Sandy Wastewater Treatment Plant Condition Assessment Improvements Project

PREPARED FOR

City of Sandy, OR

PREPARED BY

Sandy Wastewater Treatment Plant Condition Assessment Improvements Project Preliminary Design Evaluation Report

Prepared for

City of Sandy

Project No. 964-50-20-01

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WEST YOST
Water. Engineered.

FINAL REPORT | MARCH 2021

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LIST OF ACRONYMS

2019 Condition Assessment	Condition Assessment in July 2019
2019 Facilities Plan	Wastewater Facilities Plan in 2019
2019 Facilities Plan	Wastewater Facilities Plan in 2019
2020 PDR	Immediate Needs Improvements Project Preliminary Design Report
AACE	Association for the Advancement of Cost Engineering
AAF	Average Annual Flow
ACH	Air Changes per Hour
ADWF	Average Dry Weather Flow
aSRT	Aerobic Solids Retention Time
ASSB	Aerated Sludge Storage Basin
ASSB	Aerated Sludge Storage Basin
BOD	Biological Oxygen Demand
City	City of Sandy

CMU	Concrete Masonry Unit
DO	Dissolved Oxygen
EDI	Energy Dissipating Inlet
FRP	Fiberglass Reinforced Plastic
GPM	Gallons Per Mile
I&C	Instrumentation and Control
IMLR	Internal Mixed Liquor Recycle
IOT	Internet of Things
LEL	Lower Explosive Limit
MBR	Membrane Bioreactor
MCCs	Motor Control Centers
MGD	Millions of Gallons
MLSS	Mixed Liquor Suspended Solids
MMDWF	Maximum Month Dry Weather Flow
MMWWF	Maximum Month Wet Weather Flow
NFPA	National Fire Protection Association
NPDES	National Pollutant Discharge Elimination System
OPCC	Opinion of Probable Construction Cost
OSHA	Occupational Safety and Health Administration
PDF	Peak Day Flow
PDR	Preliminary Design Report
PIF	Peak Instantaneous Flow
PLC	Programmable Logic Controller
Project	City of Sandy WWTP Condition Assessment Improvements Project
PVC	Polyvinyl Chloride
RAS	Recycled Activated Sludge
RPS	Return Pump Station
SCADA	Supervisory Control and Data Acquisition
SCFM	Standard Cubic Feet Per Minute
SRT	Solids Retention Time
TAG	The Automation Group
TM	Technical Memorandum
UV	Ultraviolet
VFD	Variable Frequency Drives
WAS	Waste Activated Sludge
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

The City of Sandy (City) developed a Wastewater Facilities Plan in 2019 (2019 Facilities Plan), which identified wastewater collection, conveyance and treatment system improvements to be implemented in three phases through 2040. The 2019 Facilities Plan also identified several immediate needs projects required to improve the performance of the Wastewater Treatment Plant (WWTP).

After the 2019 Facilities Plan was completed, the City conducted a Condition Assessment in July 2019 (2019 Condition Assessment), which identified additional immediate needs projects beyond those identified in the 2019 Facilities Plan. The City then performed several operational and mechanical improvements to the WWTP after completion of the 2019 Condition Assessment.

In the summer of 2020, the City developed the Immediate Needs Improvements Project Preliminary Design Report (2020 PDR). The 2020 PDR presented a preliminary design for the improvements required at the WWTP based on the recommendations in the 2019 Facilities Plan, the findings of the 2019 Condition Assessment, and the improvements implemented in 2019.

This report evaluates the recommendations in the 2020 PDR and presents a modified set of recommended improvements, which will more efficiently utilize the City's budget while also effectively addressing the operational and maintenance deficiencies at the WWTP. These improvements will be implemented under the City of Sandy WWTP Condition Assessment Improvements Project (Project).

In addition to the recommended improvements identified in this report, a "Wish List" of improvements that can be implemented under this Project, if funding allows, or under future projects is provided in Appendix E. The items included on the Wish List are improvements identified by City and plant operations staff during site visits conducted for this Project. The Wish List is intended to be a living document that can be changed over time to keep track of small and large improvements that the City wishes to complete.

2.0 OVERVIEW OF EXISTING FACILITIES

The City of Sandy WWTP is located at 33400 SE Jarl Road in Boring, Oregon. A site plan showing the major processes, buildings, and other site features at the WWTP is shown in Figure 2-1. A summary of the design influent flows for the WWTP from the 2020 PDR are provided in Table 2-1. A summary of the major equipment sizing and design criteria from the 2020 PDR are provided in Table 2-2. The existing condition of the major processes, building and other site features are discussed in more detail in Section 3.0.

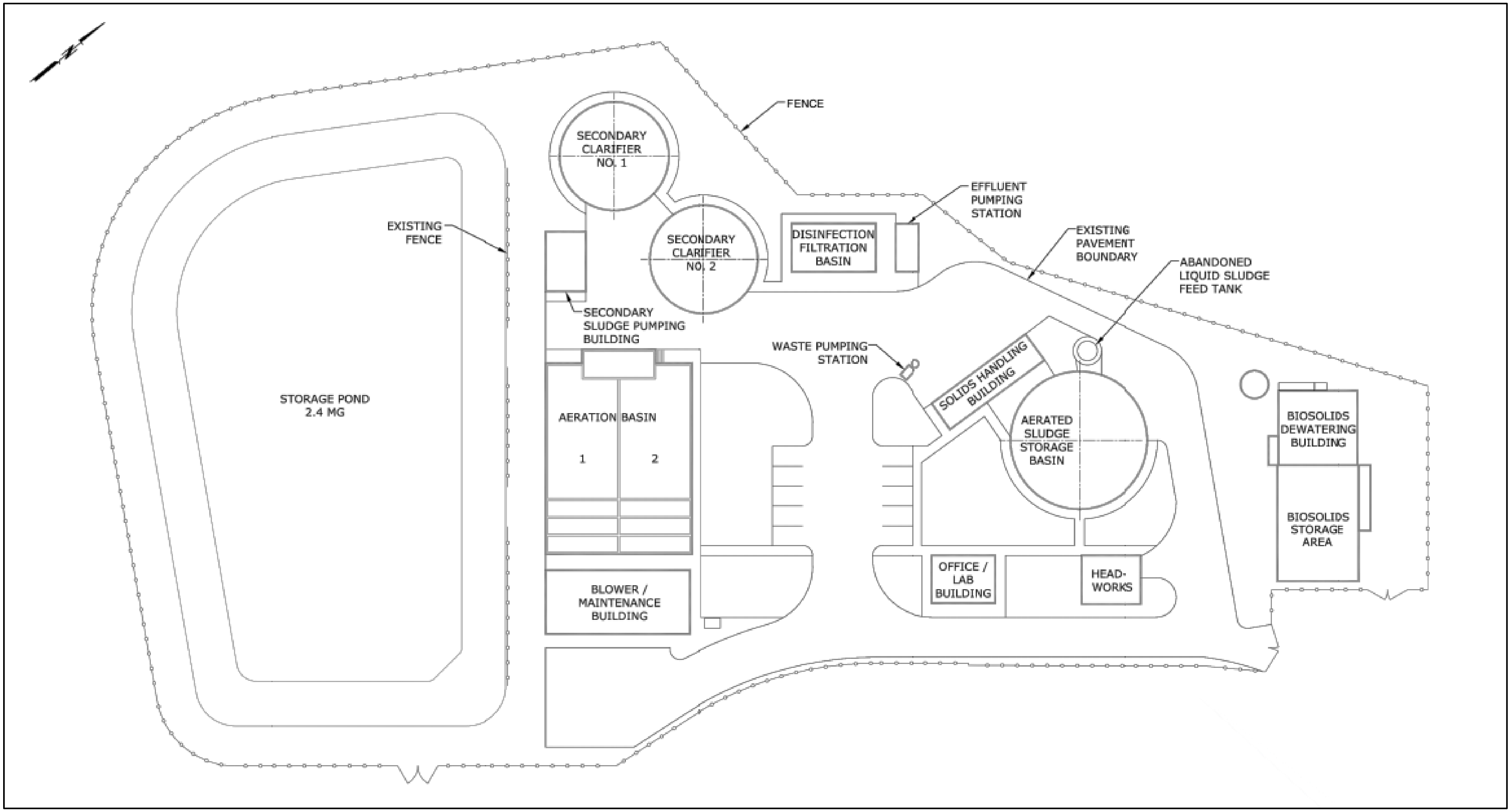

Figure 2-1. Sandy WWTP Site Plan

Table 2-1. Sandy WWTP Influent Design Flows							
Flow Condition	Design Flow, million gallons per day (mgd)						
	Exist	2025	2026[1]	2030	2035	2036[2]	2040
Average Annual Flow (AAF)	1.4	1.5	0.9	1.1	1.4	0.8	1.2
Average Dry Weather Flow (ADWF)	1.1	1.2	0.7	0.9	1.1	0.6	0.9
Maximum Month Dry Weather Flow (MMDWF)	1.4	1.5	0.9	1.2	1.4	0.8	1.2
Maximum Month Wet Weather Flow (MMWWF)	2.7	2.9	1.8	2.2	2.6	1.4	2.3
Peak Day Flow (PDF)	5.9	5.5	3.9	4.8	5.7	3.2	5.0
Peak Instantaneous Flow (PIF)	9.1	9.9	6.4	7.7	9.1	5.6	7.0

Notes:
1. First phase of the Eastside Satellite Plant begins operation in 2026
2. Second phase of the Eastside Satellite Plant begins operation in 2036.

Table 2-2. Sandy WWTP Existing Design Criteria	
Parameter	Value
Raw Screening	
Screen Type	Drum Screen
Screen Capacity	6.7 mgd
Screen Channel Width	4 ft
Screen Bar Spacing	1/4-in
Manual Screen	
Type	Bar Screen Rack
Quantity	1
Width	2 ft
Bar Spacing	3/4-inch
Grit Removal	
Type	Vortex
Max Flow	7.0 mgd
Grit Chamber Diameter	10 ft
Air Scour	75 standard cubic feet per minute (scfm)
Grit Chamber Mechanism Drive Motor	1 hp
Grit Pump	250 gpm @ 30 ft TDH, 5 hp
Grit Concentrator	250 gpm
Grit Classifier Screw Conveyor Drive	1 hp
Influent Flow Measurement	
Type	Parshall flume with level sensor
Throat width	12-inch
Capacity	9.2 mgd
Aeration Basins	
Number of Trains	2

Table 2-2. Sandy WWTP Existing Design Criteria	
Parameter	Value
Total Basin Volume	740,000 gal
Selector Cells (3 per train)	75,000 gal, ea
Aerobic Cells (1 per train)	145,000 gal, ea
Average Sidewater Depth	17.79 ft
Diffuser Type	Fine Bubble Disc, 7 in dia.
Submersible Mixers (Total 4)	4 hp
Internal Mixed Liquor Recycle Pumps (Total 2)	750 gpm @ 12.0 ft TDH, 5 hp ea
Utility Pumps (Total 2)	2,800 gpm @ 12 ft TDH, ea
Blowers (No. 1-3)	
Type	Multi-stage Centrifugal
Capacity	1,350 scfm
Motor	100 hp
Blowers (No. 4)	
Type	Positive Displacement
Capacity	1,199 scfm
Motor	60 hp
Secondary Clarifiers	
Quantity	2
Capacity	3.5 mgd, ea.
Surface Overflow Rate at Capacity	1,500 gal/day per ft^2
Diameter	54 ft
Side-water Depth	15 ft
Mechanism Drive	3/4 hp
RAS Pumps	
Quantity	2
Capacity	600 gpm @ 23 ft TDH, ea
Motor	7.5 hp
WAS Pumps	
Quantity	2
Capacity	260 gpm @ 23 ft TDH, ea
Motor	5 hp
Filters	
Type	Disk Filters
Number of Units	2
Number of Disks per Unit	6
Capacity, total	6 mgd
Average Flow Rate	2 gpm/ft^2
Disk Drive	1/2 hp, ea

Table 2-2. Sandy WWTP Existing Design Criteria	
Parameter	Value
Backwash Pump Quantity	2
Backwash Pump Drive	2 hp, ea
High Pressure Wash Pump Quantity	2
High Pressure Wash Pump Drive	40 hp, ea
Ultraviolet (UV) Disinfection	
Type	Medium Pressure
Number of Channels	1
Peak Flow Rates	7.0 mgd
Dosage	30,010 microwatt sec/cm^2
Headloss	17.7 in
Aerated Sludge Storage Basin	
Center Well	90,000 gallons
Cell No. 1:	90,000 gallons
Cell No. 2:	180,000 gallons
Decant Pumps	
Quantity	3
Capacity	50 gpm @ 22 ft TDH
Motor	1/2 hp
Sludge Transfer Pump	
Quantity	2
Motor	10 hp
Diffusers	
Center Well	270, 7-in dia fine bubble membrane disc
Cell No. 1 and No. 2	16, coarse bubble
Sodium Hypochlorite Storage & Metering Facility	
Number of Tanks	2
Tank Volume	1,000 gallons, ea
Number of Metering Pumps	2
Metering Pump Capacity	5 gph
Waste Pump Station	
Pump Station Type	Wet Pit with valve vault
Wet Pit Diameter	4 ft
Pumps	
Type	Submersible
Quantity	2
Capacity	350 gpm @ 22 ft TDH, ea
Motor	3 hp

3.0 PRELIMINARY DESIGN EVALUATION

This section summarizes the existing condition of each process area at the WWTP, the improvements recommended in the 2020 PDR, an evaluation of the 2020 PDR recommendations and a modified set of improvements recommended for implementation under this Project. Drawings of the proposed improvements are provided in Appendix A.

3.1 Headworks Facility

3.1.1 Existing Conditions

The existing headworks consists of a drum screen in a 4-foot wide channel with 1/4-inch openings; a manual screen in a 2-foot wide bypass channel; a 10-foot diameter vortex grit removal basin; and a Parshall flume for measuring influent flow. The grit basin is equipped with an airlift pump that pumps grit from the bottom of the basin and discharges it to a grit classifier. The grit classifier removes water and organic material from the grit and conveys the grit via a screw conveyor to a dumpster. The drum screen also discharges screenings to the same dumpster.

The headworks facility has the following deficiencies:

- The headworks equipment is over 20 years old and is reaching the end of its useful life.
- The drum screen does not have adequate capacity to treat future peak wet weather flows.
- Solids and rags leak through the side seals on the drum screen and influent flow periodically overflows the bypass channel isolation gate. This results in poor removal of solids and rags from the influent flow.
- There is no means of removing the screen from the channel to perform routine maintenance on the screen.
- The paddle mixer in the grit removal basin failed recently.
- The grit pump and grit pump discharge piping need replacement.
- There is no redundant mechanical screen or grit removal equipment at the headworks facility.
- The hydraulic grade line of the headworks facility is not compatible with future planned primary clarifiers, which are required to treat the additional solids load from the future Eastside Satellite MBR facility. The headworks facility will need to be relocated to a higher elevation to allow primary clarifiers to be installed at the WWTP.

3.1.2 Previous Preliminary Design Recommendations and Discussion

The 2020 PDR recommended the following improvements for the headworks facility:

- Replace the drum screen in-kind.
- Replace the vortex grit removal equipment including paddle mixer, grit pump, grit concentrator, grit classifier, and screw conveyor in-kind.
- Install a motorized crane next to the screen to improve maintenance accessibility.

- Replace the headworks equipment control panel to improve control from the Supervisory Control and Data Acquisition (SCADA) system.
- Repair/replace the conduit and wiring between field equipment and motor control centers (MCCs) in the blower building.

After reviewing the existing conditions of the headworks facility and the 2020 PDR recommendations, West Yost recommends the City make limited investments in the existing headworks facility for the following reasons:

- The biggest issue impacting operation of the headworks facility is peak flows and system hydraulics. The current headworks is simply not designed for the nearly 10 millions of gallons of (MGD) peak flows that are believed to enter the facility during peak storm events.
- The main bearing on the existing drum screen has been replaced and the screen is functioning adequately.
- Ultimately, the headworks facility will need to be relocated to a higher elevation to support the future installation of primary clarifiers as part of the major planned expansion when the Eastside Membrane Bioreactor (MBR) facility is constructed.

As a result, West Yost recommends a modified approach for addressing the deficiencies at the headworks facility as summarized in the following section.

3.1.3 Modified Preliminary Design Recommendations

Based on the analysis summarized above, it recommended that the following improvements, which will improve permit compliance, treatment performance, and maintenance access be implemented at the headworks facility under this Project:

- Install a motorized gantry crane next to the existing drum screen to assist in removing the screen from the channel for routine maintenance.
- Replace the paddle mixer in the grit basin.
- Replace the grit pump and grit pump discharge piping.
- Implement structural improvements to prevent influent flow from overflowing the bypass channel isolation gate and bypass the screen.

These recommended upgrades are shown on Drawings S000 and M001 included in Appendix A.

3.2 Equalization Basin

3.2.1 Existing Conditions

The existing flow equalization facilities consist of a flow control structure, an equalization basin and utility pumps that drain the basin and discharge flow into the aeration basins. The flow control structure was installed in 2018 and is designed to split flow from the headworks facility to the aeration basin and the equalization basin using two fixed weirs. The weir elevations are set to allow flow to the equalization basin when influent flow exceeds 2.0 mgd. The existing flow equalization facilities have the following deficiencies:

- The existing flow control structure and equalization basin do not include any instrumentation to measure flow to the equalization basins or water surface level in the basins. As a result, the basin frequently overfills.
- Large plumes of algae have been observed to build up in the equalization basin.
- The existing utility pumps that drain the basin back into the aeration basin are constant speed pumps and are oversized. Therefore, when operation staff begin draining the equalization basin, large slugs of flow with high concentrations of algae are discharged into the aeration basins. The presence of algae in the equalization basins return flow can inhibit the biological treatment in the aeration basins and result in permit violations.

3.2.2 Previous Preliminary Design Recommendations and Discussion

The 2020 PDR recommended the following improvements to the flow equalization facilities, which were focused on adding instrumentation to measure flow to the equalization basins and water level in the basins:

- Build a concrete flow control structure in the equalization basin and extend the existing 16-inch Polyvinyl Chloride (PVC) bypass pipe from the aeration basin to this flow control structure
- Install a walkway out to the concrete flow control structure.
- Install a 350 gallons per mile (gpm) submersible pump within the flow control structure to allow for drainage of the equalization basin back to the aeration basin as needed.
- Install a magnetic flow meter on the new bypass pipe and an ultrasonic level transmitter in the equalization basin.

After reviewing the existing conditions of the flow equalization facilities and the 2020 PDR recommendations, a slightly different approach is recommended for the equalization basin upgrades. Instead of building a new flow control structure, it is recommended that existing facilities be modified to better control and measure flow to the equalization basin. It is also recommended that floating aerators be added to the equalization basin to reduce the formation of algae in the basins.

3.2.3 Modified Preliminary Design Recommendations

To meet the deficiencies noted above, the following improvements are recommended for the equalization basin:

- Evaluate the design of the flow control structure using the existing Visual Hydraulics model and modify the elevation of the weirs to reduce the frequency at which raw sewage is discharged into the equalization basins. Proposed modifications include removing the existing baffles and static weir plates in the flow control structure and installing a motorized weir gate in the structure to control flow to the equalization basin.
- Install a level sensor in the existing flow control structure to measure the level over the proposed weir gate. This level measurement can be used to determine flow to the equalization basin and can also be used to send an alarm to operators and the SCADA system to inform them that flow is diverted to the equalization basin.
- Install a level sensor in the equalization basin to allow operators and the SCADA system to know the depth of the basin.

- Install floating aerators in the equalization basin to limit algae growth.

- Install motorized plug valves on the discharge piping of the existing utility pumps, which can be used to adjust the output from the pumps. This will allow operations staff to return water from the equalization basin back into the treatment plant at a rate that does not overwhelm the treatment process.

These recommended upgrades are showing on Drawings C001 and M003 included in Appendix A.

3.3 Aeration Basins

3.3.1 Existing Conditions

The existing aeration basins are split into two trains each consisting of two anoxic zones and two aerobic zones. The anoxic zones are equipped with submersible mixers and the aerobic zones are equipped with a floor-mounted grid of fine bubble diffusers. A common influent channel conveys raw sewage from the headworks facility into the first anoxic zone, first aerobic zone, or second aerobic zone of either train. Recycled activated sludge (RAS) is discharged into either the upstream or downstream end of the common influent channel where it is mixed with the raw/screened sewage before entering the aeration basins. Mixed liquor from both aeration basin trains is collected in a common effluent channel that directs flow to the secondary clarifiers. The common effluent channel also directs a portion of the flow to an internal mixed liquor recycle (IMLR) pump station that is configured to allow a portion of the mixed liquor to be returned to any of the four zones in each aeration basin train. Bypass piping allows flow from the first aerobic zone of each aeration basin train to bypass the second aerobic zone and be discharged into the common effluent channel. Air is delivered to the fine-bubble diffusers with three 1,350 scfm, 100 hp multi-stage centrifugal blowers and one 1,199 scfm, 60 hp positive displacement blower.

The aeration basins have the following deficiencies:

- Air leaks have been identified in the ductile iron air piping. Some of the air leaks have been repaired, but the air piping is in poor condition.
- The aeration basins do not have an effective aeration control system. There are two dissolved oxygen (DO) probes in the aeration basins. However, the blowers are constant speed and the air piping drop legs delivering air to the fine bubble diffusers in the aerobic zones are not equipped with flow meters and modulating valves. Therefore, airflow cannot be adequately adjusted to meet oxygen demand. This results in periods of low DO concentrations that impairs biological oxygen demand (BOD) and ammonia removal, resulting in permit violations.
- A significant amount of foam builds up in the aeration basins on a regular basis. The low DO in the aeration basins contributes to the foam build-up. Also, the mixed liquor must pass under several flow control slide gates as it flows through the aeration basins. This configuration does not allow foam to exit the aeration basins.
- The openings in the walls separating each zone of the aeration basins are located on the same side of the aeration basin. This configuration does not create a serpentine flow path through the various zones. Instead, the configuration allows flow to short circuit directly from the influent opening to the effluent opening in each zone. This results in inadequate mixing in each zone and inadequate treatment time in each zone.

- When the bypass piping connecting the first aerobic zone to the mixed liquor effluent channel is used, raw sewage entering the aeration basins will receive very little treatment, because of the short-circuiting issue noted above.
- The influent wastewater does not have adequate alkalinity and prevents the nitrification process from occurring in the aeration basins because the pH is lowered to below recommended levels. The low pH inhibits biological treatment, which results in permit violations.
- The configuration of the mixed liquor effluent channel results in more flow from the eastern train entering the IMLR pump station. Therefore, nitrified effluent from the western train is not adequately returned to the anoxic zones for dentification.
- There is not adequate means of balancing the flow from the mixed liquor effluent channel into the two secondary clarifiers.

3.3.2 Previous Preliminary Design Recommendations and Discussion

The 2020 PDR recommended the following improvements for the aeration basins:

- Replace two multi-stage centrifugal blowers with two new variable speed blowers.
- Install new motor-operated butterfly valves on the air piping drop legs serving each train.

After review, West Yost recommends a slightly different approach for the aeration basin upgrades. We do not recommend replacing the existing blowers as recommended in the 2020 PDR, nor do we think the addition of actuated butterfly valves on the existing aeration header will provide adequate aeration control. As the "heart" of the treatment process, much work is needed in the aeration basin to address the biological process and operational issues. Our recommendations are summarized in the following section.

3.3.3 Modified Preliminary Design Recommendations

A Biowin© biological process model was developed to evaluate the performance of the aeration basins and determine the improvements needed to address the deficiencies discussed above. The process modeling is summarized in the technical memorandum (TM) included in in Appendix B. Summary of key findings from the process model include:

- Optimization of the secondary process treatment system through mechanical upgrades and operational changes to the aeration basins is necessary to meet the current effluent limitations at the anticipated 2025 wet weather flows and load conditions.
- The key capacity limitation is the solids loading on the secondary clarifiers during peak flow conditions and operating the aeration basins in a fully aerobic mode with an inlet step feed will maximize treatment capacity by lowering the solids loadings to the clarifiers.
- With the recommended changes, the steady-state BioWin© modeling predicts the WWTP will be able to meet the effluent limitations following filtration. However, the State Point model predicts clarifier failure at flows exceeding 7.0 mgd which is about 2.0 mgd lower than the defined peak instantaneous flow conditions.
- The steady-state modeling approach used for this analysis does provide a conservative assessment of the available capacity for handling peak flow conditions. However, the dynamic modeling needed to fully optimize the treatment process performance for short-

term peak flow conditions is complex and requires a significant amount of process data and wastewater characterization that is not available.

- The addition of a third clarifier would eliminate performance concerns with the secondary clarifier system and would allow the aeration basins to be operated at a higher mixed liquor suspended solids (MLSS) concentration, increasing overall performance of the secondary process. However, once the new satellite treatment system is constructed, the overall loadings to the plant will decrease. Therefore, it would not be prudent to construct a new secondary clarifier facility at this time.
- It may also be possible to further lower MLSS concentrations in peak flow conditions by using the Aerated Sludge Storage Basin (ASSB) for contact stabilization. Additional modeling analysis is needed to assess this possible strategy.

Based on the results of the process modeling, it is recommended that the aeration basins be operated as described below and as summarized in Table 3-1 to improve performance and address the deficiencies discussed above:

- Anoxic/Aerobic Zone Configuration:
  - Install a divider wall in the last cell of each train, dividing those cells into two smaller cells, creating five cells in each train (Cells A1 – A5 and B1 – B5)
  - Configure the first two cells in each train as swing zones
  - Operate the swing zones in anoxic mode during the dry season and aerobic mode during the wet season
  - Operate the last three cells in each train as aerobic zones year round
- Step-Feed Operations:
  - During the dry season, it is recommended that all flow be discharged into the first swing zone
  - During the wet season, it is recommended that half the raw/screened sewage be discharged into the first swing zone of each train and the other half be discharged to the second aerobic zone of each train.
- IMLR Flows
  - During the dry season, when the first two cells of each train are being operated in anoxic modes, the IMLR pumps should be operated to return nitrified mixed liquor to the anoxic zones for denitrification. The IMLR flows should be set to the maximum 1.08 mgd per train.
  - During the winter season, when all cells are being operated in aerobic mode, the IMLR should be off.
  - The IMLR piping should be modified so that IMLR flows are discharged to the first cell of each train only.
- RAS Flows
  - It is recommended that the RAS pump be modified so that they can achieve a return rate of 50 percent of influent flow during current max day conditions (1,800 gpm).
  - The RAS pumps should be operated at a return rate of 100 percent of influent flows for influent flows up to 2.6 mgd.

— When influent flows exceed 2.6 mgd, the RAS pump should be operated at their max pumping rate 1,800 gpm.

Table 3-1. Sandy WWTP Summary of Aeration Basin Operational Recommendations

Parameter	Wet Season Operation	Dry Season Operation
Cell A1 and B1	Aerobic	Anoxic
Cell A2 and B2	Aerobic	Anoxic
Cells A3 – A5 and B3 – B5	Aerobic	Aerobic
Raw/Screened Sewage Discharge Location	33 – 50 percent to Cell A1/B1 50 – 67 percent to Cell A4/B4	100% to Cell A1/B1
RAS Rate	50 – 100 percent of Influent, 1,800 gpm max	50 – 100 percent of Influent, 1,800 gpm max
IMLR Rate	0 gpm	1,500 gpm
Aerobic Solids Retention Time (aSRT)	6.5 days	4.0 days, min
MLSS Concentration, max	1,900 mg/L	2,900 mg/L

Recommended aeration basin mechanical improvements required to implement the proposed operational changes and to address the deficiencies discussed above, are summarized as follows:

- Install a concrete baffle wall to divide the two existing aerobic cells (largest cells in each aeration train) into two smaller aerated cells;
- Replace slide gates on the influent channel with downward opening weir gates to allow control of flow into each zone;
- Modify the RAS and IMLR piping so that RAS and IMLR flows are discharged to the first zone of each train under all conditions;
- Remove the aeration piping and diffusers and install the following aeration system components:
  - Two new stainless-steel air headers, one serving each train of the aeration basins.
  - Three grids of fine bubble diffusers in each aeration basin train: one grid in the anoxic zones. one grid in the first two aerobic zones, and one grid in the final aerobic zone.
  - New air piping drop legs for each fine bubble diffuser grid.
  - New flow meters and motorized butterfly valves on each air piping drop leg.
  - Three DO probes in each train of the aeration basins.
- Install VFDs on the three existing multi-stage centrifugal blowers and implement a control strategy tied to new air drops with air mass flow meters and actuated butterfly valves;
- Implement the following improvements to create a serpentine flow path through each aeration basin train and prevent scum accumulation in each cell:
  - Provide new openings in the wall between Cell A2 and A3 and the wall between Cell B2 and B3. The new opening will be near the center of the basins.

- Provide openings in the new wall between Cells A4 and A5 and the new wall between Cells B4 and B5. The openings shall be near the outer edge of the basins.

- Add fiberglass reinforced plastic (FRP) baffles at the opening to Cells A4 and B4 to direct flow toward the center of the basins and limit short-circuiting of flow through those cells. Replace the slide gates on the effluent channel and gate between the aeration basin zones with downward opening gates to prevent foam from accumulating in the aeration basins;
- Install a concrete divider wall in the middle of the effluent channel to dedicate a single secondary clarifier to each aeration basin train to improve the flow split between the secondary clarifiers;
- Install new piping below the effluent channel to direct mixed liquor into the IMLR pump station.
- Install a gate on the overflow cutout on the utility pump station.
- If project funding allows, it is recommended to investigate a way to measure flow going into each secondary clarifier. This is placed on a Wish List of improvement included in Appendix E.

These recommended upgrades are shown on Drawings S001, S002, S003, S004, M002, M004, and M007 included in Appendix A.

3.4 RAS/WAS Pump Station

3.4.1 Existing Conditions

The RAS/ WAS pumps station consists of two 600 gpm, 7.5 hp centrifugal RAS pumps and two 100 gpm WAS pump located in the basement of a concrete masonry unit (CMU) block building north of the aeration basins and west of the secondary clarifiers. The RAS/WAS Pump Station has the following deficiencies:

- The RAS/WAS pump station building ventilation system cannot provide the minimum of six air changes per hour (ACH) required by the National Fire Protection Association (NFPA) 820 Standard for a Class 1, Division 2 area.
- The RAS/WAS pump station building does not have a lower explosive limit (LEL) gas sensor, oxygen sensor, or audio/visual gas alarm required by NFPA 820
- The RAS pumps do not have adequate capacity based on the findings of the process modeling TM provided in Appendix B.

3.4.2 Previous Preliminary Design Recommendations and Discussion

The 2020 PDR did not recommend any improvements for the RAS/WAS pump station. Based on West Yost's biological process modeling, it is recommended that the RAS pumping capacity be increased as summarized in the following section.

3.4.3 Modified Preliminary Design Recommendations

To meet the deficiencies noted above, the following improvements are recommended for the RAS/WAS pump station:

- Upgrade the HVAC system to ensure proper ventilation within the basement and building and to meet the requirements of NFPA 820.
- Install LEL gas detectors, oxygen sensors, and audio/visual gas alarms in the RAS/WAS Pump Station.
- Replace the RAS pump motors with new 20 hp, inverter duty rated motors to increase the capacity of each pump to 900 gpm.
- Install variable frequency drives (VFDs) for each RAS pump.
- Modify RAS pump discharge piping to accommodate increased pump capacity.

One opportunity that has been proposed by Veolia that was not able to be included in the current preliminary design evaluation is the potential for using ASSB Cells 1 and 2 as a contact zone during peak flows. West Yost believes this idea has merit and could potentially increase the peak WWTP capacity. Under this scenario, RAS would be pumped to ASSB Cell No.1, flow through Cell No.2 after which it would be pumped to the aeration basin. To implement this process change, the following would be required:

- A new valve vault would be constructed on the existing 8” RAS pipe;
- An 8” RAS pipeline extension would be constructed from the valve vault to ASSB Cell No.1;
- A new submersible RAS Return Pump Station (RPS) would be constructed next to the ASSB to return RAS from ASSB Cell No.2 to the aeration basin; and
- A new 8” return pipe would be installed from the RPS to the new valve vault.

If implemented, these upgrades would also allow pressate from the belt filter press to be diverted to the ASSB during peak storm events to reduce flow to the storm water pump station.

These recommended upgrades are showing on Drawings M006 included in Appendix A.

3.5 Secondary Clarifiers

3.5.1 Existing Conditions

There are two existing secondary clarifiers at the WWTP. Each clarifier is 54-feet in diameter with a 15-foot side water depth; and is equipped with a center feed column, energy dissipating inlet (EDI), flocculation well, cantilevered effluent launders with a scum baffle, a multiple uptake pipe/draft tube type sludge collection mechanism, a scum skimmer arm and a scum box. The secondary clarifiers have the following deficiencies:

- The clarifier mechanisms are over 20 years old, have reached the end of their useful life and need to be replaced.
- Scum/foam accumulates in the clarifiers.
- The sludge collection uptake pipes get clogged with rags.
- The effluent weirs are not level causing short circuiting of the flow through the units.

3.5.2 Previous Preliminary Design Recommendations and Discussion

Ovivo Eimco and Rebuild-It Services Group performed a site visit and inspection of the secondary clarifiers in June 2020. Based on the findings of that site visit and inspection, it was recommended in the 2020 PDR that the following components be replaced:

- Sludge/scum collector mechanism drive.
- Scum skimmer arm.
- Scum beach flush valves.
- Seals on sludge box.
- Sludge uptake pipe valves.
- Spray nozzles.
- Effluent weirs.
- Effluent baffles.

Rehabilitation of the secondary clarifiers and, especially, leveling the launder weirs is an important part of the project. There are a few items West Yost recommends adding to the project if funding allows as summarized in the following section.

3.5.3 Modified Preliminary Design Recommendations

The secondary clarifier improvements summarized in the 2020 PDR are recommended for implementation under this Project. It is also recommended that the following improvements be implemented:

- Replace the existing scum beach and box with a system consisting of two scum beaches and boxes, one on either side of the cantilevered launder. This will allow scum to be removed on each side of the launder.
- Replace the section of scum baffle near the new scum beaches with a deeper baffle to prevent scum from bypassing the baffle.
- If project funding allows and depending on improving gravity flow from the scum boxes, it is recommended the scum pump station be upgraded or replaced. This item is one of the items included on the Wish List of improvements in Appendix E.

These recommended upgrades are showing on Drawings M005 included in Appendix A.

3.6 Filters and UV Disinfection

3.6.1 Existing Conditions

The existing Filter and UV Disinfection Facility consists of two filter basins equipped with cloth disk filters and a UV disinfection channel equipped with 24 medium pressure UV lamps. The existing facility has the following deficiencies:

- The filter media was replaced in 2020 with new cloth media that was anticipated to allow the initial design capacity of 6 MGD to be achieved.
- However, the current filter operation appears to be limited to a capacity of approximately 3 MGD. This is at least partially due to the poor secondary effluent quality that typically flows to the filters during high flow conditions.
- It is anticipated that the recommended aeration basin and secondary clarifier upgrades will improve secondary effluent quality under higher flow conditions but it is unknown at this time how much additional filter capacity will be "recovered".
- The existing Trojan 4000 UV disinfection system is over 20 years old and has reached the end of its useful life but Veolia has indicated they are still able to get parts and that replacement of the UV system is not the highest priority in the treatment plant.
- The existing 14" outfall pipeline that connects the UV channel effluent wet well is designed with a horizontal flared inlet which allows the pipe to become airlocked.

3.6.2 Previous Preliminary Design Recommendations and Discussion

The 2020 PDR recommended the following improvements for the Filter and UV Disinfection Facility:

- Replace the existing UV system with a new higher capacity UV disinfection system;
- Perform channel modifications required to accommodate the new UV disinfection system; and
- Install a new programmable logic controller (PLC) and operator interface for the new equipment.

3.6.3 Modified Preliminary Design Recommendations

West Yost recommends the following Filter/UV area upgrades:

- Replace the existing horizontal flared inlet on the existing 14-inch outfall pipeline with a 90-degree fluted end bend that points down to help prevent air locking of the pipeline;
- Provide baffles in the filter influent channel to better control the flow split between the filter trains.
- Consider installation of a new 3 MGD tertiary treatment train consisting of a skid-system with new secondary effluent diversion pumps, new cloth media disk filters, new medium-pressure UV system, flow meter and composite sampler; and
- Rehabilitate the metal building components on the Filter/UV area cover and replace the sacrificial anode on the cathodic protection system for the structure.

These recommended upgrades are showing on Drawings C001 included in Appendix A.

3.7 Aerated Sludge Storage Basin

3.7.1 Existing Conditions

The existing ASSB is a circular structure that is split into three cells. Cell No. 1 is a circular cell located at the center of the ASSB with a volume of 90,000 gallons. The two other cells form a "donut" around the center cell. Cell No. 2 has a volume of 180,000 gallons and Cell No. 3 has a volume of 90,000 gallons. WAS and secondary clarifier scum are discharged into Cell No. 1 where it is thickened and then overflows into Cell No. 2. Sludge from Cell No. 2 is pumped to a belt filter press with a submersible pump. Filtrate from the belt filter press flows back to Cell No. 3. Decant pumps in Cells No. 2 and No. 3 convey supernatant from those cells back to the Headworks Facility. All three cells are equipped with floor-mounted diffusers that are used to provide mixing, remove ammonia, and prevent anaerobic degradation of stored sludge. Air is supplied to the ASSB with two positive displacement 800 scfm, 25 hp blowers.

A liquid sludge feed tank with recirculation pump is located next to the ASSB. The tank was previously used to mix sludge with lime and provide a sufficient hydraulic grade line for conveyance to the belt filter press. The tank and recirculation pump are currently not in use because the equipment needs to be repaired or replaced.

The ASSB has the following deficiencies:

- The submersible pump in Cell No. 2, which pumps sludge to the belt filter press, cannot meet the design flow and pressure requirements for the belt filter press.
- The ASSB structure and components are in poor condition.
- The walkway around the center cell (Cell No. 1) of the ASSB consists of a single plank of wood and handrailing that is not approved by the Occupational Safety and Health Administration (OSHA). This is a safety hazard for operators.
- The ASSB does not provide adequate sludge detention time to meet the requirements for Class B biosolids.
- There are four davit cranes at the ASSB that do not have adequate reach to remove equipment out of the ASSB and require too much force to crank.
- The existing walkway leading from the side of the ASSB to the center of the ASSB needs to be repaired and re-coated.
- The two existing blowers do not have adequate capacity.

3.7.2 Previous Preliminary Design Recommendations and Discussion

The 2020 PDR recommended the following improvements for the ASSB:

- Replace the existing center chamber walkway with 3-foot wide platform with OSHA approved handrailing; and
- Replace the four davit cranes around the ASSB with new cranes that have adequate reach and require less force to crank.

West Yost recommends more extensive upgrades to the ASSB and abandoning the proposed walkways and handrails as summarized in the following section.

3.7.3 Modified Preliminary Design Recommendations

The improvements recommended in the 2020 PDR address some operational and health and safety issues at the ASSB, but do not address solids treatment process deficiencies that would go a long way toward improving solids dewatering performance and reducing polymer consumption. West Yost recommends the following ASSB upgrades be included in the project:

- Remove the walkway around the center cell (Cell No.1) of the ASSB and do not install a new walkway
- Repair, sandblast, and paint the existing walkway leading from the side of the ASSB to the center of the ASSB.
- Re-route the belt filter press filtrate so that it is conveyed to the aeration basins via the Waste Pump Station without passing through the ASSB (see Section 3.9.3 for further discussion on re-routing of these flows)
- Rehabilitate the ASSB aeration system as follows:
  - Replace the existing aeration piping and diffusers with new piping and diffusers
  - Design the new aeration system to provide adequate mixing and to maintain a DO of 1 to 2 mg/L in each cell of the ASSB.
  - Provide four separate zones of diffusers: one in Cell No. 1, two in Cell No. 2, and one in Cell No.3
  - Provide a separate air piping drop leg for each zone of diffusers, each with a flow meter and modulating butterfly valve. The valve and flow meter will be used to control the amount of air provided to each cell of the ASSB.
  - Install a DO probe in each cell of the ASSB.
  - Install one new 800 scfm, 25 hp positive displacement blower to provide air to the ASSB along with the two existing blowers.
- Convert ASSB Cell No. 3 into an aeration/decant zone for thickening and feeding solids to the belt filter press. One of the existing decant pumps will be relocated from ASSB Cell No. 2 to ASSB Cell No. 3 so there is a decant pump on each end of Cell No.3.

These recommended upgrades are showing on Drawings C002 and M008 included in Appendix A.

3.8 Chemical Storage and Metering Facilities

3.8.1 Existing Conditions

There are two chemical storage and metering facilities at the WWTP: a sodium hypochlorite facility and a sodium hydroxide facility. The sodium hypochlorite facility consists of two 1,000 gallons storage tanks, a diaphragm metering pump skid with two metering pumps and appurtenances, and an emergency eye wash/shower. The equipment is located on the top floor of the RAS/WAS Pump Station.

The sodium hydroxide feed system is located near the headworks and consists of chemical storage totes and a diaphragm metering pump skid. The system is used to increase the pH of the raw wastewater upstream of the aeration basin, to address the low alkalinity issues.

The existing chemical facilities have the following deficiencies:

- The sodium hypochlorite storage and metering facility is not capable of disinfecting the process water system year-round. This creates a health and safety issue for the operators using the water.

- The current sodium hydroxide storage and metering facility at the headworks uses totes and is a temporary system that is manually controlled and does not allow the chemical metering pump discharge rate to be adjusted based on influent flow or process needs.

3.8.2 Previous Preliminary Design Recommendations and Discussion

The 2020 PDR recommended the following chemical storage and metering facility improvements:

- Install a new sodium hypochlorite metering pump system to pump sodium hypochlorite from the existing storage tank into the process water system to provide year-round disinfection of the process water.
- Replace the temporary sodium hydroxide feed system with a permanent system that allows the chemical feed rate to be adjusted based on influent flow and process needs.

West Yost agrees that a more permanent sodium hydroxide storage and feed system is needed, but recommends it be constructed at an alternate location that will also allow the sodium hypochlorite feed pumps for the utility water and RAS systems to be installed in a common building as summarized in the following section.

3.8.3 Modified Preliminary Design Recommendations

Several different configurations of the proposed chemical system improvements were considered. The most cost-effective approach recommended for implementation under this Project includes the following improvements:

- Install a new 16-foot by 24-foot concrete pad on the east side of the existing RAS/WAS Pump Station.
- Install an 8,000-gallon, insulated, double-walled, polypropylene tank with a mixer on the concrete pad for storage of 25 percent sodium hydroxide. It is assumed that 25 percent solution will be delivered to the site and that no on-site dilution will be needed.
- Install a fiberglass shed building on the concrete pad equipped with the following:
  - A sodium hydroxide metering pump skid with two pumps and required appurtenances.
  - A sodium hypochlorite metering pump skid with two pumps and required appurtenances.
  - A heater and ventilation fan.
  - Lighting.
  - Required LEL gas sensors, oxygen sensors, and audio/visual alarms.
- Install an emergency eye wash/shower with a 20 gpm, on-demand, tepid water heater on the new concrete pad.
- Install chemical piping required to allow sodium hydroxide to be injected into the RAS pump discharge header.
- Install chemical piping required to allow sodium hypochlorite to be injected into the process water piping and into the RAS pump discharge header.
- Chemical storage and metering facilities shall be designed to provide a minimum of 15-feet of clearance around the secondary clarifiers to allow adequate space for maintenance vehicles to drive around the clarifiers.

These recommended upgrades are showing on Drawings C001 and M005 included in Appendix A.

3.9 Waste Pump Station and Stormwater Control

3.9.1 Existing Conditions

The existing Waste Pump Station consists of a circular wet pit with two 350 gpm, 3 hp submersible pumps and an at-grade rectangular valve vault. The wet pit receives flow from the following sources and discharges it into the 24-inch pipeline that conveys raw sewage from the Headworks Facility to the Aeration Basins:

- Filter backwash water.
- Dewatering Building and Sludge Storage Facility floor drains, roof drains and foundation drains.
- Solids Handling Building roof drains and foundation drains.
- Sanitary sewer flow from the Maintenance Building.

Although the Waste Pump Station receives some stormwater runoff from the WWTP site, the majority of stormwater runoff from the site is discharged into Tickle Creek through Outfall 003. This configuration allows for the potential release of hazardous materials or chlorinated process water into Tickle Creek. To prevent accidental discharge, an inflatable plug has been inserted into the outfall. The plug is removed during storm events and re-installed during dry weather. If drainage accumulates in the outfall during dry weather conditions when the plug is installed, the flow is pumped back to the WWTP with a temporary pump.

3.9.2 Previous Preliminary Design Recommendations and Discussion

The 2020 PDR recommended the following improvements to the Waste Pump Station and stormwater control system:

- Install a new manhole on the existing 15-inch storm drain that discharges into Outfall 003.
- Install new piping to connect the new manhole to the existing Waste Pump Station.
- Install an overflow weir in the manhole that will direct stormwater drainage from the 15-inch storm drain into the Waste Pump Station during normal rain events but allow stormwater drainage during peak events to flow into the Outfall 003.

West Yost believes the proposed storm water upgrades do not provide the assurance City and Veolia staff desire related to ongoing and consistent compliance with the City's National Pollutant Discharge Elimination System (NPDES) 1200z stormwater permit. Recommendations are summarized in the following section.

3.9.3 Modified Preliminary Design Recommendations

The following improvements are recommended for implementation under this Project because they will provide a more comprehensive solution for managing onsite stormwater by directing it entirely back to the headworks downstream of the influent flow meter and composite sampler. In addition, ASSB Cell No. 3 would be freed up for use as the solids decant zone by directing pressate from the belt filter press to the storm water pump station to be recycled and treated in the aeration basin. Recommended Waste Pump Station and storm water control upgrades include the following:

- Re-route all storm drain piping to discharge into the Waste Pump Station, except for the 10-inch foundation drains from the secondary clarifiers and Filter/UV Facility and the 8-inch overflow piping from the Filter/UV Facility.
- Re-route the belt filter press pressate piping to discharge into the Waste Pump Station.
- Replace the existing submersible pumps with two new 650 gpm, 20 hp pumps with VFDs.
- Replace the pump discharge piping with larger piping to accommodate the larger pumps.
- Install a new valve vault with new valves to accommodate the larger pump discharge piping.
- Installed a new 6-inch diameter force main to convey flow from the Waste Pump Station to the 24-inch pipeline that conveys raw sewage from the Headworks Facility to the Aeration Basins.

These recommended upgrades are showing on Drawings C002 included in Appendix A.

3.10 Site Improvements

The following site improvements are recommended for implementation under this Project:

- Install a new LEL gas sensor, oxygen sensor and audio/visual alarms at the Dewatering Building
- Install new lighting throughout the site as described in Section 3.11

3.11 Electrical and Instrumentation and Control (I&C) Improvements

3.11.1 Previous Preliminary Design Recommendations and Discussion

The 2020 PDR recommended the following electrical and instrumentation and control (I&C) improvements throughout the plant:

- Inspect the MCCs and Switchgear inspected and have it serviced by a qualified electrician. After the inspection, apply labels to electrical equipment as determined by the assessment.
- It is noted that physical ingress to some electrical equipment is currently not possible because of field modifications to the equipment in the past. These situations will be identified and corrected to help ensure operations staff safety.
- Replace the PLC hardware.
- Replace the SCADA system computer.
- Upgrade the Cimplicity SCADA software to accommodate the Windows 10 operating system.
- Provide Alarming system in the upgraded SCADA.
- Update the screens to incorporate modern graphics that are easy to navigate.
- Modify the graphics for the new UV Disinfection System.
- Install high speed internet to improve remote monitoring.
- Install Ethernet Network between several buildings.

West Yost worked with The Automation Group, Inc. (TAG) and Landis to further evaluate the electrical and I&C upgrades recommended in the 2020 PDR and determine what improvements are recommended for meeting the objectives of this Project. The major control system components are discussed in Section 3.11.2 and other electrical and I&C improvements are discussed in Section 3.11.3.

3.11.2 Control System Components Evaluation

TAG considered alternatives for each component of the control system recommended for upgrade in the 2020 PDR, evaluated the alternatives, and identified a preferred alternative for each component. The components that were evaluated include:

1. PLC Architecture
2. HMI/SCADA
3. Ethernet Connections via copper CAT6 Shielded vs. Fiber
4. Alarm Dialer via software vs. direct connection (Hardware)
5. Reporting Software
6. Secure Remote Connection

A technical memorandum summarizing the evaluation performed on each of these components is included in Appendix D. The key recommendations from the evaluation are:

- Provide a new SCADA system at the WWTP that is separate from the drinking water and distribution/collections systems. This is to prevent a single failure from affecting the rest of the City.
- Retain as much of the existing PLC system as possible, but replace components needed to upgrade the system to a platform that is fully supported by the manufacturer.
- Re-write the PLC software logic to enhance the process control with the added/upgraded processes.
- Connect new devices to the upgraded PLC system and SCADA by extending the ProfiNet Network to smart communications modules on the new devices
- Use copper CAT6 shielded wire cables to connect PLCs to the new SCADA system. The CAT6 cables can be installed in existing conduits, which may have some tight bends, and can be installed in the same conduit as the camera system ethernet cables. This makes them preferable versus fiber optic cables which cannot be installed in conduits with tight bends or in the same conduits at the camera system cables.
- No new reporting software is needed at this time.
- Connect the alarm dialer system directly to the PLC. This is a more reliable method than using software as the software requires a PC to run continuously.
- Use a Tosi Box Solution to make a secure remote connection to the WWTP, when needed. This type of system uses a two-part authentication (Physical USB Key and Username/Password), which meets the latest Internet of Things (IOT) requirements for a secure connection.

3.11.3 Modified Preliminary Design Recommendations

Other electrical and I&C improvements required to support the recommended process mechanical and site improvements discussed above are as follows:

- Headworks Facility
  - Provide power from Office/Lab Building for the new jib crane.
  - Replace the four (4) existing column mounted lights with new 4-foot, vaportight, LED fixtures mounted to the steel joists.
  - Disconnect and reconnect the conductors for the grit motor.
  - Provide conduit and CAT6 cabling for camera.
- Equalization Basin
  - Provide conduit and conductors to level transmitter from the RAS Building
  - Provide conduit and conductors to aerators from the RAS Building
- Aeration Basins
  - Provide two (2) Instrumentation panels at the end of the basins. Provide CAT6 cabling back to the Blower Building Control Panel PN-1004.
  - Provide control cabling, conduit and power cabling for four (4) DO Sensors.
  - Provide control cabling, conduit and power cabling for six (7) flow meters.
  - Provide control cabling, conduit and power cabling for six (6) motorized valves.
  - Provide control cabling and conduit for two (2) level sensors.
  - Provide control cabling, conduit and power cabling for four (4) motorized actuators.
  - Provide control cabling and conduit for four (4) motorized slide gates.
- Blower Building
  - Replace existing MCC-A1 section with VFD drives for each of the four (4) blowers and an active harmonic filter.
  - Disconnect and reconnect existing conductors to each of the four (4) blower starters.
  - Provide conduit and CAT6 cabling for two (2) outdoor rated cameras.
  - Provide conduit and CAT6 cabling from new MCC-A1 to Control Panel PN-1004.
- RAW/WAS Pump Station
  - Provide new 400amp, 480/277volt panel at the RAS Building.
  - Provide 400amp conductors in spare conduits in existing conduit duct bank. Provide new conduit from the power vault to the new panel.
  - Provide new conductors and conduit for the two (2) RAS pumps from the new 400Amp panel. Remove existing conductors back to MCC-A.
  - Provide new conductors and conduit for the existing 45kVA transformer from the new 400Amp panel. Remove the existing conductors back to MCC-A.
  - Provide new 120volt branch circuits for the new chemical building from the existing panel CBP-2.
  - Replace existing conductors to the new exhaust fan.

- Secondary Clarifiers
  - Disconnect and reconnect existing conductors from secondary clarifier motors.
  - Replace existing light fixture (2 total) with new LED fixtures on a collapsible pole.
  - Replace eight (8) existing lights with new vapor tight LED fixtures.
- Filters and UV Disinfection Facility
  - Provide a new 100amp, 480/277volt panel from MCC-B for new UV train.
  - Provide new 100amp conductors and conduit from MCC-B to a new panel. Provide a 100amp circuit breaker in MCC-B.
  - Replace eight (8) existing lights with new vapor tight LED fixtures.
- ASSB
  - Remove all electrical connections.
  - Provide new VFD for new Blower No. 3. Provide new conductors and conduit from MCC-C. Provide new circuit breaker in MCC-C
- Waste Pump Station
  - Provide new VFDs (total 2) for the new stormwater pump controllers. Provide new conductors and conduit from MCC-C. Provide a new circuit breaker in MCC-C.
  - Provide a new instrumentation panel in the building. Provide one (1) CAT6 cable to Dewatering Building using the existing 1-inch conduit.
  - Provide conductors and conduit for controls to the VFDs from the control panel.
  - Provide conductors and conduit for three (3) pressure sensors to the control panel.
- Dewatering Building
  - Provide new CAT6 cable and conduit for the new camera to the control panel PN-1050.
  - Provide new conductors and conduit to the new exhaust fan in the electrical room.
- Site Improvements
  - Replace four (4) existing area pole fixtures with new LED fixtures. The poles will be reused.
  - Add five (5) new LED area lights with 20-foot poles.
  - Replace the existing building mounted flood light on the Solids Handling Building with a new LED spotlight.
  - Add (2) new LED spotlights on the roof of the Solids Handling Building.
  - Add (3) new LED spotlights on the roof structure of the Disinfection Filtration Basin.
  - Add three (3) CAT6 cables in the existing spare conduits between the Office Building and the Blower Building.
  - Add three (3) CAT6 cables in the existing spare conduits between the Blower Building and the RAS/WAS Building.
  - Add three (3) CAT6 cables in the existing spare conduits between the Office Building and the Solids Handling Building.
  - Add three (3) CAT6 cables in the existing spare conduits between the Office Building and the Effluent Pumping Building.

— Add three (3) CAT6 cables in the existing spare conduits between the Effluent Pumping Building and the Dewatering Building.

These recommended upgrades are showing on the Electrical Drawings included in Appendix A.

4.0 OPINION OF PROBABLE CONSTRUCTION COST

Table 4-1 summarizes the opinion of probable construction cost (OPCC) for the improvements recommended in this PDR. Table 4-1 also summarizes the costs for the improvements recommended in the 2020 PDR and the difference in cost between the 2020 PDR recommendations and the modified set of recommendations included in this PDR.

The OPCC summarized in Table 4-1 was developed using budgetary quotes from vendors and cost data from similar projects and includes the costs listed below:

- Direct Costs = Direct material, equipment, and labor costs
- Subcontractor Markup = 5 percent of material, equipment, and labor provided by subcontractors
- Mobilization and Demobilization = 5 percent of direct costs + subcontractor markup
- Insurance and Bonds = 3 percent of direct costs + subcontractors markup
- OH&P = 6.5 percent of direct costs + subcontractor markup
- Contingency = 15 percent of direct costs + all other markups

Other key information regarding the cost estimate is as follows:

- A detailed breakdown of the costs summarized in Table 4-1 is included in Appendix C
- The OPCC is a Class 4 estimate based on the Association for the Advancement of Cost Engineering (AACE) International guidelines. Typical accuracy ranges for Class 4 estimates are (-)15 to (-)30 percent on the low side and (+)20 to (+)50 percent on the high side.
- The costs for the RAS diversion to the ASSB discussed in Section 3.0 are not included in the OPCC.

Table 4-1. Opinion of Probable Construction Cost (OPCC) Summary

Item Description	Modified Recommendations	2020 PDR Recommendations	Difference
Headworks Facility	260,000	710,000	(450,000)
Equalization Basin	110,000	0	110,000
Aeration Basin and Blowers	1,400,000	610,000	790,000
Secondary Clarifiers	130,000	350,000	(220,000)
RAS/WAS Pump Station	80,000	0	80,000
Aerated Sludge Storage Basin	560,000	120,000	440,000
Chemical Storage and Metering Facilities	370,000	500,000	(130,000)
Waste Pump Station and Stormwater Control	270,000	70,000	200,000
Site Improvements	510,000	0	480,000
Total Construction Cost	**$3,690,000**	**$2,360,000**	**$1,330,000**
Filter and UV Disinfection Improvements	1,220,000	690,000	530,000
Total Construction Cost + Filter/UV	**$4,910,000**	**$3,050,000**	**$1,860,000**

Appendix A

Conceptual Design Drawings