Filter supply (influent) valve solenoid (FV1261) is energized. Filter supply (influent) valve (AV1261) opens.

iv. Recirculation (forward flush effluent) valve solenoid (FV1265) is energized. Recirculation (forward flush effluent) valve (AV1265) opens.

v. Recirculation cycle pilot light (269LT) is energized.

vi. Recirculation cycle timer (T8) times out.

vii. The recirculation timer (T8) is to be adjusted with an initial setting to be 3 minutes.

g. Resume Filtration Cycle

i. Filter operation resumes as described in Step 3 unless filter shutdown (Step 6) has been initiated.

5) Agitator Control

a. The operator places the agitator selector switch (217SS) in the HAND position.

i. The agitator will run but all other functions will be de-activated.

With the agitator in **MANUAL** mode, by using the manual overrides on the solenoids the filter can be temporarily operated in any cycle. The filter should be operated using this method only under emergency conditions with proper supervision.

6) Filter Shutdown

a. When the filter completes a backwash sequence as described in Steps 4.a.i through 4.g.:

i. The operator may push the master stop push button (215PB-1) at the local control panel or the HMI screen, de-energizing the following:

(1) Master control relay

(2) Agitator controls

(3) Sensors

(4) "Power On" pilot light (216LT)

ii. Re-start the filter as described, beginning with Step 1.

The filter should always be backwashed prior to a shutdown. An automatic shutdown function is programmed into the PLC and the filter is automatically backwashed, returned to filtration, and then shut down.

7) Master Stop, Power Interruption, or Filter Fault

a. Master Stop

Push master stop push button (215PB-1).

b. Power Interruption

i. All solenoid valves will de-energize. All valves will close.

ii. The filter PLC will de-energize (the cycle status is retained during a power outage).

c. Major Filter Fault

i. A major filter fault will halt the filter.

ii. The filter PLC will retain the filter cycle status.

iii. All solenoid valves will de-energize. All valves will close.

d. Restarting the Filter

i. After correcting a stop condition, power loss, or filter fault, the operator must manually restart the filter as described, beginning with Step 1.

ii. The filter will restart in the recirculation cycle, and then resume the filtration cycle, as described in Step 4.f.

8) Fault Circuit Operation

a. Fault Conditions Major:

i. Filter agitator motor phase monitor tripped.

ii. Filter agitator motor overload tripped.

iii. Filter feed pump not running.

iv. Backwash pump is not running.

v. If the backwash pump is not running, the media agitator will be stopped, in addition to annunciating the alarm.

b. Fault Circuit Operation:

i. Any of the above-listed faults till energize the "Filter Fault" pilot light.

ii. The filter fault pilot light will remain on until the fault condition is corrected and the master start/fault reset push button 215PB-2 is pressed.

For additional information on startup, operations (including controls), and shutdown, refer to Section 4.0 and sections of the Filtra Systems Manual in Volume IV of this manual.

3.4.3 Hydromation Deep Bed Filtration System I&C

Piping and instrumentation for the HDBF system is depicted schematically on Figure 3-8. This figure is to be used in conjunction with Figures 3-7, 3-9, and 3-10. This system is automated and functions are controlled through the PLC. The following are the I&C steps (refer to PLC screen captures titled "DAF Effluent Pumping" and "Media Filter" in Appendix D):

1. Effluent from the DAF unit is pumped to the HDBF system by one of the two filter feed pumps. When the filter feed pumps are operating in **AUTO** mode, the pump speed is controlled to maintain the liquid level (level transmitter LE/LIT-1211) in the DE tank. Water level in the DE tank is monitored at the PLC and has high-level and low-level alarms. The filter feed pumps can be operated manually by selecting the PID tuning icon from the "DAF System" screen (Appendix D) and pressing **AUTO** until it changes to **MANUAL**. The output (0-100) speed is then selected for the manual pump speed on the

HMI. The operator should closely watch the level in the DAF effluent chamber if operating in manual mode.

2. Influent to and effluent from the filter is controlled by pneumatically actuated valves AV-1261 and AV-1262, respectively (see Figure 3-8).
3. Differential pressure across the filter (DPIT-1281) is displayed on the HMI to determine when backwashing is required. High differential pressure alarm set points are only adjustable through the PLC software system.
4. Filter backwashing cycles are automatic; the operator assures that the backwash pumps are throttled down to 75 to 80 gpm during normal operation of the plant. Refer to Figure 3-10 for the backwash pump location. Backwash flow rate is measured and indicated at the PLC. During HDBF backwashing, the backwash pump starts and stops automatically. A sample tap (SP-16) is provided on the backwash effluent line to allow operators to visually monitor when the water is clean, indicating that backwashing is complete and can be halted. The filter can also be manually backwashed. Backwash operation includes the agitation cycle, backwash cycle, three delay cycles, and the recirculation cycle, as referenced in Figure 3-8.
5. When backwashing is completed, the backwash pump automatically stops and the HDBF valves are reconfigured automatically to place the filter in the normal filtering operating mode.
6. If the equipment is placed in manual operation, no PLC system controls are available. The HDBF can be started from the local control panel on local mode. Manual operation of the HDBF should be closely monitored by operations personnel and is not recommended unless manual operations are crucial and the operator is well-trained on the filter's functionality.

3.4.4 Hydromation Deep Bed Filtration System Design Criteria

The major components of the HDBF system are described in this section along with their specifications, manufacturer, and location within the Wyckoff GWTP.

Hydromation Deep Bed Filtration System 50M1260 – Figure 3-8

- Model: FDB-7P
- Capacity: 207 gallons
- Dimensions: 3-ft diameter x 11 ft high
- Anticipated contents: PCPs, PAHs, O&G and TSS
- Material of Construction: stainless steel 316L
- Filter Media: 12/20 mesh black walnut shells
- Manufacturer: Filtra Systems
- Location: treatment building process area
- Manufacturer Information and As-built Drawings: Volume IV of this O&M Manual. As-built drawings for the HDBF system are provided under Sections 7, 8, 9 and 10.

Filter Feed Pumps (50P1241 and 50P1242) and AFDs (50AFD1241 and 50AFD1242) – Figure 3-7

- Model: Pump – 811S1.5x1-8, Motor – 00736ST3QIE213T
- Capacity/Characteristics:
  - 70 gpm at 158 ft head
  - Motor: 7.5 hp, 460V, 3-phase, 1.15 ft2, 3,600 rpm
- Manufacturer: Griswold/Weg
- Location: treatment building process area
- Manufacturer Information: Volume II of this O&M Manual (Attachment 2.3)
- AFDs: 50AFD1241/1242
- AFD Model: ACH550PC-015A-4, 10 hp, 480V
- Manufacturer: ABB
- Location: treatment building process area
- Manufacturer Information: Volume VIII of this O&M Manual (Attachment 8.2)

Backwash Pumps (50P1351 and 50P1352) – Figure 3-10

- Model: Pump – 811-4x3-10
- Capacity/Characteristics:
  - 330 gpm at 69 ft of head
  - 15 hp, 460V, 3-phase, 1.15 ft2, 1,800 rpm
- Manufacturer: Griswold/Weg
- Location: treatment building process area
- Manufacturer Information: Volume II of this O&M Manual (Attachment 2.4)

Backwash Source Flow Meter (FE-1371) – Figure 3-10

- Model: Optiflux 4000 Series
- Capacity/Characteristics: Optiflux Mag Inductive Flow Meter measures the flow to effluent tank with an operating range of 0 to 625 gpm.
- Manufacturer: Krohne
- Location: treatment building process area
- Manufacturer information: Volume VIII – Attachment 8.1.

3.4.5 Hydromation Deep Bed Filtration System Troubleshooting Procedures

For troubleshooting the HDBF system, refer to Volume IV - Section 5 – Troubleshooting.

3.5 Granular Activated Carbon System

This section provides a system description, operational description, I&C description, the design criteria for the GAC system, and troubleshooting procedures. Specific information related to the GAC system is provided under Section 3.5.7. Figure 3-3 illustrates the layout of the treatment system and shows the GAC system location in the treatment building process area.

3.5.1 Granular Activated Carbon System Description

The GAC system follows the HDBF system in the Wyckoff GWTP and precedes the effluent tank. The GAC system removes aqueous-phase PAHs and PCPs from solution via adsorption. The GAC system may also remove some nonaqueous-phase oil and suspended solids, although this is not its primary function. The DAF and HDBF systems are included in the treatment train to remove these constituents and avoid fouling the GAC. The GAC system is the last treatment process in the sequence; therefore, PAH and PCP levels in the GAC system effluent should be lower than the discharge limits (see Table 1-1). A backwash cycle is incorporated into the GAC system to remove the buildup of solids in the carbon. The GAC system and backwash cycles are shown on Figure 3-9 (GAC System).

GAC system components include five GAC adsorbers, identified as GAC-1, GAC-2, GAC-3, GAC-4, and GAC-5. Backwash supply water is provided from the effluent tank using backwash pumps, and is transferred to the GAC adsorbers.

The physical location of the GAC system is shown in Sheet 48 in Appendix C "Applicable Project Drawings" of Volume I.

3.5.2 Granular Activated Carbon System Operational Description

1. The GAC system (see Figure 3-9) consists of five GAC adsorbers, of which three are in service at any given time and operated in series. The fourth and fifth adsorbers are usually on stand-by. A fourth bed could be placed on line to extend the carbon service time of the first bed, if necessary, as determined by process data results. The first of the three adsorbers is the lead, second is the middle, and the third is the lag adsorber. HDBF effluent (FE) enters the first of the three GAC adsorbers in the system. Operators should use the HMI screen "GAC Filters" to select which bed is in the lead, middle, lag, or off (stand-by) position at any point in time.

2. Piping and valves are installed to allow the different possible sequencing permutations for operating three GAC adsorbers in series. Tables 4-4 a through e provide five combinations for operating any of three GAC adsorbers in series. GAC effluent (labeled as PLE) from the three adsorber system enters the effluent tank as described in Section 3.6.

3. GAC adsorbers may be backwashed occasionally, although backwashing should be minimized and restricted to the active lead GAC adsorber under normal conditions.

4. Backwashing should be performed if the pressure drop across the adsorber becomes too high or when complete breakthrough occurs, in an effort to extend carbon service time, or when an operator is performing a backwash operation on a timed basis. High differential pressure for a single bed is typically considered to be 10 psid. Clean bed differential pressure is typically 1 psid or 4 psid across the entire 3-bed GAC system.

5. This can be determined by using the difference between pressure gauge 1282 (carbon vessel influent pressure) and the lead carbon vessel effluent pressure gauge. It is recommended to backwash the lead adsorber once a month, until operational conditions warrant an increased or reduced frequency. If lower pressure differentials are observed (less than 4 psi), then backwash can be done less frequently. Pressure gauges PE/PI/PT-1311 to PE/PI/PT-1315 record the effluent pressures of each of the individual adsorbers.

The carbon vessels are equipped with a safety rupture disc rated for 80 psi. Pressure in the carbon vessel should not exceed 50 psi when conducting a backwash.

6. Backwashing is also performed after installing new carbon, to remove carbon fines. Details on backwash procedures are provided under Sections 3.5.4 and 4.7.4.

7. Backwash water is provided from the effluent tank (see Figure 3-10) and conveyed by backwash pumps 50P1351 to 50P1352 to the GAC system. Backwash pumps are operated to provide a 600 gpm flow, which is measured by backwash flow meter FE/FIT-1371, for GAC adsorber backwashing (see Figure 3-10). To accomplish this flow rate, both backwash pumps are operated during a carbon system backwash event.

8. Dirty backwash water is discharged to the dirty backwash tank (see Figure 3-11).

Sampling ports SP-05, SP-06, SP-07, SP-08, SP-09, and SP-10 (see Figure 3-9 and Table 3-1) are positioned to sample treated water from each of the five carbon adsorbers and from the common effluent to monitor that contaminant levels are below discharge levels and to determine when carbon change-out is warranted. All GAC system sampling ports are shown on Figure 3-9. Sampling port SP-16 (cross-reference with Figure 3-8) is located on the backwash effluent side to determine the clarity of water and when to shut down backwash operations.

The GAC adsorbers can also receive water directly from the DAF effluent through pipeline FI/BYP (cross-reference with Figure 3-7). This line allows the operator to bypass the HDBF unit if necessary.

Flow from the GAC system goes to the effluent tank, which is described in Section 3.6.

3.5.3 Description of Carbon Change-out Procedures

Carbon will be changed out with uncontaminated water in the adsorber, as described below. Spent carbon saturated with water will be siphoned out of the adsorber into a tank truck located on the decontamination pad, using the methods specified below. Once in the truck, excess water will be drained from the spent carbon using air pressure to accelerate the process. Drained water will be returned either to a tank for treatment (dirty backwash tank [Figure 3-11], or stormwater recycle tank [Figure 3-14]), or to a floor drain (for subsequent treatment). Virgin/re-activated carbon will be conveyed from a truck to the carbon adsorber using the methods described below.

The GAC system will be operated as follows:

1. GAC-1, GAC-2 and GAC-3 vessels will be operated until PAH <u>or</u> PCP removal in the lead bed, GAC-1, is 40 percent. Constituent percent removal will be calculated as [influent concentration minus effluent concentration] divided by [influent concentration].

2. When sampling results show that PAH or PCP removal in GAC-1 is 40% or lower, a fourth bed, GAC-4, should be brought online downstream of GAC-3.

3. Continue operating the adsorber sequence in following order: GAC-1, GAC-2, GAC-3 and GAC-4.

4. When the concentration of PAH is above the detection limit in the GAC-3 effluent, the lead bed, GAC-1, should be placed offline for change-out.
5. The adsorber sequence will be modified so that the former GAC-2 becomes GAC-1, the former GAC-3 becomes GAC-2, and the former GAC-4 becomes GAC-3 in the series.

When contaminant saturation has been identified in an adsorber, the adsorber will be taken offline and isolated from the process stream, as identified in the previous steps. The carbon in the adsorber must then be removed and replaced with fresh carbon. When it is determined that carbon should be removed from an adsorber, the procedure discussed below should be followed.

There are two options to remove the carbon as slurry: one is to use air as the motive force, the other is to use water. Because of piping pressure limitations at Wyckoff, carbon will be transferred using water. If it is planned to be used in the future, the air change-out method is provided under Tigg's O&M Manual in Volume V – Section 7.1.2.1.

For this size adsorber, the container is usually a bulk trailer. The container should have a drain for removing the excess water from the carbon (prior to transportation). To ensure a proper transfer of carbon from the adsorber, it is necessary to isolate the adsorber from the process stream and to close any vent valves. This is required in order to pressurize the adsorber vessel. Valves needed to isolate the adsorbers are listed in Tables 4-5a to 4-5e.

To initiate the carbon transfer process for an adsorber, follow the steps detailed below.

1. Verify availability of water in the effluent tank. The tank should be at full capacity.
2. Prepare for carbon removal by closing all isolation valves and any other sample or flush valve.
3. Check that the settings for both the backwash pumps (50P1351 and 50P1352) and BWS-04 (associated with 50P1351) and BWS-07 (associated with 50P1352) valves are configured and will provide treated water for the routine backwash process (600 gpm for 15 minutes) for that adsorber. One of the valves needs to be completely open and the other valve partially closed to provide the desired 600 gpm flow.
4. Complete a backwash of the adsorber to be backwashed as described in Section 4.4.4. This is a routine 15-minute backwash process; however, the operator should backwash until they feel the carbon bed is sufficiently backwashed so it may remain in standby mode for several weeks or months before the carbon change-out occurs.
5. Complete the following sequence:
    a. Ensure the adsorber is full of water by opening valve CAV-# or CF-#.
    b. Check that the setting on one of the backwash pumps (50P1351 or 50P1352) on the BWS-04 or BWS-07 valves will provide treated water at 100 gpm by partially opening one of the valves and checking the backwash flow meter (FE/FIT-1371).
    c. Open the BWE/FFS-01 and the corresponding 6-inch valve (BWE/FFS-#) for the GAC to be backwashed and push approximately 100 gpm of clean or treated water

through the adsorber. The valve number here is designated as 02 to 06 for adsorbers GAC-1 to GAC-5, respectively, depending on which adsorber is having its spent carbon changed out.

d. A pressure of 10 to 20 psi at this flow rate should transfer the carbon to the bulk trailer. This can be confirmed by reading the effluent pressures at PE/PIT-1311 to PE/PIT-1315.

e. The carbon discharge valves CD-01 to CD-05 will need to be opened after the pressure on the tank has been allowed to build to this level or slightly higher.

f. Carbon will usually be pushed out at a rate of 1 to 3 pounds of carbon per gallon of water; however, there must be continuous flow.

g. Once all the carbon is out of the adsorber, an inspection through the manway may result in a washdown of any hanging carbon and a repeat of this step may be necessary to push the remaining carbon back to the bulk trailer. In addition, the diffuser nozzles should be inspected for any damage or plugging at this time. Inspect the manway gasket to determine if a new gasket is necessary to seal the manway.

h. During the carbon removal process, the bulk trailer will need to be drained at a rate similar to the fill rate of 100 gpm. Usually the draining will require frequent stopping and starting of the feed to the 3-inch discharge line. This stopping and starting can be accomplished by closing the CD-01 to CD-05 valves. When this occurs, the discharge pressure on the backwash pump must be either maintained so as not to rupture the pressure disk, or it must be shut down to avoid over-pressurization.

i. When the carbon removal process is completed, close the carbon discharge valves CD-01 to CD-05 and all the process valves and prepare to add fresh carbon as described below.

Note: After completing steps 1 through 5, a portion of the spent carbon could still remain in the bottom head; therefore, open the manway to inspect the adsorber. Depending on the quantity and location of the carbon, it may be necessary to use a hose to wash it into the bottom of the head and/or repeat the above backwashing/air pressure steps after closing the manway.

The following procedure should be used to transfer fresh carbon from a truck trailer into an adsorber after the spent carbon is removed.

1. Fresh carbon will arrive in bulk trailers, each containing 10,000 pounds of carbon to fill of two adsorbers. Each truck will have to be filled with water prior to transferring carbon into the adsorber.

2. The quantity of water required for 10,000 pounds of dry, fresh carbon is approximately 5,500 gallons, and the amount for wet reactivated carbon is approximately 4,300 gallons.

3. Most trucks are not designed as American Society of Mechanical Engineers (ASME) code pressure adsorbers; therefore, an air supply of 100 scfm and a relatively low pressure of

approximately 15 psig will be required as the motive force for the carbon transfer. Typically, the carbon change-out vendor provides air and hoses that come with the truck, or a plant air line will be required to be connected to the bulk trailer.

4. When the truck arrives, 3-inch hoses should be connected to the carbon inlet line on the adsorber to be filled (valves CF-01 to CF-05, see Figure 3-9).
5. During the carbon fill process, air within the adsorber needs to be vented as the carbon slurry is introduced. To vent the adsorber during fill operations, open vent valves GAC1-V01 to GAC5-V01.
6. **WARNING - Venting must occur for efficient transfer of GAC from the bulk trailer to the adsorber**. However, the FRP piping associated with the GAC adsorbers can handle only 10 psi maximum pressure. Care should be taken to be sure that proper venting takes place during transfer of carbon to the adsorber.
7. As the end of the carbon transfer nears, it may be necessary to vent excess water from the adsorber. Water discharged from the vent valve (GAC1-V01 to GAC5-V01) should be directed to the appropriate treatment area for processing. This water will drain to the building trench drain and to the decontamination pad sump, and eventually to the tank farm containment sump.

The following two actions must have taken place prior to placing an adsorber online:

1. The carbon particles have been classified/segregated (Section 3.5.4).
2. All of the air has been removed from the carbon pores (Section 3.5.5).

If these steps are not completed, premature breakthrough of the contaminants can occur and thus there may be poor utilization of the carbon.

3.5.4 Description of Backwashing to Segregate Carbon Procedures

The carbon should always be segregated by backwashing in each bed prior to the adsorbers being placed online. This is done in order to segregate the carbon particles, loosening them up and lifting the bed. Backwashing reverses water flow through the carbon bed to remove sediment and to fluff the carbon. This is important so that the carbon particles will always return to their same relative position in the bed after each backwashing operation. If the bed is not segregated, the carbon particles will change position and the adsorption zone (where adsorption is occurring) will be disturbed, resulting in channeling, turbulence, poor utilization of the carbon, and early breakthrough of organics.

Initial backwashing (after a carbon change-out) should be performed at a rate of 600 gpm for 45 minutes, using water from the effluent tank. Refer to the steps under Section 4.4.4 for backwash operational procedures.

Subsequent to backwashing, the system is ready to be de-aerated/pre-wetted as described in Section 3.5.5. This is performed only on adsorbers after a carbon change-out and not during a regular backwash operation.

3.5.5 De-aerating and Pre-wetting Procedures

As discussed previously, it is necessary to be sure that the carbon bed is properly de-aerated prior to placing the unit in service. This ensures proper flow through the bed to eliminate channeling, reduce pressure drop, and prevent premature breakthrough. This is performed only after a carbon change-out and a 45-minute backwash is performed, not after a routine 15-minute backwash.

A bed of carbon consists of the following:

- Void volume - 40%
- Pore volume - 40%
- Carbon skeleton - 20%

A relatively long time is required for water to enter the pores and displace the air, because the pores in dry carbon are filled with air and some adsorbed oxygen. Approximately 90 percent of the pores may be filled with water after 24 hours at an ambient temperature of 70 degrees Fahrenheit (° F). In order to have the carbon pre-wetted, the adsorber should remain filled with water for at least 24 to 48 hours with the carbon fill line open (CF-01 to CF-05), which is located in the front of the adsorber and runs up the side and empties into the top). Refer to Tigg's as-built drawings showing locations of the carbon fill lines (Section 2 in Volume V). Having this valve open will permit trapped air to escape. Air can be in trapped within the carbon, so in order to remove all the trapped air the bed should be backwashed for 10 to 15 minutes after the carbon is pre-wetted, prior to being placed online. The backwash cycle should be repeated after 2 or 3 days of operation in order to remove any remaining air that has collected in the bed.

3.5.6 Granular Activated Carbon System Instrumentation and Controls

Piping and instrumentation for the GAC system is depicted schematically on Figure 3-9. The following are the I&C steps to follow (refer to PLC screen captures titled "GAC filters" in Appendix D):

1. HDBF effluent water (FE) is pumped to the GAC system by the filter feed pumps (after passing through the HDBF).

2. Differential pressure across the active carbon adsorbers is monitored manually to determine when backwashing is required. Pressures can be read locally on the pressure gauges on the effluent of each GAC adsorber or on the HMI screen labeled "GAC Filters." High differential pressure between adsorbers is an indication for performing a backwash operation. High differential pressure for a single bed is typically considered to be 10 psid. Clean bed differential pressure is typically 1 psid, or 4 psid across the entire three-bed GAC system.

3. Backwashing is a manual operation. The entire plant is shut down (refer to Section 4.4.4) while backwashing the GAC adsorbers. The operator will set manual valves to configure flow for backwashing and manually start the backwash pumps. Refer to Figures 3-8, 3-9, and 3-10. The backwash flow rate is measured continuously at FE/FIT-1371 and indicated at the HMI. The HMI is used to allow the backwash pumps to be stopped

automatically on a timed basis (15 minutes for routine backwash and 45 minutes for backwash after carbon change-out).

4. When backwashing is completed, the operator will stop the backwash pumps and manually reconfigure the valves to place the carbon adsorber back in normal service operation.
5. Carbon change-out is a manual operation. The operator will set manual valves to take the spent bed offline and configure the new flow sequence through the three active adsorbers. Exchange of spent and fresh carbon will be manual.

3.5.7 Granular Activated Carbon System Design Criteria

The following chart lists the GAC system performance criteria.

GAC System Performance Criteria

Parameter	Design Influent (ppb)	Effluent
Total PAHs	7,000	Less than 1 ppb
PCP	300	Less than 0.1 ppb
Oil and Grease	10	Less than 1 ppm

NOTES:
PAH – polycyclic aromatic hydrocarbons
PCP = pentachlorophenol
ppb = parts per billion
ppm = parts per million

The major components of the GAC system are the GAC adsorbers, which are described in this section along with their specifications, manufacturer, and location within the Wyckoff GWTP.

Granular Activated Carbon-50M1301, 50M1302, 50M1303, 50M1304 and 50M1305 Adsorbers (Figure 3-9)

- Dimensions: 8 ft diameter x 7.5 ft bed height
- Capacity: 10,000 pounds of GAC
- Empty Adsorber Weight: 4,655 pounds
- Material of Construction: carbon steel – epoxy/polyurethane-lined
- Head Type: 2:1 Elliptical ASME
- Carbon Type: Tigg 5DR 0830
- Manufacturer: Tigg Corporation
- Estimated carbon life: 30 days to breakthrough per adsorber
- Location: treatment building process area
- Manufacturer Information and As-built Drawings: Volume V of this O&M Manual. GAC as-built drawings are located under Section 2.0.

Backwash Pumps (50P1351 and 50P1352) – Figure 3-10

- Model: Pump – 811-4x3-10
- Capacity/Characteristics:
  - 330 gpm at 69 ft of head

  - o 15 hp, 460V, 3-phase, 1.15 ft^2, 1,800 rpm
- – Manufacturer: Griswold/Weg
- – Location: treatment building process area
- – Manufacturer Information: Volume II of this O&M Manual (Attachment 2.4)

Backwash Source Flow Meter (FE-1371) – Figure 3-10

- – Model: Optiflux 4000 Series
- – Capacity/Characteristics: Optiflux Mag Inductive Flow Meter measures the flow to effluent tank with an operating range of 0 to 625 gpm.
- – Manufacturer: Krohne
- – Location: treatment building process area
- – Manufacturer information: Volume VIII – Attachment 8.1.

Refer to Section 3.12.4 for manufacturer information on GAC pressure transmitters, elements, and switches.

3.5.8 Granular Activated Carbon System Troubleshooting Procedures

For troubleshooting the GAC system, refer to Volume V - Section 4.9 – Troubleshooting.

3.6 Effluent Storage System

This section of the O&M Manual provides a system description, operational description, I&C description, and the design criteria for the effluent storage system. Specific information related to the effluent system is provided in Section 3.6.4. Figure 3-3 illustrates the layout of the treatment system and shows the effluent system location in the tank farm with the exception of the backwash pumps, which are located in the treatment building process area. Manufacturer information for effluent system equipment is provided in Section 3.6.4.

3.6.1 Effluent Storage System Description

The effluent tank follows the GAC system in the Wyckoff GWTP. A sampling station in the form of a composite sampler is located after the effluent tank to collect final effluent samples. Treated water in the effluent tank is discharged to the outfall by gravity flow. Weekly composite samples are taken to confirm that the discharged water meets the discharge requirements. Water stored in the effluent tank is used to backwash the HDBF and GAC systems. The effluent storage system is highlighted on Figure 3-10.

3.6.2 Effluent Storage System Operational Description

1. GAC system effluent (labeled as PLE – Figures 3-9 and 3-10) is pumped to the effluent tank.

2. Flow to the effluent tank is monitored by plant effluent flow meter FE/FIT-1321 (Figure 3-10 and Table 3-3).

3. The effluent tank discharges by overflow so the tank remains full except when stored effluent is being used for backwashing.

4. Backwash flow is monitored using backwash flow meter FE/FIT-1371 (Figure 3-10 and Table 3-3). The water level in the effluent tank is monitored by level transmitter LE/LIT-1331 (Figure 3-10 and Table 3-3).
5. Isolation valve PLE-09 is manually opened to allow treated water from carbon adsorbers to enter the effluent tank. Valve PLE-11 is manually opened to allow treated water to discharge to the Eagle Harbor Outfall by gravity flow (limits are identified in Table 1-1).
6. Final effluent samples are collected as required by the discharge limit criteria (24-hour composite samples and grab samples via opening valve PLE-12).
7. Effluent tank influent and backwash flows are monitored continuously. Final effluent flow to the outfall is determined as the difference between the two measured flows (on a daily average basis).
8. Backwash operations using backwash pumps 50P1351 and 1352 are performed by opening valves BWS-01, BWS-02, BWS-04, BWS-05 and BWS-07.

Sampling port SP-10 (Figure 3-9 and Table 3-1) is located prior to the effluent tank (Figure 3-9) immediately after water from the GAC system is treated. Sample port SP-11 (Figure 3-10 and Table 3-1) is located on the effluent line after the effluent tank to sample treated water using the composite sampler. All effluent storage system sampling ports, flow meters, and level transmitters are shown on Figures 3-9 and 3-10.

The physical location of the effluent tank is shown in Sheet 49 with details shown in Sheets 55 and 59 in Appendix C "Applicable Project Drawings" of Volume I.

Flow from the effluent system discharges to the Eagle Harbor Outfall.

The 6-inch-diameter FRP pipeline on the effluent tank connects to the existing 6-inch-diameter ductile iron pipeline on the east side of the site near the sheetpile wall. The DI pipeline terminates at the outfall. The 6-inch FRP pipeline is connected to the 6-inch ductile iron pipeline through a 6-inch-diameter ductile iron flanged spool.

The effluent pipeline is shown on Figure 3-15.

3.6.3 Effluent Storage System Instrumentation and Controls

The piping and instrumentation for effluent storage and pumping is depicted schematically on Figure 3-10. The following are the I&C steps to follow (refer to PLC screen captures titled "Plant Effluent" in Appendix D):

1. The liquid level (measured by LE/LIT-1331) in the effluent tank is monitored and alarmed by PLC. The PLC monitors for effluent tank high level (**HI-HI** and **HI**) and low level (**LO-LO** and **LO**) alarms. **HI-HI** alarms will cause a phone dialer operator call-out and a **LO-LO** alarm will shut down or prevent startup of the backwash pumps.
2. Flow rates for effluent tank influent and backwash flows are monitored by the PLC with flow meters FE/FIT-1321 (plant effluent) and FE/FIT-1371 (backwash source), respectively.

3.6.4 Effluent Storage System Design Criteria

The major components of the effluent storage system are described in this section along with their specifications, manufacturer, and location within the Wyckoff GWTP.

Effluent Tank (40T1330) – Figure 3-10

- Dimensions: 16 ft feet diameter x 22 ft high
- Material of Construction: FRP
- Manufacturer: Ershigs
- Capacity: 33,090 gallons
- Location: tank farm
- Manufacturer Information: Volume VI of this O&M Manual

Composite Sampler (50M1335) – Figure 3-10

- Manufacturer/Model: ISCO 3710FR
- Dimensions: 47 inches x 26 inches x 26 inches
- Accessories: Software and Controller
- Weight: 170 pounds
- Location: tank farm (next to effluent tank)
- Manufacturer Information: Volume VII of this O&M Manual (Attachment 7.7)

Backwash Pumps (50P1351 and 50P1352) – Figure 3-10

- Model: Pump – 811-4x3-10
- Capacity/Characteristics:
  - 330 gpm at 69 ft of head
  - 15 hp, 460V, 3-phase, 1.15 ft^2, 1,800 rpm
- Manufacturer: Griswold/Weg
- Location: treatment building process area
- Manufacturer Information: Volume II of this O&M Manual (Attachment 2.4)

Plant Effluent Flow Meter (FE-1321) – Figure 3-10

- Model: Optiflux 4000 Series
- Capacity/Characteristics: Optiflux Mag Inductive Flow Meter measures the flow to EQ tank with 2-inch Teflon lining and an operating range of 0 to 100 gpm.
- Manufacturer: Krohne
- Location: tank farm
- Manufacturer information: Volume VIII – Attachment 8.1.

Backwash Source Flow Meter (FE-1371) – Figure 3-10

- Model: Optiflux 4000 Series
- Capacity/Characteristics: Optiflux Mag Inductive Flow Meter measures the flow to the effluent tank with an operating range of 0 to 625 gpm.
- Manufacturer: Krohne
- Location: treatment building process area
- Manufacturer information: Volume VIII – Attachment 8.1.

Level Transmitter Effluent Tank (LE/LIT-1331) – Figure 3-10

- Model: Hydroranger 200
- Characteristics: Calibrated at 0 to 40 ft of water with the level element XPS-15 and 10-m cable
- Manufacturer: Miltronics
- Location: tank farm
- Manufacturer information: Volume VIII – Attachment 8.1.

3.7 Solids Processing System

This section of the O&M Manual provides a system description, operational description, I&C description, and the design criteria for the Solid Processing system. Specific information related to the solids processing system is provided under Section 3.7.4. Figure 3-3 illustrates the layout of the treatment system and shows the solids processing system located in the tank farm with the exception of the backwash recycle pump, which is located in the treatment building process area, and the rotary blower, which is located in the treatment building nonprocess area. Manufacturer information for solids processing system equipment is provided in Section 3.7.4.

3.7.1 Solids Processing System Description

The first function of the solids processing system is to separate solids from the backwash effluent water. Clarified backwash water (supernatant) is recycled to the EQ tank. Settled backwash solids are transferred to the digester tank and then aerobically digested. The solids processing system is shown on Figure 3-11.

Solids processing system components include the following:

- Dirty backwash tank
- Backwash recycle pump
- Digester tank
- Digester and skim pump
- Digester sludge mixers
- Filter press feed tanks (2)
- Rotary blower

The physical location of the dirty backwash tank and digester tank is shown in Sheet 49 with details shown in Sheet 56 under Appendix C "Applicable Project Drawings" of Volume I. The location of the backwash recycle pump and rotary blower is shown in Sheet 48 and the filter press feed tanks in Sheet 49.

3.7.2 Solids Processing System Operational Description

1. Used backwash water from the HDBF (Figure 3-8) and GAC system (Figures 3-8 and 3-9) pipelines, both labeled as BWE/FFE, is pumped to the dirty backwash tank (40T1440) by the backwash pumps (cross-reference to Figure 3-10).

2. Occasionally, the dirty backwash tank also receives water from the containment area sump when it contains relatively high solids. Otherwise, the sump discharges are

directed to the stormwater/recycle tank. The level in the dirty backwash tank is monitored using level transmitter LE/LIT-1441, as specified in Figure 3-11.

3. After allowing the solids to settle in the dirty backwash tank, supernatant backwash recycle (labeled as BWR) is pumped by the backwash recycle pump 50P1461 to the EQ tank for treatment or, alternately, to the stormwater recycle tank for temporary storage by opening valves BWR-01 to BWR-03 and BWR-05 to BWR-07. Manual valve BWR-01 on the side of the dirty backwash tank is used to set the supernatant draw-off point.

4. After sufficient solids have accumulated in the cone bottom of the dirty backwash tank, and after supernatant has been decanted, the solids (labeled as TS) are pumped to the digester tank (40T1420) using the filter press/digester feed pump (50P1460) with valves configured to bypass the filter press, and by opening valves TS-01 and TS-02.

5. Low pressure air (labeled as ALP) from the rotary blower through the inline silencer (cross-reference with Figures 3-11 and 3-12) is discharged into the digester tank where solids undergo aerobic digestion in the cone-bottom digester tank using the valves ALP-01 through ALP-07. Aeration of this tank is performed to biodegrade organic material associated with the solids so they are adequately stabilized for storage in drums for disposal. A coarse-bubble aeration system installed in the lower cone bottom section of the digester tank operates to maintain aerobic conditions and also mixes the tank contents. The digester air pressure blower provides positive displacement through an AFD, and delivers a designed volume up to the designated pressure at which to overcome the water levels present in the system.

6. After the solids are sufficiently digested, a portion of the solids is withdrawn from the bottom of the digester tank for dewatering by opening valves DS-01 through DS- 03. Sufficient digestion is defined as a 30 percent reduction in volatile suspended solids (VSS) as tested once a week. The level in the digester tank is monitored using level transmitter LE/LIT-1421, as shown in Figure 3-11.

7. Solids are pumped from the bottom of the digester tank (labeled as DS) by the digester/ skim pump (50P1120) and discharged into the filter press feed tanks using valves DS-05 and DS-06.

8. The operator should measure the pH of the solids solution in the filter press feed tanks. If the pH is less than 11, dry quicklime (calcium oxide) is added to the sludge in the filter press feed tanks (40T1431 or 40T1432) and mixed using impeller-type mixers (40M1431 or 40M1432). Lime is added to the solids to enhance dewatering and stabilize the sludge. The operator will add lime in quantities until the pH reads 11in the filter press feed tank.

Solids from filter press feed tanks are processed using the filter press system described in Section 3.8.

In addition to transferring solids mixture from the digester tank to the filter press feed tanks, the digester/skim pump is also used to convey nonaqueous phase liquid removed from the EQ tank to the oil processing system (as described in Section 3.9 – Figures 3-4 and 3-13).

Sampling port SP-17 (Figure 3-11 and Table 3-1) is positioned to facilitate sampling of backwash recycle from the dirty backwash tank prior to recycling to the EQ tank and stormwater recycle tank. Levels in the dirty backwash tank and the digester tank are monitored by level transmitters LE/LIT-1441 and LE/LIT-1421, respectively, as shown in Figure 3-11 and Table 3-3. Sampling port SP-17 and level transmitters 1441 and 1421 are shown on Figure 3-11, Solids Processing System I&C.

Piping and instrumentation for the solids processing system is depicted schematically on Figures 3-11 and 3-12. The following are the I&C procedures for this system (refer to PLC screen captures titled "Digester Tank" and "Dirty Backwash Tank" under Appendix D):

1. BWR-02 (FCV-1451 – Figure 3-11) is a pneumatic valve located on the dirty backwash tank outlet that relays to the HMI showing **OPEN/CLOSE** status. This is a **FAIL CLOSE** valve and can be opened/closed from the HMI. This valve can also be operated in the manual mode by first closing the instrument air supply to the valve, setting the slot handle into the slot, and opening the valve manually. If the valve needs to be operated from the HMI again, close the valve, set the slot in its upright position, check the availability of instrument air, and then open the valve from the HMI.
2. The rotary blower (ALP system – Figure 3-12) is controlled through a **LOCAL/ REMOTE/STOP** switch located on the blower control panel. The blower is operated manually by the operator by pressing the **LOCAL** option, and operated from HMI by placing it in **REMOTE**. The panel is built with an AFD that controls the speed of the blower.
3. A relief valve is located in the blower bottom that relieves pressure at 12 psi.
4. A pressure transducer is incorporated into the system that is connected to the PLC for monitoring.
5. The blower discharge pressure is set at 5 psi.
6. Decanting the dirty backwash tank, transferring settled solids from the dirty backwash tank to the digester tank, and transferring digested solids from the digester tank to the filter press feed tank(s) are all manual operations. Transferring settled and digested solids is performed through air-operated diaphragm pumps, a digester/skim pump, and a filter press/digester feed pump, all of which require high-pressure air (AHP) that is available through regulators located in the tank farm using valves AI-04, AHP-16, and AHP-17.
7. Liquid levels in the dirty backwash tank (measured by LE/LIT-1441) and digester tank (LE/LIT-1421) are monitored by the PLC and have high (**HI-HI** and **HI**) and low level (**LO-LO** and **LO**) alarms. A **HI-HI** level will send a phone dialer call-out alarm and a **LO-LO** level in the dirty backwash tank will disable the backwash recycle pump.
8. The digester sludge mixers associated with the filter press feed tanks are controlled manually through a start and stop control using LCSs 40LCS1431 and 40LCS1432, respectively.
9. The backwash recycle pump can be operated from the HMI by setting the LCS (50LCS1461) in the **REM** position. The backwash recycle pump can also be operated manually by setting the LCS in the **LOCAL** position and pressing the **START** button.

3.7.3 Solids Processing System Design Criteria

The major components of the solids processing system are described in this section along with their specifications, manufacturer, and location within the Wyckoff GWTP.

Dirty Backwash Tank (40T1440) – Figure 3-11

- Dimensions: 18-ft diameter x 14 ft high
- Capacity: 32,360 gallons
- Anticipated contents: PCPs, PAHs, O&G and TDS
- Material of Construction: FRP
- Manufacturer: Ershigs
- Location: tank farm
- Manufacturer Information and As-built drawing: Volume VI of this O&M Manual

Backwash Recycle Pump (50P1461) – Figure 3-11

- Model: Pump – 811-3x2-6
- Capacity/Characteristics:
  - 115 gpm at 28 ft of head
  - 2 hp, 460V, 3-phase, 1.15 ft^2, 1,800 rpm
- Manufacturer: Griswold/Weg
- Location: treatment building process area
- Manufacturer Information: Volume II of this O&M Manual (Attachment 2.6)

Digester Tank (40T1420) – Figure 3-11

- Dimensions: 10-ft diameter x 23.5 ft high
- Capacity: 8,790 gallons
- Anticipated contents: PCPs, PAHs, O&G and TDS
- Material of Construction: FRP
- Manufacturer: Ershigs
- Location: tank farm
- Manufacturer Information: Volume VI of this O&M Manual

Digester Skim Pump (50P1120) – Figure 3-11

- Model: AOD3
- Capacity/Characteristics: 230 gpm at 125 psig maximum air inlet pressure
- Mechanism: air-operated diaphragm
- Manufacturer: Price Pump
- Location: tank farm
- Manufacturer Information: Volume II (Attachment 2.11) of this O&M Manual

Filter Press/Digester Feed Pump (50P1460) – Figure 3-11

- Model: AOD1.5
- Capacity/Characteristics: 75 gpm at 125 psig maximum air inlet pressure
- Mechanism: air-operated diaphragm
- Manufacturer: Price Pump

- Location: tank farm
- Manufacturer Information: Volume II of this O&M Manual (Attachment 2.12)

Filter Press Feed Tanks (40T1431 and 40T1432) – Figure 3-11

- Dimensions: 4-ft diameter x 4 ft high
- Capacity: 350 gallons
- Anticipated contents: primarily O&G and TDS
- Material of Construction: open top fiberglass tank
- Manufacturer: Raven
- Location: tank farm
- Manufacturer Information: Volume VII of this O&M Manual (Attachment 7.9)

Digester Sludge Mixers (40M1431 and 40M1432) – Figure 3-11

- Model: Neptune 2.0 mixer with Leeson motor
- Capacity/Characteristics: 0.75 hp, 230V, 1,750 rpm
- Manufacturer: Neptune
- Location: inside the two filter press feed tanks located in the tank farm
- Manufacturer Information: Volume VII of this O&M Manual (Attachment 7.1)

Rotary Blower (50M1551) – Figure 3-12

- Model: 32-URAI
- Capacity/Characteristics:
  - 100 scfm at 93/50F and 3,357 rpm
  - Motor: 7.5 hp, 460V, 3,600 rpm, inverter duty
- Inlet and Discharge Pressures: 14.7 psig and 10 psig
- Blower Manufacturer: Roots Blower
- Motor Manufacturer: Toshiba
- Local Control Panel: 50LCP1551
- Location: treatment building nonprocess area
- Manufacturer Information: Volume VII of this O&M Manual (Attachment 7.3)

Level Transmitters Digester Tank (LE/LIT-1421) and Dirty Backwash Tank (LE/LIT-1441) – Figure 3-11

- Model: Hydroranger 200
- Characteristics: calibrated at 0 to 40 ft of water with the level element XPS-15 and 10-m cable
- Manufacturer: Miltronics
- Location: tank farm
- Manufacturer information: Volume VIII – Attachment 8.1.

3.8 Filter Press System

This section provides a system description, operational description, I&C description, and the design criteria for the filter press system. Specific information related to the filter press system is provided under Section 3.8.4. Figure 3-3 is the layout of the treatment system and shows the filter press system located in the tank farm with the exception of the filter press, which is located inside the treatment building process area. Manufacturer information for filter press system equipment is provided in Section 3.8.4.

3.8.1 Filter Press System Description

The filter press system transfers amended sludge to the filter press, dewaters the sludge, neutralizes the filtrate, and recycles the filtrate to the dirty backwash tank or storm- water recycle tank through the containment sump. The filter press system is shown on Figure 3-12.

Filter press system components include the following:

- Filter press feed pump
- Filter press
- Filtrate tank
- Filtrate/product disposal pump

The physical location of the filter press is shown in Sheet 48 in Appendix C "Applicable Project Drawings" in Volume I. The location of the filtrate tank is shown in Sheet 49.

3.8.2 Filter Press System Operational Description

The operational description of the filter press system is as follows:

1. After the lime and sludge are well-mixed and the filter press is prepared, the sludge mixture is pumped by the filter press/digester feed pump (50P1460) to the filter press (Figures 3-11 and 3-12), and the filter press run is initiated. Solids from the filter press feed tanks (labeled as SS) are sent to the filter press by operating valves SS-01, SS-02, SS-03, TS/SS-01, and AHP-16, and by using the filter press/digester feed pump.
2. The dewatering run continues until the filter press/digester feed pump reaches a maximum discharge pressure, indicating that dewatering is completed. At that time, the filter press feed pump is turned off.
3. During the press run, filtrate water (labeled as F) pressed from the solids is discharged by gravity flow to the filtrate tank.
4. After completion of the press run, the filter press plates are separated and the filter cake that is removed from the press falls through a chute into the collection bin (55-gallon drum).
5. The filtrate pH is manually adjusted to near-neutral in the filtrate tank by adding sodium bisulfite, then mixed with an impeller-type mixer (50M1480). The pH is measured with a hand-held meter.
6. The neutralized filtrate is pumped from the filtrate tank by the filtrate/product disposal pump (50P1490) to the containment sump using AHP through valve regulator AHP-17.
7. Alternately, the neutralized filtrate can be discharged via a flexible hose to the process floor drain and ultimately returned to the EQ tank for treatment. The filtrate/product disposal pump is used for two functions: the one described above, and for transferring

oil from the product tank to a tank truck for disposal. Both these functions occur infrequently.

3.8.3 Filter Press System Instrumentation and Controls

Piping and instrumentation for the filter press system is depicted schematically on Figure 3-12.

The controls on the filter press include one switch, which is an on/off and open/close level switch to open/close plates. All filter press system operations are manual, batch processes.

3.8.4 Filter Press System Design Criteria

The major components of the filter press system are described in this section along with their specifications, manufacturer, and location within the Wyckoff GWTP.

Filter Press/Digester Feed Pump (50P1460) – Figure 3-11

- Model: AOD1.5
- Capacity/Characteristics:75 gpm at 125 psig maximum air inlet pressure
- Mechanism: air-operated diaphragm
- Manufacturer: Price Pump
- Location: tank farm
- Manufacturer Information: Volume II of this O&M Manual (Attachment 2.12)

Filter Press (50M1470) – Figure 3-12

- Dimensions: 12 ft by 3.5 ft by 5.1 ft
- Capacity: 10 cubic ft, 35-60% of cake (dry weight solids)
- Number of Chambers: 1 head, 19 intermediate and 1 tail
- Filter cake thickness: 1.25 inches
- Plate weight: 53 pounds
- Plate size: 800 millimeters (mm)
- Shipping weight: 5,000 pounds
- Manufacturer: Alantes Chemical Systems
- Location: treatment building process area
- Manufacturer Information: Volume VII of this O&M Manual (Attachment 7.8)

Filtrate Tank (50T1480) – Figure 3-12

- Dimensions: 4-ft diameter x 4 ft high
- Capacity: 350 gallons
- Anticipated contents: primarily O&G and TDS
- Material of Construction: open top fiberglass tank
- Manufacturer: Raven
- Location: tank farm
- Manufacturer Information: Volume VII of this O&M Manual (Attachment 7.10)

Digester Sludge Mixer (50M1480) – Figure 3-12

- Model: 1.0 mixer with Leeson motor
- Capacity/Characteristics: Motor: 0.5 hp, 230V, 1,750 rpm

– Location: inside the filtrate tank located in the tank farm
– Manufacturer Information: Volume VII of this O&M Manual (Attachment 7.1)

Filtrate/Product Disposal Pump (50P1490) – Figure 3-11

– Model: P400
– Capacity/Characteristics:20 gpm at 28 ft of head
– Mechanism: air-operated diaphragm
– Manufacturer: Wilden
– Location: treatment building/tank farm
– Manufacturer Information: Volume II of this O&M Manual (Attachment 2.9).

3.9 Oil Processing System

This section of the O&M Manual provides a system description, operational description, I&C description, and the design criteria for the oil processing system. Manufacturer information related to the oil processing system is provided in Section 3.9.4. Figure 3-3 is the layout of the treatment system showing the oil processing system located in the treatment building process area with the exception of the product tank and the digester/skim pump, which are located in the tank farm.

3.9.1 Oil Processing System Description

The oil processing system separates, manages, and removes NAPLs from groundwater by the DAF system, skimming/decanting in the EQ tank, and froth pumps from DAF operation. The oil processing system is shown on Figure 3-13.

Oil processing system components include the following:

- Froth tank
- Decant pumps (2)
- Oil pump
- Product tank
- Froth pumps (2)
- Digester/skim pump
- Filtrate/product disposal pump

The physical location of the froth tank is shown in Sheet 48 with details shown in Sheet 63 in Appendix C "Applicable Project Drawings" in Volume I. The location of the decant pumps and froth pumps is shown in Sheet 48 and the product tank in Sheet 49.

3.9.2 Oil Processing System Operational Description

The oil processing system operation is as follows:

1. Oily froth and sludge from the DAF unit (Figure 3-5) is pumped to the froth tank (Figure 3-13) (labeled as FRI) by one of the two froth pumps (50P1251 and 50P1252) as shown in Figure 3-7. The operator will need to open valves FRI-01 through FRI-04 and FRI-06 through FRI-08, and FRI-10. Use DAF tank valve FRI-01 to remove froth and valve FRI-02 to remove sludge. Valves FRI-03, FRI-04, and FRI-06 isolate froth pump 50P1251, and valves FRI-07, FRI-08, and FRI-10 isolate froth pump 50P1252. The pumps

should be cycled often to increase their life span. These pumps operate on a set timer (for example, 60 minutes) with pump speeds set locally to a range of 8 to 10.5 percent stroke length.

2. LNAPL, DNAPL, and solids skimmed from the EQ tank that accumulate in the EQ skim sump (operation described under Section 3.2 and Figure 3-4) are pumped either directly to the product tank (using isolation valve NAPL-06) or to the froth tank (using isolation valve NAPL-05) by the digester/skim pump (50P1120). Both the product tank and the froth tank are shown in Figure 3-13. This process line is labeled as NAPL. The digester/skim pump (50P1120) uses high-pressure air through valve AHP-15 to pump contents either to the product tank (40T1400) or to the froth tank (50T1380) by opening valves NAPL-03 and NAPL-04. If the fluid is predominantly oil, it should be pumped directly to the product tank using valve NAPL-06. If the fluid contains an appreciable amount of water, it should be pumped to the froth tank using valve NAPL-05 for further separation.

3. The froth tank increases contact time and surface area to release air from the froth generated by the DAF system. The froth tank is a three-compartment tank designed to trap LNAPL and DNAPL. The compartments are formed by an overflow weir, an underflow weir, and a final overflow weir to control water level in the first two compartments of the tank. DNAPL is trapped in the first compartment, and LNAPL is trapped in the second compartment.

4. Periodically, NAPLs are drawn off from these compartments using oil pump 50P1410, which conveys them to the product tank as shown in Figure 3-13 using valves NAPL-07 through NAPL-12. The oil pump uses high-pressure air with the opening of valve AHP-18.

5. The product tank provides oil storage and further phase separation. The tank has outlets at multiple depths to allow decanting of separated water.

6. Decanted water from the product tank is discharged by gravity to the containment area sump (and recycled back to the EQ tank for treatment) by opening overflow (OF) valves OF/DC-1 through OF/DC-7. Periodically, oil from the product tank is transferred to a tanker truck for disposal by operating valve NAPL-13. This is accomplished using either the filtrate/product disposal pump (50P1490) or by a vacuum pump provided with the tank truck.

7. Froth tank effluent water (labeled as FRE) is recycled from the third compartment of the froth tank back to the EQ tank by the two decant pumps 50P1391 and 1392 (associated valves FRE-01, FRE-03, FRE-04 and FRE-06) as shown in Figure 3-13. These decant pumps are typically operated on **AUTO** controlled by the AFDs through the level transmitter (LIT-1381) mounted on the froth tank. The liquid level in the third compartment is monitored and used to control the speed of the decant pump. The operator can select the froth tank level set point to use for decant pump control. Level in the froth tank is measured using level transmitter LE/LIT-1381. The decant pumps can also be run in manual operation. Manual operations should be closely monitored by the operator because the froth tank third compartment is relatively small and the compartment can quickly be emptied, which would cause the pumps to run dry.

The filtrate/product disposal pump is also used to transfer filtrate generated by the filter press during sludge dewatering to the containment sump as described in Section 3.8. The digester/skim pump is described in Section 3.7 because it is also used to periodically transfer digested solids from the digester tank to the filter press feed tank(s) for dewatering.

Sampling port SP-12 (refer to Figure 3-7 and Table 3-1) is provided for sampling the froth from DE. Sampling port SP-13 (Figure 3-13 and Table 3-1) is positioned to sample FRE (decant water) from the froth tank prior to recycling to the EQ tank. Sampling port SP-14 (Figure 3-13 and Table 3-1) is positioned to sample product NAPL from the froth tank prior to its entry into the product tank.

3.9.3 Oil Processing System I&C

Piping and instrumentation for the oil processing system is depicted schematically on Figure 3-13 and described as follows (refer to PLC screen captures titled "Froth Tank" in Appendix D):

1. The liquid level in the overflow (third) compartment of the froth tank (measured by level transmitter LE/LIT-1381) is monitored through the PLC and used to control the speed of the decant pumps. A level indicator on the froth tank controls the decant pumps. Decant pumps are operated on **AUTO** by AFDs through the level transmitter (LIT-1381) set point in the froth tank. There are **LO-LO**, **LO**, **HI** and **HI-HI** alarms associated with the froth tank. The **LO** and **HI** alarms are displayed in the HMI alarm screen. The **HI-HI** alarm will be displayed on the HMI alarm screen and will also signal the phone dialer system for an emergency operator. The **LO-LO** alarm is interlocked to shut down the decant pumps and will be displayed on the HMI alarm screen.

2. All other operations described in this section are manual, including transferring LNAPL and DNAPL from the froth tank to the product tank via the oil pump, decanting water from the product tank, transferring oil from the product tank to a tanker truck, and transferring NAPLs from EQ skim sump to froth or product tanks.

3. The oil, digester/skim, and filtrate/product disposal pumps are air diaphragm pumps controlled manually by varying air pressure using the air pressure regulator located on the AHP line at the tank farm.

3.9.4 Oil Processing System Design Criteria

The major components of the oil processing system are provided in this section along with their specifications, manufacturer, and location within the Wyckoff GWTP.

Froth Tank (50T1380) – Figure 3-13

- Dimensions: 4 ft wide x 13 ft long x 6 ft high
- Capacity: 2,330 gallons
- Anticipated contents: PCPs, PAHs, O&G and TDS
- Material of Construction: FRP
- Manufacturer: Ershigs
- Location: treatment building process area
- Manufacturer Information and As-built drawing: Volume VI of this O&M Manual

Decant Pumps (50P1391 and 50P1392) and AFDs (50AFD1391 and 50AFD 1392) – Figure 3-13

- Model: Pump – 811LF1.5x1-8, Motor – 00118ST3QIE143T
- Capacity/Characteristics:
  - 10 gpm at 29 ft of head
  - Motor: 0.75 hp, 460V, 3-phase, 1.15 ft^2, 1,800 rpm
- Manufacturer: Griswold/Weg
- Location: treatment building process area
- Manufacturer Information: Volume II of this O&M Manual (Attachment 2.5)

AFDs: 50AFD1391/1392
AFD Model: ACH550PC-03A3-4, 1 hp, 480V
Manufacturer: ABB
Location: treatment building process area
Manufacturer Information: Volume VIII of this O&M Manual (Attachment 8.2)

Oil Pump (50P1410) – Figure 3-13

- Model: P400
- Capacity/Characteristics:
  - 15 gpm at 11 ft of head
- Mechanism: air-operated diaphragm
- Manufacturer: Wilden
- Location: treatment building process area
- Manufacturer Information: Volume II of this O&M Manual (Attachment 2.9).

Product Tank (40T1400) – Figure 3-13

- Dimensions: 10 ft wide x 29 ft long
- Capacity: 8,315 gallons
- Anticipated contents: PCPs, PAHs, O&G and TDS
- Material of Construction: carbon steel with epoxy lining with FRP cover lid
- Manufacturer: Selway Corporation; tank and cover lid – Ershigs
- Location: tank farm
- Manufacturer Information: Volume VII of this O&M Manual (Attachment 7.11)

Filtrate/Product Disposal Pump (50P1490) – Figure 3-13

- Model: P400
- Capacity/Characteristics: 20 gpm at 28 ft of head
- Mechanism: air-operated diaphragm
- Manufacturer: Wilden
- Location: treatment building/tank farm
- Manufacturer Information: Volume II of this O&M Manual (Attachment 2.9).

Froth Pumps (50P1251 and 50P1252) – Figure 3-7

- Model: Milroyal C
- Capacity/Characteristics:
  - 780 gph at 75 psig discharge pressure

   - Motor: Baldor/Reliance VEM3558/P56X-1536 - 2 hp, 460V, 3-phase, 1.15 ft2, 725 rpm
- Manufacturer: Milton Roy
- Location: treatment building process area
- Manufacturer Information: Volume II of this O&M Manual (Attachment 2.1)

Digester Skim Pump (50P1120) – Figure 3-4

- Model: AOD3
- Capacity/Characteristics: 230 gpm at 125 psig maximum air inlet pressure
- Mechanism: air-operated diaphragm
- Manufacturer: Price Pump
- Location: tank farm
- Manufacturer Information: Volume II (Attachment 2.11) of this O&M Manual

Level Transmitter Froth Tank (LE/LIT-1381) – Figure 3-13

- Model: Hydroranger 200
- Characteristics: Calibrated at 0 to 40 ft of water with the level element XPS-15 and 10-m cable
- Manufacturer: Miltronics
- Location: treatment building process area
- Manufacturer information: Volume VIII – Attachment 8.1.

3.10 Containment Area and Sump

This section of the O&M Manual provides a system description, operational description, I&C description, and the design criteria for the Containment Area and Sump. Specific information related to the containment area and sump system is provided under Section 3.10.4. Figure 3-3 is the layout of the treatment system and shows the containment area system located in the tank farm with the exception of the stormwater recycle pump, which is located in the treatment building process area.

3.10.1 Containment Area and Sump Description

Containment pads are provided for outdoor tank equipment (tank farm containment pad) and for a truck decontamination area (decontamination pad) at the Wyckoff GWTP. The containment pads contain and collect stormwater, decontamination water, and spills. Secondary containment is provided for the outdoor process tanks and equipment. The tank farm containment pad provides secondary containment for the tanks and process equipment located in the outdoor containment area. The decontamination pad/sump provides containment and collection of water from truck decontamination, washdown water from spills during truck loading/unloading, and water from spills/washdown water in the treatment building. Stormwater and decontamination water are collected at a combined containment area sump.

The Stormwater recycle tank primarily stores stormwater from outdoor containment areas. This tank can also provide temporary storage of filter backwash water before it is pumped back to the EQ tank for treatment in conjunction with influent groundwater. Any water transferred to the Stormwater recycle tank should be relatively clean (that is, solids removed, since this tank does not have a cone-bottom). Backwash water with high solids content should be first transferred to the cone-bottom dirty backwash tank to settle the solids. The containment area and sump are shown on Figure 3-14.

Containment area and sump components include the following:

- Tank farm containment pad
- Containment area sump
- Containment area sump pumps (2) with control panel
- Decon pad
- Stormwater recycle tank
- Stormwater recycle pump

The physical location of the stormwater recycle tank is shown in Sheet 49 with details shown in Sheet 58 in Appendix C “Applicable Project Drawings” in Volume I. The location of the sump pumps is shown in Sheet 49, the stormwater recycle pump in Sheet 48.

3.10.2 Containment Area and Sump Operational Description

1. Water from stormwater runoff and washdown water from both the tank farm containment and decon pads, plus washwater and spills from the treatment building, discharge by gravity flow (labeled as STW) to the containment area sump (Figure 3-14).

2. Valves STW-01 and STW-02 are opened to discharge the water from the existing decontamination pad and the tank farm containment pad. Both the containment area sump pumps shown in Figure 3-14 (40P1501 - associated valve STW-04, and 40P1502 - associated valve STW-06) should be cycled in order to increase the overall life of each pump. The sump pumps should typically be operated in **AUTO** mode and will turn on and off based on the water level inside the containment area sump.

3. The sump pumps transfer water from the containment area sump to either the stormwater recycle tank or the dirty backwash tank (Figure 3-11) for treatment.

4. Water that is relatively free of solids is directed to the stormwater recycle tank with open/close of the STW-07 valve.

5. Water containing relatively high solids is directed to the dirty backwash tank (cross-reference with Figure 3-11) by open/close of the STW-08 valve.

6. The sump pumps are mounted on rails to facilitate removal and maintenance. Washdown water inside the treatment building is collected in trench drains and conveyed to the containment area sump. A backflow prevention device (weighted flap valve) is installed to prevent backflow into the building if a tank fails in the tank containment pad area.

7. The water level in the stormwater recycle tank should be maintained as low as possible to maximize the available storage capacity, and is measured using level transmitter LE/LIT-1521 (Figure 3-14 and Table 3-3).

8. Clarified backwash water can be pumped from the dirty backwash tank to the stormwater recycle tank when necessary, but normally it is returned directly to the EQ tank.
9. The stormwater recycle pump 50P1541 shown in Figure 3-14 (associated valves STW-10 and STW-12) pumps water from the stormwater recycle tank back to the EQ tank for treatment (cross-reference with Figure 3-4).
10. Pneumatic valve STW-09 controls the flows from the stormwater/recycle pump and directs them to the EQ tank.
11. A leak monitoring system is installed for underground FRP double-walled containment pipes that connect process equipment between the treatment building and the tank farm. The system is installed for 12 different double-walled containment pipes and valves (through stainless steel pipe connected to the double-walled pipe) installed above the sump. These 12 valves need to be open at all times. It is recommended that the operators visually check once a week for any water leaking out of the stainless steel pipes.

Sampling port SP-18 (Figure 3-14 and Table 3-1) is located to sample effluent from the storm- water recycle tank prior to recycling to the EQ tank.

3.10.3 Containment Area and Sump I&C

Piping and instrumentation for the containment area and sump are shown on Figure 3-14. Directions for using the I&C include (refer to PLC screen captures titled "Stormwater/Recycle Tank Containment Area" in Appendix D):

1. The sump pump control panel (40LCP1500) has a breaker that is set to the **ON** position. The panel also has two separate switches for pump #1 and pump #2 with options for auto/off/hand. The sump pumps are normally placed in **AUTO** position. The pumps can be operated in manual or auto mode. In auto, these pumps work off of float switches. Once the water level reaches the **HI** level float, one pump automatically turns on and at the **HI-HI** float the second pump turns on. Similarly, when the water level reaches the **LO** level float switch, one pump turns off and when water reaches the **LO-LO** switch the second pump turns off.
2. STW-09 (FCV-1531 – Figure 3-14) is a pneumatic valve located on the stormwater recycle tank outlet that relays to the HMI showing open/close status. This is a **FAIL CLOSE** valve and can be opened/closed from the HMI. This valve can also be operated in the manual mode by first closing the instrument air supply to the valve, setting the slot handle into the slot, and opening the valve manually. If the valve needs to be operated from the HMI again, close the valve, set the slot in its upright position, be sure instrument air is available, and then open the valve from the HMI.
3. The stormwater/recycle pump can be operated from the HMI by setting the LCS 50LCS1541 in the **REM** position. The stormwater recycle pump can also be operated manually by setting the LCS in the **LOCAL** position and pressing the **START** button.
4. Liquid levels in the stormwater recycle tank (measured by LE/LIT-1521) are monitored by the PLC and have high level (**HI-HI** and **HI**) and low level (**LO-LO** and **LO**) alarms. The **HI-HI** alarm will be displayed on the HMI alarm screen and will also signal the

phone dialer system for an emergency operator. The **LO-LO** alarm will be displayed on the HMI alarm screen and is interlocked to prohibit operation of the stormwater recycle pump.

3.10.4 Containment Area and Sump Design Criteria

The major components of the containment area and sump are described in this section along with their specifications, manufacturer, and location within the Wyckoff GWTP.

Containment Area Sump (Figures 3-4, 3-10, 3-11, 3-12, 3-13, and 3-14)

- Dimensions: 4 ft long x 70 ft wide x 5.7 ft high
- Capacity: 11,880 gallons
- Location: tank farm

Sump Pumps (40P1501 and 40P1502) – Figure 3-14

- Model: NP3102X-643
- Capacity/Characteristics:
  - 215 gpm at 35 ft of head
  - Motor: 5 hp, 460V, 3-phase, 1,800 rpm
- Manufacturer: Flygt/Triangle Pump
- Control Panel: 40LCP1500
- Location: tank farm
- Manufacturer Information: Volume II of this O&M Manual (Attachment 2.2)

Stormwater Recycle Tank 40T1520 – Figure 3-14

- Dimensions: 13 ft diameter x 18 ft high
- Capacity: 17,870 gallons
- Anticipated contents: stormwater and filter backwash water
- Material of Construction: FRP
- Manufacturer: Ershigs
- Location: tank farm
- Manufacturer Information and As-built drawing: Volume VI of this O&M Manual

Stormwater Recycle Pump (50P1541) – Figure 3-14

- Model: Pump – 811-3x1.5-6
- Capacity/Characteristics:
  - 70 gpm at 26 ft of head
  - Motor: 1 hp, 460V, 3-phase, 1.15 ft2, 1,800 rpm
- Manufacturer: Griswold/Weg
- Location: treatment building process area
- Manufacturer Information: Volume II of this O&M Manual (Attachment 2.7)

Level Transmitter Stormwater Recycle Tank (LE/LIT-1521) – Figure 3-14

- Model: Hydroranger 200
- Characteristics: Calibrated at 0 to 40 ft of water with the level element XPS-15 and 10-m cable

- Manufacturer: Miltronics
- Location: tank farm
- Manufacturer information: Volume VIII – Attachment 8.1.

3.11 Plant Air and Water Systems

This section of the O&M Manual provides a system and operational description, I&C description, and the design criteria for the plant air and water systems. Manufacturer information in Volume VII includes the air receiver, air compressors, and air dryer. Manufacturer information on the plant water systems is described under "Non-Process Equipment" in Volume IX. Specific information related to this section is provided in Section 3.11.23. Figure 3-3 is the layout of the treatment system and shows the plant water and air systems located in the treatment building process and nonprocess area locations, respectively, with the exception of the air receiver, plant water storage tank, and W-2 well water pump, which are located outside and to the west of the treatment building.

3.11.1 Plant Air and Water Systems and Operations Description

The following two sections describe the compressed air and water supply requirements integral to the overall operation of the GWTP. The air compressors are located in the mechanical room of the treatment building as shown in Sheet 69 in Appendix C "Applicable Project Drawings" in Volume I. The plant water system is located in the west end of the process area as shown in Sheets 33 and 69.

3.11.1.1 Plant Air System

Two air systems, AHP and instrument air (AI), provide air for plant operations. The air for both systems is provided by air compressors 50M1651 and 50M1652. The compressors have a capacity of approximately 80 scfm at 120 psig. The two air compressors are located in the process mechanical room, and are piped for parallel operation but typically operate individually to provide the required air flow for plant operations. Compressor system #1 and compressor system #2 can each supply sufficient air for both the instrument air system and the plant process air system. The two compressor systems can be isolated by valve AHP-05. Typically, valve AHP-05 is left in the open position and only one compressor is powered up. Each compressor operates automatically based on the compressor discharge pressure. The compressors can load and unload at an adjustable pressure setting. Currently, system#1 (50M1651) loads at 115 psi and unloads at 120 psi and system #2 (50M1652) loads at 110 psi and unloads at 120 psi. The compressed air flows through a particulate filter before providing AHP to air receiver 50T1465, which provides storage volume of the AHP for use in the plant.

AHP air is used by the DAF system for saturated air and turbidity meter panel purging using isolation valve AHP-09), by the HDBF system to operate pneumatic valves, and by the air diaphragm pumps (oil pump, filtrate product disposal pump, digester/skim pump and filter press/digester feed pump) during solids and oil processing and filter press operations. Quick-connect fittings for the AHP system are located in the tank farm and treatment building. The operator can tap into these to operate the air diaphragm pumps and for general plant air uses. AHP-19, located at the south-west end of the treatment building, isolates valves AHP-15, AHP-16 and AHP-17 for operating the digester/skim pump and the filter press/digester feed pump. AHP-15, AHP-16, and AHP-17 valve locations have mounted pressure regulators to assist with operation of these pumps.

The process equipment high-pressure air demand set points are:

1. DAF air saturation system: 110 psi
2. Hydromation deep bed filter pneumatic valves: 85 psi
3. Filter press blowdown system: 60 psi
4. Filter press plate spreader: 110 psi
5. Air diaphragm pumps: 120 psi

Instrument air (AI) is derived from air compressor system discharge air that is then passed through a refrigerant air dryer (removes moisture in the compressed air to a minus 40-pressure dew point) followed by a particulate filter. The AI supply can be isolated by valves AI-01 (located in the mechanical room) and AI-04 (located in the south wall of the treatment building by the decant pumps). The instrument air system pressure can be read from a pressure regulator by valve AI-04. The tank farm pneumatic valves are DI-01 (FV1021), BWR-02 (FV1451), and STW-09 (FV1531), located on the discharge from the EQ tank (40T1010), dirty backwash tank (40T1440), and storm- water recycle tank (40T1520), respectively. In addition, AI is used to operate the hydraulic pump for the filter press (50M1470) through the isolation valve AI-02, and to operate pneumatic pumps in the extraction well field through regulator and isolation valve AI-03.

The process equipment instrument air demand set points are:

1. Tank farm pneumatic isolation valves: 62 psi
2. Filter press hydraulic pump: 110 psi
3. Hammerhead pumps: 45 psi (this can be increased or decreased depending on the required pumping rate needed for the hammerhead pump).

Valves AHP-02, AHP-04, AHP-05, AHP-06, and AHP-20 serve primarily as isolation valves for the air compressors and air receiver when transferring air to process equipment. AHP-05 isolates instrument air from process air and must remain open for either compressor to provide both instrument and process air. The valve is typically operated in the closed position.

The air compressor system is shown in Figure 3-6 and Figure 3-12 and is cross-referenced to system operations requiring compressed air in Figures 3-4, 3-5, 3-8, 3-11, 3-12, 3-13, and 3-14.

3.11.1.2 Plant Water Supply System

This section describes the plant's potable and non-potable water supply systems.

Potable Water Systems

Potable water provided by the City through an 8-inch line enters the building through a 2-inch line. A flow meter located outside the gate to the building meters the water usage. A backflow preventer (50BFP05) is located after the flow meter. An annual inspection of the backflow preventer and flow meter is required by a certified technician.

Potable water supply is used for general potable use inside the building (sinks, bathrooms, shower), to feed the electric water heater located in the mechanical room, and for safety equipment such as eye washes and emergency showers.

Nonpotable Water Systems

The nonpotable water supply system (Figure 3-6) consists of a water well (W2) equipped with a submersible pump and an existing 4-inch-diameter buried pipeline from the well to the GWTP building. The source of W2 water is from a well located outside the site fence inside a pump house located to the west of the site. Well W2 is 815 feet deep with 16-inch-diameter casing set to a depth of 420 feet. A 4-inch-diameter drop pipe conveys water from the submersible pump to the surface. The site's deep well submersible pump operates based on demand controlled by an ultrasonic level transducer in water storage tank 50T1570.

The water storage tank (50T1570), pressure tank (50T1575) and water pumps (50P1581 and 50P1582) are used to provide nonpotable water to the process system, including supply to the polymer system, process pump mechanical seals, and washdown water for the tank farm and process building. The pressure tank provides pressurized bladder storage for the water process system. The well pump is controlled by a level control system in the water storage tank. The tank level and water pressure can be monitored at the HMI. Plant water is pumped by the W-2 plant water pumps into the plant water system and into the plant water pressure tank.

Operation of the water pumps is controlled by a pressure switch located at the pump discharge that controls the on and off setting of the pumps with two selector switches: **PUMP1/PUMP2** and **HAND/OFF/AUTO**. This pressure switch is connected to an LCS located at the southwest corner of the treatment building.

3.11.2 Plant Air and Water Systems I&C

Following are the steps for control of the nonpotable water system (refer to PLC screen captures titled "Plant Water" and "Plant Air") in Appendix D):

1. The level switch LSHL-1570 on the plant water storage tank controls the W2 nonpotable well water from the W2 well. The level is calibrated so that a low level alarm is triggered at 25 percent tank height and a high level alarm is triggered at 75 percent of the tank height. The well pump turns on at 25 percent (3-foot tank height – low level) and turns off at 75% percent (7-foot tank height – high level). These low and high set points are operator adjustable.
2. The pressure switch on the discharge of the two plant water pumps controls the on and off setting of the pumps. These are set at 50 psi for pump on and 65 psi for pump off.
3. Flow switch 1620 on the W2 line (next to the polymer system) from the plant water pumps ensures flow of water to the polymer blend tank while it is mixing.
4. The PLC monitors the system for water pressure from a pressure gauge (PI/PE/PT-1591).

3.11.3 Plant Air and Water Systems Design Criteria

The major components of ancillary equipment are described in this section along with their specifications, manufacturer, and location within the Wyckoff GWTP.

3.11.3.1 Plant Air System

Air Compressors (50M1651 and 50M1652) – Figure 3-6

- Model: 20D
- Capacity/Characteristics: 125 psig at 80 scfm
- Motor: 20 hp, 460V, 3-phase
- Conditions: Temperature 155˚F, 50M1651 loads at 115 psig, unloads at 125 psig, 50M1652 loads at 110 psig and unloads at 120 psig, oil differential pressure – 0 psi and separator differential pressure – 5 psig
- Manufacturer for compressor: Sullivan Palatek
- Location: treatment building nonprocess area mechanical room
- Manufacturer Information: Volume VII (Attachment 7.5) of this O&M Manual

Air Dryer Model: ICE 100
Capacity/Characteristics: Dew point set at 34˚F and ice demand at 37˚F
Manufacturer: Motivair
Location: treatment building nonprocess area mechanical room
Manufacturer Information: Volume VII (Attachment 7.6) of this O&M Manual

Air Receiver (50T1465) – Figure 3-12

- Capacity/Characteristics: 3,000 gallons/165 psig at 400˚F
- Dimensions: 66 inches outer diameter x 214 inches long
- Weight: 7,000 lbs
- Manufacturer: Manchester Tank
- Location: outside, west of treatment building
- Manufacturer Information: Volume VII (Attachment 7.2) of this O&M Manual

Air Pressure Regulators

- Regulator for AI-03 valve – Model R180-12 located in treatment building by north wall, made by Master Pneumatics with pressure range of 0-150 psig
- Regulator for AHP-17 valve – Model 1500 series located in the tank farm by north wall, made by ARO Ingersoll Rand with pressure range of 0-160 psig
- Regulator for AHP-16 valve – Model 1500 series located in the tank farm by north wall, made by ARO Ingersoll Rand with pressure range of 0-160 psig
- Regulator for AHP-15 valve – Model 1500 series located in the tank farm by south wall, made by ARO Ingersoll Rand with pressure range of 0-160 psig
- Regulator for AI-04 valve – Model 67CFR-239 located in treatment building by south wall, made by Fisher controls with maximum pressure of 250 psig

Air Particulate Filters

- Filter between AHP-10 and 11 valves – Model HN2L-6QUG located in treatment building by DAF recirculation system made by Parker Filtration with maximum flow of 83 scfm
- Filter discharge of air compressors – Model 6B279-L07 located in treatment building mechanical room made by Wilkerson Corporation with maximum pressure of 150 psig
- Filter discharge of air dryer – Model F-28 Series located in treatment building mechanical room made by Wilkerson Corporation with maximum flow of 149.8 scfm
- Filter at turbidimeter – Model R-12 Series located in treatment building made by Wilkerson Corporation with maximum flow of 40 scfm
- Filter spare for treatment building – Model R-18 Series made by Wilkerson Corporation with maximum flow of 97 scfm

3.11.3.2 Plant Water Supply System

Water Well Submersible Pump – Figure 3-6

- Model Number: 6-T15-200
- Capacity/Characteristics: Design flowrate: 225 gpm at 200 ft total dynamic head (TDH)
- Motor: 15 hp
- Manufacturer: Berkley
- Location: well W2 (outside, south of treatment building)

Water Storage Tank (50T1570) – Figure 3-6

- Dimensions: 61 inches outer diameter x 141 inches overall height
- Capacity: 1,500 gallons
- Manufacturer: Poly Processing
- Location: outside, west of treatment building
- Manufacturer Information: Volume IX (Attachment 9.1) of this O&M Manual

Plant Water Pressure Tank (50T1575) – Figure 3-6

- Model: WX-456-C
- Capacity/Characteristics: 422 gallons/ASME rated, 125 psig
- Dimensions: 4 ft diameter x 6.75 ft high
- Manufacturer: Amtrol
- Location: treatment building process area
- Manufacturer Information: Volume IX (Attachment 9.2) of this O&M Manual

Water Transfer Pumps (50P1581 and 50P1582) – Figure 3-6

- Model: VM06B Series
- Capacity/Characteristics: 88 gpm at 112 ft TDH with maximum pressure at 48 psig
- Manufacturer: Taco Pumps
- Location: inside treatment building, west end of treatment building process area
- Manufacturer Information: Volume IX (Attachment 9.3) of this O&M Manual

Electric Water Heater WH-1

- Model: DVE-250
- Capacity/Characteristics: 250 gallons/ ASME 150 psig rated, 60 kilowatts (kW), 480V
- Dimensions: 93 inches x 36 inches x 43 inches, vertical orientation
- Manufacturer: A.O. Smith
- Location: treatment building nonprocess area
- Manufacturer Information: Volume IX (Attachment 9.4) of this O&M Manual

Domestic Hot Water Circulating Pump (HWCP-01)

- Model: LR-15BWR
- Characteristics: 5 gpm at 10 ft TDH, 150 psig/225˚F, 125 watts (W), and 2,950 rpm
- Hot water Circulating Pump Manufacturer: Bell-Gossett

Expansion Tank

- Model: ST-30V-C
- Capacity/ Characteristics: 14 gallons/150 psig/2,000˚F
- Manufacturer: Amtrol
- Location: treatment building nonprocess area
- Manufacturer Information: Volume IX (Attachment 9.4) of this O&M Manual

3.12 Control System Equipment

Following is a list of major control equipment and instrumentation used in the treatment system. Manufacturer information and operation procedures on the control panel and instrumentation are provided in Volume VIII, Attachment 8.1. Table 3-12 is the panel to the equipment crosswalk that illustrates how wires are installed from panels to equipment.

3.12.1 Design Criteria for Process Control Panel (50CP1001)

- Model: A727218FSD for enclosure and A72P72F1 for the back panel
- Dimensions: 72 inches wide by 72 inches by 18 inches deep
- Material Type: NEMA-12 enclosure
- Manufacturer: Hoffman
- Location: treatment building process area

3.12.2 Design Criteria for Programmable Logic Controller (50PLC1001)

- Model: 1769-L35E
- Capacity: 64 megabyte (MB) nonvolatile memory
- Manufacturer: Allen Bradley
- Location: treatment building process area

The PLC software used to run the treatment plant is RS Logix 5000 with an RS View 32 HMI screen.

3.12.3 Design Criteria and Operation for Human Machine Interface

- Model: 6155-NPXPH
- Capacity: 40 gigabyte (GB) drive
- Manufacturer: Allen Bradley
- Location: treatment building control room

The control room is equipped with a desktop HMI and a work station, and a network switch that allows communication to the PLC in the process area.

The operator can perform the following operations from the HMI:

- Select which pump will turn on as the lead pump for the pump pairs (DAF feed pumps, filter feed pumps, backwash pumps and decant pumps). The lead pump of the pair will start by default, such as during a HDBF automatic backwash, because pumps cycle during the backwash cycle and filtration cycle.
- Operate pneumatic valve (DI-01) from the HMI for **OPEN/CLOSE** functionality. This valve is located between the EQ tank and DAF feed pumps.
- Operate DAF feed pumps 50P1101 and 50P1102 using the **START/STOP** button and select either (a) auto mode based on the EQ tank water level set point, or (b) manual mode and the pump output speed from the HMI when the pump AFD is in **AUTO** mode.
- Operate the DAF auger and recirculation pump (50P1135) using the **START/STOP** button when the units are placed in the **REM** position at the local DAF control panel (50LCP1121).
- Operate filter feed pumps 50P1241 and 50P1242 using the **START/STOP** button and select either (a) auto mode based on the DAF effluent tank water level set point, or (b) manual mode and the pump output speed from the HMI when the pump AFD is in **AUTO** mode.
- Shut down the HDBF unit automatically using the **STOP** button.
- Complete an automatic backwash of the HDBF unit without operator intervention, based on a timed filtration cycle or high differential pressure. A forced HDBF backwash occurs when the operator selects the **BACKWASH** button on the HMI.
- Adjust the HDBF filtration cycle run time.
- Operate the backwash pumps (50P1351 and 50P1352) through LCSs 50LCS1351 and 50LCS1352, respectively, based on a set time of operation. This operation can also be performed from the HMI when the LCS is placed in the **REM** position.
- Operate froth pumps 50P1251 and 50P1252 through LCSs 50LCS1251 and 50LCS1252, respectively, based on a set time of operation. This operation can be performed from the HMI when the LCS is placed in the **REM** position.
- Operate pneumatic valve BWR-02 from the HMI for **OPEN/CLOSE** functionality. This valve is located between the dirty backwash tank and the backwash recycle pump.

- Operate backwash recycle pump 50P1461 through LCS 50LCS1461. This operation can be performed from the HMI when the LCS is placed in the **REM** position.
- Operate rotary blower 50M1551, which is equipped with an AFD operated from the HMI in **REM** mode through LCP 50LCP1551.
- Operate decant pumps 50P1391 and 50P1392 with AFDs 13911 and 1392, respectively, with speed, run, and auto controls for transferring decant water from froth tank 50T1380. Control the decant pumps using the **START/STOP** button and select either (a) auto mode based on the froth tank water level set point, or (b) manual mode and the pump output speed from the HMI when the pump AFD is in **AUTO**.
- Operate pneumatic valve STW-09 from the HMI for **OPEN/CLOSE** functionality. This valve is located between the stormwater recycle tank and the stormwater/recycle pump.
- Operate stormwater recycle pump 50P1541 through LCS 50LCS1541. This operation can be performed from the HMI when the LCS is placed in the **REM** position.
- Adjust the desired DAF polymer dosage amount, the polymer concentration in the blend tank, and the specific gravity of the neat polymer.

In addition, the operator can monitor the following from the HMI:

- Flow rates of plant influent and DAF influent as registered in flow meters FE/FIT-1009 and FE/FIT-1010, respectively
- Status of which DAF feed pumps are in operation (50P1101 or 1102), operating mode (auto/manual), pump speed, pump operating set point, and corresponding run time hours
- Pneumatic valve DI-01 status (opened/closed)
- EQ tank level status as registered in LE/LIT-1011
- Status of DAF skimmer, mixer, recirculation pump and auger
- Flow rate of recirculation system as registered in flow meter FE/FIT-1137
- DAF froth level (1131) and effluent chamber (1211) level status as registered in LE/LIT-1131 and LE/LIT-1211.
- Status of which filter feed pumps are in operation (50P1241 or 1242), operating mode (auto/manual), pump speed, pump operating set point, and corresponding run time hours.
- Status of whether the froth pumps are in operation (50P1251 or 1252), and corresponding run time hours.
- Value of turbidity as registered in turbidimeter AE/AIT-1245.
- DAF effluent pressure reading (PE/PI/PT-1310).

- HDBF status for power, filtration, backwash, agitation, delay, recirculation, fault, and tripped, valves FV1261, FV1262, FV1263, FV1264, FV1265, FV1266 and FV1281, respectively
- HDBF remaining time for current filtration cycle
- HDBF pressure readings DPIT-1281 and PIT-1282
- GAC pressure readings PE/PI/PT-1311 to PE/PI/PT-1315
- Status of which GAC adsorber is in the off, lead, mid and lag configuration
- Flow rate of GAC effluent water as registered in flow meter FE/FIT-1321
- Effluent tank level status as registered in LE/LIT-1331
- Status of whether the backwash pumps (50P1351 or 50P1352) are in operation, and corresponding run time hours.
- Flow rate of backwash source as registered in flow meter FE/FIT-1371
- Froth tank level status as registered in LE/LIT-1381
- Status of which decant pumps are in operation (50P1391 or 1392), operating mode (auto/manual), pump speed, pump operating set point, and corresponding run time hours
- Digester tank level status as registered in LE/LIT-1421
- Blower pressure reading (PIT-1555)
- Blower status (**ON/OFF**)
- Dirty backwash tank level status as registered in LE/LIT-1441
- Pneumatic valve BWR-02 status (Opened/Closed)
- Status of whether the backwash recycle pump (50P1461) is in operation, and its corresponding run time hours
- Status of whether the stormwater recycle pump (50P1541) is in operation, and its corresponding run time hours
- Pneumatic valve STW-09 status (Opened/Closed)
- Status of sump pumps 40P1501 or 1502 (**ON/OFF/HI-HI**)
- Stormwater recycle tank level status as registered in LE/LIT-1521
- Polymer pump status (**ON/OFF**)
- Polymer panel status (**ON/OFF/WATER/LO FLOW**)
- Polymer system status (**HI PRESS**)

- Polymer system parameters (DAF dosage in ppm, specific gravity of neat polymer, and blended tank concentration in percent)
- Plant air pressure status as recorded in PT-1466 and PT-1650
- Plant water storage tank level status as registered in LIT-1570
- Plant water pressure status as recorded in PT-1591

A list of PLC inputs/outputs showing device number, description, corresponding process and instrumentation diagram (P&ID) figure, and PLC address is provided in Table 3-4. PLC shop/loop drawings of the system are provided in Volume VIII – Attachment 8.1 – Volume 3 of TSI's manual. Table 3-5 is a list of alarms and their troubleshooting procedures. Table 3-6 is a list of operator set points as entered in the HMI. The **HI** and **LO** set points are operator-adjustable, as depicted in the yellow shaded boxes of the PLC screen captures in Appendix D.

3.12.4 Design Criteria and Operation for the Autodialer

- Model: Series VSS
- Dimensions: 12 inches x 10 inches x 5 inches
- Capacity: 16 channels with a 20-hour battery backup
- Manufacturer: Raco Manufacturing
- Location: treatment building control room

The treatment system is equipped with an autodialer, a remote alarm dialog monitor with solid state message recording, located in the treatment building control room where, if an alarm sounds, the dialer will call the operator for either troubleshooting the alarm or acknowledge the alarm. Operator contact information is stored in the autodialer in a sequence so that the alarm is troubleshot within a certain time period, depending on which operator is on call. To program, dial "7" followed by sequence # followed by (area code) and the seven-digit number, and then press **ENTER**. For acknowledging the alarm, the operator presses "9" on his/her phone. Manufacturer information on the autodialer is provided under Volume VIII – Attachment 8.4.

Following is a list of alarm channels, alarm type, and the corresponding alarms that will call the operator through the autodialer:

Channel 1 – Power alarm

- UPS Failure- (Power Outage)

Channel 2 – Tank high water level and other critical operation alarms

- EQ Tank **HI** Level Alarm
- DAF Effluent Chamber **HI** Level Alarm
- Froth Tank **HI** Level Alarm
- Digester Tank **HI** Level Alarm
- Backwash Tank **HI** Level Alarm
- Stormwater Tank **HI** Level Alarm
- Containment Sump **HI- HI** Level Alarm

- W2 Water Tank **LO-LO** Alarm
- Air Compressor Discharge Pressure **LO** Alarm
- Fire Alarm Control Panel Alarm
- Plant Process Air Pressure **LO** Alarm
- Plant Water Pressure **LO** Alarm
- DAF Froth Level **HI** Alarm
- HDBF Differential Pressure **HI** Alarm
- DAF Recycle Flow **LO** Alarm
- EQ Tank **LO-LO** Level Alarm
- Froth Tank **LO-LO** Alarm
- W2 Water Tank Level Control **HI** -**HI** Alarm

Channel 3 – Miscellaneous alarms

- DAF Emergency Eyewash Alarm
- Filter Press Emergency Eyewash Alarm
- Containment Area Emergency Eyewash Alarm
- DAF Effluent Turbidity **HI** -**HI** Alarm
- GAC Filter Influent Bypass Inlet Pressure **HI** -**HI** Alarm
- GAC 1 Discharge Pressure **HI** -**HI** Alarm
- GAC 2 Discharge Pressure **HI** -**HI** Alarm
- GAC 3 Discharge Pressure **HI** -**HI** Alarm
- GAC 4 Discharge Pressure **HI** -**HI** Alarm
- GAC 5 Discharge Pressure **HI** -**HI** Alarm

Channel 4 – Not currently used

Channel 5 – Lone operator alarm

- Autodialer Lone Operator Countdown Timer Alarm

The channel 5 alarm is initiated by the operator and protects operators working alone. The lone operator countdown timer, which is adjustable between 60 and 120 minutes, is currently set at 75 minutes. Before the timer completely counts down, the operator must return to the autodialer and reset the alarm by switching the key to the **OFF** position and returning the key to the **ON** position. If the operator fails to reset the alarm, the autodialer will automatically dial out and attempt to contact the next on-call operator to notify them that the onsite operator is not responding. Before the operator leaves the site, they should return the autodialer key to the **OFF** position.

Emergency Call-out Procedures

This section is to familiarize personnel with emergency call-out procedures, identify limitations on personnel actions when responding to an emergency call-out after hours or on weekends, and provide answers to questions about emergency call-out protocols. The Wyckoff facility has a Verbatim® autodialer installed in the main operator control room that is connected to various alarms in the plant PLC. If an alarm condition exists, the autodialer will immediately begin calling operating personnel, presenting them with a prerecorded message that indicates an alarm condition and the corresponding alarm channel that initiated the call-out. Personal and site phone numbers are stored in the autodialer's memory and will be dialed in the order in which they are installed. If an individual being called cannot answer their phone, or does not acknowledge the alarm, the autodialer will automatically go to the next phone number on the list and will continue to do so until the alarm is acknowledged or the alarm action is corrected.

The alarm can be acknowledged by pressing the number "nine" (9) on any touch-tone phone, and/or by manually pressing the **ACK** button on the autodialer, which is located in the main operator control room.

In addition to the autodialer, a "countdown timer" is installed in the operations room that will be activated upon arrival of the respondent, using the provided access key. The respondent must reset the timer every 75 minutes. If the timer is not reset, it will automatically notify the auto-dialer and the autodialer will begin calling other personnel. The countdown timer is used to notify other personnel if the respondent is injured or if the timer was not reset for some other reason.

1. When an individual receives an alarm condition phone call from the autodialer and is able to respond, they should acknowledge this by pressing the number "nine" (9) on their phone key pad after the message is complete and the individual hears a "warble" sound at the conclusion of the message.
2. If the individual is unable to respond to the alarm, they should immediately hang up their phone, because the autodialer will recognize this and immediately go to the next phone number on its list.
3. It is expected that all operating personnel will try to the best of their ability to respond to alarm conditions.
4. Immediately upon arrival, the respondent (lone operator) shall start the countdown timer and continue to reset the countdown timer at no longer than 75-minute intervals. The countdown timer will be set to notify the autodialer 75 minutes after it has been set or reset.
5. The countdown timer alarm will be on channel five of the Verbatim® autodialer. If an associate receives a channel five alarm, it will be assumed that another associate is already at the site and is unable reset the timer or has forgotten to reset the timer. This associate will immediately call the plant. If nobody answers, this associate will attempt to notify another associate to respond immediately to the plant. If this associate is unable to respond and cannot make contact with another associate, this person will immediately notify a "911" operator.
6. If the procedures needed to correct the alarm condition require two individuals (the "buddy system," according to the Site Health and Safety Plan), the individual will attempt to notify another individual for assistance and will continue these attempts until another individual is onsite and prepared to assist. **Under no circumstances will an individual attempt these procedures alone**.
7. If an individual receives an alarm condition call from the autodialer but is unable to respond, and soon after receives the same alarm condition call, it will be assumed that no one else has acknowledged the alarm. At this time, that individual will attempt to

notify another associate and will continue to do so until contact is made. It is also expected that the individual will, if at all possible, attempt to make themselves available to respond.

8. As a last resort, if an individual must have assistance to correct the alarm conditions and cannot make contact with other operations associates, the individual will attempt to contact backup personnel. Each operations associate will have access to phone numbers for available backup personnel.

9. All operations associates will be trained on how to correct all possible alarm conditions that may occur. If an associate responds to an alarm condition and is unsure of the proper procedure for correcting the problem, that associate will promptly notify other associates for advice. If no associate is able to give advice, the responding individual will use their best judgment to correct the condition.

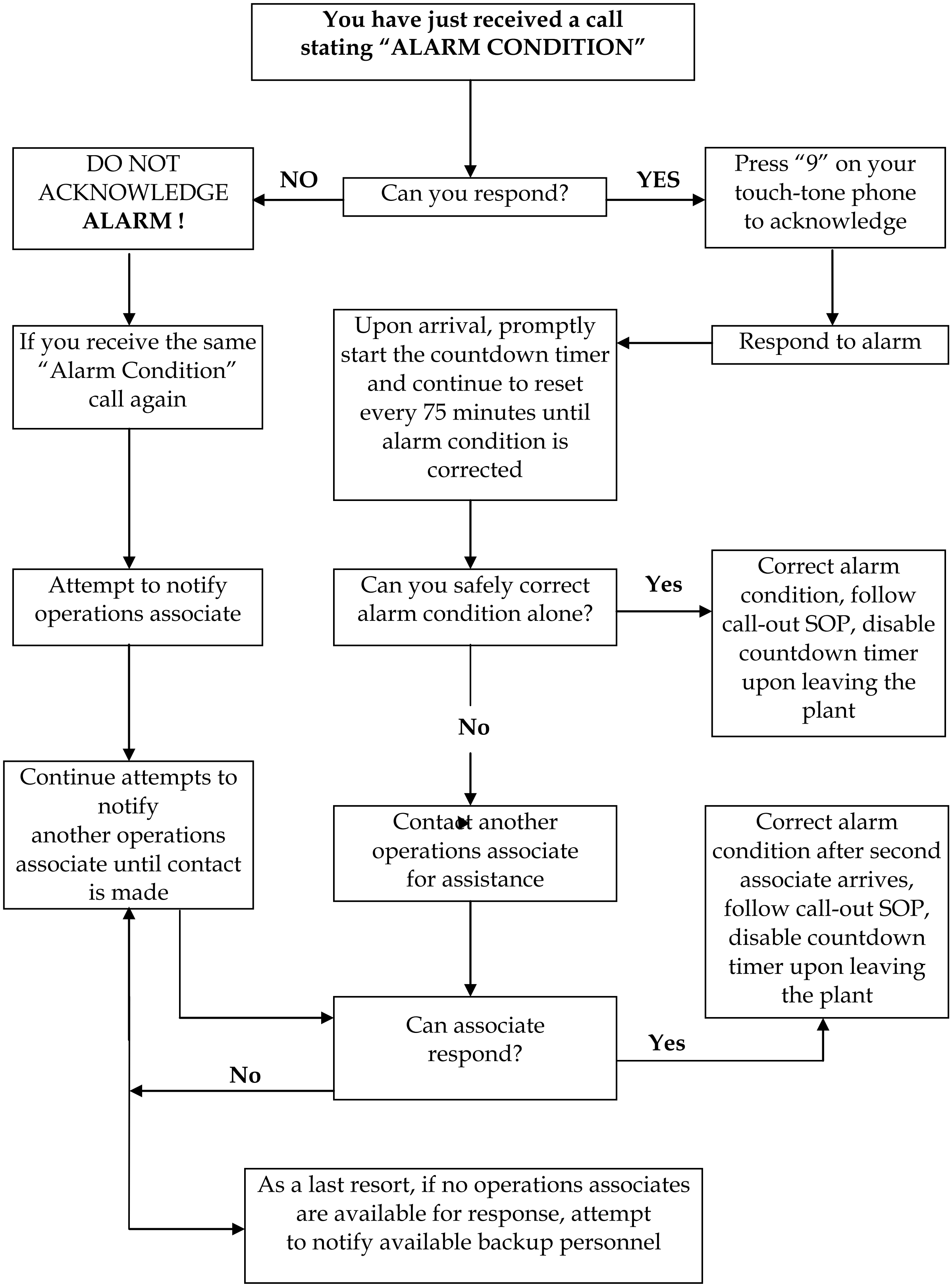
10. It shall be understood by all responding individuals that when they are onsite by themselves, under no circumstances will they attempt to perform any tasks that could endanger themselves. **Under no circumstances** will that individual perform any task that requires the buddy system, such as work inside the inhalation exclusion zone or work performed with a respirator. **Under no circumstances** will that individual perform any major repairs or electrical troubleshooting. **Under no circumstances** will that individual perform any work outside of the office without starting the *countdown timer.*

11. For security purposes, upon arriving at the site, respondent(s) shall lock the gate behind themselves after entering.

12. Upon leaving the site, the respondent will disable the *countdown timer*.

Alarms will be responded to according to the following decision chart:

ALARM CONDITION FLOWCHART



3.12.5 Pressure Gauges/Transmitters/Elements/Switches

Manufacturer information on pressure gauges, transmitters, elements and switches is provided under Volume VIII – Attachment 8.1. The following text provides design criteria along with tables for each of the gauges, transmitters, elements, and switches, respectively.

Type: Pressure Gauges
Manufacturer: Ashcroft
Location: treatment building process area and tank farm
Table 3-7: List of Process Pressure Indicators

Type: Pressure Transmitters
Model: 30151TG2A2B21AB4M5
Manufacturer: Rosemount
Location: treatment building process area and tank farm
Table 3-8: List of Process Pressure Transmitters

Type: Pressure Elements
Model: 50 201SS 04T XCG
Manufacturer: Ashcroft
Location: treatment building process area and tank farm
Table 3-9: List of Process Pressure Elements

Type: Pressure Switches
Model: B4-24-b-XCH-X07
Manufacturer: Ashcroft
Location: treatment building process area and tank farm
Table 3-10: List of Process Pressure Safety Switches

3.13 Electrical System Equipment

Following is a list of major electrical equipment and instrumentation used in the Wyckoff groundwater treatment system. Detailed procedures showing the sequence of operations is provided in Volume XI.

3.13.1 Fire Alarm System

A fire alarm system with a phone dialer is installed inside the treatment building. Manual pull stations, heat detectors, smoke detectors, horns and strobes are provided as part of the system. The fire alarm is a Gamewell-FCI 7100 series multiprocessor-based analog addressable system. Smoke detectors are located in the electric room and above the fire alarm control panel in the corridor. The remainder of the detectors located throughout the treatment building are heat detectors. Manual pull stations are located by each exterior door of the treatment building. If there is a fire, the fire alarm system alerts the monitoring company, Alarm Center Inc., which in turn will contact the fire department to dispatch fire fighters. All operations are performed from the fire alarm control panel located in the corridor, where the fire alarm panel controls the fire suppression system. If a fire alarm sounds, evacuate the site according to site safety procedures. If a trouble alarm sounds, the panel display will highlight a code indicating the cause and/or the location of the problem.

For a trouble alarm, the panel will send a signal to the monitoring company, which will contact the individuals designated by the plant operations company. The matrix in Table 3-11 provides the sequence of operations.

Manufacturer information on fire alarm system components, sequencing, and operation drawings are provided in Attachment 10.1 of Volume X.

3.13.2 Fire Suppression System

A fire suppression system is installed in the electric room of the treatment building. The system is a Fike SHP PRO series control system, which is a conventional detectable system for use with clean agent extinguishing. The suppression system works in tandem with the building fire alarm system, which initiates the fire alarm signals and alerts the fire alarm monitoring company. The SHP PRO is designed for use with Fike Clean Agent Suppressant HFC-227. The system is equipped with one suppression agent discharge nozzle, which is located on the ceiling in the electrical room. Also installed are one photoionization detector and one smoke detector, which are located on the ceiling in the electrical room. The main controller, located in the electric room, contains all the electronics required for a complete detection and control system suitable for most applications. The SHP PRO provides 10 status light-emitting diodes (LEDs) (Air Conditioning Normal, Alarm, Pre-Discharge, Release, Supervisory, Trouble, Panel Silenced, Abort, Release Disabled, Ground Fault) for instant feedback. The system has been designed to comply with National Fire Protection Association (NFPA) standards.

Table 3-11 illustrates the sequence of operation as follows:

1. Upon detection of 2 percent smoke by the photo ion smoke detector located in the electric room and the corridor, heating, ventilation, and air conditioning (HVAC) equipment will be shut down.
2. This will signal the fire alarm system.
3. The fire alarm system will sound fire alarm evacuation signals.
4. This will in turn signal the central fire station, which will dispatch fire fighters.
5. Also upon detection of 2 percent smoke from the smoke detector (Step 1), a second alarm will be produced from the horn: strobes, followed by a bell.
6. Also upon detection of 2 percent smoke, a 30-second countdown to clean agent discharge will be initiated.
7. The ringing of the bell will alert the operator whether to prevent discharge of clean agent.
8. If the operator chooses to prevent discharge of fire agent, the abort switch (two yellow buttons in the electric room) will be pushed and held, which in turn will bypass the HVAC interlock.
9. If the operator chooses to discharge clean agent, clean agent will be discharged and discharge strobes will operate.

Placing the System Offline for Maintenance or Hot Work Operations

CAUTION

Before any planned maintenance to the fire suppression system or prior to the start of any hot work, grinding, sanding, or painting operations, the fire suppression system must be placed offline to prevent accidentally activating the alarms and possibly discharging the fire suppression clean agent.

Procedure:

1. Call the fire alarm remote monitoring company and notify them that the system will be offline for a specified time. An example of this would be from 0800 to 1130 AM.
   a. Contact the fire chief at Alarm Center Inc, at 1-800-752-2490.
   b. Provide account number and individual security code (not listed here for security purposes).
2. Notify the City of Bainbridge Island Fire Department that the system will be offline for a specified time.
   a. City of Bainbridge Island Fire Department business hours are from 0800 to 1700 Monday through Friday. Telephone number is 206-842-7686

Manufacturer information on fire suppression system components, sequencing, and system operation drawings are provided in Attachment 10.2 of Volume X.

3.13.3 Power Distribution Panel Boards

Main distribution panel (MDP) and lighting panel (LP) boards provide electrical distribution for the plant. MDP components are connected directly through the MCC (MCC-1), which is in turn controlled by the manual transfer switch (MTS-1). There are four MDP components, including MDP-1, MDP-2, MDP-3 and MDP-4. MCC-1 is an Allen Bradley Model Series M capable of providing 480V service. LP components are interconnected and feed off the LP-1 panel, which in turn feeds from MCC-1 through the T-2 transformer. There are four LP components, including LP-1, LP-1A, LP-2 and LP-3. LP models are provided by Seimens. Table 3-12 lists which equipment is fed by which panel. Manufacturer information on the panel boards can be found in Attachment 11.2 of Volume XI.

Lockout / Tagout

The following procedures for equipment lockout/tagout (LOTO) were developed for use by CH2M HILL personnel. Any other operating company shall review these procedures and verify that they are acceptable and meet company safety requirements before performing LOTO required maintenance activities.

The purpose of equipment LOTO is to prevent unauthorized or accidental startup of a piece of equipment, which may cause equipment damage, personal injury, or death. Energy control procedures and employee training guidelines will be followed to be sure that before any employee performs any servicing or maintenance on a machine or equipment where unexpected energizing, startup, or release of stored energy could occur and cause injury, the machine or equipment shall be isolated and rendered inoperative.

Energy sources referred to in this program are any sources of electrical, mechanical, hydraulic, pneumatic, chemical, or thermal energy.

The procedures in this program refer to affected and authorized employees. Affected employees are those whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed, or to work in such an area. An authorized employee is one who locks or implements a LOTO procedure on machines or equipment in order to perform the servicing or maintenance on that machine or equipment. An affected employee and an authorized employee may be the same person.

Whenever major replacement, repair, renovation or modification of machines or equipment is performed, and whenever new machines or equipment are installed, energy-isolating devices for such machines or equipment shall be designed to accept lockout devices.

A LOTO table identifying pieces of equipment and isolation points is provided in Table 3-13.

PROCEDURES

LOTO procedures will be performed by authorized personnel only and will consist of the following procedures, which will be performed in the following sequence:

1. **Preparation for Shutdown:**
   Before an authorized employee turns off a machine or equipment, the employee will have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy. Affected employees shall be notified by the employer or authorized employee of the application and removal of lockout or tagout devices. This notice shall occur both before the controls are applied, and after they are removed from the machine or equipment.

2. **Machine or Equipment Shutdown:**

   The machine or equipment will be turned OFF or shut down using the normal operating controls according to the manufacturer's procedure and/or established local SOPs.

3. **Machine or Equipment Isolation:**

   All energy-isolating devices that are needed to control the energy to the machine or piece of equipment will be physically located, operated, and installed in such a manner as to isolate the machine or equipment from the energy source. The external breaker should be **LOCKED** in the **OPEN** circuit mode.

4. **Lockout or Tagout Device Application:**

   a. Lock and tag-out all energy-isolating devices. This will be conducted by authorized personnel.

   b. Lockout devices, where used, will be affixed in a manner that will hold the energy-isolating devices in a **SAFE** or **OFF** position.

c. Tagout devices, where used, will be affixed in such a manner that they will clearly indicate that the operation or movement of energy-isolating devices from a **SAFE** or **OFF** position is **PROHIBITED.**

5. **Stored Energy:**

   Following the application of lockout or tagout devices to energy-isolating devices, all potentially hazardous stored or residual energy shall be relieved, disconnected, restrained or otherwise rendered safe. Relieve trapped pressure, bleed the lines, open vent valves, release tension on springs or block movement, drain process piping, verify that extreme heat or cold has dissipated, and use blank flanges when needed.

   If there is a possibility of reaccumulation of stored energy to a hazardous level, continue verifying isolation until servicing or maintenance is completed, or until the possibility of such accumulation no longer exists.

6. **Verification of Isolation:**

   Make sure that danger areas are clear of personnel. Prior to starting work on machines or equipment that has been locked out or tagged out, the authorized employee will verify that isolation and deenergization of the machine or equipment has been accomplished by attempting to restart the machine.

Lockout/Tagout Devices:

The multiple hole lockout with warning tag will be the standard lockout device. This lock-out allows from one to six people to install their individual lock. Each person involved with the piece of equipment will install his/her lock. Each employee issued lockouts will have a lock exclusively for his/her use. No person, with the exception of the project manager or his/her appointed representative, will have a key to another employee's lock. If a lock must be removed, only the employee who installed the lock or the project manager or his/her appointed representative has authority to do so. Only one tag will be used per piece of equipment under LOTO. Each person working on the machine or equipment will have his/her signature on the warning tag. Additionally, each tag will include the date, name(s) of workers, and equipment name.

The laminated warning tag (also the standard warning tag used with lockouts) and nylon self-locking cable tie will be the standard isolating device used when lockout devices cannot be used. The warning tag will be completely filled out in indelible ink. The nylon cable tie (zip tie) shall have minimum tensile strength of 50 psi.

If an energy-isolating device cannot be locked out, the tagout program will provide a level of safety equivalent to that obtained by using a lockout program.

Tagout System:

When a tagout system is used, the following procedures must be observed:

1. Tags are warning devices attached to energy-isolating devices and do not provide protection from the energy source.

2. When a tag is attached to an energy-isolating means, it is not to be removed without authorization of the authorized person responsible for it. It is never to be bypassed or ignored.
3. Tags must be legible and understandable by all authorized and affected employees, as well as anyone else in the work area.
4. Tags must be made of materials able to withstand the environment in which they are placed.
5. Tags must be securely attached to energy-isolating devices so that they cannot be accidentally detached during use.

Before lockout or tagout devices are removed and energy is restored to the machine or equipment, procedures will be followed and actions taken by the authorized employee(s) to achieve the following:

1. **Equipment Check:**

   The work area will be inspected to ensure that nonessential items have been removed and machine or equipment components are operationally intact.

2. **Employee Check:**

   a. The work area will be inspected to ensure that all employees have been safely positioned or that they have left the area.

   b. Before lockout or tagout devices are removed and before machines or equipment are energized, affected employees will be notified that the lockout or tagout devices have been removed.

3. **Lockout or Tagout Removal:**

Each lockout or tagout device shall be removed from each energy-isolating device by the employee who applied the device. However, when the authorized employee who applied the lockout or tagout device is not available to remove it, that device may be removed under the direction of the project manager or his/her appointed representative only, provided that the project manager or his/her appointed representative has been trained in the lockout/ tagout program and have signed the attached sheet that specifies procedures for this exception.

Additional Requirements:

1. **Testing or Positioning of Machines, Equipment, or Components.**

   When lockout or tagout devices must be temporarily removed from the energy-isolating device and the machine or equipment energized to test or position the machine, equipment, or component, the following sequence of actions will be followed:

   a. Perform the three steps previously described in “Release from Lockout or Tagout.”

   b. Deenergize all systems and reapply energy control measures in accordance with the six steps previously described in “Implementation of Lockout Procedures.”

2. **Outside Personnel (Contractors, etc.)**

   a. Whenever outside servicing personnel are to be engaged in activities covered by the scope and application of this standard, the operators and the outside employer will inform each other of their respective lockout or tagout procedures.

   b. Operations supervisors will be sure that their personnel understand and comply with restrictions and prohibitions of the outside employer's energy control procedures.

Training:

Operations personnel shall be provided training to be sure that employees understand the purpose of the LOTO program and that they have the knowledge and skills required for the safe application, usage, and removal of energy controls. Training shall include the following:

1. Authorized employees shall receive training in recognition of hazardous energy sources, the type of energy in the workplace, and the methods and means necessary for energy isolation and control.
2. Affected employees shall be instructed in the purpose and use of the energy control procedures.
3. Any other employees in the work area shall be instructed in the LOTO procedures.
4. Retraining shall be provided for authorized and affected employees whenever there is a change in job assignments or in equipment that could present a new hazard.
5. Retraining shall be performed whenever a periodic inspection reveals that there are deviations from or inadequacies in the employee's knowledge of the energy control procedures.
6. All training shall be documented. This written record shall include the employee's name and the date of training.

Procedures for Lockout/Tagout Removal by Project Manager or His/Her Appointed Representative

Exception to paragraph three under Release From Lockout or Tagout.

1. Verification by the project manager or his/her appointed representative that the authorized employee who applied the device is not at the facility.
2. Making all reasonable efforts to contact the authorized employee to inform him/her that his/her lockout or tagout device has been removed.
3. Ensuring that the authorized employee has this knowledge before he/she resumes work at the facility.

I have read and understand the energy control procedures for machines and equipment. I also have read and understand the above procedures for LOTO removal by the project manager or his/her appointed representative.

Project Manager's signature______________________________ Date______________________

3.13.4 Local Control Stations

LCSs are installed for the pumps that do not have AFDs. Froth pumps, backwash pumps, the backwash recycle pump and the stormwater recycle pump all have an LCS. LCSs are designated 50LCS1251/1252, 50LCS1351/1352, 50LCS1461, and 50LCS1541, respectively. These LCSs are connected to MCC-1. In addition, the tank mixers for the filter press feed tanks (40LCS1431/1432) and the filtrate tank (50LCS1480) have LCSs. These LCSs are connected to panel board LP-1A. When these stations are placed in the **REM** position, the pumps can be started and stopped from the HMI. Also, these stations have local **START/STOP** buttons to operate the pumps when the LCS is placed in manual mode. Manufacturer information and wiring diagrams of the LCS components are in Attachment 11.3 of Volume XI.

3.13.5 Adjustable Frequency Drives

AFDs feed the two decant pumps, the two DAF feed pumps, and the two filter feed pumps. The AFDs adjust the speed of the 480V, 3-phase pump motors by adjusting the frequency from 0 to 60 Hz. The frequency is adjusted via a dial with a read-out that displays percent of 60 Hz. The AFDs can run in both **AUTO** and **MANUAL** mode. In the manual mode, increases or decreases of the frequency changes the pump speed. In automatic mode, the frequency is connected to and controlled from the HMI. Any faults are cleared through the panel provided in front of the AFD. Information regarding the programming of the AFDs can be found in Volume VIII, Attachment 8.2.

3.14 Support Systems

The support system includes other equipment and devices that indirectly support the Wyckoff GWTP, but are not an integral part of the process (for example, exhaust fans, building heaters, air conditioner). HVAC systems such as the exhaust fans, louvers, air conditioner, wall heaters, and safety shower units were provided and described in detail in Volume XII. Locations of the devices discussed in this section are shown in Sheets 69, 71, 72 and 73 in Appendix C "Applicable Project Drawings" in Volume I.

3.14.1 Electrical Room Ventilation Fan

The treatment building's electrical room is equipped with a ventilation fan (SF-1), motorized louver and dampers with operators MD-5, MD-6, MD-7 and MD-8, and a thermostat. When the temperature exceeds the adjustable thermostat set point, a switch will automatically open the motor-activated louvers and start the fan motor to circulate air through the building. The fan draws air from the mechanical room and exhausts through the louvers in the mechanical and electrical rooms. SF-1 is a Cook 195SQN-B that delivers 2,800 cfm of room air. The fan includes a belt drive with a 1 hp, 460 volt, 60 Hz, 3-phase, and totally enclosed fan-cooled (TEFC) motor. The intake louvers are Ruskin, Model ELF375DX, variable size (18 inches by 30 inches high and 36 inches by 36 inches high) and are controlled by Belimo Models AF-120 and NF-120, 120 volt, single phase, 60 Hz actuator motors. Manufacturer's information is included in Attachments 12.1 and 12.2 of Volume XII.

3.14.2 Process Area Ventilation Fans

The treatment building process mechanical room is equipped with two ventilation fans (EF-1 and EF-2) and motorized louvers and dampers with operators (MD-1, MD-2, MD-3 and MD-4). Switches located below the fans operate the fans. Fan EF-1 is tied to dampers MD-1 and MD-3 and fan EF-2 is tied to dampers MD-2 and MD-4. The ventilation units feed off panel LP-1A.

The fans (EF-1 and EF-2) are Cook 24XMW, which deliver 2,400 cfm. Each fan includes a belt drive and a 0.5-hp, 115 volt, 60 Hz, 3 phase, and TEFC motor. The intake louvers are Ruskin, Models ACL845 and ELF375DX (see manufacturer information) and are operated by Belimo Models AF-120 and NF-120, 120 volt, single phase, 60 Hz actuator motors. Manufacturer's information is included in Attachments 12.1 and 12.2 of Volume XII.

3.14.3 Locker, Shower, and Restroom Ventilation Fan

The locker/shower/restroom is equipped with a cabinet fan (EF-3). Exhaust fan EF-3 will start automatically when the lights are turned on in the shower or restroom.

EF-3 is a Cook GN-320, which delivers 150 cfm. Manufacturer's information is included in Volume XII, Attachment 12.1.

3.14.4 Air Conditioner

The treatment building's Control Room 102 is heated and cooled by a Friedrich, Model ES12L33 wall-mounted air conditioner (ACU-1) located on the north side of the building. The unit feeds off panel LP-3. Manufacturer's information is included in Volume XII, Attachment 12.3.

3.14.5 Safety Shower Systems and Thermostatic Mixing Valves

The plant is equipped with combination shower and eye/face wash features. Two safety shower systems (SSH-1) are located in the treatment building and one SSH-2 is located in the tank farm. Water for the systems is fed by W1 potable water from the City.

SSH-1 is a Haws Model 8346, which features a 10-inch acrylonitrile butadiene styrene (ABS) plastic showerhead and a stainless steel receptor with twin ABS plastic. The unit also comes with a tempered water blending system Model TWBS.SH (thermostatic mixing valves) to mix hot and cold water and provide tempered water up to 40 gpm for emergency shower and eyewashes. Manufacturer information is provided in Volume IX, Attachment 9.4.

SSH-2 is a Haws Model 8300FP freeze-proof combination, which features a 10.62-inch ABS plastic showerhead and a stainless steel receptor with twin ABS plastic. The model is supplied with two self-draining valves. These valves are installed below the frost line to prevent the supply water from freezing. One is located about 3 feet below the ground surface east of the decontamination pad, approximately halfway between the tank farm and the building; the second is located approximately 3 feet below the SSH-2 valve. The unit also comes with a tempered water blending system Model TWBS.SH to mix hot and cold water and provide tempered water up to 40 gpm for emergency shower and eyewashes. Manufacturer information is provided in Volume IX - Attachment 9.4.

3.14.6 Electric Wall Heaters

The treatment building has two wall-mounted electric heaters (WH-1 and WH-2). One is located in Locker Room 103 and the other is located in Restroom 105. The wall heaters are QMARK, Model CWH3404, 4 kW and 2 kW capacities, each delivering an air flow of 100 cfm. The units feed off panels MDP-3 and LP-3. Manufacturer's information is included in Volume XII, Attachment 12.4.

3.14.7 Gasoline Engine Generator

A portable 20 hp Honda Model EB11000 standby generator with 24 ampere-hours (AH)/5 hours lead acid batteries is available at the Wyckoff GWTP. If a power failure occurs, this generator provides capacity for the lighting loads and limited nonprocess loads such as fire alarm, 120 VAC convenience outlets, and limited HVAC located within the building. The existing power system has a manual transfer switch located inside the electrical room just downstream of the main service meter that enables the entire plant to be connected to this mobile generator at 480 volts. The unit is connected to the manual transfer switch (MTS-2) through an inlet box (120/240V, 50A). This generator can run for approximately 8 hours using its integral fuel tank. If a normal (utility) power failure occurs, the Wyckoff GWTP will shut down.

The small generator can be rolled outdoors from storage, plugged into an electrical receptacle, and started manually. The manual transfer switch allows lighting and other backed-up loads to be switched between utility and generator power. These loads are all fed from a 120/240 V 1-phase panel board fed through the manual transfer switch. The following list is a detailed, step-by-step procedure showing how to connect and operate the generator:

1. Move generator and cord set from mechanical room to southeast corner of the treatment building.
2. Plug the cord into the generator and generator inlet on the side of the treatment building.
3. Be sure that the main breaker on the generator is in the “off” position.
4. Start the generator by turning the engine switch to “start” and releasing the switch after the engine starts.
5. Allow the generator to warm up.
6. In LP-3, turn off all breakers EXCEPT circuits 6, 8, 9, 12, 18, 22, and 38.
7. Inside the electrical room, realign the transfer switch on MTS-2 from the utility position to the generator position.
8. Turn the generator breaker to the “on” position.
9. In LP-3, close the desired breakers (one at a time) to add load to the generator.
10. Monitor the fuel level. NOTE: one tank of fuel in the generator is adequate for approximately 8 hours of operation.

Upon return of normal power, the panel board and its loads are manually transferred back to normal power. The generator is manually shut down and rolled back into storage. The plant is manually restarted after utility power returns.

Manufacturer information on the generator can be found in Attachment 12.5 of Volume XII.

3.14.8 Transient Voltage Surge Suppressor

The transient voltage surge suppressor (TVSS) for the treatment building is a Service Track ST240 Model TK-ST240-3Y-480-L from Total Protection Solutions. The TVSS is located next to the MCC bus in the electrical room to reduce random, high- energy, short-duration electrical power anomalies. The TVSS is connected directly with MCC-1. Manufacturer information on the TVSS can be found in Volume XII (Attachment 12.6).

3.14.9 Uninterruptible Power Supply

The Powerware 9170 + uninterruptible power supply (UPS) located in the treatment building is a 10 KVA, 120V, single-phase modular UPS includes battery modules and power modules. These modules plug into a rack cabinet structure containing additional control, communication, and display functions that enable integrated control of all power modules. The UPS is housed in a single cabinet, with extra battery capacity housed in auxiliary battery cabinets, and provides battery backup for LP-2. If there is a power outage, the UPS keeps the HMI, PLC, and fire panels operational.

Manufacturer information on the UPS is provided in Volume XII, Attachment 12.7.

3.14.9.1 UPS System Description

- Model: Eaton PowerWare 9170
- Serial #: PW9170-660I
- System Control Password: 2639
- Indicator Lights:
  - Red: Unit has detected an alarm condition
  - Yellow: Unit is operating on battery power and producing output voltage
  - Green: Unit is operating on AC utility power and producing output voltage

3.14.9.2 UPS Operating Description

There is no physical On/Off switch for the UPS. The On/Off function must be accessed through the front panel display. The unit is password protected.

Normal Operations:

When the plant is operating under normal power, the UPS front panel display should read as follows:

- Mode: Auto
- Status: On-line
- Green indicator light will be illuminated

Power Outages:

If there is a power outage, all systems connected to panel LP-2 will run off the UPS system. These include the PLC, Fire Panel, autodialer, and Control Room receptacles (HMI). The UPS automatically switches to “On Battery” when a power outage is detected. The front display panel will read the following:

- Mode: Auto
- Status: On Battery
- Yellow indicator light will be illuminated

When power is restored, the UPS automatically switches to on-line after a five (5) second delay. The green indicator light will be illuminated.

Bypass Mode:

If the operator needs to perform maintenance on the UPS, the UPS should be placed in bypass mode by engaging the external bypass switch.

Press the red button beside the switch before turning. This button sends an electrical signal to the UPS to switch to internal Bypass Mode. The button also operates a mechanical interlock to prevent the switch from being turned without first signaling the UPS. When the red button is released, the UPS remains in Bypass Mode and must be manually returned to the Auto Mode by selecting the mode on the front panel display.

To switch from bypass mode and return to auto mode:

- Press MENU. Toggle up/down arrows to scroll to “System Mode Preferences.” Press ENTER.

- Enter the password (2639) using the up/down arrows. Press ENTER.
- Toggle the up/down arrows to select AUTO. Press ENTER.

Shutdown Procedures:

To turn the system off:

- Press the OFF button
- Enter the password (2639) using the up/down arrows. Press ENTER.
- "Turn Unit Off" will appear. Toggle up/down arrows to select YES or NO. Press ENTER.

The UPS system will rarely need to be shut down. If performing maintenance on the UPS, switching to bypass mode will usually be preferred over a system shutdown.

3.15 Hazardous Waste Disposal Events

This section is intended to familiarize personnel with all the steps necessary to initiate and complete a hazardous waste disposal event.

3.15.1 Pre-Disposal Event Steps

- Determine the hazardous waste inventory. Develop a complete list of all inventory stored onsite. This list should include quantities of all drummed waste, liquid NAPL, and any other materials that require offsite disposal.
- Be sure that a proper waste profile has been developed for each waste stream. Example A describes the information that is required.
- Inform the operations team of the current site inventory and need for a disposal event.
- Contact an approved hazardous waste disposal contractor.
- Provide the waste inventory, waste profiles, and tentative dates for the event.
- The disposal contractor should provide a current list of proposed facilities for disposal of each waste stream, as required by the CH2M HILL subcontracting process. This list will be reviewed by CH2M HILL to verify that the facilities are currently permitted to manage the types of wastes proposed for disposal. (Other operating companies should request information from their disposal contractor in accordance with their company policies.)
- Generate a letter of intent to the EPA Remedial Project Manager (RPM) that lists the proposed disposal facilities.
- The disposal facility must send a copy of the Off-Site Rule (OSR) approval documentation to CH2M HILL (or the current facility operating company). CH2M HILL will verify the current status of OSR approval by contacting the EPA Regional OSR Coordinator for the region where the facility is located. Current OSR approval must be received from EPA before a scheduled event can occur. Copies of the letter of intent, the signed Off-site approval documentation, and the EPA OSR Coordinator's current

approval will be forwarded to the CH2M HILL project manager and a copy retained for onsite records.

Example B provides a copy of these letters. These are not formal letters but are a general statement of intent to use for a particular waste site for approval by the EPA.

- Coordinate with the disposal contractor and the EPA representative signing the manifests regarding the following information:
- Disposal event date
- Waste Profile Sheet. The EPA representative reviews and approves the Waste Profile Sheet prior to the disposal event. A copy will be sent to the site by the EPA representative for onsite records.
- Waste Manifest. The disposal contractor provides a draft version of the manifest for review and approval by the EPA representative prior to the disposal event date.
- Equipment and resources required to perform the disposal work.
- Coordinate mobilization of equipment and resources needed for the disposal event.

3.15.2 Disposal Event Steps

- Provide the disposal contractor with a site safety briefing before beginning onsite work.
- The EPA representative will be onsite to oversee drum labeling, loading and truck placarding.
- After all wastes have been properly labeled and trucks bear the correct placards, the EPA representative will review and sign all manifest documentation before waste can leave the site.
- Manifest documentation will be copied and filed for reference.

3.15.3 Post-Disposal Event Actions

- The disposal facility will send the completed manifest to the EPA within 30 days of the event. If more than 45 days elapses, notify the EPA representative, who will file an exception report to EPA and the Washington State of Ecology, Dangerous Waste Section.
- Upon destruction or permanent storage, the disposal contractor will send a Certificate of Destruction or Disposal to EPA.

These documents will be filed onsite and with the EPA representative.

EXAMPLE A – WASTE PROFILES

This example describes information to be provided, if known, to the disposal contractor so they can complete a Waste Profile Sheet and the waste manifest.

Waste description
Common name of waste
Process generating the waste

Physical Properties
Physical state – solid, liquid, gas
Odor
Color
Viscosity, if liquid present
Number of layers/phases
Flash point
pH
Specific gravity
British thermal units per pound (Btu/lb)

Chemical Composition
These are chemical compounds that make up the waste, typically a percentage totaling 100 percent.

Constituents
This includes specific chemical compounds that are determined to be in the waste, and are presented by concentration or by toxicity characteristic leaching procedure (TCLP) concentration. Specify whether this information is based on knowledge or on analytical testing. If testing, then provide the analytical results.

Regulatory Status
EPA waste codes
State waste codes
Land disposal requirements

EXAMPLE B – EXAMPLE LETTERS

Example Letter of Intent

17 November 2009

SUBJECT: Wyckoff/Eagle Harbor Superfund Site, Wyckoff Soils and Groundwater Operable Unit, Plant Operations & Maintenance with OMI, PN C1947 – Off-Site Policy Certification Requirement

ATTN: Mr. Howard Orlean
U.S. Environmental Protection Agency
Region 10
1200 Sixth Avenue – ECL-113
Seattle, WA 98101

Dear Mr. Orlean:

1. The Environmental Protection Agency (EPA) requires the Off-Site Policy Certification for all hazardous wastes removed from Superfund Sites for disposal to ensure that the disposal facility is accredited.
2. Hazardous wastes will be removed from the Wyckoff/Eagle Harbor Superfund Site during the time frame of December1, 2009 through December 31, 2009.
3. All other requirements related to the transport and disposal of hazardous wastes, including paperwork, manifesting, labeling and placarding, will be followed.
4. Please contact me at (206) 780-1711, if you have any questions.

Enclosures

Stanley Warner
Site Manager

PROPOSED FACILITIES TO BE USED FOR THE WASTE DISPOSAL EVENT 12-2009

OMI proposes the following vendors for the scheduled disposal event for the month of December 2009. We would like to schedule this event during the time frame of December 1, 2009 thru December 31, 2009. This event will dispose of an estimated 96,000 pounds of conditioned and dewatered biosolids from the existing treatment plant aeration basin and aerobic digester at the Wyckoff site. This waste will be removed from the aeration basin and aerobic digester, conditioned, and transferred to a total of six 20-yard roll-off containers for dewatering for a period of 2 to 7 days for each container. The waste will then be transported to Chemical Waste Management of the Northwest in Arlington, Oregon, for final landfill disposal.

Contacts for this event:

Phillips Services (PSC) will manage disposal for the following waste stream.
This facility is operated as:

Burlington Environmental Inc.
20245 77th Ave. S.
Kent, Washington 98032
EPA ID # WAD 991281767
Facility Manager: Nick DeLeon
Phone Number: 253-872-8030

Dewatered and Conditioned Tank Bottom Solids: **K001 Waste** This waste will be sent to Chemical Waste Management of the Northwest in Arlington, Oregon: CERCLA Approved Facility.

Chemical Waste Management of the Northwest
17629 Cedar Springs Lane
Arlington, Oregon 97812
EPA ID #: ORD 089452353
Facility Manager: Gary Fisher
Phone Number: 541-454-3234
Current Inventory on site: Estimated 96,000 lbs

Example Off-Site Certification Letter

24 November 2009

Mr. Warner,

I confirmed that the following facility is acceptable to receive CERCLA waste under the off-site rule (OSR):

Chemical Waste Management of the Northwest
17629 Cedar Springs Land
Arlington, OR 97812
RCRA ID#: ORD 089452353

The OSR acceptability status is dynamic in nature and subject to change. Region 10 has instituted a policy where we conduct a verification of continued acceptability (VCA) on facilities that have been previously found acceptable under the OSR. The purpose of a VCA is to provide a periodic check to assure that the facility continues to be acceptable. VCAs are conducted when a request for OSR status is received and the previous VCA had been conducted more than 60 days prior. AVCA is valid for 60 days.

Let me know if you any further questions.

Adam Baron
Environmental Protection Specialist
U.S. EPA, Region 10 (OCE-127)
1200 Sixth Avenue, Suite 900
Seattle, WA 98101
(206) 553-6361

3.16 Spill Prevention and Emergency Response

This Spill Prevention and Emergency Response section presents the requirements and procedures that CH2M HILL will follow during the operation of the GWTP in case of an accidental release of pollutants to the environment. Any other operating company shall review these procedures and verify that they are acceptable and meet company safety requirements before performing operations activities.

The objectives of this Spill Prevention and Emergency Response section are the following:

- To reduce the potential for spills of hazardous materials, wastes, or petroleum products into the environment during remedial actions in quantities that could be harmful to human health or the environment.
- To provide the emergency procedures to be followed in the event of a spill of petroleum products or hazardous substances at the Wyckoff/Eagle Harbor Superfund Site.

3.16.1 Spill Prevention

Operations staff will manage any hazardous materials or petroleum products stored and used onsite in a manner that prevents their escape into the environment by site staff or subcontractor actions. An inventory of hazardous materials should be maintained onsite and updated as necessary if additional significant material storage is required at the site.

Daily inspections of potential release sites will be conducted for spills or leaks by operations staff in conjunction with their other routine O&M inspections. These inspections will be scheduled and tracked using onsite inventory management and inspection sheets.

A copy of the MSDS for each chemical used onsite will be maintained onsite. Each employee can review these at any time. Routinely review material safety data sheets (MSDSs) for any new or existing chemical received on site.

Chemicals received onsite will be unloaded on top of the decontamination pad located on the south side of the treatment building. The decontamination pad has secondary containment and can contain a spill should one occur when unloading chemical drums/containers. Similarly, disposal drums will be loaded onto vehicles parked on the decontamination pad. Disposal drums will not be transported (e.g. by hand truck) to clean areas and loaded onto vehicles.

3.16.2 Spill Response

Spill response activities should be undertaken only when it is safe to do so. All personnel must have completed spill response training. The responder must have received a medical clearance to wear a respirator, and the responder must have completed a respirator fit test within the past year. If it is unsafe to respond to a spill, personnel should use the appropriate site evacuation signals listed in Table 3-14, evacuate the area immediately, and call 911.

The following information, if known, should be provided to all emergency personnel:

- Source of spill
- Type of material spilled
- Approximate volume of the spill
- Time/date discovered
- Has the flow stopped?
- Are there any injuries or property damage?
- Has a body of water been affected or threatened?
- Cause of incident

When determining whether or not it is safe to respond, the following criteria will be considered:

1. Whether the spill poses a potential hazard to human health and/or the environment.
2. Whether the spill poses a potential hazard of fire or explosion.
3. The origin of the release.
4. The condition of the source of discharge (that is, repairable leaks, a leak under control, easily moved, unmovable, potential for wetting).
5. The physical state of release (solid, gas, or vapor).
6. Noticeable reactions (such as fuming, flaming, or gas generation).
7. The amount of material released.

Spill Notification and Reporting:

Operations personnel or subcontractors discovering a spill will immediately notify the Project Manager or Supervisor, who will subsequently inform the EPA Project Manager. The level of notification required will depend on the severity of the spill and the location of the spill.

CERCLA requires that a release to the environment of any hazardous substance over its reportable quantity (RQ) be reported to the National Response Center (NRC) (40 CFR 302.6). The Project Manager/Supervisor, in consultation with an Environmental Manager or regulatory expert, will determine the appropriate level of spill notification required.

Also the Clean Water Act (CWA) (40 CFR 110.6) requires that spills of oil-containing materials that:

> "Cause a film or sheen upon or discoloration of the surface of the water or adjoining shorelines or cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines"

be reported to the NRC immediately. The Project Manager/Supervisor will determine the appropriate level of spill notification required.

Since the site is a Large Quantity Generator of dangerous waste, the Dangerous Waste regulations (WAC 173-303-145) also require notification of the Washington Department of Emergency Management, if a spill of dangerous waste reaches the environment (e.g., to the water or outside the Area of Contamination). The Project Manager/Supervisor will determine the appropriate level of spill notification required.

Notification procedures are summarized below:

- **Level I Spill**

  A Level I spill would be within the cleanup capability of the facility and, therefore, would **not** require Bainbridge Island Fire Department (911) notification. An example of a Level I spill would be a 25-gallon localized upland release within the exclusion zone (area of contamination) of hydraulic fluid from a ruptured line on a piece of heavy equipment. Also, because the groundwater is being captured and remediated in this area, and oil was used in the process that caused the contamination, no additional notifications are required.

  Contained spills (see below) are generally Level 1 spills.

- **Level II Spill**

  A Level II spill would be beyond the cleanup capability of the facility or extends beyond the exclusion zone and would require Bainbridge Island Fire Department (911) notification. The onsite Project Manager or site Supervisor has the primary responsibility for contacting the fire department. However, if there is an immediate threat to human health or the environment, all onsite personnel are responsible for contacting onsite emergency personnel, as well as outside emergency services.

  An example of a Level II spill would be a 100-gallon product recovery storage tank spill that escaped the GWTP containment pad and reached Puget Sound. Other criteria for fire department notification are a threat to health and safety, or offsite migration either overland or through some sort of conveyance such as storm drains or ditches. That is, all spills outside the facility or that threaten surface water, or other resources outside the facility, require a Level II response. The Project Manager/Supervisor will direct the cleanup, drawing on technical assistance from other team members and any external resources deemed necessary.

  Uncontained spills and spill of hazardous materials not found in the exclusion zone (see below) are generally Level II spills.

- **Contained Spills**

  If a spill is contained onsite in secondary containment (e.g. in the treatment building containment trench, in the decontamination pad sump or inside the tank farm) or within the exclusion zone (if the spill contains materials being remediated), governmental agencies may not have to be contacted. Because the reporting requirements for onsite spills are less stringent, the project manager typically does not have to be immediately notified unless the spill exceeds 5 gallons.

- **Uncontained Spills**
  If a spill is not contained on the Superfund site and goes beyond the established property boundaries, it may be necessary to contact various regulatory agencies within

24 hours or sooner. Emergency telephone numbers are included in Table 3-15A, and emergency information needed for notification is included in Table 3-15B.

Immediately notify the Project Manager/Supervisor of all spills that are not contained onsite so that the appropriate agencies and personnel can be contacted. **EPA will immediately be notified (within 15 minutes) of the initial discovery of the spill or release.**

- **Hazardous Materials Not Found in the Exclusion Zone**

  If a spill is of a hazardous material that is not part of the contamination at the site, is not being used to remediate the site, and exceeds an RQ, it may be necessary to contact various regulatory agencies within 24 hours or sooner. Emergency telephone numbers are included in Table 3-15A, and emergency information needed for notification is included in Table 3-15B.

  Immediately notify the Project Manager/Supervisor of all spills that are not contained onsite so that the appropriate agencies and personnel can be contacted. **EPA will immediately be notified (within 15 minutes) of the initial discovery of the spill or release.**

Operations staff will report any onsite spills that occur using a spill incident response form. The spill incident response form is provided in Appendix J. This form requires reporting the date and time of the spill, its location, the material spilled, its quantity, the time period over which the material was spilling to the environment, list of any body of water contaminated, response to the spill, and other pertinent information.

Responding to a Spill:

Successful response to a spill incident requires effective, immediate actions, prompt notification, and timely commitment of resources for containment and cleanup. For a Level II spill, the site must be secured and access controlled as rapidly as possible. Site personnel will follow response procedures described here in the event of a spill of hazardous materials or petroleum products to either prevent their release to the environment, or to contain them should they be released.

If an operator responds to a spill they should follow the steps listed below. Table 3-16 is a summary of spill response equipment.

1. Put on the appropriate PPE listed in the Site Health and Safety Plan and delineate the spill area using "Do Not Enter" barricade tape.

2. Stop the source of discharge immediately if it is safe to do so. Whenever possible, the source of discharge should be stopped remotely by shutting down pumps or turning off equipment. (MCC in the old GWTP for the EWs, or the operator room HMI computer for the GWTP.) If a spill cannot be stopped remotely, plug the leak or use other safe engineering methods to control the spill.

3. Contain the release if it is safe to do so. The containment wall around the treatment plant will contain most spills. **If a spill occurs inside the containment area**, a water hose should be used to wash the spilled materials into the rainwater or containment sump.

4. **If the spill is outside of the containment area** or cannot be washed into the rainwater sump, it may be contained by constructing temporary dams or diversions, or by using absorbent socks or other absorbent materials.

5. Cleanup should be undertaken only if it is safe to do so. Solid materials can typically be cleaned up using a broom or a shovel. Absorbent materials can be placed on liquid spills so they can also be cleaned up with a broom or shovel. If absorbent materials are not used, a liquid spill can be pumped into an appropriate container. Emergency spill kits are maintained by CH2M HILL on the north end of the existing GWTP, inside of the new treatment plant building and near the center of the extraction and monitoring well field.

6. All spill residues should be placed in a U.S. Department of Transportation (U.S. DOT) -approved container and properly labeled with the appropriate hazard class, date, and a description of the materials. If the spill residue is hazardous waste, then the container(s) will also be labeled with a hazardous waste label and appropriate hazardous waste code. Hazardous waste containers will be inspected weekly (and the inspection documented) while onsite.

7. The Project Manager will arrange for disposal of the material.

8. Use the appropriate decontamination procedures outlined in the Site Health and Safety Plan.

3.17 Drum Handling

This section has been developed to familiarize personnel with the proper procedures for handling and storing 55-gallon hazardous waste drums onsite.

Solids waste may at times need to be stored in 55-gallon drums for later disposal. Solids may be dropped from the filter press chute or added by shovel or other manual methods,. Following is a list of the materials that may be required to be stored in drums.

- Spent hydromation filter walnut shell media
- Dewatered biosolids
- Sump solids
- PPE, including used absorbent pads
- Miscellaneous materials that are contaminated shall be addressed in a special "as needs require" status to determine the disposal method. Nothing that is contaminated on site shall be disposed of without first addressing best methods. This determination shall be made by the site manager and shared with EPA personnel for approval.
- Care should be taken when filling drums with shovels to avoid back strains or any lifting, twisting motions. PPE for this activity will be determined on an individual activity basis. Generally, standard safety rubber boots, safety glasses, nitrile gloves and cotton coveralls should meet most of the PPE requirements.

- These materials will be stored in drums and shall not be mixed
- When the drums are full they will be labeled with the contents using a special drum crayon that resists weathering and is easy to see on the black drums.
- The drums shall be secured with a drum lid band and the band tightened to seal the container. The drum lid bands use a 15/16-inch wrench and socket size to tighten the bolts.
- The materials in the drum and the date the drum was filled will be written both on the sides on the drum and on the lid for ease of later identification.
- If the drum contains hazardous waste, the drum will be inspected weekly while on site, and the inspections will be documented. The weekly drum inspection checklist is provided in Appendix K.
- PPE drums will not be capped and sealed until they are full. Every effort should be made to fill these drums as full as possible and pack them as densely as possible. This is important especially with PPE. Drums are priced for disposal on a per drum basis, not by weight. For other wastes, drums will not be capped and sealed until they are 90% full. Ten percent of the drum capacity should be left for expansion of drum contents.
- These drums will be stored at the rear of the treatment pad on treated 2 by 4s to keep them off the treatment pad and to deter rusting.
- Specially designed yellow cone polyethylene caps will be installed on the drums to prevent water from ponding on the drum lids and accelerating rust.
- Drums should be moved using the drum dolly provided. Care should be taken in moving drums with the drum dolly to prevent back strain and to provide foot protection.

4.0 Treatment Plant Startup and Shutdown Procedures

This section of the O&M Manual includes the following procedures for startup, normal operations, and shutdown of the Wyckoff GWTP:

1. Treatment Plant Pre-Startup Requirements – Section 4.1. To be performed prior to initial startup of the plant and after an extended shutdown period (more than a day).
2. Treatment Plant Startup, Normal Operations, and Shutdown Procedures – Sections 4.2 to 4.8. These are detailed operating procedures for startup, normal operations, and shutdown.
3. Overall Treatment Plant Startup and Shutdown Procedures for Normal Operations – Sections 4.9 and 4.10, respectively. This is performed typically after a short- term plant shutdown (less than a day).
4. Compressed Air and Plant Water Systems Shutdown – Section 4.11. Performed only if there is an extended shutdown period and/or maintenance is performed on these systems
5. Winter Freeze Protection Shutdown – Section 4.12.

CAUTION: Equipment warning and safety information presented under Sections 5.13 and 5.14 need to be adhered to prior to starting up and shutting down the treatment system.

4.1 Treatment Plant Pre-Startup Requirements

Mandatory pre-startup procedures include procedures for compressed air systems, plant water systems, and GAC valve positioning.

4.1.1 Compressed Air Systems Startup Procedures

Startup procedures for the compressed air systems are as follows:

1. Inspect and check compressors in accordance with the manufacturers' manuals prior to startup (for example, check the oil). Refer to Section 5.6.4.
2. Verify that valves AHP-02, AHP-04, AHP-05, AHP-06, AHP-20, and AI-01 (associated with the downstream piping associated with the air dryer) are open. AHP-20 is located overhead on the west wall of the treatment building near GAC-5.

CAUTION: Do not start the compressors until the valves mentioned above are open.

3. Verify that valve AHP-19 is closed (it is located inside the treatment building by the louver/filter press on the southwest wall). This feeds valves AHP-15, AHP-16, and AHP-17, which are not required for normal plant operation of the air diaphragm pumps

in the tank farm for the oil and solids processing system. AHP-19 should be opened for solids transfer (see Figure 3-11) and NAPL processing (see Figure 3-4).

4. Verify that air is flowing through the HVAC system (operation of the louvers in the mechanical and electrical room). This air flow is required to cool the air compressors in order to maintain proper operating temperature.
5. Be sure that the compressor disconnect switches are in the ON position.
6. Place the compressor (#1 or #2) in AUTO by a switch located in their panels.
7. Verify that air pressures are correct by monitoring pressure gauge 1651 (air compressor 50M1651) and pressure gauge 1652 (air compressor 50M1652).
8. The AHP from the compressor goes to air receiver tank 50T1465, which supplies AHP to the process system.
9. Verify AHP air pressure (120 psi) at the HMI through pressure transmitter PI/PT-1466.
10. Verify that the inlet and outlet valves associated with the air dryer are open and the bypass valve is closed.
11. Turn the air dryer on by pressing the ON/OFF button. The normal set point for the system is dew point, set at 34˚F and ice demand set at 37˚F.
12. The instrument air (AI) will be online when valve AI-01 is open. Verify system pressure at PI/PT-1650.
13. Verify that valve AI-04 (located by the south wall near the decant pumps) is open for operation of the three pneumatic valves (DI-01, BWR-02, and STW-09) in the tank farm. The pressure regulator associated with the AI-04 valve is set at 62 psi.

4.1.2 Plant Water Systems Startup Procedures

CAUTION: The plant water pumps cannot be started unless their associated suction and discharge valves are open (in this case, W2-01, W2-02, W2-05, W2-06, W2-09, W2-10 and W2-11).

The sequence of activities to be followed for plant water system startup is shown below:

1. Verify the well pump for the W2 well disconnect is in the **ON** position (this pump is located in the pump house outside the site fence).
2. Verify that the local disconnects and breakers for both plant water pumps (50P1581/1582) are in the **ON** position.
3. Check for water level in the plant water storage tank. The water level needs to be greater than 2.0 feet.
4. Verify that valves W2-01 and W2-16 (located outside by the plant water storage tank) are in the **OPEN** position.
5. Verify that valves W2-02, W2-05, W2-06 and W2-09 (all located by the water pumps) are open.

6. Open valves W2-11, W2-12, and W2-13 (located by the polymer system).
7. Open valve W2-10 to the plant water pressure tank (50T1575).
8. Place either water pump #1 or #2 in the **AUTO** position. A pressure switch on the pump discharge line will control the pumps at the following settings: 50 pounds psi – pump turns on; 65 psi – pump turns off.
9. At this point, plant water is available for distribution for process operations.

4.1.3 Granular Activated Carbon Adsorber Valve Positioning

Reference Figures – Figures 3-8 and 3-10

1. Verify that valve PLE-10 (Figure 3-10) is closed. This valve is located by the effluent tank in the tank farm.
2. Open valve PLE-09 (Figure 3-10). This valve is located near the stormwater/recycle pump (50P1541) by the south wall of the treatment building.
3. Verify valve PLE/RCY-01 is closed.
4. Verify whether the GAC adsorbers are filled to the top with water.
5. Set valve **OPEN** and **CLOSE** positions for normal operations depending on which adsorbers are in the lead, middle, and lag configuration (refer to Tables 4-4a to 4-4e).

4.2 Extraction System, Equalization Tank, and Dissolved Air Flotation Startup and Shutdown Procedures

The following sections describe the startup and shutdown procedures for the extraction system, EQ tank, and DAF system.

4.2.1 Startup and Shutdown Procedures for the Extraction System and Equalization Tank

Refer to the list of valves in Table 4-1. Reference Figures 3-4 and 3-15.

4.2.1.1 Equalization Tank Normal Operations Startup Procedure

1. Verify valves NAPL-01 and NAPL-02 are closed.
2. Open valve PLI-01 located at EQ tank 40T1010.
3. Open pilot study valve located outside the north end of the treatment building to operate the wells from the pilot study area of the well field.
4. Open valve STW-13 (located at the EQ tank).
5. Verify valve PLI-00 is open to direct contaminated water to the EQ tank.
6. Start extraction wells manually per Section 4.2.1.2.

Under normal conditions the tank level is maintained at half full (14 ft) by the DAF feed pumps, which are controlled by AFDs and the EQ tank level controller built into the PLC that controls the speed of the pump. The DNAPL settles to the bottom of the tank and the LNAPL floats to the top. Under normal conditions, pneumatic valve DI-01 (to the DAF feed pumps) is open and valves NAPL-01 and NAPL-02 are closed.

4.2.1.2 Groundwater Extraction System Startup Procedure

The normal operations valve alignment for the progressive cavity groundwater pumps is as follows:

VALVE NUMBER	POSITION
GW-1	OPEN, PUMP ON
GW-2	OPEN, PUMP ON
GW-3	CLOSED
GW-4	CLOSED
GW-5	CLOSED
GW-6	CLOSED
GW-7	CLOSED
SV-1	CLOSED

Former Process Area Progressive Cavity Pumps

The procedure for starting the groundwater extraction pumps and well field is as follows:

1. Verify correct valve alignment for normal operations.
2. Energize the groundwater pump breakers located in the old treatment plant MCC. Breakers are located on the northeast wall.
3. PW-1 and PW-9, and PW-5 and PW-8 are on the same electrical circuit so if PW-8 or PW-9 need to be started up independently, this must be done at the local electrical control box at the well.
4. Visually confirm that each well is pumping by observing the flow meter at each well. Flow rate should be confirmed at the local flow meter.

NOTE: Each individual extraction well pump may have to be primed again before they will start pumping continuously.

CAUTION: Just because a pump is on does not mean it is pumping. Visual confirmation of flow is needed by observing the flow meter at the well. If fluid is not present at the pump, severe damage may occur to the pump rotor and stator.

Pilot Extraction Well Hammerhead Pumps

1. Verify the compressed air systems have been started in accordance with Section 4.1.1.
2. Open the instrument air supply valve AI-03 to the Hammerhead pumps located high on the wall (near the middle of the north wall) in the treatment building. Supply air pressure to the Hammerhead pumps should be 65 psi at a minimum. This can be determined locally at the pressure regulator.

3. Energize the pilot extraction wells EW-2 and EW-6 by opening fully the local air supply valve located at each pump.

4. Visually confirm that each well pump is pumping by listening to the air exhaust and observing the stroke counter at each well.

The flow rate in gallons per minute from the Hammerhead pumps can be calculated by multiplying the number of strokes per minute (by listening to the pump air exhaust) by 0.8 gallons: (SPM x 0.8) = gpm.

4.2.1.3 Shutdown for Extraction System and Equalization Tank

The valve alignment for the progressive cavity groundwater pumps for shutdown is the same as that for normal operations and is as follows:

VALVE NUMBER	POSITION
GW-1	OPEN, PUMP OFF
GW-2	OPEN, PUMP OFF
GW-3	CLOSED
GW-4	CLOSED
GW-5	CLOSED
GW-6	CLOSED
GW-7	CLOSED
SV-1	CLOSED

The sequence of activities to be followed for the extraction system and EQ tank shutdown is shown below.

1. Shut off the former process area extraction wells by de-energizing the groundwater pump breakers located in the old treatment plant MCC. Breakers are located on the northeast wall. You can also de-energize each individual groundwater pump by placing the local controller at each pump in the OFF position.

2. De-energize the pilot extraction wells EW-2 and EW-6 by closing the local air supply valve located at each pump.

3. Close the instrument air supply valve AI-03 to the Hammerhead pumps located high on the wall (near the middle of the north wall) of the treatment building.

4. Close valve PLI-01 on the EQ tank.

4.2.2 Dissolved Air Flotation Pre-Startup Procedure

DAF initial pre-startup and initial startup activities were performed during GWTP commissioning to determine the polymer dosage for the DAF system. Refer to the startup plan and test logs in Appendix H for details. It may be necessary to perform these activities after a long plant shutdown time or if any drastic changes are observed in water influent characteristics.

The following pre-startup steps must be performed and checked prior to DAF system startup:

1. Set up the plant air and water systems in accordance with Sections 4.1.1 and 4.1.2. This includes water for the polymer solution and air for the DAF system operation. The pressure for the plant air system should be set between 110 and 125 psig. Set the pressure for the air filter/regulator (located between AHP-10 and AHP-11) at 110 psig. Valves AHP-10 and AHP-11 are located by the DAF unit air saturation system.
2. Verify that the disconnect switches for DAF feed pumps 50P1101 and 50P1102 and Filter Feed pumps 50P1241 and 50P1242 are set to the **ON** position.
3. Be sure that adequate water is provided to the mechanical seals of the DAF feed pumps and the filter feed pumps. The seal water should be set to 0.25 gpm on the rotometer. Seal water must be turned off after a pump is shut down.
4. Confirm that all the polymer system components are set up and working properly. This includes filling the polymer blend tank by mixing the neat polymer with W2 water, and checking that the polymer feed pump is ready to feed polymer into the DAF influent line. See Section 4.2.3 for polymer system startup procedures.

4.2.3 Polymer System Startup

Reference Figure 3-6.

The polymer system is turned on after turning on both the DAF feed pump and the recirculation pump (Step 17 of Section 4.2.4). The polymer system is designed to make a batch of dilute polymer mixture that is fed to the DAF influent. Liquid raw polymer is sent through a neat polymer pump into a mixing unit where W2 water enters and the mixture is mixed using mixer 50M1601. Water pressure from W2 flow sends the mixed contents to the mixed polymer storage tank (40T1620). Level in tank 40T1620 is maintained with a level sensor (1631). Contents from tank 40T1620 are pumped by an LMI Milton Roy metering pump (50P1640) into the DAF unit. The polymer system prepares batches of dilute polymer at a concentration of 0.16 percent. This is fed to the DAF influent line at a dosage rate of 1.75 ppm using polymer feed pump 50P1640. At a DAF feed flow rate of 80 gpm, the polymer feed rate is approximately 360 ml/min. If the DAF feed flow rate changes, the polymer flow rate will be adjusted automatically by the PLC logic. The stroke speed of the polymer feed pump varies the polymer flow into the DAF influent and is controlled locally by the PLC.

Following is the startup procedure for the polymer system:

1. Be sure that W2 water is available and ready to be used by verifying that valves W2-11, W2-12, and W2-13 are open.
2. Verify that ball valves PO-01 and PO-02 are closed.
3. Open ball valves PO-03, PO-04, and PO-06 associated with the polymer solution and polymer feed pump (50P1640).
4. The metering pump is controlled by the PLC if it is placed in external operations mode. A switch on the polymer control panel (50LCP1601) allows the operator to place the system in **AUTO** mode (see Step 17 under Section 4.2.4).

4.2.4 Dissolved Air Flotation System Normal Operations Startup Procedure

Refer to the list of valves in Table 4-1, along with the startup activities discussed below. Reference Figures 3-4, 3-5, 3-6 and 3-7.

Polymer dosage and performance tests were completed during initial facility startup. The operator does not need to perform initial startup procedures every time the plant is shut down (for example during GAC backwash or HDBF backwash operations, or for routine maintenance operations).

NOTE: It is important that while starting up the DAF unit as described below, starting up the HDBF as described in Section 4.3.1 will need to be performed concurrently.

CAUTION: The DAF feed pumps and filter feed pumps cannot be started until the suction and discharge valves associated with these pumps are open. In this case these are DI-01, DI-02, DI-04, DI-05, DI-07, and valves downstream DI-08, DI-09, and DI-10 for the DAF feed pumps; and DE-01, DE-02, DE-04, DE-05, DE-07, and valves downstream DE-08 and FI-01 for the filter feed pumps.

CAUTION: Prior to starting the DAF system from its local control panel, place the red emergency stop handle in the **ON** position. After turning **ON** the panel, press the alarm silencer and the over- torque reset to disable the noise and the red siren light on top of the panel.

1. The skimmer speed should be at 35 percent of full speed. The mixer speed should be at 50 percent of full speed. The mixer and skimmer are started from the local control panel.
2. The DAF recycle (DR) breakout valve DR-03 should be at its correct set point, which is set during startup.
3. Verify that inlet and outlet valves DR-01 and DR-02 associated with the DAF recirculation pump are open.
4. Verify that water is present in the effluent chamber of the DAF unit at half level before starting recirculation pump 50P1135.
5. Start the recirculation pump from the HMI. At this point, the air saturation tank will fill with water.
6. Valve DR-V01 mounted on top of the air saturation tank allows a small continuous flow of water and air to bleed off back to the DAF unit.
7. Verify DAF air saturation system set points:
    a. DAF Recirculation Pump Flow Rate - 72 to 75 gpm.
    b. Air Supply Pressure to Air Saturation Tank - 110 psi
    c. Saturation Tank Pressure - 60 to 80 psi
    d. Plant Air Flow to Saturation Tank - 3.5 scfm
8. Verify that the air pressure to valve DI-01 (located at the EQ tank) is sufficient for proper operation (62 psi).
9. Open valves DI-02, DI-04, DI-05, DI-07, DI-08, DI-09, and DI-10 manually.

10. Open valves DE-01, DE-02, DE-04, DE-05, DE-07, and DE-08 manually. These are downstream of the DAF unit.
11. Open valve FRI-01 (froth) and close valve FRI-02 (sludge) at the DAF unit.
12. Be sure adequate W2 water is provided to the mechanical seals of the DAF feed pumps and the filter feed pumps. This should be set to 0.25 gpm on the rotometer. Seal water must be turned off after a pump is shut down.
13. Open pneumatic valve DI-01 from the HMI.
14. Before proceeding to the steps below, complete HDBF startup procedure steps 1 to 13 from Section 4.3.1.
15. Place DAF feed pump AFDs in AUTO. Set the EQ tank PID level controller in AUTO at the HMI. Select DAF feed pump 50P1101 from the HMI by clicking START.
16. Place filter feed pump AFDs in AUTO. Set the DAF unit PID level controller in AUTO at the HMI. Select filter feed pump 50P1241 from the HMI by clicking START.
17. Start the polymer system by placing it in AUTO at the local control panel.
18. Refer to Section 4.3.1 for HDBF startup procedure step # 14 so that effluent water from the DAF unit enters the HDBF system.
19. Turn the auger on from the HMI (when the DAF local control panel associated with the auger is in REM mode) once a day to remove the sludge from the bottom of the DAF unit. Refer to Section 4.7.1 for procedures for removing the sludge using the froth pumps.

4.2.5 Dissolved Air Flotation and Polymer System Shutdown Procedures

The sequence of activities to be followed for DAF and polymer systems shutdown is shown below:

1. The polymer system should be shut down by placing the polymer control panel switch in the **OFF** position and turning off the metering pump.

CAUTION: The DAF feed pumps and filter feed pumps must be shut down before the suction and discharge valves associated with these pumps are closed; in this case, DI-01, DI-02, DI-04, DI-05, DI-07, and valves downstream DI-08, DI-09, and DI-10 for the DAF feed pumps; and DE-01, DE-02, DE-04, DE-05, DE-07, and valves downstream DE-08 and FI-01 for the filter feed pumps.

2. Shut off the feed to the DAF unit from the HMI by selecting the DAF feed pumps screen from the HMI and pressing the STOP button. Pressure switches located at the pumps have an automatic safety shutoff at 30 psi.
3. Shut off the filter feed pumps by selecting the filter feed pump screen from the HMI and pressing the STOP button.
4. Stop the skimmer and flocculator (mixer) from the local DAF control panel after the DAF feed pumps and filter feed pumps have been shut down for approximately 30 minutes.

5. Shut off the seal water to the DAF feed and filter feed pumps.
6. Shut off air flow to the pressurization tank (air saturation tank) by closing the air inlet valves (AHP-12 to AHP-14) and allow the pressurization tank air pressure gauge 1138 to read zero before turning off the recirculation pump. (NOTE: The pressurization tank carries a large volume of compressed air during operation. If the recycle stream is shut down before the air volume is bled off, the air will evacuate the pressurization tank and enter the DAF tank. This large release of air can cause surface turbulence inside the flotation area of the DAF tank).
7. Shut off the recirculation pump at the HMI by selecting the recirculation pump screen and pressing the **STOP** button.
8. Verify that pneumatic valve DI-01 closes automatically at the HMI 3 minutes after shutting down the DAF feed pump.

4.3 Hydromation Deep Bed Filter Startup and Shutdown Procedures

Verify that the list of valves in Tables 4-2 and 4-3 are positioned for normal and backwash operations of the HDBF unit. Reference Figure 3-8.

4.3.1 Hydromation Deep Bed Filter Normal Operations Startup Procedures

CAUTION: Monitor vent valve AV-1266 twice a week to be sure it does not open during a timed backwash or during a manual backwash.

The sequence of activities to be followed for HDBF startup is shown below.

In addition, refer to Section 3.4.2 for details on how the cycles operate automatically.

1. Verify that backwash pump disconnects are in the **ON** position. Place the selector switches for the backwash pumps in the **REM** position.
2. Be sure that adequate water is provided to the mechanical seals of the backwash pumps. The seal water should be set to 0.25 gpm on the rotometer.
3. Open the air supply valve to the HDBF panel.
4. Verify that air is available at 85 psi to operate the pneumatic valves of the HDBF unit (this is part of the pre-startup air system requirements). This can also be verified by checking the air regulator pressure gauge at the HDBF instrument panel.
5. All valve open/close positions associated with HDBF valve operations are automatic. Refer to Figure 3-8 for the different cycles.
6. Verify that manual isolation valves V-111, V-112, V-113, V-114, and V-115 for the HDBF unit are open.
7. Verify that valve FI/BYP-02 is closed.
8. Turn the disconnect switch of the HDBF unit to the **ON** position.

9. Verify that valve BWE/FFS-01 is closed to be sure that backwash effluent from the filter system enters the dirty backwash tank.
10. Verify that valves BWS-04 and BWS-07 associated with backwash pumps 50P1351 and 50P1352 are set in a partially closed position (position determined during plant initial startup). Flow rate of the backwash supply water must be 70 to 80 gpm, as read at FE/FIT-1371 (backwash pumps are set to remote at the LCS).
11. Close valves BWS/FFE-01 and BWS-08 (located by GAC-1).

NOTE: The following steps 12, 13, and 14 are to be performed concurrently with steps 15, 16, and 17 in Section 4.5.4.

12. Open valve FI-01.
13. Verify that valve FI/RCY-01 is closed.
14. On the HDBF system control panel (50CP1001), place agitator in AUTO position, turn on power, pull out the master stop knob, and press the "Master Start/Fault Reset" button. Also refer to Step 1 pre-start procedures under Section 3.4.2.
15. HDBF should now be operational, first in recirculation mode followed by filtration mode, and it will automatically cycle to backwash mode. The filtration cycle is set at 24 hours and is operator-adjustable.
16. When the HDBF is ready for backwash, the system will send a signal to the PLC, which will automatically start the backwash pump based on either a high differential pressure of 20 psid (recorded at DPIT-1281), or a filtration cycle of 24 hours, – whichever occurs first.
17. After the backwash cycle is complete (20 minutes), the system will return to filtration mode.

4.3.2 Hydromation Deep Bed Filter Shutdown Procedures

The filter has to be backwashed prior to shutdown. Refer to Step 6 in Section 3.4.2 regarding the steps for the different cycles.

1. Perform HDBF backwash by pressing the **BACKWASH** button on the HMI screen.
2. The filter can also be shut down by clicking the **STOP** button from the HMI and then performing a manual backwash by manually pressing the **BACKWASH** button on the local control panel.
3. Allow the filter to complete the backwash and return to the filtration cycle.
4. Push in the master stop knob on the local control panel.
5. Turn the disconnect switch of the HDBF unit to the **OFF** position.

4.4 Granular Activated Carbon System Startup, Shutdown, and Backwash Procedures

Tables 4-4a to 4-4e are valve reference tables for each GAC adsorber series configuration. Tables 4-5a to 4-5e are for backwash operation of all five GACs. Wherever the number (#) associated with a GAC identification is mentioned in this section, it refers to GAC units GAC-1 through GAC-5. Reference Figures 3-8, 3-9, and 3-10.

4.4.1 Granular Activated Carbon Normal Operations Startup Procedures

Depending on which adsorbers are in the lead, middle, and lag configuration (refer to Tables 4-4a to 4-4e), the following sequence of activities should be performed.

1. Water should be flowing from the HDBF unit.
2. Verify that valve PLE-09 (located by the south wall near the stormwater/recycle pump) is open to be sure treated water is being stored in the effluent tank (40T1330). This will branch to the effluent tank unit process described next.
3. Monitor pressures on pressure gauges 1310 to 1315.
4. Verify flow to the effluent tank by checking the flow as registered on FE/FIT-1321.

4.4.2 Short-Term Shutdown of Granular Activated Carbon Adsorber Procedures

A short-term shutdown is most likely to occur during weekend shutdown or routine system maintenance. During a short-term shutdown, the adsorbers can remain filled with water unless work is being performed on the adsorbers themselves.

During this period, the entire plant will be shut down, which means shutdown of the DAF feed pumps and the filter feed pumps. It may be necessary to close the inlet and outlet (GAC#I-01 and GAC#E-01) to prevent any siphoning or drainage from the adsorbers (where # refers to 1 to 5).

4.4.3 Long-Term Shutdown of Granular Activated Carbon Adsorber Procedures

A long-term shutdown is most likely to occur during events such as spent carbon change-out, changes in the system configuration, or major maintenance. During a long-term shutdown, the adsorbers should be completely drained to minimize the potential for biological growth and septic bed conditions. The adsorbers will have to be backwashed and the air eliminated before they are restarted. During this period the entire plant will be shut down. The long-term shutdown is any period of time greater than 3 days, depending on the operational status of the other process equipment.

The adsorbers are drained of excess water by opening valves CAV-01 to CAV-05 on the compressed air supply line while making sure the adsorber drain valves GAC1-D01 to GAC5-D01 (DV-01 to DV-05 of Tigg manual) are open.

4.4.4 Backwashing of Granular Activated Carbon Adsorber Procedures

The following sequence of activities takes place during a routine backwashing process (15 minutes at 600 gpm):

1. Shut down the plant by turning off the DAF feed pumps, filter feed pumps, DAF unit and HDBF unit from the HMI.
2. Verify that valve BWS-01 is open.
3. Verify that valves BWS-02, BWS-04, BWS-05 and BWS-07 associated with both backwash pumps 50P1351 and 50P1352 are completely open.
4. Verify that both backwash pumps' disconnects are in the ON position.
5. Be sure adequate water is provided to the mechanical seals of the backwash pumps. The seal water should be set to 0.25 gpm on the rotometer.
6. Note the level reading in effluent tank 40T1330. Be sure that the effluent tank is full to the overflow level (30,158 gallons) so the backwash process can be completed.
7. Verify there is sufficient storage capacity in the dirty backwash tank to receive new dirty backwash water. Prior to backwashing, water should be removed from the tank until the dirty backwash tank level is 0.43-foot.
8. Follow the valve positioning for backwash identified in Tables 4-5a to 4-5e for GACs #1 to #5, depending on which adsorber is backwashed. To isolate the adsorber, close the treated water's respective effluent valves and the influent valves for the GAC units [GAC1-E01 and FE-01 for GAC-1, GAC2-E02 and FE-03 for GAC-2, GAC3-E01 and FE-05 for GAC-3, GAC4-E01 and GAC4-I01 for GAC-4, and GAC5-E01/02 and GAC5-I01 for GAC-5]. Open the backwash discharge valve for the adsorber to be backwashed using valve BWE/FFS-#. Open the backwash supply valve for the adsorber to be backwashed using valve BWS/FFE-#.
9. Verify that valve BWS-08 is closed.
10. Place 50LCS1351 and 50LCS1352 associated with the backwash pumps in the **REM** position.
11. Turn backwash pumps 50P1351 and 50P1352 on from the HMI by selecting a run time of 15 minutes and selecting the pump **START** button.
12. One of valves BWS-04 and BWS-07 will need to be wide open and the other valve will need to be adjusted so that the total flow registered at FE/FIT-1371 reads 600 gpm after starting the backwash pumps.
13. Backwash effluent flows into the dirty backwash tank. The operator needs to monitor the dirty backwash tank level and the flow from the carbon adsorber.
14. Once backwash is complete, the backwash pumps will automatically shut down based on the run time (15 minutes) selected at the HMI.
15. Close backwash supply valve BWS/FFE-01 and the corresponding BWS/FFE-#, and close backwash discharge valve BWE/FFS-01.

16. The operator will need to re-configure the valve open/close positions (in accordance with Table 4-4) for normal GAC operations.

4.5 Effluent System Startup and Shutdown Procedures

Refer to the list of valves in Table 4-6 for startup. Reference Figure 3-10.

4.5.1 Effluent System Normal Operations Startup Procedures

The following sequence of activities is to be used during the effluent system startup process:

1. Verify that valve PLE-10 (located by the effluent tank) is closed.
2. Open valve PLE-11 to discharge treated effluent from the effluent tank to the Eagle Harbor Outfall.
3. Verify that the automatic composite sampler is in place.
4. Verify that valve PLE-12 is in the open position.
5. Start the composite sampler by turning the unit on. The composite sampler needs to have the sample volume that is collected for each event verified each time the unit is turned on. The sampler automatically turns off when a sampling event is completed.
6. Verify the discharge flow to the Eagle Harbor Outfall by observing a constant level in the effluent tank and no flow from the overflow vent.

4.5.2 Effluent System Shutdown Procedures

The following sequence of activities is to be used during the effluent system shutdown process:

1. Verify no flow is registered on flow meter 1321.
2. Shut down the composite sampler.

4.6 Solids Processing and Filter Press System Startup and Shutdown Procedures

General: Open valve AHP-19 (located inside the treatment building by the south wall near the plant water pumps) that feeds valves AHP-16 and AHP-17 to operate the digester/skim pump and filter press/digester feed pump. Reference Figure 3-11 and Table 4-7.

4.6.1 Startup Procedure for Supernatant from Dirty Backwash Tank

CAUTION: The backwash recycle pump cannot be started before the suction and discharge valves associated with it are open. The backwash recycle pump must be shut down before the suction and discharge valves associated with it are closed; in this case, BWR-01, BWR-02, BWR-03, BWR-05, BWR-06.

1. Verify the availability of air for operating valve BWR-02.
2. Close valve BWR-07 and open valves STW-13 and BWR/FI/RCY-01.

3. Verify that the local disconnect for the backwash recycle pump is in the **ON** position.
4. Verify that the water supply is adequate for the backwash recycle pump mechanical seals.
5. Verify that the backwash recycle pump LCS (50LCS1461) is in the **REM** position.
6. Check the water level in the dirty backwash tank. The water level should be at least 3 feet above the top of the conical base.
7. Open valves BWR-03 and BWR-05 associated with backwash recycle pump 50P1461. With valve BWR-06 open, the water will flow to the EQ tank. The operator has the option of sending the water to the stormwater recycle tank by opening valve BWR-07 and closing valve BWR-06.
8. Open valve BWR-01.
9. Open pneumatic valve BWR-02 from the HMI.
10. Start the backwash recycle pump from the HMI.
11. Observe the level in the dirty backwash tank as monitored by LE/LIT1441.

4.6.2 Shutdown Procedure for Supernatant from Dirty Backwash Tank

The low level switch will shut down the backwash recycle pump after the level reaches 1.5 feet, as read by the LE/LIT-1441 at the HMI. The operator has the option of turning the backwash recycle pump manually by clicking on **STOP** from the HMI.

Verify that valve BWR-02 is closed, because shutting down the backwash recycle pump should automatically close valve BWR-02 3 minutes after shutting down the pump.

4.6.3 Startup Procedure for Solids from Dirty Backwash Tank

1. Set the filter press/digester feed pump 50P1460 for operation.
2. Connect the suction hose from the filter press/digester feed pump to valve TS/SS-01 (camlock fitting attached) and connect the discharge hose from the filter press/digester feed pump to valve DS-02 (camlock fitting attached).
3. Open valves TS-01, TS-02, TS/SS-01, DS-01, and DS-02.
4. Attach the air line (located in the tank farm) from AHP-16 to the air attachment on the filter press/digester feed pump.
5. Adjust the air pressure regulator to approximately 50 psi or other operator-based adjustment.
6. A mixture of solids and water is removed from the dirty backwash tank's conical base.
7. Transfer the contents (solids/liquid mixture) from the bottom of the dirty backwash tank to the digester tank.

4.6.4 Shutdown Procedure for Solids from Dirty Backwash Tank

1. Once the transfer is accomplished, shut off the air feed to the filter press/digester feed pump.
2. Close valves TS-01, TS-02, DS-01 and DS-02.
3. Disconnect hoses (if necessary).

4.6.5 Startup Procedure for Solids from Digester Tank

1. Open valves ALP-01, ALP-02, ALP-03, ALP-04, ALP-05, ALP-06, and ALP-07.
2. Place the rotary blower disconnect switch in the **ON** position.
3. Set the frequency of the rotary blower at 30 Hz.
4. The rotary blower is turned on through a local REMOTE/STOP switch located on the local blower control panel. The speed of the blower is set by the operator using an AFD built in the panel. Pressure monitors are installed in the lines to monitor air pressure.
5. The rotary blower AFD maintains the dissolved oxygen level by slowing the air volume to the digester tank. The dissolved oxygen level must be monitored by the operator and the blower speed adjusted as necessary by the operator.
6. Check the VSS reduction. When it reaches 30 percent reduction, set digester/skim pump 50P1120 for operation.
7. Verify that valves DS-01, DS-02, DS-03 and DS-04 are closed.
8. Open valves DS-05 and DS-06.
9. Connect the suction hose from the digester/skim pump to valve DS-02 (camlock fitting attached) and connect the discharge hose from the digester/skim pump to valve DS-03 (camlock fitting attached) to direct solids to filter press feed tank #1 (40T1431) via valve DS-05.
10. Perform Step 9 with the DS-06 valve for solids feeding the filter press feed tank #2 (40T1432).
11. Open valves DS-01, DS-02, and DS-03.
12. Attach the air line (located in the tank farm) from AHP-17 to the air attachment on the digester/skim pump.
13. Adjust the air pressure regulator to approximately 50 psi or other operator-based adjustment.
14. CH2M HILL Contents from the digester tank are transferred to the two filter press feed tanks.

4.6.6 Shutdown Procedure for Solids from Digester Tank

1. Once contents are transferred, shut off the air feed to the digester/skim pump.
2. Close valves DS-01, DS-02, and DS-03.
3. Disconnect hoses (if necessary).

4.6.7 Startup and Shutdown Procedures for Solids Mixture from Filter Press Feed Tanks to Filter Press

Reference Figures 3-11 and 3-12.

1. Turn the hydraulic control valve to the **CLOSE** position. Turn the air on to the hydraulic pump by opening valve AI-02. The cylinder will push the filter plates forward.
2. After the press has closed, turn the hydraulic control valve to the **CLAMP** position. Allow the hydraulic pressure to build to a maximum of 4,000 psi.
3. Open the filter center feed valve and the four filtrate discharge valves. These valves are associated with the filter press and are not shown in Figures 3-12 and 3-13.
4. Open valve F-01 to the filtrate tank (50T1480).
5. Position a 55-gallon drum under the sludge hopper of the filter press.
6. Turn on Mixer #1 through the digester mixer local control station (40LCS1431) by placing the switch in the **ON** position to mix the contents in filter press feed tank #1 and condition the digester sludge to a pH of 11.0 with the addition of lime. Repeat this step for Mixer #2.
7. Connect a 2-inch suction hose from filter press feed tank #1 through valve TS/SS-01 (camlock fitting) to the suction side of the filter press/digester feed pump (50P1460), and connect a 2-inch discharge hose from the discharge side of the filter press/digester feed pump to valve SS-03 leading to the inlet piping on the filter press.
8. Open valves SS-01 and TS/SS-01 and valves SS-03 and SS-04 to the filter press.
9. Connect air pressure regulator and air supply hoses through valve AHP-16 to the filter press/digester feed pump. Adjust the air pressure regulator to 25 psi.
10. Start the filter press/digester feed pump at 25 psi and start filling the filter press at low pressure so that the solids coat the chambers evenly, without blinding the cloths.

CAUTION: maximum pressure should not exceed 100 psi. As the filter press fills with sludge, a decrease in filtrate leaving the filter press should be observed, and the filter press/digester feed pump will slow down. Increase the pressure to the filter press/digester feed pump in increments of 10 to 15 psi to obtain a maximum pressure of 100 psi to maintain a clear flow of filtrate from the plate press.

NOTE: The overall cycle time is very dependent on the concentration of the inlet sludge. Higher concentrations reduce the cycle time. Typical cycle time is from 2 to 4 hours.

11. The cycle is usually complete when the filter press/digester feed pump is operating between 95 and 100 psi, with a count of 15 to 18 seconds between strokes.
12. **STOP** the filter press/digester feed pump, and drain excess pressure off the system by opening drain valve SS-D01 to the stabilized solids piping feeding the filter press.
13. **CLOSE** discharge valve SS-01 from filter press feed tank #1, and **CLOSE** inlet piping valve SS-04 to the filter press.
14. **CLOSE** the filter center feed valve, and **CLOSE** the four filtrate discharge valves.
15. **OPEN** one filtrate discharge valve, and **OPEN** the air valves on the blowdown standpipe (AHP-07 and AHP-08).
16. When free water is no longer being discharged, **OPEN** the second filtrate discharge valve, and **CLOSE** the first filtrate discharge valve.
17. Continue this process until all free water has been discharged from all four filtrate discharge valves.
18. **CLOSE** air valve AHP-08 on the blowdown standpipe and bleed off all air pressure.
19. **CLOSE** all filtrate discharge valves.
20. Be sure the liquid valves and all air inlet valves are **CLOSED**.
21. Turn the hydraulic valve control switch to the **OPEN** position.
22. Filter plates can be separated manually one at a time, or the system is equipped with a pneumatic plate spreader.
23. To operate the plate spreader, the filter press must be in the **OPEN** position.
24. Position the spreader arm between the two plate handles, which are at the end of the plate stack (toward the hydraulic ram end). Once the spreader arms are in position, pull the actuator lever and the plate spreader arms will lift between the plates and then spread the plates apart.
25. After separating the plates, retract the plate spreader by pushing the lever toward the plate stack. Sludge can now be cleaned from the plates.
26. Use a nonabrasive nylon or wooden paddle to remove any cake that does not fall free.
27. Continue this sequence until all filter plates have been emptied of cake.
28. Thoroughly clean the filter with a brush and soapy water when sludge begins to cake on the plates, or after pressing operations are completed.
29. Thoroughly inspect the O-ring sealing surfaces of the gasketed plates. The gasket should remain seated in the gasket groove and be thoroughly cleaned. Residues left in this area may prevent proper sealing of the plates.
30. Transfer portable mixer 50M1480 to the filtrate tank and connect it to a power source.

31. Start the mixer through the filtrate tank LCS (50LCS1480) by pressing the **START** button.
32. Add sodium bisulfite until a pH of 7 is maintained in the tank.
33. Connect the hose to valve F-02, then open valve F-02 and drain the neutralized filtrate to the sump.

4.7 Oil Processing System Startup and Shutdown Procedures

Refer to the list of valves in Table 4-8 for startup. Reference Figures 3-4 and 3-13.

4.7.1 Startup and Shutdown Procedures for Froth and Decant Water Recovery - Froth Tank

CAUTION: The decant pumps and froth pumps cannot be started before suction and discharge valves associated with them are open. The decant pumps and froth pumps must be shut down before the suction and discharge valves associated with them are closed; in this case, FRE-00, FRE-01, FRE-03, FRE-04 and FRE-06 for the decant pumps; and FRI-01, FRI-02, FRI-03, FRI-04, FRI-06, FRI-07, FRI-08, and FRI-10 for the froth pumps.

1. Verify valves NAPL-05, NAPL-06, NAPL-07, NAPL-08, and NAPL-09 associated with the froth tank are closed.
2. Valve FRI-01 (froth) with the DAF unit should be open from the DAF startup.
3. Verify that the froth pumps' (50P1251 and 50P1252) local disconnects are in the **ON** position.
4. Be sure that valves associated with the froth pumps are open: FRI-03, FRI-04, and FRI-06 for pump #1, and FRI-07, FRI-08, and FRI-10 for pump #2.
5. Check the level in the froth tank through level sensor LS1131.
6. Place either froth pumps' #1 or #2 LCSs 50LCS1251 or 50LCS1252 in the **AUTO** position.
7. Select a run time (chosen by the operator) for froth pumps #1 or #2 from the HMI and set the pump speed at the pump. Froth pump #1 is typically set to 8.5 percent and froth pump #2 is typically set to 10 percent. The pump speed setting should be adjusted as necessary to maintain flow. The operator should closely monitor the froth pump effluent piping for excessive vibration as the froth pump speed is increased.
8. Turn froth pump on from the HMI.
9. Froth flows into the froth tank (50T1380).
10. Read the level in the froth tank from level sensor LS1381.
11. The froth pumps will shut down based on the run time selected from Step 7. If the LCS is placed in **LOCAL** mode, shut down the froth pump using the **STOP** button on the LCS.
12. Once a day, open valve FRI-02 and close valve FRI-01 to remove sludge and operate the froth pumps as described above.

13. Be sure adequate water is provided to the mechanical seals of the decant pumps. The seal water should be set to 0.25 gpm on the rotometer. Seal water must be turned off after a pump is shut down.
14. Verify that the decant pumps' (50P1391 and 50P1392) local disconnects are in the ON position.
15. Open valve FRE-00 and verify that valves associated with the decant pumps are open (FRE-01 and FRE-03 for decant pump #1 and FRE-04 and FRE-06 for decant pump #2).
16. Place the PID level controller for the froth tank in the **AUTO** position from the HMI. Set the level at 3 feet.
17. Turn on the AFD associated with decant pump #1 and place it in **AUTO**. Decant pump #1 will turn on in **AUTO** mode when the operator pushes the **START** button from the HMI. It is controlled by an AFD with level in the froth tank.
18. Repeat Step 18 with decant pump #2 if the operator chooses to operate it.

4.7.2 Procedure for DNAPL Recovery from Equalization Tank

1. Verify that valves NAPL-01 and NAPL-02 are closed.
2. Connect one end of a hose to valve NAPL-02, placing the other end of the hose in the EQ skim sump.
3. Open valve NAPL-02.
4. DNAPL contents are transferred to the EQ skim sump.
5. The operator should stop the transfer when there is water flowing through valve NAPL-02.
6. Close valve NAPL-02.
7. Disconnect the hose from valve NAPL-02.

4.7.3 Procedure for LNAPL Recovery from Equalization Tank

The following procedure is used to recover LNAPL from the EQ tank. In order to perform this, the operator will shut down the plant on any particular day while the well field pumps are running. This will raise the water level in the EQ tank to the top in order to perform the LNAPL recovery.

1. Verify valves NAPL-01 and NAPL-02 are closed.
2. Follow shutdown procedures for the HDBF system as described in Section 4.3.2.
3. LNAPL collected in the EQ tank is transferred by connecting a hose to valve NAPL-01 and placing the other end of the hose in the EQ skim sump. Connect the hose to valve NAPL-01 and place the other end of the hose in the EQ skim sump.
4. Watch the level in the EQ tank rise and wait until it reaches 23.5 feet as recorded in the LE/LIT-1011 on the HMI.

5. Open valve NAPL-01.
6. For the last 6 inches (corresponding level 23.5 feet), place the DAF feed pumps in manual mode by placing the level controller in manual. This is done at the HMI by selecting the DAF feed pump icon and then selecting the PID tuning from the drop down menu.
7. Bring the level slowly up to 24 feet by adjusting the speed of the pump to be slightly lower than the well field flow rate into the EQ tank.
8. Follow the startup procedure for the HDBF system, as described in Section 4.3.1, by bringing the filter feed pumps and HDBF unit online.
9. LNAPL from the EQ tank will start flowing through valve NAPL-01 and will discharge into the EQ skim sump.
10. The operator will be able to determine by visually looking at the contents to see if water is mixed with product, and can stop the transfer once he/she determines the contents are mostly water.
11. Close valve NAPL-01.
12. Drain the water in the drop pipe to be sure all water is removed.
13. Adjust the DAF feed pump flow setting back to **AUTO** and set the level point to 12 feet. The plant is back in normal operation with the DAF feed pump ramping up in order to maintain the level set point.
14. Disconnect the hose from valve NAPL-01.

4.7.4 Startup and Shutdown Procedures for NAPL Transfer from Equalization Skim Sump to Froth Tank

1. Allow the NAPL contents (from the same procedure performed in Sections 4.7.2 and 4.7.3) in the EQ skim sump to settle for at least approximately one hour.
2. Connect the suction hose from the digester/skim pump to valve NAPL-03 (camlock fitting attached) and connect the discharge hose from the digester/skim pump to valve NAPL-04 (camlock fitting attached) to direct NAPL to the froth tank.
3. Verify that valves FRE-00, NAPL-06, NAPL-07, NAPL-08, NAPL-09, and NAPL-10 are closed.
4. Open valve NAPL-05.
5. Attach the air line (located in the tank farm) from AHP-15 to the air attachment on the digester/skim pump and set the air pressure regulator to 50 psig.
6. Transfer NAPL contents to the froth tank.
7. Once contents are transferred, shut off the air feed to the digester/skim pump.
8. Close valves NAPL-03, NAPL-04 and NAPL-05.

9. Disconnect hoses (if necessary).

4.7.5 Startup and Shutdown Procedures for NAPL Transfer from Equalization Skim Sump to Product Tank

1. Allow the NAPL contents (from the same procedures performed in Sections 4.7.2 and 4.7.3) in the EQ skim sump to settle for at least approximately one hour.
2. Connect the suction hose from the digester/skim pump to valve NAPL-03 (camlock fitting attached) and connect the discharge hose from the digester/skim pump to valve NAPL-04 (camlock fitting attached) to direct NAPL to the froth tank.
3. Verify that valves FRE-00, NAPL-05, NAPL-07, NAPL-08, NAPL-09, and NAPL-10 are closed.
4. Open valve NAPL-06.
5. Attach the air line (located in the tank farm) from AHP-15 to the air attachment on the digester/skim pump and set the air pressure regulator to 50 psig.
6. Transfer NAPL contents to the product tank
7. Once contents are transferred, shut off the air feed to the digester/skim pump.
8. Close valves NAPL-03, NAPL-04, NAPL-05 and NAPL-06.
9. Disconnect hoses (if necessary)

4.7.6 Startup and Shutdown Procedures for NAPL Transfer from Froth Tank to Product Tank

1. Verify valves associated with the froth tank (NAPL-05, NAPL-06, NAPL-07, NAPL-08, NAPL-09, NAPL-10, NAPL-11, and FRE-00 are closed.
2. AHP should be available for operating the oil pump (50P1410).
3. Set the oil pump for operation.
4. Connect the suction hose from the oil pump to valve NAPL-10 and connect the discharge hose from the oil pump to valve NAPL-11.
5. Open valves NAPL-07, NAPL-08, NAPL-09, NAPL-10, NAPL-11, and NAPL-12.
6. Attach the air line (located in the tank farm) from AHP-18 to the air attachment on the oil pump and set the air pressure regulator to 50 psig.
7. Transfer NAPL contents from the froth tank to the product tank.
8. Once contents are transferred, shut off the air feed to the oil pump.
9. Close corresponding valves NAPL-10 and NAPL-11.
10. Disconnect the hoses.
11. Close valves NAPL-07, NAPL-08, NAPL-09 and NAPL-12.

4.7.7 Startup and Shutdown Procedures for NAPL Transfer for Loadout and Decant Water Removal from Product Tank

1. Product contents from the product tank are transferred to a tanker loadout by opening valve NAPL-13.
2. Overflow/decant water at different levels in the product tank can be removed by opening any one of the seven valves OF/DC-1 to OF/DC-7 and discharging the contents to the containment sump by gravity.

4.8 Containment System Startup and Shutdown Procedures

Refer to the list of valves in Table 4-9 for startup. Reference Figure 3-14.

CAUTION: The stormwater/recycle pump cannot be started before suction and discharge valves associated with it are open. The stormwater/recycle pump must be shut down before suction and discharge valves associated with it are closed; in this case, STW-09, STW-10, and STW-12.

1. Verify the stormwater recycle tank is at a minimum level of 5 feet.
2. Open valves STW-01 and STW-02 associated with the decontamination pads.
3. Open valves STW-04 and STW-06 associated with sump pumps #1 and #2.
4. Open valve STW-07 and close valve STW-08. This will direct the water to enter the stormwater recycle tank. The operator has the option of sending the water from the sumps directly to the dirty backwash tank by opening valve STW-08 and closing valve STW-07.
5. Place the stormwater/recycle pump LCS (50LCS1541) in the **REM** position.
6. Visually check the contents of the containment sump for the presence of water.
7. Place the breaker for the sump pump control panel in the **ON** position.
8. Sump pumps #1 and #2 are placed in the **AUTO** position and they will turn on based on the water level in the sump.

Water flows to the stormwater recycle tank.

9. Be sure adequate water is provided to the mechanical seals of the stormwater/recycle pump. The seal water should be set to 0.25 gpm on the rotometer. Seal water must be turned off after a pump is shut down.
10. Open pneumatic valve STW-09 from the HMI.
11. Open valves STW-10 and STW-12 so that contents from the stormwater recycle tank are sent to the EQ tank for treatment, or open valve STW-D04 to send the contents to the containment sump, depending on the level in the containment sump. Valves STW-10 and STW-12 are located at the stormwater/recycle pump inside the treatment building. Verify that valve STW-13 is open. This valve should be opened by following the EQ tank/DAF unit process startup steps.

12. Vent by opening valves STW-V01 and STW-V02 to clear the lines of any air. These valves are located by the stormwater/recycle pump inside the treatment building.
13. Operate the stormwater/recycle pump (50P1541) by starting it from the HMI.
14. Transfer contents from the stormwater recycle tank until the low level switch turns off the stormwater/recycle pump (which is 1 ft – **LO-LO** alarm).
15. Vent again by opening valves STW-V01 and STW-V02 to clear the lines of any air.
16. Verify that valve STW-09 is closed, because shutting down the stormwater/recycle pump should automatically close valve STW-09 after the pump has been shut down for 3 minutes.

4.9 Overall Wyckoff Treatment Plant Startup

The procedure presented below is for a quick overall plant startup (after a short-term shutdown of less than a day). It is assumed that the valves for normal operations are in their respective open/close positions as described in Sections 4.2 to 4.5 and Section 4.7.1.

1. Be sure that all the pre-startup requirements listed in Section 4.1 are met.
2. From the HMI the operator will open pneumatic valve DI-01.
3. Be sure the disconnects for the DAF feed pumps, filter feed pumps, DAF control panel, HDBF system, and the backwash pumps are in the **ON** position.
4. Start the DAF and air saturation systems:
    a. Turn on the skimmer from the local DAF control panel, and set the speed to 35 percent.
    b. Turn on the mixer from the local DAF control panel, and set the speed to 50 percent
    c. Turn on recirculation pump 50P1135 from the HMI.
    d. Be sure that the switch on local control panel of the polymer system is in the **AUTO** position.
5. Start the HDBF filter.
    a. Be sure that all manual isolation valves associated with the HDBF unit are open.
    b. Be sure the seal water (nonpotable) for the mechanical seals for the backwash pumps is on.
    c. Be sure that the backwash pumps have been throttled to 80 gpm and are in the REM position on the HMI and that the backwash pump valves are open.
    d. On the HDBF system control panel (50CP1001), place the agitator in the AUTO position, turn on power, pull out the master stop knob, and press the "Master Start/Fault Reset" button.
    e. Start the filter feed pumps in AUTO from the HMI (50P1241 or 50P1242). Place corresponding AFDs in the AUTO position. Pumps are started and the PID

controller is placed in AUTO from the HMI. Be sure the seal water for the pumps is on and set at 0.25 gpm.

6. Start the DAF feed pumps (either 50P1101 or 50P1102). Place the corresponding AFDs in the **AUTO** position. Pumps are started and placed the PID controller is placed in **AUTO** from the HMI. Be sure that the seal water for the DAF feed pumps is on and set at 0.25 gpm.
7. Start the froth pumps (either 50P1251 or 50P1252) from the HMI by placing the corresponding LCS in the **REM** position. Also, start the froth tank decant pumps (either 50P1391 or 50P1392) from the HMI by placing the PID controller in **AUTO**. Valve positions are described in Section 4.7.1.
8. Monitor plant operations.

4.10 Overall Wyckoff Treatment Plant Shutdown

The procedure presented below is for a quick overall plant shutdown (less than a day).

The sequence of events for plant shutdown are as follows:

1. Shut down the HDBF system from the HMI by clicking the **STOP** button. It is recommended to perform a manual backwash from the local HDBF panel prior to shutdown by pressing the manual backwash button.
2. Shut down the filter feed pumps from the HMI.
3. Shut down the DAF feed pumps from the HMI by clicking the **STOP** button. Valve DI-01 will turn off 15 minutes after the DAF feed pumps shut down.
4. Shut down DAF unit components mixer and skimmer from the local DAF control panel and the recirculation pump from the HMI after approximately 30 minutes of operation to be sure that all froth is removed from the unit.
5. Shut down the decant pumps from the HMI by clicking the **STOP** button.
6. The froth pumps will shut down based on a timer set in the HMI or by pressing the **STOP** button from the HMI when the LCS is placed in the **REM** position.
7. Shut off the seal water to the DAF feed pumps, filter feed pumps, decant pumps and backwash pumps.
8. Turn off the disconnects for the HDBF, DAF feed pumps, filter feed pumps, decant pumps, froth pumps, and the backwash pumps.

4.11 Compressed Air Systems and Plant Water Systems Shutdown Procedures

Compressed air system and plant water system shutdowns are performed only when the plant is shut down for an extended period and/or maintenance is being performed on these systems.

4.11.1 Compressed Air Systems Shutdown Procedures

Shutdown is performed only if the entire plant is shut down. The following sequence of activities is to be followed for compressed air systems shutdown:

1. The air compressor is shut down by placing the knob in the **OFF/RESET** position.
2. Turn off the air dryer by pressing the **ON/OFF** button for 3 or 4 seconds.
3. The valves can be left open as-is from the startup.
4. Turn the disconnect switches for the air compressors **OFF**.
5. Close isolation valves AHP-02 and AHP-04.

4.11.2 Plant Water Systems Shutdown Procedures

CAUTION: The plant water pumps must be shut down before suction and discharge valves associated with them are closed; in this case, W2-01, W2-02, W2-05, W2-06, W2-09, W2-10, and W2-11.

The following sequence of activities are to be followed for plant water system shutdown:

1. Shut down the plant water pumps locally by placing the knob in the **OFF** position.
2. The valves can be left open as-is from the start up procedure.

4.12 Winter Freeze Protection Shutdown Procedures

These procedures are broken into two sections. Section 4.12.1 covers freeze protection measures that need to be taken whenever overnight freezes are expected (ambient temperature less than 30 ˚F), and daytime temperatures will be above freezing. **The plant is to remain on line and closely monitored**.

Section 4.12.2 covers long-term freezing temperature (temperatures at 27 ˚F or below), where daytime temperatures will remain at or below freezing. **The plant and well field are to be placed off line**.

In cases where it is uncertain what the weather will be doing, procedures from both sections 4.12.1 and 4.12.2 shall be performed.

It is critical that these procedures be understood completely by all associates to ensure that the plant is fully prepared for any freezing conditions, thus protecting the plant equipment and process from suffering adverse damage. All Wyckoff staff will monitor forecasted weather predictions via the NOAA weather web site and the KOMO 4 news web site.

4.12.1 Moderate Freezing Conditions

The following procedures shall be followed:

Treatment Plant Heater Units

1. Turn on unit heater UH-1 in the process room East. Panel LP-1 breakers 22-24.
2. Turn on unit heater UH-3 in the process room West. Panel LP-1 breakers 17-19.

3. Turn on heater unit in bathroom and place on low setting.
4. Turn on heater unit in operator room and place on low setting.

Treatment Plant Potable Water System

1. Install drop light inside site backflow preventer cover outside of south gate. The electrical outlet is located outside of the site trailer electrical building.
2. Close tempered water supply to tank farm eye wash/emergency shower valves TW-01 and HWR-01 located on southeast wall of process room. Drain shower to tank farm sump.

Dirty Backwash Tank

1. Check that cone bottom drain valve TS-01 is closed.
2. Open valve TS-02.
3. Open valves SS-01, SS-02, SS-03 and TS/SS-01 to drain fluid from the piping and mixing tanks.
4. Open valve SS-D01 located in the tank farm sump.

Digester

1. Check that cone bottom drain valve DS-01 is closed.
2. Open valves DS-02, DS-03, DS-04, DS-05 and DS-06.
3. If the digester is empty, open valve OF/DC-08.
4. If the digester has fluid in it, fully raise the telescoping valve on top of the tank and lock it in the up position, then open valve OF/DC-08

Filtrate Tank

1. Open valves F-01 and F-02.
2. Open valve F-D01 located in the tank farm sump.

Product Tank

1. Check that NAPl-15 is closed.
2. Open NAPL-13 and remove drain plug from 2-inch FRP piping near valve NAPL-15

Equalization Tank Skim Sump Piping

1. Open NAPL-14 and NAPL-4.
2. Open valve NAPL-D02 located in the tank farm sump.
3. Open valves NAPL-06, NAPL-10, NAPL-11 and NAPL-12.

Decon Trailer

1. Leave water running slightly in sinks.

Pressure Washer

1. Disconnect pressure hose.

2. Drain pressure hose by elevating hose and opening wand valve.

Boot Wash Hoses

1. Disconnect boot wash hose from hose bib.
2. Boot wash tubs must be dumped at the end of the day. Tubs should be dumped directly at tire wash drain to prevent ice conditions on tire wash pad.

Steam Cleaner

1. Drain valve must be removed from the Steam Cleaner water system.
2. Drain all water from the Steam Cleaner hose by disconnecting hose and elevating while opening wand valve.

W-2 Non-potable Water System

1. Close tank farm non-potable water supply valve W2-15 located in the process room southeast corner.
2. Disconnect all hoses from hose bibs in tank farm and drain hoses.
3. Open all hose bib valves in tank farm to drain copper piping.
4. Close W-2 water drain valve ¼ turn. The buried valve is located east of the decon pad centered between the plant and tank farm. After the water has drained, place the valve back in its original position. The extension handle wrench for the valve is located inside the treatment plant along the southeast wall near the eyewash station.
5. Disconnect plant decon pad washdown hose from hose bib and drain. Install hose bib weather cover outside of south process room's south roll up door near decon pad.
6. Close valve W2-14 located in the northeast corner of process room and disconnect 2-inch union located outside of the building to drain the 2-inch copper and HDPE piping.

In addition to these tasks, Section 4.12.2 tasks will also need to be completed during severe freezing weather conditions.

4.12.2 Severe Freezing Conditions

Whenever severe freezing conditions are anticipated, all the previously mentioned tasks under Section 4.12.1 must be performed, as well as the following tasks in this section.

Refer to the plant shutdown procedures described in Sections 4.2 through 4.8. Shut down the EWs and the treatment plant. Place all pumps and equipment in the **OFF** position.

Pilot Area Extraction System

1. Place the Hammerhead pumps at EW-2 and EW-6 off line by closing the local air supply valves to the pump. Be sure all hammerhead pumps have completed pumping.
2. Close the Hammerhead pump well influent valve located outside of the plant door on the north side of the building.

3. Connect 1-inch chemical transfer hose to the well header piping located east of extraction well EW-2 and run the hose to the containment sump at extraction well PW-1.
4. Open the 1-inch drain valve located on the header piping and drain the contents of the header piping to the sump at PW-1.

Process Area Extraction Wells

1. Pump down all containment sumps if necessary.
2. Place the following EWs off line at the local controller: PW-1, PW-2, PW-4, PW-5, PW-6, PW-8, and PW-9.
3. Open the EW drain valve and open the sump suction valve.
4. At each EW pump remove the pump housing drain plugs.
5. Close plant influent valve PLI-01 located on the Plant Influent Tank.
6. Open the Hammerhead pump well influent valve located outside of the plant door on the north side of the building to drain the remaining fluid in the header to the tank farm sump.

Product Pumps

1. Product pumps should be run backwards for approximately 10 seconds to purge pump of any water. Check that the supply piping is open to the atmosphere prior to running the pump.
2. Remove pump housing drain plugs.

Plant W-2 Water System

1. Turn off the site deep well pump by placing breaker (Well Pump Feeder) located in the electrical room to the **OFF** position.
2. At the HMI, disable the plant W-2 water tank level alarm and plant water pressure alarm.
3. Turn off #1 and #2 plant water pumps at the local knife switches by placing them in the **OFF** position. Place the pump selector switch in the **OFF** position.
4. Close the following W-2 water valves located at plant water pumps W2-02, W2-06 and W2-10.
5. To drain non-potable water from the plant water tank, slowly disassemble the 3-inch blank flange located next to the plant water pumps and allow the water to drain onto the plant floor and be directed to the tank farm sump.

Effluent Tank

1. Open plant effluent valve PLE-10 to drain the contents of the effluent tank to Eagle Harbor.
2. After the effluent tank is completely drained, open sample port SP-11 located next to the composite sampler.

3. Open drain valves BWS-D01, BWE-FFE-D01, and PLE-D01 located in the tank farm sump.

Equalization Tank

1. Close valve STW-13.
2. Open drain valves STW-D05 and PLI-D01 located in the tank farm sump.
3. Open sample port SP-0 located on the EQ tank influent piping.
4. Open sample port SP-1 located on the EQ tank effluent piping.

Stormwater Tank

1. Open valves PLE-D01-SWT, SWT-D04, and BWR-D01 located in the tank farm sump.
2. Open sample port SP-18 located on the stormwater tank effluent piping.

Dirty Backwash Tank

1. Close chain-operated backwash tank effluent valve BWR-01.
2. At the HMI, open air actuated valve BWR-02 for 30 seconds and then close the valve at the HMI.

Tank Farm Sump

1. After all piping has drained to the sump, place one of the submersible pumps in the hand position and manually pump the water from the containment sump to the storm-water tank until the pump loses suction. When completed, place both submersible pumps in the **OFF** position.
2. Open valves STW-D01, STW-D02, and STW-D03 located in the tank farm sump.
3. Open valve STW-08 located on the Backwash Tank, then close valve STW-08 after the piping has completed draining.

Air Diaphragm Pumps

1. All air diaphragm pumps must be drained of all liquids. The simplest method is to invert the pump, allowing all liquids to run out the discharge fitting.

Decon Trailer

1. Turn off the hot water heaters.
2. Close the potable water supply valve to the trailer.
3. Disconnect the water hose and drain all water from the trailer.

OMI Office Trailer

1. Leave water running slightly in sinks.

CH2M HILL Office Trailer

1. Leave water running slightly in sinks.

Potable Water System

If there is a possibility of the site losing electrical power during freezing weather conditions, the site potable water will have to be secured and the backflow preventer drained.

1. Close the site potable water valve located just upstream of the site backflow preventer.
2. Drain water from the backflow preventer by loosening the 2-inch pipe unions and drain water from the unit.
3. Go back to the site decontamination trailer and open the potable water supply valve for the trailer located below grade and drain the remaining water left in the backflow preventer piping which will also drain the water in the process building piping.
4. After all water has drained from the backflow preventer, reassemble the 2-inch unions and leave the water supply valve in the off position.

5.0 Treatment Plant Maintenance Management and Safety Warnings

This section covers the maintenance requirements for the process pumps, DAF unit, DAF polymer system, HDBF unit, GAC systems, FRP tanks, plant air systems, control system equipment, nonprocess equipment, fire alarm and suppression systems, and panel boards. The order in which these are arranged in this section is the same order in which the individual manufacturer information volumes are listed. Maintenance Summary Forms for the major process equipment listed in subsections below are provided in Appendix E of Volume I. These forms include a summary of equipment data, manufacturer's local representative contact information, maintenance requirements, a lubricant list (if any), and any recommended spare parts. A list of local spare parts supply vendors is provided in Appendix F.

This section also covers an information sheet on operator warnings when operating equipment, and the related safety aspects.

5.1 Pumps Inspection and Maintenance Requirements

Maintenance and inspection requirements for all pump types are provided in this section.

5.1.1 Froth Pumps Maintenance and Inspection Requirements

For froth pumps 50P1251 and 50P1252, preventive maintenance includes the following:

FROTH PUMPS PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
Replace hydraulic oil	Semi-annually
Check drive gear oil level	Monthly, add as needed
Change gear drive lubricant and clean magnetic filter below crosshead chamber	Every 6 months or 2,500 service hours, whichever occurs first. Recommended after initial 90 days in service.
Lubricate drive motor	Annually
Check valves self-cleaning using pump hot detergent solution for 15 minutes, followed with water flushing.	As needed
Clean and flush supply tank and piping	Annually
Clean suction line strainer	As required or needed
Flush ball check valves with clean liquid	As often as necessary for accurate metering
Inspect HPD liquid end displacement chamber	Every 6 months or 2,500 service hours, whichever occurs first.
Replace hydraulic oil strainer	Annually

Corrective maintenance includes the following equipment:

- Relief valve assembly

- Re-fill valve assembly
- Diaphragm replacement

Additional details on maintenance information for the froth pumps is provided in Section 4.0 under Attachment 2.1 of Volume II.

5.1.2 Sump Pumps Maintenance and Inspection Requirements

For sump pumps 40P1501 and 40P1502, preventive maintenance includes the following:

SUMP PUMPS PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
Inspect visible parts on pump, pump casing, and impeller for wear	Annually
Check lubricant/coolant level and condition, change as necessary	Annually
Check cables and cable entry for wear and tightness	Annually
Inspect pump voltage draw and meggar readings	Monthly
Check function of level sensors, starter, and monitoring equipment	Annually
Check rotation direction of pump	When reconnecting
Check pipes, valves, and peripheral equipment	Annually
Check cooling system	Annually

5.1.3 Centrifugal Pumps Maintenance and Inspection Requirements

For filter feed pumps 50P1241 and 50P1242, backwash pumps 50P1351 and 50P1352, decant pumps 50P1391 and 50P1392, stormwater recycle pump 50P1541, and backwash recycle pump 50P1461, preventive maintenance includes the following:

CENTRIFUGAL PUMPS PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
Check bearing and lubricant condition	Weekly
Check shaft seal condition	Weekly
Check pump vibration and lubricate	Weekly
Check pump discharge pressure	Weekly
Check foundation and hold-down bolts for tightness	Quarterly
Change oil every 3 months or 2,000 operating hours, whichever comes first	Quarterly
Check shaft alignment	Quarterly
Verify pump performance	Annually
Establish performance benchmarks during early stages of pump operation while parts are new and installation adjustments are correct. The data include pump developed head, flow rate, motor ampere draw and vibration	Annually

Maintenance information for all the centrifugal pumps is provided in the routine and preventive maintenance section in the Griswolds Installation and Operation Manual in Volume II. In addition, maintenance summary forms for the above-mentioned pumps are provided in Appendix E.

5.1.4 Dissolved Air Flotation Feed Pumps Maintenance and Inspection Requirements

For DAF pumps 50P1101 and 50P1102, preventive maintenance includes the following:

DAF PUMPS PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
Flush or clean pumps	As needed to remove buildup of medium deposits
Lubricate pumps	Quarterly
Lubricate the pin joint with SM-Pin Seals. It is advisable to change the oil and check the seals of the pin joints.	When replacing worn joints and when disassembling the pump Amount: 1.22 fl oz. per joint
Shaft sealing through single mechanical seal. If excessive leaks occur, the spring tension and the seal surfaces should be checked.	Replace seal as necessary.
Motor cleanliness. Motor should be kept clean and free from dust, debris, and oil. A jet of compressed air can be used to remove nonabrasive dust from the fan cover and any accumulated grime from the fan and cooling fins. Terminal boxes should be cleaned and their terminals free from oxidation, in perfect mechanical condition, and all unused space dust-free.	Monthly or as required by conditions
Motor Lubrication. Motor noise should be measured to check for unusual noises. A uniform hum is a sign that the bearing is running perfectly.	Periodically when motor is overhauled or disassembled
V-Belt Lining Inspection	Quarterly
V-Belt drives, sheave alignment, and bearing wear inspection	Quarterly

Detailed maintenance information for the DAF feed pumps is provided in the routine and preventive maintenance section in the Netzsch Installation and Operation Manual provided in Volume II, Attachment 2.8.

5.1.5 Air-Operated Diaphragm Pumps Maintenance and Inspection Requirements

For air-operated diaphragm pumps, including oil pump 50P1410, filtrate/product disposal pump 50P1490, digester/skim pump 50P1120, and filter press/digester feed pump 50P1460, preventive maintenance includes the following:

AIR-OPERATED DIAPHRAGM PUMPS PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
Inspect visible parts for wear	Quarterly
Check for proper air pressure	As needed to control discharge flow rate.
Check pipes, valves, and equipment	Annually

These pumps are pre-lubricated and do not require in-line lubrication. Additional lubrication will not damage the pump.

5.1.6 Dissolved Air Flotation Recirculation Pump Maintenance and Inspection Requirements

For DAF recirculation pump 50P1135, maintenance and inspection are done on an as-needed basis. No particular recommendations were provided by the manufacturer, but references to instructions are provided in the following table:

DAF RECIRCULATION PUMP PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL/ INSTRUCTIONS
Grease lubrication	See Tables 2, 3, and 4 for Sulzer CPT Chemical Process Pumps in Attachment 2.10 in Volume II
Oil lubrication	See Table 5 for Sulzer CPT Chemical Process Pumps in Attachment 2.10 in Volume II
Noise and vibration analysis	See instructions in Section 5 for Sulzer CPT Chemical Process Pumps in Attachment 2.10 in Volume II
Discharge pressure	See instructions in Section 6 for Sulzer CPT Chemical Process Attachment 2.10 in Volume II
Corrosion and wear	See instructions in Section 7 for Sulzer CPT Chemical Process Pumps in Attachment 2.10 in Volume II
Shaft seals monitoring	See instructions in Section 8 for Sulzer CPT Chemical Process Pumps in Attachment 2.10 in Volume II
Pump washdown	See instructions in Section 9 for Sulzer CPT Chemical Process Pumps in Attachment 2.10 in Volume II
Shaft seals maintenance	See instructions in Section 10 for Sulzer CPT Chemical Process Pumps in Attachment 2.10 in Volume II
Open impeller clearance	See instructions in Section 11 for Sulzer CPT Chemical Process Pumps in Attachment 2.10 in Volume II
NOTE: During operation, observe for surface temperatures on volute casing, bearing housing, and shaft seals (measure on case cover and motor).	

For delivery, if the pump is replaced, the bearing housing of this pump must be emptied of oil. Be sure to fill the housing with hydraulic oil that has a viscosity of ISO VG 46. Pay attention to and observe the sight glass on the side of the bearing housing. The housing is full of oil when the level fills half of the sight glass. After filling the housing, re-secure the filler vent plug. Always check the oil level before operating the pump. After the initial 100 hours of use, the oil in this unit should be replaced. From that point on, oil changes will vary between 6 months, if bearing housing temperature is 170˚F, and up to 1 year if below 170˚F.

Corrective maintenance includes:

- Following safety procedures before starting any repairs
- Using appropriate equipment and tools
- Following disassembly procedures
- Following re-assembly procedures

Detailed maintenance information and procedures for the DAF recirculation pump are provided under Sulzer's Installation and Operation Manual provided in Volume II – Attachment 2.10.

5.2 Dissolved Air Flotation System Inspection and Maintenance Requirements

For the DAF (M1121), preventive maintenance includes the following:

DAF SYSTEM PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
Drain and replace drive oil	10,000 hours
Inspect anodes for loss of material	Quarterly
Inspect zinc anodes for loss of material	Quarterly
Grease shaft bearings	Monthly
Check drive oil levels	Monthly
Lubricate skimmer tracks	Monthly
Clean strainer	Bi-weekly
Check oil torque box plunger	Weekly

Inspection activities include the following:

DAF SYSTEM INSPECTION REQUIREMENTS	INTERVAL
Inspect and repair paint	Annually
Inspect torque control device	Annually
Drain, clean, and inspect tank internals	Semi-annually
Check sprocket wear	Semi-annually
Inspect chain for wear	Semi-annually
Inspect wear shoes and strips (1/4” minimum)	Semi-annually
Check sprocket alignment	Semi-annually
Inspect condition of flight wipers	Monthly
Inspect fasteners for tightness	Monthly
Visually inspect skimmer mechanical for wear	Weekly
Test torque box limit switches	Weekly
*Inspect recirculation pump	Weekly
*Inspect drive mechanisms	Weekly
Inspect smooth operation of skimmers	Daily
Listen for unusual mechanical noises	Daily
Inspect zinc anodes for loss of material	Quarterly
*See individual component under Volume III, Attachment 3.1 for details.	

For detailed maintenance information procedures, refer to Westech’s maintenance information for the DAF system under Volume III – Attachment 3.1.1.

5.3 Hydromation Deep Bed Filtration System Inspection and Maintenance Requirements

HDBF filter maintenance requirements are detailed in Section 6 of the Filtra Systems Manual in Volume IV.

For the HDBF system (50M1260), preventive maintenance includes the following:

HDBF SYSTEM PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
Vent air out of the vessel	Performed after prolonged shutdown (1 week and more), or after adding media
Inspect the wedge wire basket for wear	Annual, or earlier if conditions warrant
Clean the media scrubber basket	Annual, or earlier if conditions warrant
Inspect the clean discharge wedge wire plenum	Performed only if continual evidence of media is seen in the discharge line, or if high pressure differential across the filter immediately after backwash is observed
Remove media from vessel	Based on frequent observance of high differential pressure
Media charging and media control	Perform monthly

5.4 Granular Activated Carbon System Inspection and Maintenance Requirements

The fixed bed carbon system is designed to require minimal maintenance. The following inspection activities should be performed with regard to the carbon adsorbers, ancillary piping, valves and gauges.

For GAC systems 50M1301, 50M1302, 50M1303, 50M1304, and 50M1305, preventive maintenance includes the following inspection activities:

GAC SYSTEM PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
Perform an internal inspection of an adsorber	After spent carbon removal
Inspect the lining to verify it has not been damaged	After spent carbon removal
Inspect the underdrain laterals in the collector to be sure they are intact and not plugged	After spent carbon removal
Check pressure gauges periodically to allow proper operation	Monthly
Inspect piping and valving for signs of wear or leakage	Monthly

For additional information, refer to Volume V.

5.5 Fiberglass-Reinforced Plastic Tanks Inspection and Maintenance Requirements

Prior to first time online service of FRP tanks, and after any system maintenance, the following equipment inspection and operational checks shall be conducted.

For FRP tanks 40T1010, 40T1330, 40T1440, 40T1420, 40T1520, and 50T1380, preventive maintenance includes inspection of the following:

FRP TANKS PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
Inspect vent lines, overflow lines, and the tank itself for foreign debris and loose materials that could cause plugging and remove as needed.	Monthly
Inspect all fasteners on piping for proper tightness	Monthly
Inspect for obvious structural damage (for example, broken or fractured fittings or attachments, punctures, cuts, or delaminations).	Monthly
Inspect for impact damage, particularly on inside surfaces. These may appear as white areas, with star-shaped surface cracks or crazes.	Monthly

5.6 Other Process Equipment Inspection and Maintenance Requirements

The following six sections describe maintenance activities recommended for other process equipment not described above.

5.6.1 Mixers Maintenance Requirements

For mixers 40M1431, 40M1432, and 50M1480, preventive maintenance includes the following:

MIXERS PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
Inspection	Quarterly
Cleaning	Quarterly
Motor lubrication	Semi-annually

Maintenance information for digester sludge mixers is provided in Volume VII – Attachment 7.1.

5.6.2 Rotary Blower Maintenance Requirements

For rotary blower 50M1551, preventive maintenance includes the following:

ROTARY BLOWER PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
Lubrication	Weekly
Checking for hot spots	Weekly
Check for vibration and measure pressures and temperatures	Weekly

5.6.3 Filter Press Maintenance Requirements

For filter press 50M1470, periodic maintenance is summarized below:

FILTER PRESS PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
Lubricant - check reservoir level	Bi-weekly
Filter Press - inspect condition of plates	Monthly
Clean - excessive dirt, grease, etc.	Monthly
Filter Press - clamp pressure	Monthly
Filter Press - cylinder boot	Monthly
Filter Press - plumbing	Monthly
Leakage - seals, seams, flanges, etc.	Monthly
Filter Press - relief valve, proper adjustment	Monthly
Filter Press - replace hydraulic oil	Semi-annually

5.6.4 Air Compressors Maintenance Requirements

For air compressors 50M1651 and 50M1652, periodic maintenance is summarized below:

AIR COMPRESSORS PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
Lubricant level – Palasyn 45	Once daily
Drain condensate from auxiliary receiver	Once daily
Check instrument pressure gauges	Once daily
Change compressor lubricoolant filter	Once every 1,000 hours
Perform sample analysis of lubricoolant	Once every 1,000 hours
Inspect air filter element	Once every 1,000 hours
Lubricant Palasyn 45 – Drain lubricoolant and replace with fresh charge. Inspect interior of tank.	Once every 4,000 hours or once a year
Replace oil filter	Delta P exceeds 15 pounds per square inch differential (psid) or once every 1,000 hours
Replace air filter	Once every 1,000 hours
Check air/oil separator	Differential pressure exceeds 8 psid
Clean or replace air filter element upon inspection	Once every 1,000 hours
Clean - excessive dirt, grease, etc.	Once a week
Motor - excessive vibration	Once a week
Replace filter bag	Once a week
Operation - proper operation	Once a week

Follow the maintenance actions listed in Section 6 - Maintenance of the Sullivan Palatek Model 20D compressor in Attachment 7.5 of Volume VII.

5.6.5 Air Receiver Maintenance Requirements

For air receiver 50T1465, follow the maintenance schedule provided below:

AIR RECEIVER PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
Record pressure gauge	Once daily
Drain condensate	Once every 3 days

5.6.6 Air Dryer Maintenance Requirements

Follow the maintenance schedule as provided below:

AIR DRYER PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
Visually inspect for proper condensate drain operation	Weekly
Release pressure by isolating the dryer from the compressed air system by closing inlet and outlet valves	Monthly
Clean or replace condensate drain trap filter	Monthly

5.7 Turbidimeter Maintenance Requirements

For turbidimeter AE/AIT-1245, the sequential steps for calibrating the online turbidimeter are provided below.

The manufacturer recommends calibrating the Surface Scatter 7 sc (SS7 sc) instrument at least every 3 months or any time the light source is replaced or adjusted.

A calibration cylinder and a 500-ml bottle of 4,000 NTU formazin primary standard solution is included for convenient calibration of the SS7 sc. After the formazin standard solution is added to the cylinder, the instrument is set to the value of the standard.

1. Prepare the formazin standard solution at the desired NTU value. The 4,000-NTU standard supplied with the instrument can be used at full strength and only requires mixing (by inverting the bottle repeatedly). If a dilution of the 4,000-NTU standard is desired, the manufacturer recommends it to be no lower than 300 NTU. Dilutions must be made just prior to use. Dilute formazin solutions are unstable and should be discarded when calibration is complete. Use filtered sample or demineralized water for dilution.
2. Turn off sample flow to the instrument and drain the turbidimeter body. Insert the calibration cylinder into the top of the body.
3. From the main menu on the SS7 sc, select SENSOR SETUP and confirm.
4. If multiple sensors are attached to the controller, choose **SELECT SENSOR>SS& SETUP** and confirm.
5. Select **CALBRATE** and confirm.

6. Select **PERFORM CAL** and confirm. Select the available Output mode (Active, Hold, or Transfer) and confirm. In this case it will be Active.
7. Enter the **STD VALUE** and confirm. Confirm to continue.
8. Follow the display prompt and place the formazin standard into the calibration cylinder, allowing it to overflow. Only allow the solution to stand long enough to allow bubbles on or near the surface to dissipate. Close the sensor door and confirm to continue.
9. The **TURB** value displayed is the standard value determined using the gain from the previous calibration. Confirm to accept and continue with the calibration.
10. If no selection is made for a set period of time, the screen will prompt to remix the standard to avoid a change in the value of the standard.
    a. Open the SS7 sc and remix the standard.
    b. Close the door and confirm to continue.
11. Confirm to calibrate. When the calibration is completed successfully, the display will show **GOOD CAL**! and the new calibration gain value. Confirm to accept the calibration.
12. Enter the initials of the user performing the calibration and confirm.
13. The controller will prompt for **NEW BASELINE.** Confirm to establish new baseline or press **BACK** to exit.
14. Remove calibration cylinder from the body. The instrument is now calibrated.
15. Close the drain valve and restore the sample flow. If no verification is done, the display will prompt to return to measurement mode. Confirm to continue measurements.

Instrument verifications are intended as a simple check to ensure SS7 sc functionality between calibrations. Verifications should be performed on a monthly basis using a manufacturer-provided standardization plate.

Verification directly after calibration is used to establish the baseline. Any verification until the next calibration that uses the same verification standard will reference the recorded value from the baseline verification as the "expected value.” In order for the verification to pass, the measured value should be within the limits set by the Pass/Fail Criteria of the baseline value.

Before starting the verification, read section 5.5.3 in the User Manual.

1. From the Main Menu, select **SENSOR SETUP** and confirm.
2. If multiple sensors are attached to the controller choose **SELECTS ENSOR>SS7 SETUP** and confirm.
3. Select **CALIBRATE** and confirm.
4. Select **VERIFICATION** and confirm.
5. Select **PERFORM VER** and confirm.

6. The serial number on the standardization plate to be used for verification should match the serial number listed on the **VALID SN** screen. Confirm to accept the displayed serial number.

IMPORTANT NOTE: If the serial numbers do not match, a verification baseline must be established before verification can be performed.

7. Select the available Output Mode (Active, Hold, or Transfer) from the list box and confirm.

8. Position the plate on top of the sample cylinder.

    a. Shut down the sample flow and wipe off the top of the sample cylinder.

    b. Place the standardization plate on top of the sample cylinder so that the light beam strikes the center of the plate. Note the orientation of the plate and always place it in the same position when using it to check standardization.

    c. Close the door to eliminate stray light. Confirm to continue.

9. When the displayed turbidity value is stable, confirm to select the measured reading. After confirming the reading:

10. **GOOD VER!** will be displayed if the verification is good, with an option to continue or to abort. Confirm to continue. Enter the operator initials and confirm.

11. **BAD VER!** will be displayed if the verification is bad, with an option to repeat or exit. To repeat the verification, confirm to return to the **VALID SN** screen (Step 6).

12. Open the SS7 sc to remove the plate. Restart the sample flow and close the door. Confirm to return the instrument to measurement mode.

NOTE: After confirmation of return to measurement mode, the instrument will equilibrate for 2 minutes before the output mode changes. Instrument measurements will show on the display, but the value will flash and a **OUT MODE WARN** warning will display until the 2-minute equilibration period is complete.

Refer to the Hach Manual for the calibration cylinder method. This manual is located in Volume VIII – Attachment 8.3.

Scheduled periodic maintenance requirements of the SS7 sc turbidimeter are minimal. Standardization checks and calibration are the primary requirements. Other scheduled maintenance includes removing a sensor from the system, installing a sensor on the system, and cleaning the turbidimeter.

Unscheduled maintenance includes lamp replacement, light source assembly maintenance, and detector assembly replacement.

Detailed maintenance information on the above scheduled and unscheduled tasks is provided in Volume VIII – Attachment 8.3.

5.8 Fire Alarm System Maintenance Requirements

To keep the fire alarm system in excellent working order, ongoing maintenance is required per the manufacturer's recommendations and Underwriters Laboratories (UL) and NFPA standards, and applicable state and local codes. At a minimum, the requirements of Chapter 7 of NFPA, the National Fire Alarm Code, shall be followed. Environments with large amounts of dust, dirt, or high air velocity require more frequent maintenance. A maintenance agreement should be arranged through the local manufacturer's representative. Maintenance should be scheduled monthly or as required by national and/or local fire codes, and should be performed by authorized professional fire alarm installers only.

The general maintenance activities for fire alarm systems are provided below:

- Test and calibrate alarm sensors, such as flame and smoke detectors, per manufacturer specifications. This requires knowing about the different sensors and their testing requirements, failure modes, and re-installation requirements.
- Simulate inputs and test the annunciators. This requires specific knowledge of the system being tested.
- Set sensitivity. This requires an understanding of the particular system, the specific application, and fire detection theory.
- Coordinate with the local fire department to test the input to their system.
- Check the battery for corrosion and expiration date, then take appropriate action, if necessary.

5.9 Motor Control Center/Panel Board Inspection and Maintenance Requirements

For MCCs and panel boards, follow the maintenance schedule provided below:

MCC/PANEL BOARD PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
Inspect all motor control and panel board installations.	Monthly
Perform a visual inspection, front and rear, to see that there is no evidence of loose parts, warping, or undue vibration. Take steps to remedy any deficiencies of this nature that may appear.	Monthly
Keep the assembly dry. Cover to prevent moisture from dripping on equipment.	Monthly
Do not block vents or flaps.	Monthly
Perform an overall visual inspection.	Semi-annual
Check all indicators, meters, and instruments for proper operation. Make sure all bolted connections are secure.	Semi-annual
Verify operation of heaters and thermostats, if used.	Semi-annual
Check for undue noise and vibration that might loosen bolted connections.	Semi-annual
Look for evidence of moisture in the switchgear, and	Semi-annual

MCC/PANEL BOARD PREVENTIVE MAINTENANCE REQUIREMENTS	INTERVAL
note any unusual amount of ozone odor.	
Bolted connections should be tight. Discoloration, excessive corrosion, or embrittled or discolored insulation may indicate an overheated connection.	Annual
Inspect all cables for tight connections and ample support.	Annual
Inspect control wiring for signs of wear and damage. Replace wire wherever doubtful.	Annual
Examine resistors and other devices prone to overheating.	Annual
Open all hinged doors and remove bolted panels.	Annual
Clean insulation thoroughly.	Annual
Withdraw and clean all drawout components.	Annual
Clean the stationary portion of the switchgear by wiping with a clean cloth.	Annual
Use dry, compressed air in inaccessible areas.	Annual
Remove the covers of all panel devices where possible.	Annual
Check wiring for secure connections. Clean contacts on relays and switches wherever necessary. Replace covers.	Annual
Remove air filters when used. Flush with clean water if necessary. Coat filters with Super Coat Adhesive or equivalent. Inspect the gearing of lift devices, if used. For normal operation use a heavy gear lubricant. In very dirty or gritty conditions, use a dry lubricant.	Annual
Follow the recommendations of any individual device instructions furnished for maintenance of the device.	Annual
Perform maintenance of contactors as recommended in instructions furnished with the unit.	Annual
Inspect secondary wiring bundles for signs of discoloration because of heat or chafing. Check for cracked or embrittled insulation. Replace wire whenever doubtful.	Once every 2 years
Inspect primary insulation system for accumulated contamination. Clean insulation with a dry cloth, dry-air, vacuum or, if necessary, with an OSHA-approved solvent.	Once every 2 years
Check the calibration of protective relays approximately every 2 years.	Once every 2 years
Follow the recommendations of any individual device instructions furnished for maintenance of the device.	Once every 2 years
NOTES: OSHA = Occupational Safety and Health Administration	

5.10 Adjustable Frequency Drive Maintenance Requirements

AFD maintenance requirements are listed below:

- **Keep it Clean.** Dust on AFD hardware can cause a lack of airflow, resulting in diminished performance from heat sinks and circulating fans. Dust on an electronic device can cause malfunction or even failure. Dust absorbs moisture, which also contributes to failure. Periodically spraying air through the heat sink fan is a good preventive maintenance measure. Discharging compressed air into an AFD is a viable option in some environments, but typical plant air contains oil and water. To use compressed air for cooling, use air that is oil-free and dry.

- **Keep it Dry.**
- **Keep Connections Tight.**
- As part of a mechanical inspection procedure, do not overlook internal AFD components. Check circulating fans for signs of bearing failure or foreign objects, usually indicated by an unusual noise or shafts that appear wobbly.
- Inspect DC bus capacitors for bulging and leakage. Either could be a sign of component stress or electrical misuse.
- Take voltage measurements while the AFD is operating. Fluctuations in DC bus voltage measurements can indicate degradation of DC bus capacitors. Measurements more than 4VAC may indicate a capacitor filtering problem or a possible problem with the diode bridge converter section (ahead of the bus). If there are such high voltage levels, consult ABB (drive manufacturer) before taking further action. With the AFD in **START** mode and at zero speed, the output voltage should read 40VAC phase-to-phase or less. If it is more than this, there is a possible transistor leakage. At zero speed, the power components should not be operating. If readings are 60VAC or more, expect power component failure.
- Store spare AFDs in a clean, dry environment, with no condensation allowed. Place this unit in the preventive maintenance system so it can be powered up every 6 months to keep the DC bus capacitors at their peak performance capability.
- Regularly monitor heat sink temperatures. Most AFD manufacturers make this task easy by including a direct temperature readout on the keypad or display. Verify where this readout is, and make checking it part of a weekly or monthly review of AFD operation.

5.11 Building Concrete Coating System Maintenance Requirements

Proper maintenance will increase the life and maintain the appearance of a new floor coating. The frequency of maintenance depends on the work environment and the amount of dirt and debris that accumulates on the floor. Dirt and dust are abrasive and quickly dull the finish and decrease the life of the coating, and liquids can stain and damage the finish. The greater the accumulation of dirt and debris and the more harsh the environment, the more frequent the need to clean. Refer to Appendix I for floor coating system details and application instructions.

A. Develop a regular floor care maintenance program to include the following maintenance tips:
    - Sweep the floor each day with a broom or mechanized cleaning equipment.
    - Scrub the floor at least once a week using the correct brush and detergent.
    - Clean up spills immediately before they have a chance to damage the finish.
    - Place mats near entryways to minimize tracking in dirt and moisture.
    - Repair any large gouges or scratches as soon as possible.

- Do not slide heavy machinery or materials across the floor without protection. This will scratch and gouge the floor coating.
- Avoid dropping heavy or pointed items on the floor.
- Do not allow spills to remain on the floor.
- Do not use stiff bristle brushes and caustic cleaning solutions on the coatings because this will dull the surface.

B. Care for a coated floor

Because of the nonporous nature of the coating, a coated floor will require less maintenance than an uncoated concrete floor. To maximize the life of a new flooring investment, a daily maintenance program should be established. Routine sweeping and scrubbing will minimize scratching from abrasive dust, limit dirt and debris buildup, and extend the appearance and life of the floor.

SWEEPING - Sweep floors daily with a broom or mechanized sweeping equipment to prevent dust and dirt from accumulating. If using a mechanized sweeper, be sure to use a soft bristle brush. Stiff brushes may scratch the coating, causing a loss of gloss.

SCRUBBING - The frequency of scrubbing depends on the amount and type of dirt and debris that has accumulated; however, all floors should be scrubbed at least once a week. High traffic areas such as aisle ways should be scrubbed daily. Use a mop and bucket, or for greater productivity, use a mechanized scrubber. Areas where oil and grease are prevalent require daily attention. Any liquid spill can cause a slip hazard and should be cleaned up immediately.

SPILLS - Any liquid spill is a safety hazard and should be cleaned up immediately. Spills of caustics, acids, and solvents should be cleaned up immediately to prevent damage to the floor coating. Harsh liquids that are allowed to remain on the floor may soften, discolor, or completely remove a coating or sealer. If chemicals are prevalent in the area, consult your Carboline technical sales representative for a guide to the chemical resistance properties of the floor coating. Contact for Carboline is Bruce Mitchell at (503) 703-7228.

SCRATCHES AND GOUGES - Avoid scraping and sliding heavy machinery, pallets, or sharp objects across the floor, because this can cut and gouge the coating. In a coating, deep cuts or gouges result when heavy or sharp items are scraped or dropped on the surface. These damaged areas allow moisture to seep under the coating and can result in peeling.

To repair damaged areas, follow these steps:

- Clean the area of any grease, oil, and dirt and debris using trisodium phosphate (TSP) detergent
- Sand the scratched or gouged area by hand using 100 grit sandpaper and feather the edges until smooth
- Rinse well and allow to dry

Repair the damaged area using the original coating material per instructions. STAIN PREVENTION AND REMOVAL - If stains do occur, begin removal with a mild solution, progressing to stronger removers until the stain disappears. For safety, always wear rubber gloves and eye protection when working with chemicals.

- Grease and oil stains - Grease and oil may stain the coating, particularly if allowed to remain on the floor over 24 hours. Scrub the area with TSP. Follow instructions on detergent labels.
- Dried spills and stubborn stains.

If a spill is not caught in time it may dry, leaving a film or stain that is difficult to remove. Take the following steps:

1. If the spill has dried, use a plastic tool to remove any residue, taking care not to scratch the coating.
2. Wet a clean cloth with an ammonia-based household cleaner and wipe the stained area to remove the stain.
3. If the stain persists, wet a cloth with TSP and wipe the area.
4. If the stain still remains, try lightly sanding the area with 0000 steel wool.
5. If the above steps are unsuccessful, consult the Plasite technical sales representative for assistance.

RUBBER BURNS - Fork lift and other vehicle tires often leave rubber burns in the coating.

To remove these burns, follow the steps below:

1. Spot the stained area with Citric Clear and agitate with a stiff brush or mechanical scrubber. (NOTE: waste must be disposed of in a sanitary sewer or in accordance with local regulations. Do not dispose of waste in storm sewers. Follow label directions carefully.)
2. Add TSP or detergent and water to form an emulsion.
3. Scrub thoroughly.
4. Rinse the area completely with water.

5.12 Uninterrupted Power Supply Maintenance Requirements

Maintenance of the UPS includes the following items:

- Check operating environment for clean, cool, dry conditions.
- Inspect and clean the unit.
- Check operation of fans.
- Check and tighten all connections.
- View and record the alarm and inverter logs.
- Check the batteries.

- Check the displayed UPS readings against actual measurements and recalibrate if necessary.
- Perform a system test.
- Check and record the values of the parameters in the system status menu 1 while the system is online and on battery.
- Check the metal oxide varistor (MOV) surge suppression pack.

5.13 Operator Warning Information

This section provides information on warning conditions and activities that can be avoided and prevented while operating equipment. This section is to be used in parallel with Section 5.14, which discusses safety warnings related to unit processes described in Sections 3.0 and 4.0.

5.13.1 Pumps

The warning information for pumps includes centrifugal pumps and progressing cavity pumps (filter feed, backwash, decant, stormwater recycle, backwash recycle, and DAF feed pumps):

- Always be sure that the seal water is on and flowing. Damage to the seals, shaft, or shaft sleeve can occur otherwise.
- Never run a pump with the discharge valve closed. Excessive heat can be created in the pump, causing damage to the impeller, bearings, and casing. Pumps can explode if they get too hot or are not allowed to cool properly. Do not operate a pump below the minimum rated flows.
- Never exceed the manufacturer's allowable rotational speed. A pump is designed to run at a maximum speed, and if that speed is exceeded the pump can come apart.
- Not following operating procedures and practices could result in personal injury or loss of life, or destruction of equipment.
- Serious injury or damage to the equipment could result unless care is taken to properly lift and support equipment.
- Never apply heat to remove an impeller. Trapped liquid, when heated, may cause an explosion.
- Never use heat when disassembling the pump.
- Never operate the pump without the coupling guard in place.
- Always start the pump with the proper prime.
- Never operate the pump without the suction valve fully open.
- Never operate the pump with safety devices disengaged.

- Always lock out the driver before performing maintenance on the pump.
- Severe damage can occur if the pump is operated in a reverse direction.
- Swapping any two leads can change the rotation direction.
- Standard lube oil is flood oil. Prior to initial operation and at regular intervals, fill with flood oil.
- Never mix greases of different consistencies or types.
- Never allow a pump to run dry or without having liquid in the seal chamber. Pumps must be primed before operation.
- NEMO pumps (DAF feed pumps) are positive displacement progressing cavity pumps that have the potential to generate very high pressure capable of bursting vessels or pipes. Excessive pressure can overload the drive train or exceed the pressure limitations of the housings and their connections, resulting in damage or breakage

5.13.2 Granular Activated Carbon Adsorbers

- Never exceed the manufacturer's pressure ratings or disable any safety devices. A GAC adsorber can rupture if it is filled with excessive pressure. Never replace ruptured discs with discs greater than the manufacturer's recommendations, or replace with any other device.
- Activated carbon can reduce oxygen levels in confined spaces. Use and comply with all applicable confined space entry procedures when entering adsorbers containing carbon, or from which carbon is removed.

5.13.3 Fiberglass-Reinforced Plastic Tanks

Never pressurize FRP storage tanks or the tank can fail. These tanks are designed for atmospheric pressure.

5.13.4 Rotary Blower

Never exceed the manufacturer's pressure settings or ratings. Never exceed pressure ratings or re-adjust or bypass the manufacturer's settings or safety bypass. Excessive pressure can cause damage to the blower and/or the electric motor.

5.13.5 Air Diaphragm Pumps

Never exceed the manufacturer's maximum operation pressure, which is 125 psig. Excess operation pressure can cause damage to or destruction of the pump, and/or damage to the delivery system as a result of excessive pressure buildup in the system.

5.13.6 Air Compressors

Never exceed the manufacturer's pressure ratings or pressure settings. Never bypass the manufacturer's safety devices. Excessive pressure can cause damage to the equipment and injury or death to personnel.

5.13.7 Froth Pumps

- Do not start the pump drive motor before filling the gear box with oil, or serious damage will occur.
- The pressure relief valve is factory set to open at a pressure slightly above the pump maximum operating discharge pressure; never set the valve at any greater pressure.
- Keep hands away from the reciprocating plunger and crosshead.
- Do not leave a pump operating unattended with the shut-off valve closed. Excessive pressure can build quickly, possibly causing severe damage to the pump and/or piping.
- Before performing any maintenance and disassembly procedures, relieve all pressure from the system, isolate the liquid end from all sources of process liquid with appropriate valving, and purge the liquid end of all process liquid.

5.13.8 Submersible Pumps

The following operating actions could lead to damage of the submersible pumps:

MECHANICAL – Damage caused by pumping or mixing liquids in excess of 115˚F when not authorized by Flygt in writing; damage caused by dropping the pump; damage caused to the pump's leakage sensor resulting from a pump more than 10 degrees off vertical; and damage to pumps, parts, or other accessories caused by freight carriers.

ELECTRICAL – Damage to pumps and motors when inappropriate or inadequate panels are used and have not prevented failure; damage to pumps when the failure is electrically related and proof of motor protection cannot be supplied; motor burnouts that are caused by excessive high or low voltage or unbalanced voltage conditions; damage caused by excessive starting frequency (starting more than 15 evenly spaced starts per hour) unless authorized by Flygt; damage caused by repeated attempted starts after overload protection has tripped (without investigating the cause); damage caused by not using protective leakage and overheating devices; and motor rewinding performed by an unauthorized rewind facility.

HYDRAULIC – Damage caused by running a pump in reverse; damage caused by pumping within the dotted portion of published curves unless authorized by Flygt in writing; and damage caused by pumping volatile liquids or liquids that are corrosive or hazardous, except where approved by Flygt.

OTHER – Damage caused by pumping liquids with higher viscosity or higher specific gravity than Flygt's printed recommendations, unless authorized and approved by Flygt in writing; damage resulting from normal wear and tear in normal operation of the pump; damage to products derived from their use in applications not recommended by Flygt's printed instructions or sales literature; damage caused from the use of non-Flygt manufactured or supplied parts; damage caused by impellers not recommended within published curves, sales literature, or technical manuals; product failures that are not reported within the required 30 days from the failure; and pumps and parts damaged by freezing and lightning.

5.13.9 Dissolved Air Flotation System

Compressed air is used in the air saturation tank. Air under pressure may present an explosive danger when removing components or initiating operation.

- Do not override or block off vents or pressure relief valves. Use isolation valves to close off circuits being removed.
- The air saturation tank should be vented and drained completely prior to inspection through the side flanges of the vessel. Air can be vented off in the return line above the vessel. The water can be drained at the bottom of the vessel through the valve.
- Use caution when opening valves. Open valves slowly to prevent loud noise or blown debris. When starting equipment, open valves slowly.
- Do not operate equipment with partial power to some components, or missing a phase.
- Do not operate equipment with clogged effluent, influent, or float lines.
- Do not operate equipment with damaged, crushed, or cut electrical conduits or cables.
- Do not run equipment unattended if a torque control device is not connected to the DAF control panel
- The DAF unit is not configured for outdoor use or operation in sub-freezing temperatures.

5.14 Plant Safety Warnings

The following plant safety warnings are provided for each of the major component systems. Serious damage to equipment or harm to employees could occur if these warnings are not followed.

5.14.1 Equalization Tank and Wells

CAUTION: Always assure that all valves to and from the pumps are open. Running pumps dry or under excessive head pressure can cause damage to equipment.

CONFINED SPACE: The EQ tank is a confined space. Always use Confined Space entry procedures if entering the tank.

WARNING: Fall protection is required if personnel will be doing work on the tank.

WARNING: Always wear proper PPE while working around the EQ tank because of possible contamination.

5.14.2 Dissolved Air Flotation System

CAUTION: Always assure that all valves to and from the pumps are open. Running pumps dry or under excessive head pressure can cause damage to equipment.

WARNING: For rotating equipment, always be sure that all guards are installed on pumping equipment.

WARNING: Automatic restarting or electrical shock can cause injury or death. Open and lock main disconnect and any other circuits before working on the air system or servicing air compressors.

WARNING: Exercise caution around moving parts. Keep hands, clothing etc. away from moving parts. Always de-energize, lock, and tag equipment before working on it or before adjustments are made.

CAUTION: Compressed air is used in the saturation tank. Always use extreme caution because this may present an explosion hazard. Always depressurize the system if working on it or doing maintenance.

CONFINED SPACE: The DAF tank is a confined space. Always use confined space entry procedures if entering the tank.

WARNING: Always wear eye protection while working around equipment.

WARNING: Always wear proper PPE while working around the DAF unit because of possible contamination.

For additional safety instructions, refer to Westech's O&M Manual in Volume III – Attachment 3.1.1.

5.14.3 Hydromation Deep Bed Filtration System

CAUTION: Always be sure that all valves to the pumps are open. Running pumps dry can cause damage to the equipment. Possible personnel injury can also occur as a result of the pump overheating.

WARNING: Automatic restarting or electrical shock can cause injury or death. Open and lock the main disconnect and any other circuits before working on or servicing equipment.

CAUTION: Compressed air is used to operate automatic valves. Always use extreme caution because this may present an explosion hazard. Always depressurize the system if working on it or doing maintenance.

WARNING: Caution should be used while working around equipment. Equipment runs automatically.

WARNING: Always wear eye protection while working around equipment.

5.14.4 Granular Activated Carbon Adsorbers

- **Pressure Relief Warning:** To avoid adsorber damage and endangerment of operations personnel, do not block the pressure relief device from venting to the atmosphere.
- **May Reduce Oxygen Available for Breathing:** Wet activated carbon in confined spaces may reduce oxygen below the level needed to support life. This potential lack of oxygen makes the use of an independent air supply necessary.
- **May cause fire in contact with strong oxidizers:** Contact between activated carbon and a strong oxidizing agent such as liquid oxygen or concentrated ozone is not

recommended. Also, reactive chemicals in contact with activated carbon may oxidize, decompose, or polymerize to produce heat that could result in combustion.

- **Other Potential Hazards-Process vapors or liquids:** Activated carbon adsorption adsorbers, by virtue of their use, may generate irritating, toxic, or explosive vapors.
- **Ungrounded systems may accumulate static electricity:** All systems should be grounded to avoid static electrical shock or ignition hazards.
- **Confined Space:** The GAC adsorber is a confined space. Always use confined space entry procedures when entering the adsorber.

5.14.5 Digester and Dirty Backwash Tank Operation

WARNING: Assure that all appropriate PPE is worn while working on the digester and dirty backwash equipment.

WARNING: While using positive displacement diaphragm pumps, do not exceed the maximum air inlet pressure. Be sure that all hoses and components are capable of withstanding the high pressures created by pump discharge. High pressure can cause serious personnel injury and property damage.

CAUTION: Always depressurize the system and pump before disconnecting or performing any maintenance on the diaphragm (filter press feed) pump.

WARNING: Always be sure that blower valves are open prior to starting the blower.

WARNING: Open and lock the main disconnect and any other circuits before working on or performing maintenance on the blower.

Warning: Use extreme caution and wear all appropriate PPE while working with chemicals such as lime or acids.

5.14.6 Filter Press

CAUTION: Do not operate equipment without eye protection.

CAUTION: Do not operate equipment unless safety guards or devices are in place and properly adjusted.

CAUTION: Disconnect electrical power before servicing the filter press. Always lock and tag the unit electrical system.

CAUTION: The unit uses high pressure air and hydraulic fluid. Always lock and tag all air and hydraulic system valves before servicing the filter press.

5.14.7 Sump System

CAUTION: Always be sure that all valves are open on the discharge side of the pump to prevent excessive head pressure that can cause damage to the pump and piping. Be sure that pumps are completely submerged; running a pump dry can cause damage to the equipment.

WARNING: Automatic restarting or electrical shock can cause injury or death. Open and lock the main disconnect and any other circuits before working on or servicing equipment.

5.14.8 Oil Processing

WARNING: Assure that all appropriate PPE is worn while working on the oil processing equipment.

CAUTION: Always be sure that all valves to the pumps are open. Running pumps dry can cause damage to the equipment. Possible personnel injury can also occur as a result of the pump overheating.

WARNING: Automatic restarting or electrical shock can cause injury or death. Open and lock the main disconnect and any other circuits before working on or servicing equipment.

WARNING: While using a positive displacement diaphragm pump, do not exceed the maximum air inlet pressure. Be sure that all hoses and components are capable of withstanding the high pressures created by pump discharge. High pressure can cause serious personnel injury and property damage.

CAUTION: Always depressurize the system and pump before disconnecting equipment or performing any maintenance.

CAUTION: All tanks are considered confined spaces. Always use proper confined space entry procedures when entering a tank.

5.14.9 Air System and Water System

DANGER: Air/oil under pressure can cause severe personal injury or death. Shut down the compressor; relieve the system of all pressure; disconnect, tag, and lock out the power supply to the starter before removing valves, caps, plugs, fittings, bolts, and filters.

DANGER: The compressor, air/oil reservoir, separation chamber and all piping and tubing may be at high temperature during and after operation.

WARNING: Automatic restarting or electrical shock can cause injury or death. Open and lock the main disconnect and any other circuits before working on the air or water systems or servicing air compressors or water pumps, piping, or receiver and pressure tanks.

DANGER: Always drain the water system of pressure before working on or servicing the system.

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State of Washington NPDES Requirements

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Major Equipment Manufacturer's Warranty

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