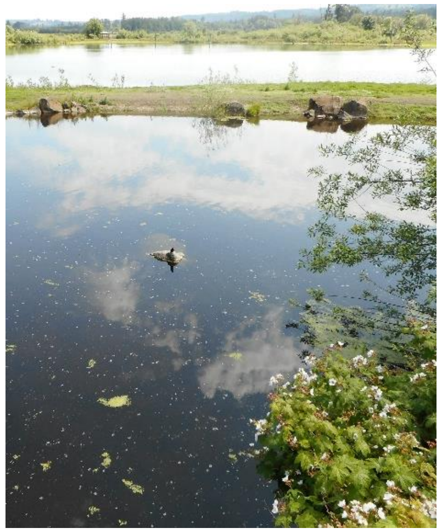
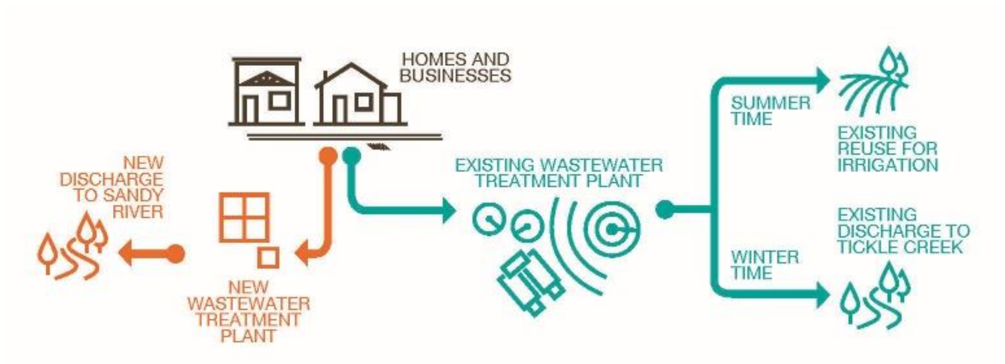


Photo provided by Wolf Water Resources



CITY OF SANDY

Detailed Discharge Alternatives Evaluation Final Report

June 2021

This project was funded in part by the Oregon State Lottery and administered by the Oregon Business Development Department.

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Executive Summary

Introduction

The City of Sandy (City) is a growing community and has an aging existing WWTP and collection system. Based on growth and deterioration of the existing sanitary sewer system, the City's existing wastewater treatment plant (WWTP) does not have adequate capacity to continue to serve the City. Additionally, DEQ regulations such as the Three Basin Rule mandate that the discharge into Tickle Creek, which is part of the Clackamas River Basin, may not be increased. To address these issues and to prepare for future growth, the recent Wastewater System Facilities Plan (WSFP) and continuing analysis associated with this plan recommend that the only feasible long term solution is to construct a new satellite treatment facility and a new year-round outfall to the Sandy River. This new facility will work in concert with the existing WWTP, which will be upgraded to meet wastewater effluent quality requirements for Tickle Creek. The WSFP also includes rehabilitation to the existing sewer collection network.

The City of Sandy Detailed Discharge Alternatives Evaluation (DDAE) Study provides an evaluation of discharge alternatives building on the adopted Recommended Plan contained in the WSFP. The goal of the DDAE is to identify and evaluate discharge options in lieu of or in combination with a direct year-round discharge to the Sandy as proposed in the WSFP Recommended Plan.

Summary of the Scope

This document is associated with Task 9.1 of the project scope of work, which involves consolidating the information, including evaluations, findings, and recommendations from each of the memoranda into a single report identified in the scope-of-work. This memorandum is divided into sections based on the technical memoranda provided under the scope of work followed by summary conclusions for the DDAE.

Analysis Summary

TM-3: Alternative Wastewater System Connection

Technical Memorandum 3 (TM-3) contains a summary of information regarding pumping raw wastewater from the City to either the Clackamas County Water Environment Services (WES) Tri-City Water Pollution Control Plant (WPCP) or the City of Gresham WWTP (Gresham WWTP). Alignments, capital costs, and lifecycle costs for each option were developed. It was assumed that the cost was a planning estimate to be used solely for the purpose of a detailed discharge alternatives evaluation for the City.

The purpose of documenting these alternatives was to verify the results of previous planning efforts presented in the City's WSFP, prepared in 2018. In the WSFP, it was documented that the discharge alternatives to WES and Gresham represented greater costs than the alternatives outlined for a new discharge to the Sandy River, which totaled approximately $60M. The evaluation relative to the WES and Gresham alternatives was completed at a planning level effort based several assumptions. The evaluation presented with the memorandum represents additional details relative to pipe routing and pump stations, additional cost analysis and additional information provided through discussions with staff from WES and the Gresham WWTP. The estimated costs for the WES and Gresham alternatives were $116M and $130M, respectively.

The costs outlined within TM-3 are significantly higher than the Sandy River Discharge Alternative. Based on that, as well as the uncertainty associated with exporting flows and the associated, potentially higher operational costs, these alternatives are not recommended for this project.

TM-4: Basis of Design Report

The purpose of this technical memorandum is to summarize the activities of Task 3: Sandy Wastewater Treatment Facilities Basis of Design. Specifically, the report provides greater clarification of the design criteria for the existing City of Sandy WWTP (Sandy WWTP) and the Eastside MBR Facility, as recommended in the WSFP.

As part of the WSFP, the 20-year flow and load projections for the entire system were developed as shown on **Table ES-1** through **Table ES-3**.

A summary of the projected flows from 2017 to 2040 to the existing Sandy WWTP based on proposed staging of the Eastside MBR Facility is shown in **Table ES-4**, and the revised wastewater loads to the Sandy WWTP are show in **Table ES-5** and **Table ES-6.**

For the Eastside MBR Facility, a summary of the projected flows is shown in **Table ES-7**, and the projected wastewater loads are show in **Table ES-8** and **Table ES-9.**

Table ES-1 | Summary of Existing and Projected Flow

Flow	Existing Flow, MGD	2040 Flow, MGD
Annual Average Flow (AAF)	1.4	2.39
Average Dry Weather Flow (ADWF)	1.0	2.0
Average Wet Weather Flow (AWWF)	1.78	3.05
Maximum Month Dry Weather Flow (MMDWF)	1.5	2.4
Maximum Month Wet Weather Flow (MMWWF)	2.6	4.1
Peak Week Flow (PWF)	4.0	6.6
Peak Day Flow (PDF)	8.9	12.1
Peak Instantaneous Flow (PIF)	10.3	14.0

Table ES-2 | Current BOD_5 and TSS Loads

2017 Population	Parameter	Monthly Average			Maximum Month		
		Concentration (mg/L)	Load (ppd)	Load Factor (ppcd)	Concentration (mg/L)	Load (ppd)	Load Factor (ppcd)
Summer Season (May 1 through October 31)							
11,800	BOD_5	286	2,500	0.209	455	3,600	0.305
11,800	TSS	280	2,400	0.201	456	3,500	0.294
Winter Season (November 1 through April 30)							
11,800	BOD_5	192	2,400	0.203	297	3,500	0.294
11,800	TSS	190	2,400	0.202	342	3,900	0.333

Notes:

1. ppd= pounds per day
2. ppcd = pounds per capita per day

Table ES-3 | 2040 BOD_5 and TSS Loading Projections

2040 Population	Parameter	Monthly Average		Maximum Month	
		Load Factor (ppcd)	Load (ppd)	Load Factor (ppcd)	Load (ppd)
Summer Season (May 1 through October 31)					
22,400	BOD_5	0.209	4,700	0.305	6,800
22,400	TSS	0.201	4,500	0.294	6,600
Winter Season (November 1 through April 30)					
22,400	BOD_5	0.203	4,600	0.294	6,600
22,400	TSS	0.202	4,500	0.333	7,500

Notes:

1. ppd= pounds per day
2. ppcd = pounds per capita per day

Table ES-4 | Summary of Current and Projected Flow (MGD) to Existing Sandy WWTP

Flow Event	2017	2020	2025	2026[1]	2030	2035	2036[2]	2040
AAF	1.4	1.45	**1.53**	0.93	1.14	**1.35**	0.76	1.20
ADWF	1.08	1.12	**1.18**	0.72	0.88	**1.05**	0.59	0.93
AWWF	1.78	1.85	**1.95**	1.19	1.45	**1.73**	0.97	1.53
MMDWF	1.41	1.46	**1.54**	0.94	1.15	**1.37**	0.77	1.21
MMWWF	2.66	2.76	**2.91**	1.8	2.17	**2.58**	1.44	2.27
PWF	5.01	5.19	**5.48**	3.34	4.08	**4.85**	2.71	4.28
PDF	5.87	6.08	**6.42**	3.91	4.77	**5.68**	3.18	5.02
PIF	9.05	9.38	**9.9**	6.40	7.73	**9.13**	5.63	7.00

Notes:

1. First stage of Eastside MBR Facility begins operation in 2026
2. Second stage of Eastside MBR Facility begins operation in 2036

Table ES-5 | Sandy WWTP Average Day BOD_5 and TSS Loading Projections

Year	Average Dry Weather			Average Wet Weather		
	Flow, MGD	BOD_5, ppd	TSS, ppd	Flow, MGD	BOD_5, ppd	TSS,ppd
2020	1.12	2,700	2,600	1.85	2,600	2,600
2025	1.18	3,100	3,000	1.95	3,000	3,000
2026[1]	0.718	1,900	1,800	1.19	1,800	1,800
2030	0.878	2,300	2,200	1.45	2,300	2,200
2035	1.05	2,800	2,700	1.73	2,700	2,700
2036[2]	0.585	1,600	1,500	0.97	1,500	1,500
2040	0.925	2,300	2,200	1.53	2,300	2,300

Notes:
1. First stage of Eastside MBR Facility begins operation in 2026
2. Second stage of Eastside MBR Facility begins operation in 2036

Table ES-6 | Sandy WWTP Maximum Month BOD_5 and TSS Loading Projections

Year	Maximum Month Dry Weather			Maximum Month Wet Weather		
	Flow, MGD	BOD_5, ppd	TSS, ppd	Flow, MGD	BOD_5, ppd	TSS, ppd
2020	1.46	3,900	3,800	2.76	3,800	4,300
2025	1.54	4,500	4,300	2.91	4,300	4,900
2026[1]	0.9375	2,700	2,600	1.78	2,700	3,000
2030	1.1475	3,400	3,300	2.17	3,300	3,700
2035	1.37	4,100	4,000	2.58	4,000	4,500
2036[2]	0.765	2,300	2,200	1.44	2,200	2,500
2040	1.205	3,400	3,300	2.27	3,300	3,700

Notes:
1. First stage of Eastside MBR Facility begins operation in 2026
2. Second stage of Eastside MBR Facility begins operation in 2036

Table ES-7 | Summary of Projected Flow for Eastside MBR Facility in MGD

Flow Event	2026[1]	2030	2035	2036[2]	2040
AAF	0.60	0.60	0.60	1.20	1.20
ADWF	0.46	0.46	0.46	0.93	0.93
AWWF	0.76	0.76	0.76	1.53	1.53
MMDWF	0.60	0.60	0.60	1.21	1.21
MMWWF	1.14	1.14	1.14	2.27	2.27
PWF	2.14	2.14	2.14	4.28	4.28
PDF	2.51	2.51	2.51	5.02	5.02
PIF	3.50	3.50	3.50	7.00	7.00

Notes:
1. First stage of Eastside MBR Facility begins operation in 2026
2. Second stage of Eastside MBR Facility begins operation in 2036

Table ES-8 | Eastside MBR Facility Average Day BOD_5 and TSS Loading Projections

Year	Average Dry Weather			Average Wet Weather		
	Flow, MGD	BOD_5, ppd	TSS, ppd	Flow, MGD	BOD_5, ppd	TSS, ppd
2026	0.46	1,211	1,164	0.76	1,173	1,167
2040	0.93	2,337	2,248	1.53	2,270	2,259

Table ES-9 | Eastside MBR Facility Maximum Month BOD_5 and TSS Loading Projections

Year	Maximum Month Dry Weather			Maximum Month Wet Weather		
	Flow, MGD	BOD_5, ppd	TSS, ppd	Flow, MGD	BOD_5, ppd	TSS,ppd
2026	0.60	1,764	1,700	1.14	1,695	1,920
2040	1.21	3,411	3,288	2.27	3,288	3,724

The report further evaluated and determined that flows at the Diversion Pump Station were sufficient to consistently send the required flow to the Eastside MBR Facility.

The Biowin biological process model of the existing Sandy WWTP, developed as part of the WSFP, was evaluated at key points in the phased implementation plan outlined in the WSFP to confirm performance of the Sandy WWTP. The results of the biological process analysis showed that the planned improvements at the Sandy WWTP along with the staged construction of the Eastside MBR Facility will result in the facility meeting its permit through 2040, assuming all equipment operates as designed. The upcoming immediate needs improvements project will improve performance of key unit processes, including the aeration basins and the secondary clarifiers that had resulted in permit exceedances. In addition, increased capacity of the sodium hydroxide feed system was found to be key for meeting the ammonia permit limit. The phasing of the improvements to the Sandy WWTP outlined in Phase 2 of the WSFP should be implemented based on the observation of growth in the community that results in increased flow and load to the WWTP.

As noted in the WSFP, the Eastside MBR Facility will be constructed under two stages. TM-4 provides a basis of design for the unit processes to be constructed including identifying design criteria and redundant equipment requirements. The Eastside MBR Facility will consist of headwork, membrane bioreactor, UV disinfection, and post-aeration. The headworks facility will consist of the three fine screens after Stage 2 construction, each with a rated capacity of 3.5 MGD with openings less than 2 mm. A single vortex grit removal system with a rated capacity of 7.0 MGD will be installed in Stage 1. The MBR will consist of a total of four trains; two trains will be installed during Stage 1 construction, and the remaining two trains will be installed under Stage 2. Four in-pipe UV disinfection systems will be installed to disinfect the secondary treated wastewater to discharge to the Sandy River or to meet either Class A Recycle Water standards for irrigation or discharge to Roslyn Lake. Finally, a post-aeration system will be installed to increase the dissolved oxygen to 6 mg/L to meet the discharge effluent requirements that were identified in the preliminary anti-degradation analysis (TM-11). A summary of the design criteria can be found on Table 5-2 in TM-4. A preliminary layout of the Eastside MBR Facility is shown on **Figure ES-1**.

TM-5: Sandy River Temperature Evaluation

Technical Memorandum 5 (TM-5) is a deliverable under Task 4.2 of the DDAE program. This memo includes a review of potential impacts to temperature on the Sandy River due to effluent discharges from the proposed, new membrane bioreactor facility.

Part of the WSFP Continuing Planning Services project, TM-5 is an update to the memo prepared on May 22, 2019. This update provides the opportunity to review this topic with additional temperature data collected on the Sandy River, and updated estimates of river flows, effluent flows, and effluent temperatures.

The project team used new and updated data to review potential temperature impacts to the Sandy River from the proposed new Eastside MBR Facility. Results from this new review are consistent with those from 2019: the planned effluent discharge into the Sandy River will need thoughtful temperature design and management to meet regulatory temperature thresholds, especially as the community grows. Furthermore, this updated temperature review results in the following conclusions.

- Temperature will be one of the more challenging issues to address during the final design and National Pollutant Discharge Elimination System (NPDES) permitting process for the Eastside MBR Facility and Sandy River discharge.
- With population growth at the City and climate change, temperatures and heat load will increase, resulting in greater need for temperature management and likely more stringent regulatory controls.
- As summarized in TM-5, summer and fall discharges to the Sandy River (especially in the future) could result in violations of current regulatory temperature thresholds if temperature is not managed appropriately. Preliminary analysis indicates that these thresholds could be exceeded before 2030.
- The City will want to continue to work closely with the Oregon Department of Environmental Quality (DEQ) to better understand which regulatory thresholds will govern final design and permitting. There are currently several thresholds listed in the total maximum daily load (TMDL) study and in the Antidegradation Internal Management Direct (IMD).
- Likewise, the City will want to coordinate closely with DEQ on methodology for temperature reviews. For planning purposes, it was assumed that 1/4 of the Sandy 7Q10 River flows would mix with effluent (consistent with DEQ's point source temperature

reviews in the Sandy River TMDL). Other methodology could assume 100 percent of 7Q10 river flows for mixing and different temperature thresholds.

- Final NPDES permitting reviews of temperature will require outfall design, dilution modeling, and related mixing zone studies to better estimate mixing and dilution of effluent when it enters the Sandy River. The regulatory temperature thresholds would need to be met after the effluent mixes and travels to the defined regulatory mixing zone boundary.
- The DDAE planning study identified and recommended the Roslyn Lake site for discharging portions of the effluent (into constructed wetlands) during summer and fall periods to help eliminate/minimize temperature impacts to the Sandy River now and into the future.

TM-6: Sandy River Water Quality Sampling and Testing Program Summary

Technical Memorandum 6 (TM-6) contains a summary of 2019-2020 Sandy River water quality data collected in proximity to alternatives for the outfall location of the proposed Eastside MBR Facility. The City and DEQ hope to determine compliance with anti-degradation laws set forth in the Oregon Administrative Rules (OAR) regulated by the DEQ in the NPDES permitting process.

Murraysmith collected grab samples and Alexin Analytical Laboratories, Inc in Tigard, Oregon analyzed the samples in accordance with the Sampling and Testing Plan prepared August 7, 2019. Waterways Consulting, Inc installed temperature probes which recorded measurements on a 15-minute interval from July through October in 2019 and 2020. River discharge was estimated using instantaneous data from USGS Gages. TM-6 summarizes the findings for the following parameters: pH, bacteria, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Total Kjeldahl Nitrogen (TKN), ammonia, nitrate, nitrite, phosphorus, Total Organic Carbon (TOC), hardness, chromium, iron, temperature, and flow.

This ambient water quality data was used to inform design proposals such as outfall site selection as described in Technical Memorandum 7.1 (TM-7.1). The data will be used as the project moves forward to better understand the water quality characteristics of the Sandy River. In this memorandum, Murraysmith recommends continued water quality sampling on a quarterly basis to provide a robust dataset for these evaluations.

TM-7.1: Sandy River Outfall Siting Study

This technical memorandum is a summary of Task 5: The Sandy River Outfall Siting Study. The purpose of Task 5 is to review alternative discharge locations on the Sandy River for placing the outfall from the proposed Eastside MBR Facility.

The reviewers conducted desktop and field studies to evaluate key river characteristics that would make for a good outfall site including:

- River depth and velocity, to provide good water quality mixing conditions
- Channel geologic/geomorphic stability, so that the channel would not migrate away from the outfall over time
- Fish use for spawning/rearing/migration, to minimize fisheries impacts/concerns
- Distance from the new treatment plant, for pipe economy
- Outfall accessibility, for construction and operation and maintenance
- Related characteristics

Based on the results of Task 5 (The Sandy River Outfall Siting Study), the Ten Eyck Road and Revenue Bridge site is the recommended location for the new outfall. This site has several advantages over other alternatives.

- This river reach is dominated by bedrock, so the channel does not migrate in this area, providing for greater geomorphic stability and consistent outfall operating conditions.
- This reach of the river is deep and has reasonable velocity (providing greater dilution and dispersion) and good water quality mixing characteristics.
- The area has less public accessibility than river reaches near the park and less potential for vandalism (although that possibility needs to be considered during final design).
- This location is upstream from the Cedar Creek fish hatchery; therefore, there would be less potential for impacts to hatchery fish.
- This reach is used for anadromous fish migration, not spawning or rearing, so anadromous fish would just be passing through.
- This site seems to have the greatest agency support based on preliminary meetings.
- Revenue Bridge provides a good river crossing location for the effluent pipeline that would carry effluent to the Roslyn Lake area, where it could be reused for creating wetlands, as described in Technical Memorandum 9-10.

TM-7.2: Pipe Routing

Technical Memorandum 7.2 (TM-7.2) summarizes the evaluation and findings associated with routing the effluent pipeline from the proposed Eastside MBR Facility to potential discharge locations identified on the Sandy River, and a recommended pipeline route from the river up to Roslyn Lake. The memorandum includes a summary of route selection criteria and a summary of potential alternatives. The preliminary cost estimates presented in TM-7.2 are planning estimates to be used solely for the purpose of a detailed discharge alternatives evaluation for the City. The memorandum also outlines, on a preliminary basis, pipeline routing considerations and conceptual design elements for the recommended route for the pipeline.

The purpose of the study is to determine a practical route for the effluent pipe relative to the selected outfall locations and assist with developing conceptual level costs estimates. The purpose of documenting the alternatives and the preferred route is to evaluate the feasibility of routing the pipeline along various alignments and identify the challenges and required engineering to develop a final pipeline route. Other key considerations to develop final alignment recommendations and final routing concepts include permitting, easement and property acquisition needs, geotechnical considerations, pipe material selection, detailed hydraulic analysis, and final designs associated with the effluent pipe. It is anticipated that these elements will be further evaluated in subsequent permitting and preliminary design phases of the project. An overview map of the pipeline routing alternatives is shown in **Figure ES-2**.

The team reviewed three options for routing the pipeline between the plant and the river (Segment 1) and three options between the river and the Roslyn Lake site (Segment 2). The alternatives were assessed relative to several criteria outlined above including construction at highway and bridge crossings, maintenance accessibility, system control, geological stability, opportunity projects, and the cost factors associated with each criterion. Based on the evaluation, the preferred route is Segment 1 Option 1.B and Segment 2 Option 2.B, as shown in **Figure ES-2**. This selected route extends through City right-of-way, through the City's Sandy River Park and across ODFW and private property to the Sandy River. Between the Sandy River and the Roslyn Lake site, it extends along County right-of-way. The estimated cost for this proposed pipeline is approximately $12.8 M.

Additional data collection and analysis is recommended to verify the concepts presented in TM-7.2. Further evaluations should include geotechnical investigations, outreach to private property owners regarding easements, discussions with ODFW, ODOT, and the County to confirm routing, opportunity projects, and permit requirements.

TM-8 Water Recycling Market Assessment

Technical Memorandum 8 (TM-8) contains a summary of information collected during the Water Recycling Program Customer Outreach study as part of the City's Detail Discharge Alternatives Evaluation. The initial Water Recycling Program Customer Outreach conducted by Barney & Worth, Inc. (B&W) evaluated several sites to determine if a property or properties near the City or along the proposed effluent pipe route had the irrigation demands to take all or most of the effluent from the City's proposed Eastside MBR Facility. The goal was to find an irrigator or irrigators which could take effluent during the summer and shoulder seasons (late spring and early fall) to help minimize the flows to the Sandy River during these times of year. TM-8 provides an analysis which evaluates the options for providing recycled water to potential customers including the pumping requirements, pipeline alignments, and capital and lifecycle costs. Eight options were initially considered relative to large irrigators and five options are considered for small use irrigators.

The purpose of TM-8 is to document the evaluation of potential options and opportunities to expand the City's successful water recycling program based on effluent from the Eastside MBR Facility.

Based on the analysis of cost and potential discharge rates, the large-scale irrigator sites did not show real market demand for the recycled water and required larger capital investments because of the longer pipeline lengths required between the main effluent piping routed to the Sandy River and the potential irrigation sites. The small-scale irrigator sites showed greater current irrigation utilization rates and required a much smaller capital investment due to the shorter pipeline lengths from the preferred pipeline alignments.

It is recommended to pursue a recycled water program for irrigators close to the preferred pipeline alignment. In TM-8, Murraysmith recommends the City establish a fair basis to extend recycled water to interested users based on the length of pipe required for service and the total supply of recycled water requested. Some of these potential users of the recycled water will require little capital investment to connect to the main pipeline and will benefit from the availability of recycled water. Additionally, irrigation use of the recycled water will help reduce discharges to the Sandy River during the critical dry months of the year.

TM-9 & 10 Indirect Discharge and Roslyn Lake Alternatives Site Review

This technical memorandum summarizes Task 7 of the Detailed Discharge Alternatives Evaluation: Indirect Discharge and Roslyn Lake Alternatives. The regulations surrounding indirect discharge (Technical Memorandum 9) and site reviews and analysis of indirect discharge (Technical Memorandum 10) are related. Thus, both aspects are summarized in this one document, Technical Memorandum 9 and 10 (TM-9 & 10).

Based on this review, it is anticipated that DEQ will regulate the proposed discharge to the Sandy River and the Roslyn Lake constructed wetlands through a single NDPES permit. DEQ currently regulates the City's discharge to Tickle Creek and the container nursery that way. It is not clear if DEQ will modify the existing Tickle Creek permit by adding the Sandy River and Roslyn Lake discharges, or if they will issue a new permit for the Sandy River and Roslyn Lake discharges.

The City has the opportunity to construct wetlands to beneficially recycle/reuse the high-quality effluent from the proposed Eastside MBR Facility. The Roslyn Lake site seems well suited for this approach and Trackers Earth (the property owner) is interested in partnering with the City on this type of a project. The project team will need to conduct further reviews of soils/infiltration and of existing wetlands and waterways on the Roslyn Lake property as the project moves into final design to better understand associated opportunities and constraints.

Based on these planning level reviews, the City would need to construct approximately 30 to 60 acres of wetlands and the construction cost would be approximately $3 million to $6 million dollars. See **Figures ES-3** and **ES-4** for a plan and profile view of the proposed wetlands concept.

TM-11 Anti-degradation Report

Technical Memorandum 11 (TM-11) describes the proposed Eastside MBR Facility and the proposed discharge into the Sandy River. The discharge into the Sandy River would constitute a new, permitted effluent discharge. Therefore, the proposed project is subject to a water quality antidegradation review (OAR-340-041-0026). Furthermore, since the proposed discharge would be to a water quality limited waterbody, the antidegradation review would follow the approach outlined for these waterbodies in the IMD for antidegradation reviews (ODEQ, 2001).

The purpose of TM-11 is to describe the proposed project and summarize the antidegradation review and findings. The following conclusions are based on the results of that review.

- The new Eastside MBR Facility would discharge into the Sandy River using a new pipeline and outfall. The final pipe alignment and outfall location are currently being determined.
- The Eastside MBR Facility would generate high-quality effluent using modern technology.
- The project engineers have evaluated the potential impacts from the proposed discharge using DEQ's methodology for evaluating discharges into the Sandy River from the Sandy River Basin TMDL (assuming 25 percent of the 7Q10 river flows mix with effluent).
- The antidegradation thresholds under review include: (1) no greater than 0.25 °F temperature increase, and (2) no greater than 0.1 mg/L decrease in dissolved oxygen, after mixing at the end of an assumed mixing zone.
- With estimated effluent flows from the Eastside MBR Facility for existing (2020) conditions, the discharge would not exceed the antidegradation thresholds for temperature or dissolved oxygen.
- With estimated flows from the Eastside MBR Facility for future (2040) conditions (as the community grows), the discharge would start to exceed the antidegradation thresholds for temperature and dissolved oxygen during the summer and fall months.
- The City proposes a temperature management plan where they would land apply a portion of the high-quality effluent during summer and fall to prevent possible thermal impacts to the river.
- The exact months and amount of effluent to be land applied will be determined during final design and through the NPDES permitting process.
- To prevent possible impacts to dissolved oxygen, the City proposes a DO management plan where they would land apply a portion of the effluent during the summer and fall, and also oxygenate the effluent as needed.

- The exact months and amount of effluent to be land applied will be determined during final design and through the NPDES permitting process.
- The review of other water quality parameters will occur, as needed, during the NPDES permitting process once a new outfall location has been identified and when mixing zone boundaries and estimated dilution are better known.
- Other environmental reviews for the project under local, state, and federal regulations will progress as the project moves from the planning to design phases.

DDAE Program Summary

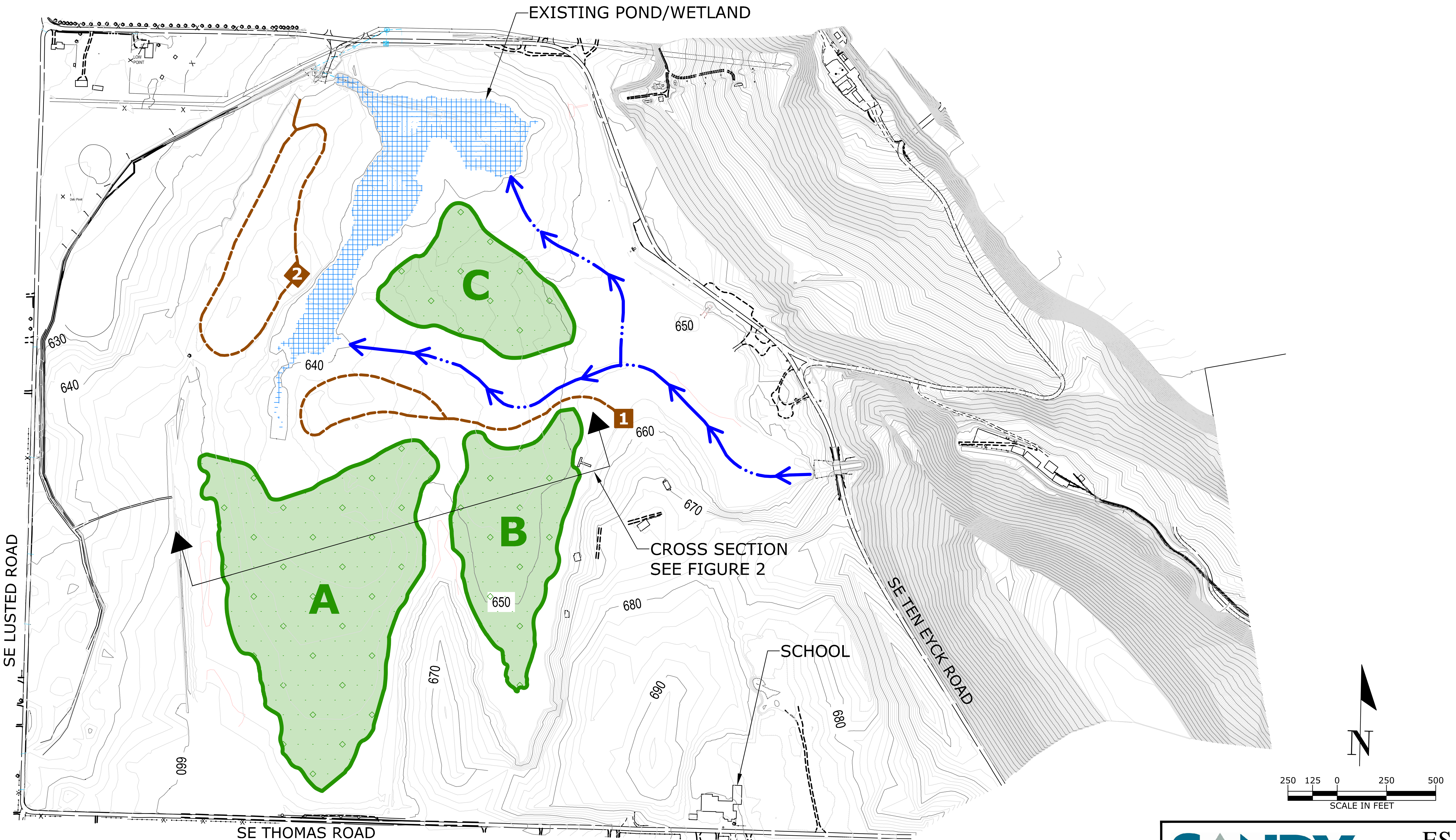
The City's DDAE Study provides an evaluation of discharge alternatives to the Sandy River for the proposed Eastside MBR Facility. It also included reviewing alternatives to the discharge to the Sandy River including irrigation potential and the potential to conveying raw sewage to WES and the City of Gresham WWTP which were found to be less cost effective.

The DDAE included development of concepts for the diversion pump station and the Eastside MBR Facility, furthering concepts for effluent pipeline routing and development of concepts for improvements at the Roslyn Lake site.

Based on analyses in the DDAES, it was found that, as the community grows, discharges to the Sandy River will start to exceed the temperature impacts threshold during the summer months. To address this, the DDAE assessed concepts for discharging to Roslyn Lake and reviewed these with the property owner of the former lake. The concepts involve constructed wetlands sized to accept the flows without discharge to downstream water bodies. The DDAE also reviewed 3 alternatives for effluent pipeline routing. The selected route extends through City right-of-way, through the City's Sandy River Park and across ODFW and private property to the Sandy River. Between the Sandy River and the Roslyn Lake site, it extends along County right-of-way.

The goal of the DDAE Study was to build on previous planning work to select an outfall location, assess the feasibility of discharging to the Sandy River relative to temperature and other impacts and evaluate the feasibility of discharging to the former Roslyn Lake site if there were limitations identified relative to discharges to the River. Following preliminary concept development and analyses, the City and the engineering team met with regulatory agencies to review the feasibility relative to the agencies perspective an identify potential issues relative to permitting. The agencies were in favor of the proposed outfall location and leveraging the Roslyn Lake site to minimize temperature impacts to the River. The team also reviewed the feasibility of discharging to the Roslyn Lake site with the property owner. There were several site visits and meetings with the property owner to outline preliminary concepts. The concepts of constructed wetlands and trail system were acceptable to the property owner. Additionally, the feasibility of routing the effluent pipeline through ODFW property and private properties was assessed. Based on discussions with ODFW and property owners, the proposed route appears to be feasible on a preliminary basis.

The DDAE Study evaluated alternatives and assessed the feasibility of preliminary concepts relative to the satellite facility, the outfall location and pipeline routing. The City has a program that includes acquiring permits, developing final design and eventually construction of the wastewater system improvements. The next steps following the DDAE Study include further assessments and analysis to further establish concepts outlined in the DDAE Study. These include further investigations at the Roslyn Lake site, the satellite facility, and diversion pump station sites and additional assessment of the pipeline routing to confirm routing and property owners' willingness to provide easements. There is significant permitting work to completed prior to final designs including acquiring an NPDES permit for the outfall, permitting associated with the Roslyn Lake site and permits associated with the effluent pipeline.



LEGEND

TRAILS
WETLANDS
VIEWING PLATFORM LOCATION
NATURAL WATERS

SANDY
WHERE INNOVATION MEETS ELEVATION

ES-3

Detailed Discharge Alternatives Evaluation

WETLAND CONCEPT PLAN

NOVEMBER 2020

20-2276

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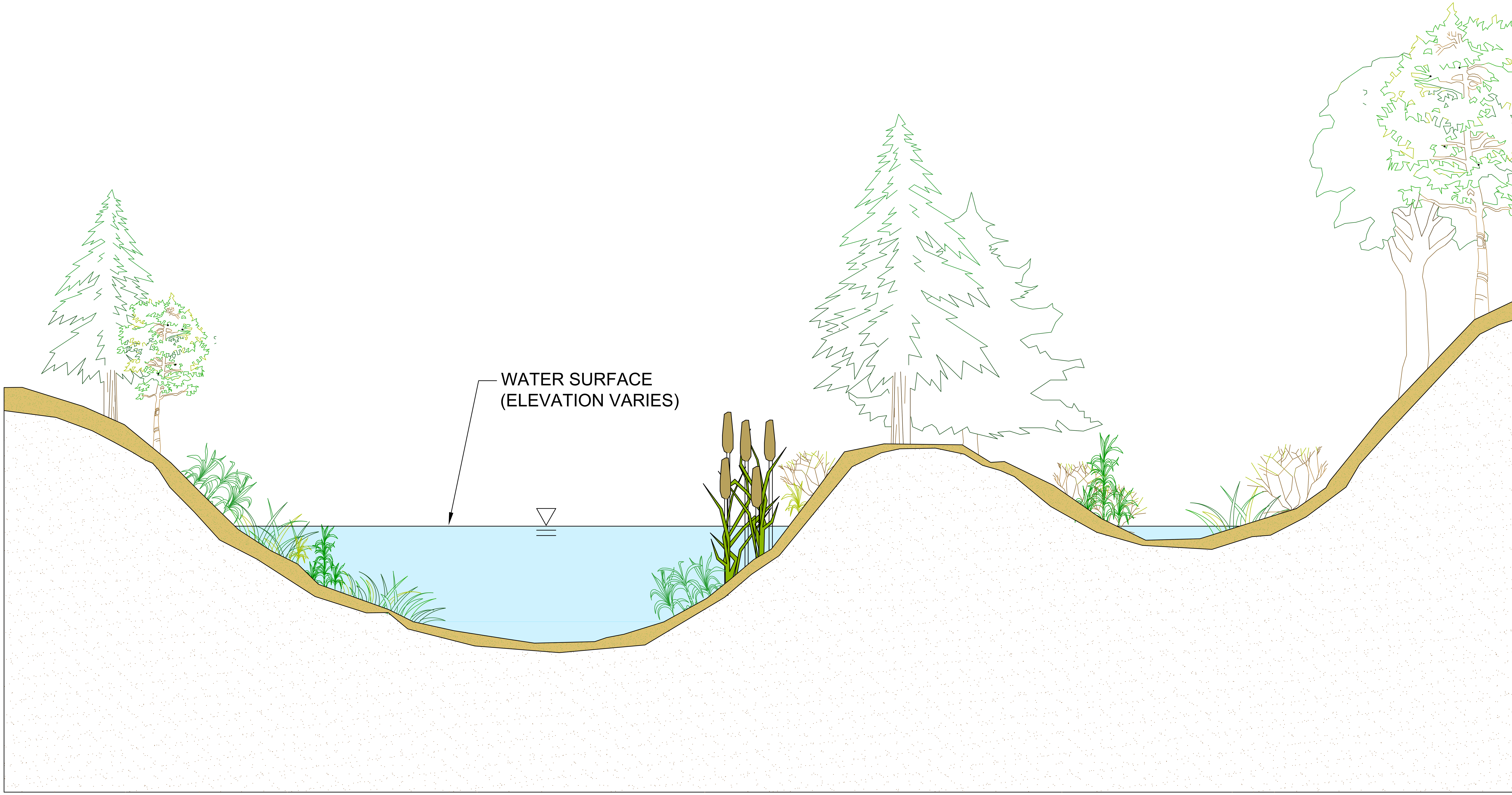


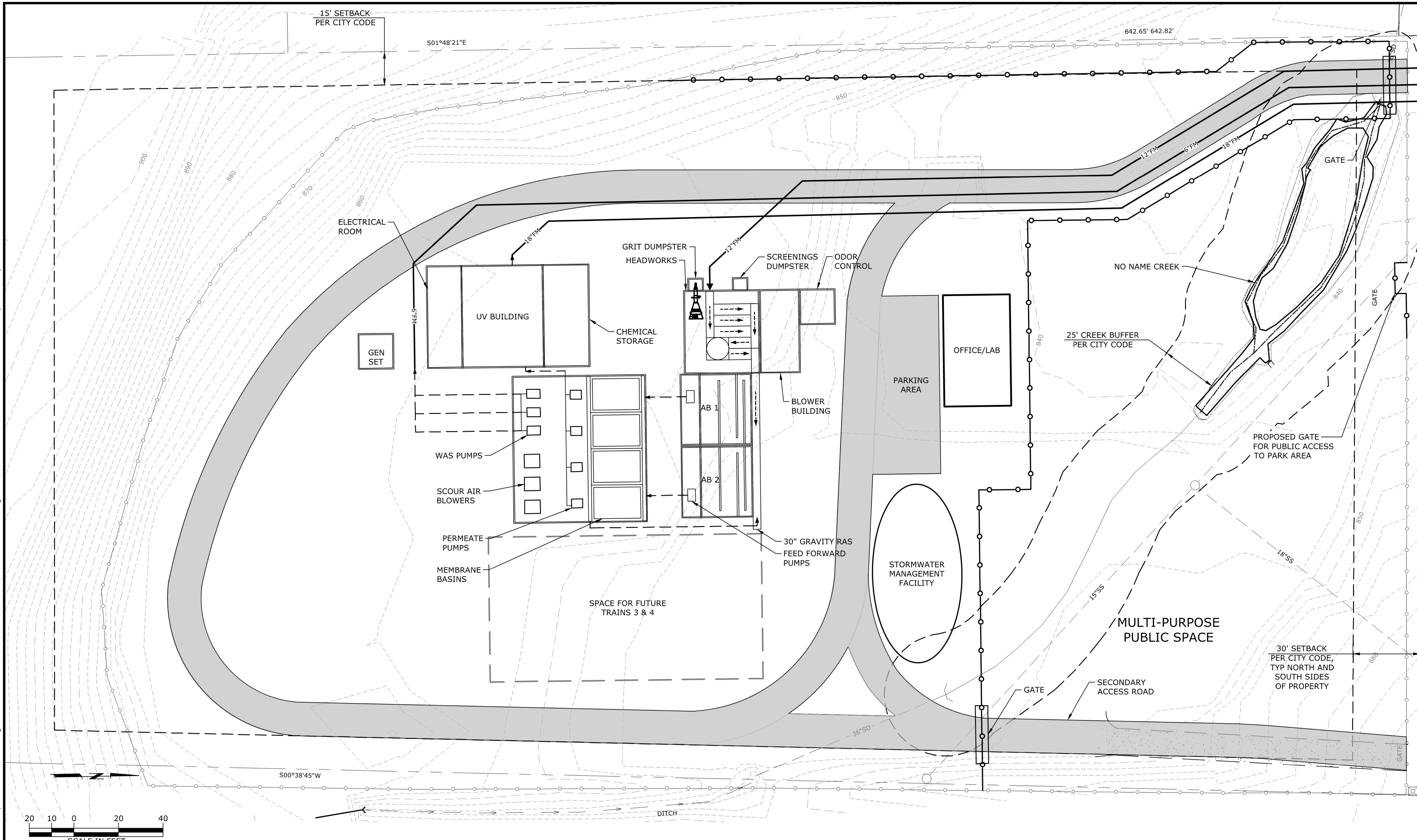
ES-4

SANDY
WHERE INNOVATION MEETS ELEVATION

Detailed Discharge
Alternatives Evaluation

WETLAND CONCEPT SECTION

NOVEMBER 2020
20-2276



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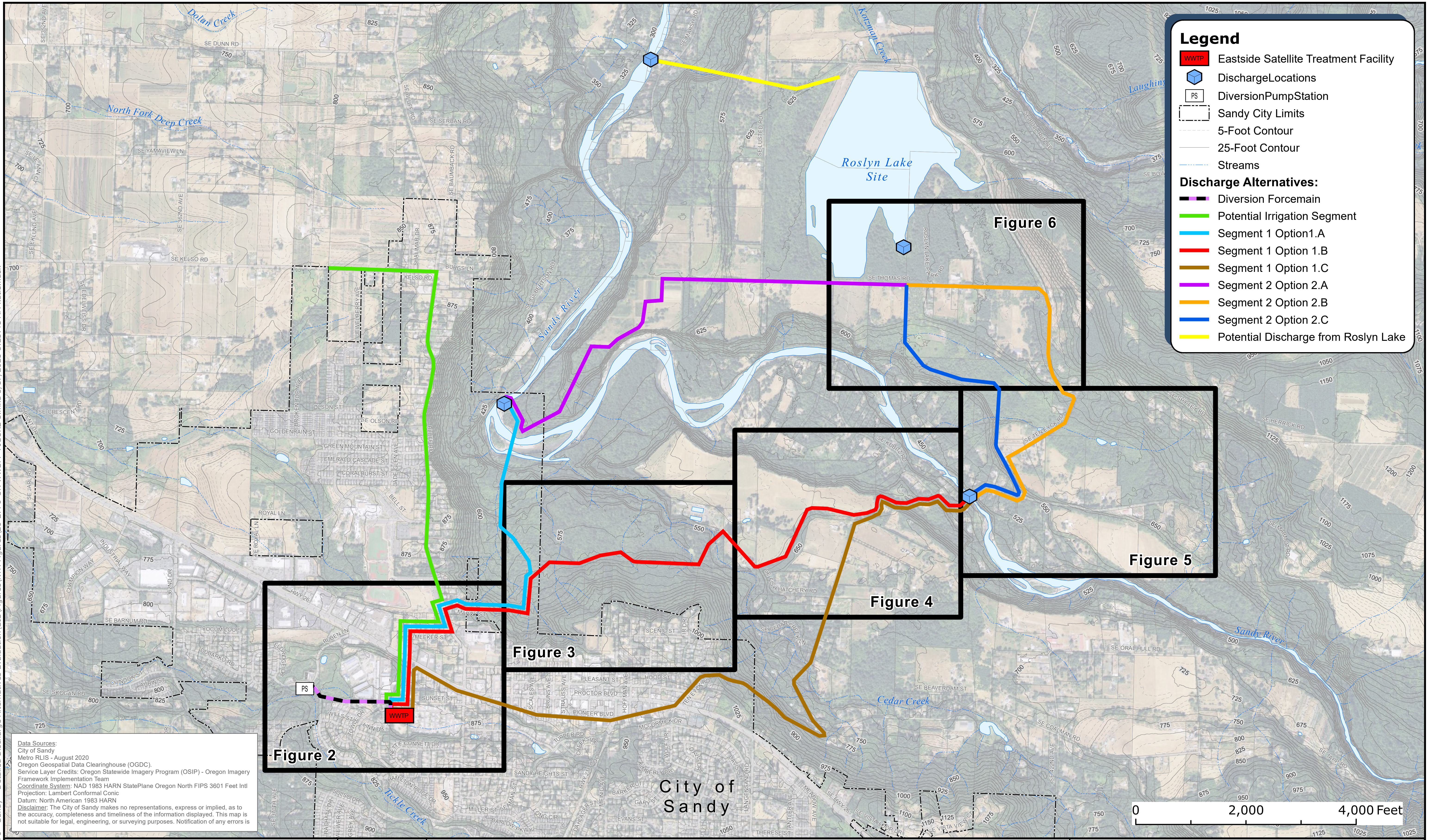
SANDY
WHERE INNOVATION MEETS ELEVATION

EASTSIDE SATELLITE TREATMENT FACILITY BASIS OF DESIGN

PRELIMINARY CONCEPTUAL EASTSIDE SATELLITE TREATMENT FACILLITY SITE PLAN

PROJECT NO.: 20-2776 | SCALE: AS SHOWN | DATE: NOVEMBER 2020

SHEET
ES-1



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murraysmith

SANDY WHERE INNOVATION MEETS ELEVATION

City of Sandy, Oregon
Wastewater System Facility Plan

ES-2
PIPELINE ALTERNATIVES

February 2021

20-2776

Technical Memorandum 3

Date: September 24, 2020

Project: City of Sandy – Detailed Discharge Alternative Evaluation

To: Jordan Wheeler,
Mike Walker, Director of Public Works
Thomas Fisher, Engineering Technician
City of Sandy, Oregon

From: Matt Hickey, PE
Jessica Cawley, PE
Murraysmith

Re: Alternate Wastewater System Connection Options TM-3

Introduction

This memo contains a summary of information regarding pumping raw wastewater from the City of Sandy (City) to either the Clackamas County Water Environment Services (WES) Tri-City Water Pollution Control Plant (WPCP) or the City of Gresham Wastewater Treatment Plant (WWTP). Alignments, capital costs, and lifecycle costs for each option have been developed. It is assumed that the cost is a planning estimate to be used solely for the purpose of a detailed discharge alternatives evaluation for the City of Sandy.

Purpose

The purpose of documenting these alternatives is to verify the results of previous planning efforts presented in the City of Sandy Wastewater System Facility Plan prepared in 2018. In the Facility Plan, it was documented the discharge alternatives to WES and Gresham represented greater costs than the alternatives outlined for a new discharge to the Sandy River which totaled approximately $60M. The evaluation relative to the WES and Gresham alternatives was completed at a planning level effort which included limited detail. The evaluation presented with the memorandum, represents additional details relative to pipe routing and pump stations, additional cost analysis and additional information provided through discussions with staff from the WES and the Gresham WWTP's. An overview map of the connection alternatives is shown in Figure 1.

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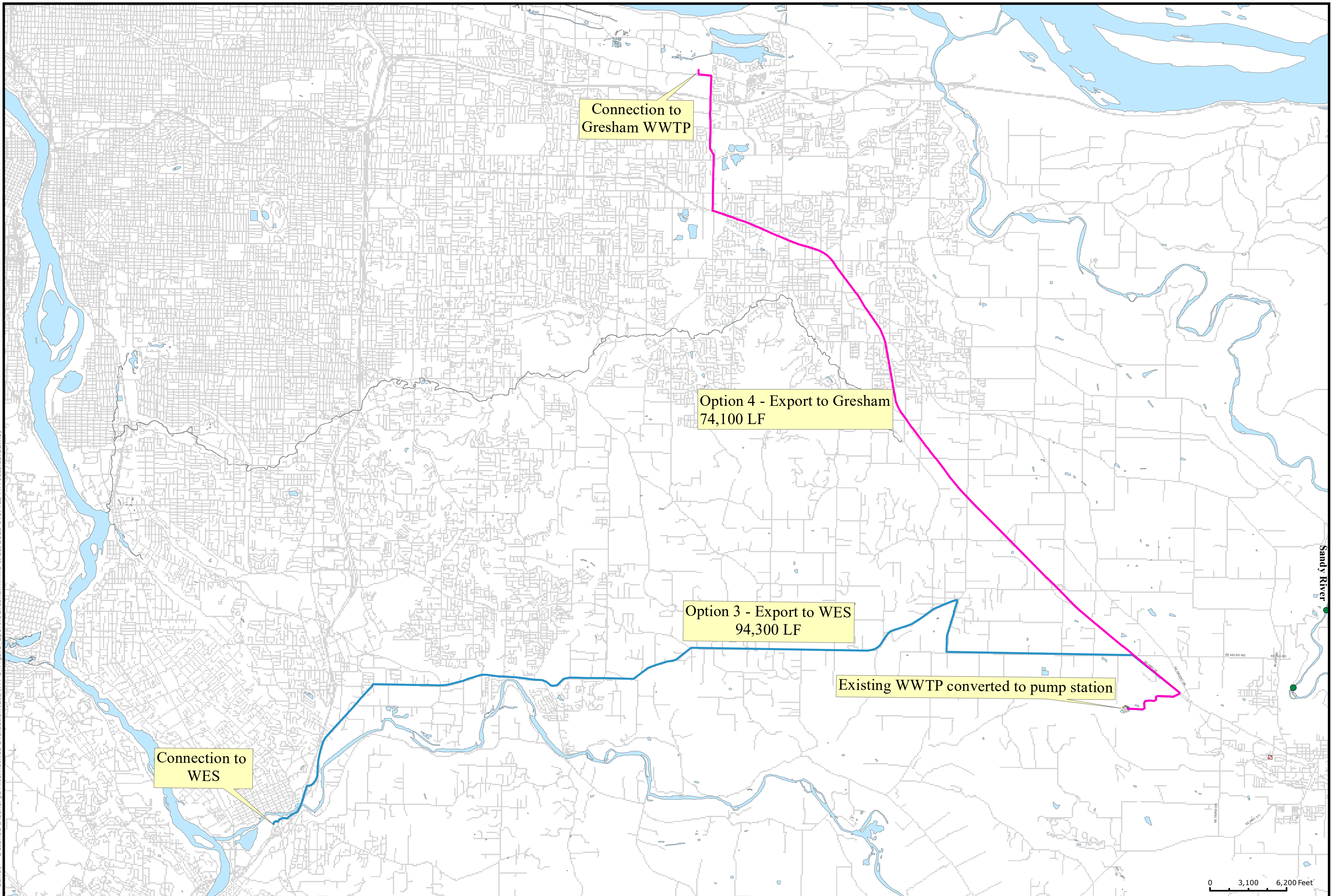

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SANDY
WHERE INNOVATION MEETS ELEVATION

City of Sandy, Oregon
Detailed Discharge Alternatives Evaluation

Legend

Discharge Alternatives

- Option 3
- Option 4

Figure 1
Overview Map
Alternative
Wastewater System
Connection Options

August 2020 20-2776

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Scope

The following items are included in the scope of this memo:

1. Meet with representatives from Clackamas County WES and the City of Gresham to discuss the ability of capacity and potential capitalization costs associated with accepting, treating and discharging the City's raw wastewater.
2. Develop alternatives, including preliminary pipeline alignment and costs, for pumping and transmission of raw wastewater from the City of Sandy to either WES or Gresham
3. Capital and 20-year lifecycle costs for each alternative
4. Figure of pipeline alignments

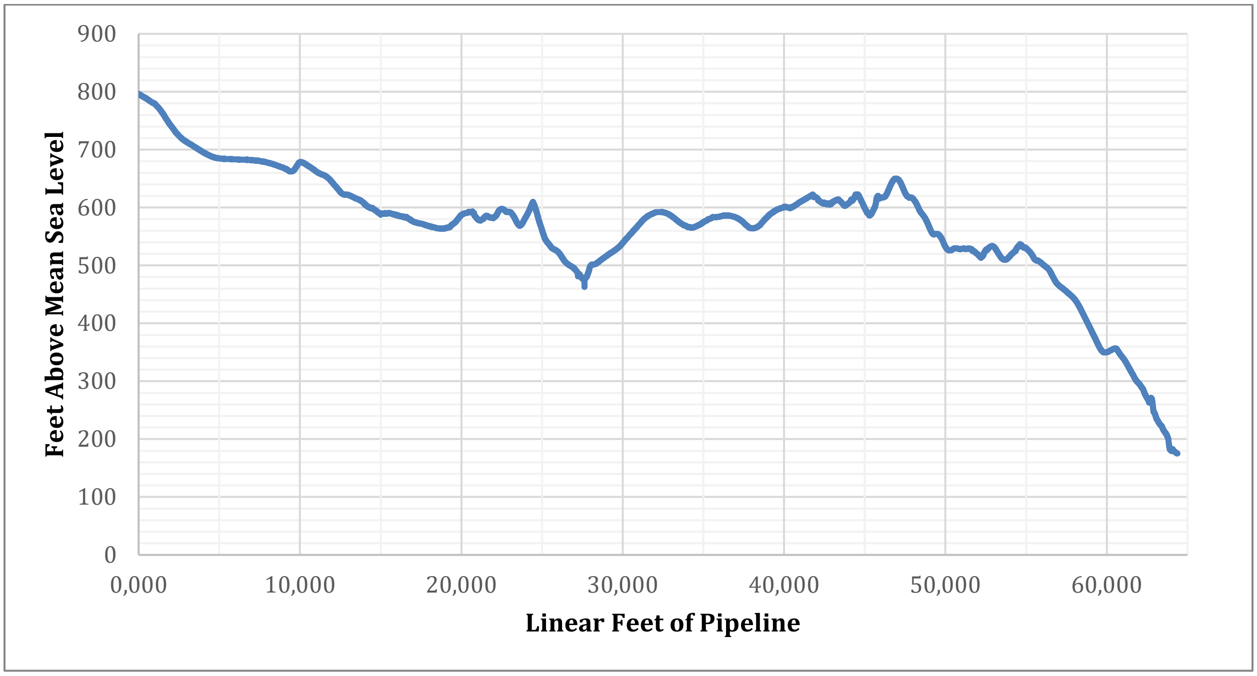
Connection Alternatives

The two options considered for this evaluation are the WES and Gresham facilities. Exporting raw wastewater to WES is identified as *Option 3* and exporting raw wastewater to the Gresham facility as *Option 4*. The proposed pipeline routes were selected following major roads, minimized pipeline distances, and avoided major stream crossings.

Connection Point to the Clackamas WES Collection System

A preliminary evaluation was conducted for connecting to the WES collection system to be treated at the Tri-City WPCP. This pipeline route follows Highway 26, Kelso Road, Richey Road, and Highway 212. The connection point is assumed to be the existing WWTP. The connection point will likely be further out in the collection system, but for the high-level analysis, it was assumed the capacity upgrades to the collection system needed to accommodate the City's flows would be equal to or less than the cost to pipe directly to the WPCP. The profile for the potential force main route is shown in **Figure 2**.

Figure 2 | Profile of Sewer Alignment from Sandy to WES



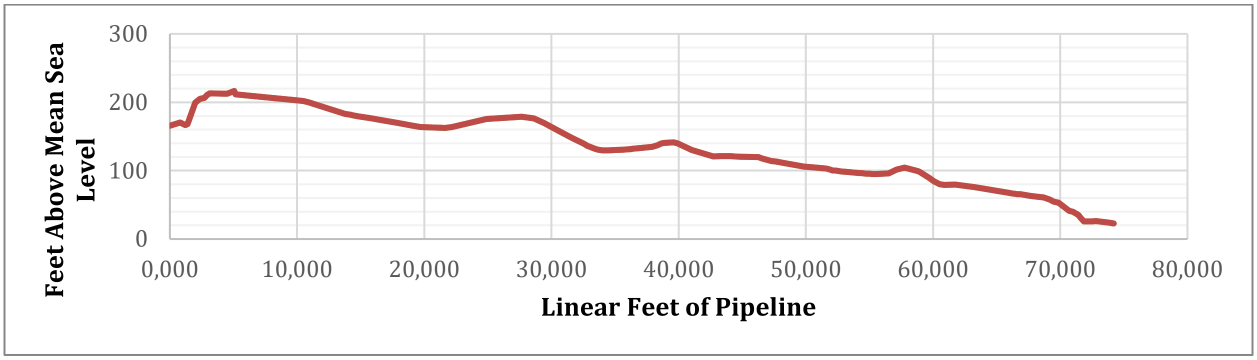
WES is currently upgrading their collection system capacity and it is assumed that a fee would be apportioned as a capital cost for the proportional capacity improvements necessitated by the connection to both the collection system and the Tri-City WPCP. The costs are based on a 24" force main (FM) to be installed less than 20 feet deep and include trenching, excavation, manhole installations, resurfacing costs of a main arterial, and contingency costs. The potential conveyance system will also include two pump stations.

Connection Point to the Gresham WWTP

An evaluation to determine appropriate trunk lines to connect to within the Gresham system were simplified by assuming the cost of capacity improvements to the collection system would be approximately equal to the cost of piping directly to the Gresham WWTP.

It is assumed that a fee would be apportioned as a capital cost for the proportional capacity improvements required for the WWTP to accept flows from the City of Sandy. **Table 2** lists the capitol costs associated with connecting to the Gresham WWTP. The costs are based on a 14 MGD lift station to be installed at the existing wastewater treatment plant and then to flow by gravity to the Gresham WWTP. The profile for the potential force main alignment is shown in Figure 3 below.

Figure 3 | Profile of Sewer Alignment from Sandy to Gresham WWTP



One pump station is required for this alternative, and the remainder of the pipeline can be conveyed via gravity. The gravity pipe meets minimum slope requirements and would have an average depth of 12 feet below ground surface. Figure 3 shows the profile of the alignment to the Gresham WWTP. The maximum depth below ground surface is approximately 35 feet.

Capital Cost Evaluation

Capital costs for exporting wastewater to WES or Gresham include pipeline materials and installation, pump station costs, and a connection fee to the system. Not included in these costs are the annual pumping costs, collection system maintenance fees and treatment fees per gallon of wastewater. A description of each the capital costs is described in the following sections.

Pipeline Costs

Pipeline costs assume an average of 20 feet of depth based on the analysis of the profiles and preliminary pump station locations. These costs include trenching, excavation, manhole installations, resurfacing costs of a main arterial, and contingency costs. Costs are differentiated between gravity lines and force mains in the cost estimate. Manholes are assumed every 400 feet. Force mains and gravity lines are sized to satisfy City hydraulic design criteria utilizing flow rates established for 2040 with pipe degradation and respective RDII reduction.

Pump Station Costs

Pump station installation costs will include excavation and installation of a wet well, pumps, and associated mechanical and electrical improvements. It does not include odor control.

Connection Fees

Capital costs to connect to the system were discussed with personnel from WES and the City of Gresham. However, without conducting a detailed study on the capacity improvements required for the collection system and treatment systems to accommodate flows from the City of Sandy, an estimate of the connect fee was not provided by City representatives. Meeting were not conducted in person. A copy of correspondence is found in **Attachment 1, 2, 3, and 4**. In lieu of an agreed upon cost, average construction costs provided by RS Means for wastewater treatment facilities per gallon were used to estimate approximate connection fees for the treatment facilities. This is based on either buy-in to the existing WWTP's if capacity is available or contributing to the cost of plant upgrades to accommodate additional flows from Sandy. The estimate of the collection system portion of the connection fee required to accommodate the additional flow from Sandy was excluded from the connection fee and instead approximated by including the cost of piping directly to the WWTPs instead of the more likely situation of finding an appropriate location in the collection system to discharge to and paying associated fees to help the upgrade the collection system to accommodate the increase in flow volume.

Summary of Costs

Export to Clackamas County – WES

The total conceptual level opinion of probable project cost to export the raw wastewater from the existing City of Sandy WWTP to the Clackamas County – WES Tri-City WPCP are listed below in **Table 1**. Gravity piping costs assume a depth between 25 and 30 feet and sized so that minimum slopes allow for 2 feet per second scour velocity when flowing full.

Table 1 | Conceptual Level Cost Estimate for Conveyance from Sandy to WES WWTP

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST
36-inch Gravity main	39,900	LF	$ 1,300	$ 51,870,000
16-inch Force main	24,500	LF	$ 700	$ 17,150,000
Pump Station	2	EA	$ 10,780,000	$ 21,560,000
Connection Fee	4,540,000	GPD	$ 5.59	$ 25,380,000
			Total Project Cost[1]	**$ 115,960,000**
	Construction Contingency		30%	Included
	Design:		20%	Included
	Construction Management:		15%	Included
	Public Involvement/Permitting:		3%	Included
	Contractor Overhead/Profit:		20%	Included

Note:

1 Cost estimates represent a Class 5 budget estimate in 2020 dollars, as established by the American Association of Cost Engineers. This preliminary estimate class is used for conceptual screening and assumes project definition maturity level below two percent. The expected accuracy range is -20 to -50 percent on the low end, and +50 to +100 percent on the high end, meaning the actual cost should fall in the range of 50 percent below the estimate to 100 percent above the estimate.

Export to Gresham

The total conceptual level opinion of probable project cost to export the raw wastewater from the existing City of Sandy WWTP to the Gresham WWTP are listed below in **Table 2**. Gravity piping costs assume a depth between 25 and 30 feet and sized so that minimum slopes allow for 2 feet per second scour velocity when flowing full.

Table 2 | Conceptual Level Cost Estimate for Conveyance from Sandy to Gresham WWTP

DESCRIPTION	QTY	UNIT	UNIT COST		TOTAL COST	
36-inch Gravity main	69,000	LF	$	1,300	$	89,700,000
16-inch Force main	5,200	LF	$	700	$	3,640,000
Pump Station	1	EA	$	10,780,000	$	10,780,000
Connection Fee	4,540,000	GPD	$	5.59	$	25,380,000
				Total Project Cost[1]	**$**	**129,500 ,000**
		Construction Contingency	30%			Included
		Design:	20%			Included
		Construction Management:	15%			Included
		Public Involvement/Permitting:	3%			Included
		Contractor Overhead/Profit:	20%			Included

Note:

1 Cost estimates represent a Class 5 budget estimate in 2020 dollars, as established by the American Association of Cost Engineers. This preliminary estimate class is used for conceptual screening and assumes project definition maturity level below two percent. The expected accuracy range is -20 to -50 percent on the low end, and +50 to +100 percent on the high end, meaning the actual cost should fall in the range of 50 percent below the estimate to 100 percent above the estimate.

Life Cycle Costs

As presented above, the capital costs are substantially higher for the WES and Gresham alternatives than the recommended option for discharging to the Sandy River. Since these options do not appear to be viable when compared to the recommended Sandy discharge, the additional effort to provide life cycle cost estimates for the two alternatives were not developed for this memorandum. Additionally, it is anticipated the operational needs and associated costs will be similar to or greater than the operational costs for the recommended Sandy River alternative. This is based on potentially similar costs for treatment and substantially more cost to maintain and operate significantly more infrastructure (longer pipelines and more pump stations) needed for the WES and Gresham alternatives.

Conclusion and Summary

The alternatives outlined in this memorandum involve an evaluation of exporting flows to existing treatment facilities outside of the City. The purpose of the analysis is to compare these to the recommended alternative to discharge to the Sandy River. Based on the costs outlined above being significantly higher than the Sandy River Discharge Alternative, as well as the uncertainty associated with exporting flows and associated potentially higher operational costs, these alternatives are not recommended for this project. This comparison further verifies the Sandy River alternative appears to be the preferred option for long term wastewater discharge for the City.

Cc: Matt Hickey, Murraysmith

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murraysmith

City of Sandy

SANDY
WHERE INNOVATION MEETS ELEVATION

Sandy Wastewater Treatment Facilities Basis of Design Report

March 2021 | Project # 20-2776

Sandy Wastewater Treatment Facilities Basis of Design Report

City of Sandy

March 2021

Murraysmith

888 SW 5th Avenue
Suite 1170
Portland, OR 97204

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A - City of Sandy WWTP NPDES Permit
B - Existing Sandy WWTP Process Model Report
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D - Proposed Eastside Satellite Treatment Facility Process Model Report

Section 1

Section 1

Introduction

1.1 Purpose

The purpose of this basis of design report is to document the further evaluation of the recommendations made in the Wastewater System Facilities Plan (Facilities Plan). Specifically, this basis of design report will provide greater clarification of the design criteria for the existing City of Sandy Wastewater Treatment Plant (WWTP) and the Eastside Satellite Treatment Facility as recommended in the Facilities Plan.

1.2 Background

The City owns and operates the City of Sandy WWTP to serve the residents and businesses of Sandy, Oregon. For nearly 20 years the City has used contract operators to operate the plant. The plant is currently operated by Veolia North America.

The treatment system, shown in **Figure 1-1**, was first constructed around 1971 and included screenings, contact stabilization process, effluent polishing pond, and disinfection using a chlorine contact tank before discharging into Tickle Creek. The last major treatment plant update occurred in 1997 when the entire plant was updated to include new screening, grit removal, activated sludge secondary treatment process, disk cloth filtration, and UV disinfection. During the summer months from May through October, treated WWTP effluent is utilized for irrigation by a local container plant nursery. During the winter months from November through April, when no irrigation water is needed at the nursery, water is discharged to Tickle Creek.

Recently, the treatment plant has exceeded its National Pollutant Discharge Elimination System (NPDES) permit effluent levels for total suspended solids (TSS), biochemical oxygen demand (BOD_5), ammonia, *E. coli* bacteria, chlorine, and stream discharge dilution requirements.

In 2017, the City retained Murraysmith to develop a Facilities Plan to develop improvements to handle growth for the next 20 years. The facilities plan completed in 2019 evaluated both improvements required for the collection and the existing treatment system. The facilities plan recommended immediate improvements and long-term improvements at the existing Sandy WWTP. It also recommended a new Eastside Satellite Treatment Facility that will be constructed in two stages in 2026 and approximately 2036 to progressively treat half of the flow from the collection system. Below is a summary of the phased treatment improvements identified in the Facilities plan.

1.1.1 Phase 1 (2021 through 2026):

Phase 1 improvement include immediate needs improvements for the existing Sandy WWTP as well as construction of a new Eastside Satellite Treatment Facility as outlined as follows:

- Existing Sandy WWTP Improvements
    - Replace the existing mechanical screen
    - Replace the grit removal system mechanical components.
    - Improve equalization basin flow control
    - Replace existing aeration basin blowers to provide better air control.
    - Repair existing secondary clarifier mechanism and releveling the clarifier effluent weir.
    - Replace the existing UV disinfection system.
- Stage 1 Eastside Satellite Treatment Facility Construction
    - Construct new 3.5 million gallons per day (MGD) Satellite Treatment Plant with:
        - Headworks (Fine Screen and Grit Removal)
        - Two Membrane Bioreactor (MBR) Trains
        - UV Disinfection System
        - Effluent Aeration System

1.1.2 Phase 2 (2025 through 2032)

Phase 2 improvement include process and capacity improvements to the Existing Sandy WWTP as outlined as follows:

- Existing Sandy WWTP Improvements
    - Upgrade Headworks Facility
    - Install Two Primary clarifiers.
    - Conversion to anaerobic digestion.
    - Upgrade the solids handling system including new sludge dewatering and dryer equipment.

1.1.3 Phase 3 (2033 through 2040)

Phase 3 improvement include expansion of the Eastside Satellite Treatment Facility as outlined as follows:

- Stage 2 Eastside Satellite Treatment Facility Construction
    - Expand the MBR to treat 7.0 MGD peak flow.

1.3 Overview

The preliminary basis of design report is divided into four sections including Introduction, Planning and Design Criteria, Existing Sandy WWTP Biological Process Analysis, and Proposed Eastside Satellite Treatment Facility Basis of Design, and Conclusion.

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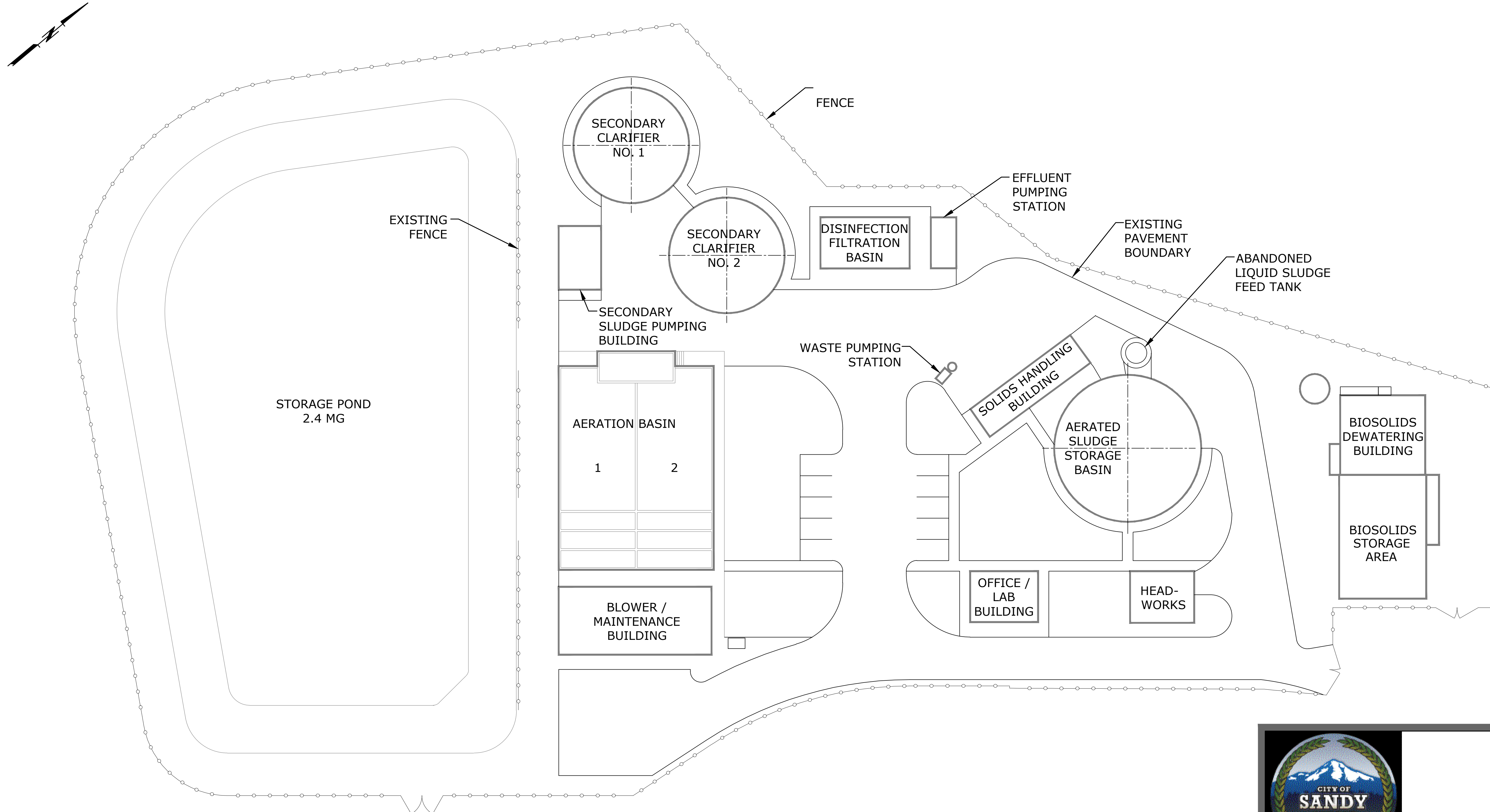

SITE PLAN
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CITY OF SANDY
WWTP

EXISTING
SITE PLAN

December 2020

FIGURE 1-1

murraysmith

Project # - 19-2445

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Section **2**

Section 2

Planning and Design Criteria

2.1 Regulatory Considerations

2.1.1 Existing Sandy WWTP

City of Sandy NPDES Permit #102492 was renewed on January 23, 2010, allowing the discharge of treated effluent to Tickle Creek about one mile downstream of the plant (Outfall 001) during the Winter NPDES Permit Season from November 1st to April 30th, and to a local container plant nursery for recycled water irrigation during the Summer NPDES Permit Season from May 1st to October 31st (Outfall 002). A copy of the City's NPDES Permit is included in **Appendix A**. The NPDES permit expired on November 30, 2013. The permit was submitted for renewal in March 2013, but the permit has not been renewed to date.

Table 2-1 is a summary of waste discharge limitations for the Sandy WWTP Outfall 001 to Tickle Creek as contained in Schedule A of the City's NPDES Permit.

Table 2-1
Outfall 001 NPDES Waste Discharge Limits[a]

	Monthly Average Concentration (mg/L)	Weekly Average Concentration (mg/L)	Daily Maximum Concentration (mg/L)	Monthly Average Load[b] (ppd)	Weekly Average Load[b] (ppd)	Daily Maximum Load[b,c] (ppd)
Winter Season (November 1 through April 30)						
BOD_5	10	15	NA	125	187	250
TSS	10	15	NA	125	187	250
Ammonia	3.7	NA	10.9	NA	NA	NA

Notes:
a) From current Sandy WWTP NPDES Permit #102492 for File Number 78615.
b) Mass load limits are based upon WWTP average dry weather design flow of 2.5 MGD.
c) The daily mass load limit is suspended on any day in which the flow to the treatment facility exceeds 2.5 MGD.
Abbreviations:
mg/L = Milligrams per liter.
ppd = Pounds per day.

During the allowed Winter NPDES Permit Season discharge to Tickle Creek from November 1st to April 30th, the current permit limits discharge to Tickle Creek when the available stream dilution is less than 10 based on the following equation:

$$Dilution = \frac{(Q_e + Q_s)}{Q_e}$$

Where: Q_e = WWTP Discharge Flow in MGD
Q_s = Tickle Creek Flow measured at a gauging station 1 mile upstream from Outfall 002 in MGD

The NPDES does allow for emergency overflow discharge to Tickle Creek at the plant site (Outfall 003) when flows exceed 4.0 MGD.

2.1.2 Future Eastside Satellite Treatment Facility

Since the Eastside Satellite Treatment Facility has not yet been issued an NPDES permit, there are no specific targets that are required to date. However, based on performance of similar technology, results of a preliminary anti-degradation analysis, as well as anticipated Class A Recycle Water quality requirements, the following effluent limits will be used for the design.

Table 2-2
Estimated Eastside Satellite Treatment Facility Effluent Limits

Parameter	Monthly Average Concentration
BOD_5	<5 mg/L
TSS	<5 mg/L
Ammonia	<1 mg/L
pH	> 6
Dissolved Oxygen (DO)	> 6 mg/L
Turbidity	2 NTU
Total Coliform	< 2.2 total coliform/100 mL
Temperature	< 20[1]

Notes:
[1]Exact temperature requirement varies by season, river flow, and other environmental conditions.
Abbreviations:
mg/L = milligrams per liter
NTU = nephelometric turbidity unit
mL = milliliter

2.2 Design Criteria and Planning Period

As part of the Facilities Plan, the 20-year flow and load projections for the entire system were developed as shown on **Table 2-3** through **Table 2-5**.

Table 2-3
Summary of Existing and Projected Flow

Flow	Existing Flow, MGD	2040 Flow, MGD
Annual Average Flow (AAF)	1.4	2.39
Average Dry Weather Flow (ADWF)	1.0	2.0
Average Wet Weather Flow (AWWF)	1.78	3.05
Maximum Month Dry Weather Flow (MMDWF)	1.5	2.4
Maximum Month Wet Weather Flow (MMWWF)	2.6	4.1
Peak Week Flow (PWF)	4.0	6.6
Peak Day Flow (PDF)	8.9	12.1
Peak Instantaneous Flow (PIF)	10.3	14.0

Table 2-4
Current BOD_5 and TSS Loads

2017 Population	Parameter	Monthly Average			Maximum Month		
		Concentration (mg/L)	Load (ppd)	Load Factor (ppcd)	Concentration (mg/L)	Load (ppd)	Load Factor (ppcd)
Summer Season (May 1 through October 31)							
11,800	BOD_5	286	2,500	0.209	455	3,600	0.305
11,800	TSS	280	2,400	0.201	456	3,500	0.294
Winter Season (November 1 through April 30)							
11,800	BOD_5	192	2,400	0.203	297	3,500	0.294
11,800	TSS	190	2,400	0.202	342	3,900	0.333

Notes:
1. ppd= pounds per day
2. ppcd = pound per capita per day

Table 2-5
2040 BOD_5 and TSS Loading Projections

2040 Population	Parameter	Monthly Average		Maximum Month	
		Load Factor (ppcd)	Load (ppd)	Load Factor (ppcd)	Load (ppd)
Summer Season (May 1 through October 31)					
22,400	BOD_5	0.209	4,700	0.305	6,800
22,400	TSS	0.201	4,500	0.294	6,600
Winter Season (November 1 through April 30)					
22,400	BOD_5	0.203	4,600	0.294	6,600
22,400	TSS	0.202	4,500	0.333	7,500

Notes:
1. ppd= pounds per day =
2. ppcd = pound per capita per day

There is limited historical influent Total Kjeldahl Nitrogen (TKN) and ammonia data at the plant, therefore the nitrogen loads were estimated using the ammonia data collected in 2018 from the wastewater characterization data as discussed in **Section 3.2**. The BOD_5 loads during sampling were approximately the same as the monthly average BOD_5 load; therefore, it was assumed that the ammonia loads collected during that time also represented the monthly average ammonia loads. To estimate the maximum month load for ammonia, we assumed that the multiplier between maximum month BOD_5 and monthly average BOD_5 (~1.5) is the same as maximum month ammonia and monthly average ammonia. Since the data we have available is limited, it was assumed that the wet weather and dry weather loads are the same for monthly average and maximum month. **Table 2-6** and **Table 2-7** summarizes the current and projected ammonia loads for the entire system.

Table 2-6
Current Nitrogen Loads

2018 Population	Parameter	Monthly Average		Maximum Month	
		Load (ppd)	Load Factor (ppcd)	Load (ppd)	Load Factor (ppcd)
12,180	Ammonia	287	0.024	431	0.035
12,180	TKN	413	0.034	619	0.051

Note:

1. ppd= pounds per day =
2. ppcd = pound per capita per day

Table 2-7
2040 Nitrogen Loading Projections

2040 Population	Parameter	Monthly Average		Maximum Month	
		Load Factor (ppcd)	Load (ppd)	Load Factor (ppcd)	Load (ppd)
22,400	Ammonia	0.024	528	0.035	792
22,400	TKN	0.034	760	0.051	1,139

Notes:

1. ppd= pounds per day =
2. ppcd = pound per capita per day

As outlined in the Facilities Plan, a new Eastside Satellite Treatment Facility that will treat half of the collection system flow will be constructed in two stages (2026 and 2036) by the end of the planning period; therefore, the existing treatment plant will only treat half of the 2040 flow in the long-term but will need to treat all of the current flow in the near term before stage 1 is complete. A summary of the projected flows from 2019 to 2040 to the existing Sandy WWTP based on proposed staging of the Eastside Satellite Treatment Facility are shown in **Table 2-8**, and the revised wastewater loads to the Sandy WWTP are show in **Table 2-9** and **2-10.**

Table 2-8
Summary of Current and Projected Flow (MGD) to Existing Sandy WWTP

Flow Event	2017	2020	2025	2026[1]	2030	2035	2036[2]	2040
AAF	1.4	1.45	**1.53**	0.93	1.14	**1.35**	0.76	1.20
ADWF	1.08	1.12	**1.18**	0.72	0.88	**1.05**	0.59	0.93
AWWF	1.78	1.85	**1.95**	1.19	1.45	**1.73**	0.97	1.53
MMDWF	1.41	1.46	**1.54**	0.94	1.15	**1.37**	0.77	1.21
MMWWF	2.66	2.76	**2.91**	1.8	2.17	**2.58**	1.44	2.27
PWF	5.01	5.19	**5.48**	3.34	4.08	**4.85**	2.71	4.28
PDF	5.87	6.08	**6.42**	3.91	4.77	**5.68**	3.18	5.02
PIF	9.05	9.38	**9.9**	6.40	7.73	**9.13**	5.63	7.00

Notes:
1. First stage of Eastside Satellite Treatment Facility begins operation in 2026
2. Second stage of Eastside Satellite Treatment Facility begins operation in 2036

Table 2-9
Sandy WWTP Average Day BOD_5 and TSS Loading Projections

Year	Average Dry Weather			Average Wet Weather		
	Flow, MGD	BOD_5, ppd	TSS, ppd	Flow, MGD	BOD_5, ppd	TSS,ppd
2020	1.12	2,700	2,600	1.85	2,600	2,600
2025	1.18	3,100	3,000	1.95	3,000	3,000
2026[1]	0.718	1,900	1,800	1.19	1,800	1,800
2030	0.878	2,300	2,200	1.45	2,300	2,200
2035	1.05	2,800	2,700	1.73	2,700	2,700
2036[2]	0.585	1,600	1,500	0.97	1,500	1,500
2040	0.925	2,300	2,200	1.53	2,300	2,300

Notes:
1. First stage of Eastside Satellite Treatment Facility begins operation in 2026
2. Second stage of Eastside Satellite Treatment Facility begins operation in 2036

Table 2-10
Sandy WWTP Maximum Month BOD_5 and TSS Loading Projections

Year	Maximum Month Dry Weather			Maximum Month Wet Weather		
	Flow, MGD	BOD_5, ppd	TSS, ppd	Flow, MGD	BOD_5, ppd	TSS, ppd
2020	1.46	3,900	3,800	2.76	3,800	4,300
2025	1.54	4,500	4,300	2.91	4,300	4,900
2026[1]	0.9375	2,700	2,600	1.78	2,700	3,000
2030	1.1475	3,400	3,300	2.17	3,300	3,700
2035	1.37	4,100	4,000	2.58	4,000	4,500
2036[2]	0.765	2,300	2,200	1.44	2,200	2,500
2040	1.205	3,400	3,300	2.27	3,300	3,700

Notes:
1. First stage of Eastside Satellite Treatment Facility begins operation in 2026
2. Second stage of Eastside Satellite Treatment Facility begins operation in 2036

Once the Eastside Satellite Treatment Facility begins operation in 2026, waste activated sludge (WAS) solids from that plant will be sent to the Sandy WWTP through the sewer collection system since the satellite treatment facility will not have solids handling facilities due to the proximity to existing residences. As a result, the design for the Sandy WWTP will account for the additional load from the Eastside Satellite Treatment Facility. **Table 2-11** estimates the additional load to the Existing Sandy WWTP from the biosolids discharged from the Eastside Satellite Treatment Facility based on the results of the Biowin process model for the facility discussed in **Section 4**. Note that while the flow is the same between dry weather and wet weather conditions, the BOD and TSS loads are different which is a better representative of the impact on the existing Sandy WWTP.

Table 2-11
Projected Eastside Satellite Treatment Facility WAS BOD_5 and TSS Loads to Existing Sandy WWTP

Parameter	Stage 1 Maximum Month (2026)		Stage 2 Maximum Month (~2036)	
	Dry Weather Load	Wet Weather	Dry Weather	Wet Weather
Flow, gpd	15,200	15,200	30,400	30,400
BOD_5, ppd	255	320	510	640
TSS, ppd	1095	1175	2100	2350

Note:

1. gpd= gallons per day

For the Eastside Satellite Treatment Facility, a summary of the projected flows is shown in **Table 2-12**, and the projected wastewater loads are show in **Table 2-13** and **2-14.**

Table 2-12
Summary of Projected Flow for Eastside Satellite Treatment Facility in MGD

Flow Event	2026[1]	2030	2035	2036[2]	2040
AAF	0.60	0.60	0.60	1.20	1.20
ADWF	0.46	0.46	0.46	0.93	0.93
AWWF	0.76	0.76	0.76	1.53	1.53
MMDWF	0.60	0.60	0.60	1.21	1.21
MMWWF	1.14	1.14	1.14	2.27	2.27
PWF	2.14	2.14	2.14	4.28	4.28
PDF	2.51	2.51	2.51	5.02	5.02
PIF	3.50	3.50	3.50	7.00	7.00

Notes:

1. First stage of Eastside Satellite Treatment Facility begins operation in 2026
2. Second stage of Eastside Satellite Treatment Facility begins operation in 2036

Table 2-13
Eastside Satellite Treatment Facility Average Day BOD_5 and TSS Loading Projections

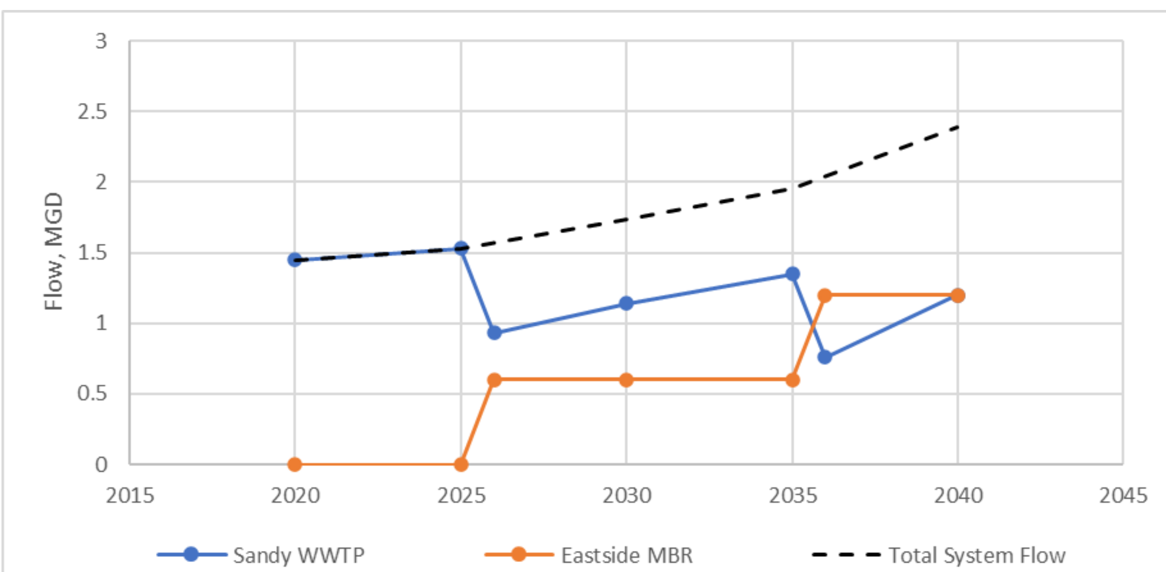
Year	Average Dry Weather			Average Wet Weather		
	Flow, MGD	BOD_5, ppd	TSS, ppd	Flow, MGD	BOD_5, ppd	TSS, ppd
2026	0.46	1,211	1,164	0.76	1,173	1,167
2040	0.93	2,337	2,248	1.53	2,270	2,259

Table 2-14
Eastside Satellite Treatment Facility Maximum Month BOD_5 and TSS Loading Projections

Year	Maximum Month Dry Weather			Maximum Month Wet Weather		
	Flow, MGD	BOD_5, ppd	TSS, ppd	Flow, MGD	BOD_5, ppd	TSS,ppd
2026	0.60	1,764	1,700	1.14	1,695	1,920
2040	1.21	3,411	3,288	2.27	3,288	3,724

The projected division of flow between the two plants can be seen on **Figure 2-1**.

Figure 2-1
Projected Average Annual Flow to the Existing Sandy WWTP and Eastside Satellite Treatment Facility



The collection system was modeled to confirm that sufficient flow was available at the diversion pump station to deliver the required flow to the Eastside Satellite Treatment Facility. The following table shows the projected monthly average flows at the diversion pump station.

Table 2-15
Projected flow at Monthly Average Flows at Diversion Pump

Month	Flow (MGD)				
	2020	2026	2030	2036	2040
January	1.58	1.92	2.14	2.23	2.28
February	1.45	1.78	2.00	2.08	2.13
March	1.61	1.95	2.18	2.26	2.31
April	1.43	1.74	1.95	2.16	2.29
May	1.4	1.60	1.74	1.94	2.07
June	1.1	1.42	1.64	1.70	1.75
July	0.76	1.21	1.50	1.44	1.39
August	0.69	1.14	1.43	1.36	1.32
September	0.73	1.18	1.47	1.40	1.36
October	1.41	1.74	1.97	2.05	2.10
November	1.75	2.09	2.32	2.67	2.90
December	1.66	2.00	2.23	2.44	2.59

The table shows that there is sufficient flow at the diversion pump station to provide consistent flow to the Eastside Satellite Treatment Facility.

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Section 3

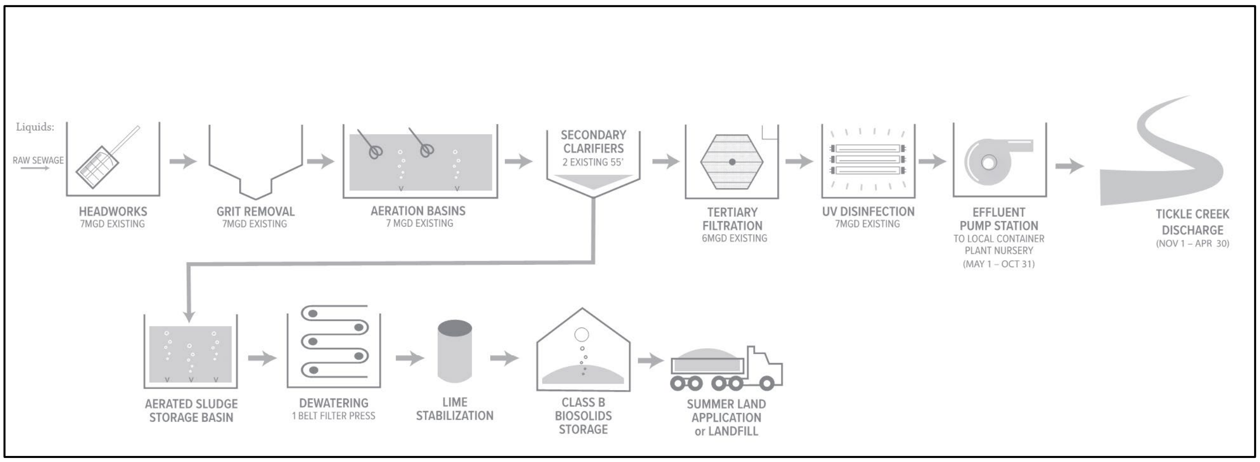
Section 3

Existing Sandy WWTP Biological Process Analysis

3.1 Background

The existing process schematic for the existing Sandy WWTP is shown on **Figure 3-1** below. A detailed list of mechanical equipment and design capacity can be found in the *Section 7.3 - Existing WWTP Capacity Evaluation* of the *Facilities Plan*.

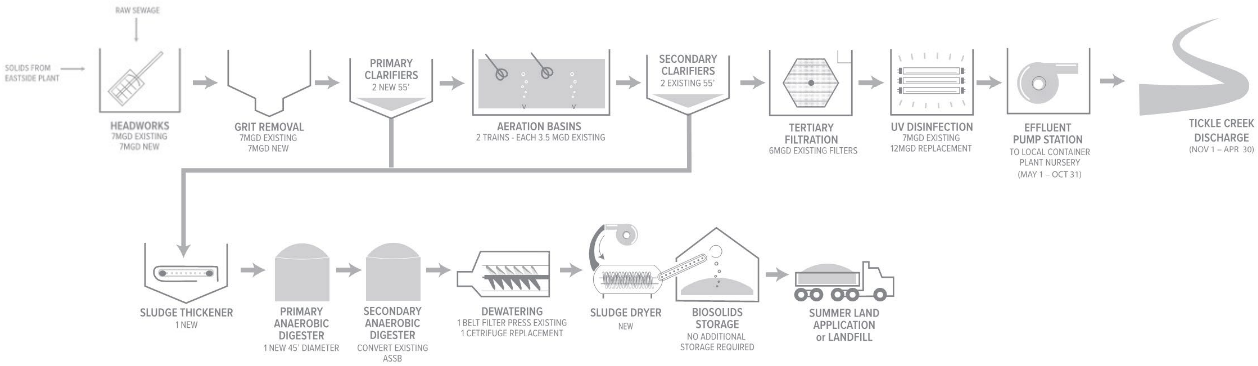
Figure 3-1
Existing WWTP Process Schematic



The plant lacks redundancy for 2040 MMWWF in the headworks, secondary treatment, and tertiary filter. To improve plant redundancy and performance, the Facilities Plan proposed several improvements to the Sandy WWTP including expanding the headworks, adding primary clarifiers, modifying the aeration basin to create plug flow and upgrading the solids processing by constructing two anaerobic digesters as summarized in Section 1.2 and shown on **Figure 3-2**.

As noted earlier, WAS solids from the Eastside Satellite Treatment Facility will be discharged into the collection system, so process improvements will have to account for the additional solids loading as noted in **Table 2-11**. The following section will evaluate the biological process capacity of the existing wastewater treatment plant in context of the planned improvements at the Sandy WWTP as well as the staged construction of the Eastside Satellite Treatment Facility.

Figure 3-2
Proposed Existing Sandy WWTP Improvements Process Schematic



3.2 Biological Process Performance Evaluation

3.2.1 Estimated WWTP Influent Characteristics and Model Input

To improve the reliability of the process model, an extensive wastewater characterization program was enacted from May to September 2018. This program involved taking samples twice monthly from various processes throughout the plant. Samples were taken from the influent (Inf), return activated sludge (RAS), aerated sludge storage basin, gravity belt filter pressate, and plant effluent.

The influent sampling values in **Table 3-1** were used to develop the wastewater fractionation for the process model. Based on the flows in **Table 2-8** and loads analysis in **Table 2-9** and **2-10** as well as the wastewater characterization data, the resulting influent characteristics used in the process model simulations are summarized in **Table 3-2**.

Table 3-1
Influent Wastewater Characterization Sampling Results

Parameter	Average Concentrations, mg/L
Chemical Oxygen Demand (COD)	500
Filtered COD	127
Flocculated-Filtered COD (FF COD)	104
BOD_5	327
TSS	229
TKN	52
Ammonia-N	37.5
Total Phosphorus (TP)	5.4
Alkalinity (as Calcium Carbonate)	172

Table 3-2
Influent Wastewater Characterization Model Input

Model Inputs	2020 ADWF	2020 MMDWF	2020 MMWWF	2025 MMDWF	2025 MMWWF	2026[1] MMDWF	2026[1] MMWWF	2040[2] MMDWF	2040[2] MMWWF
Flow, MGD	1.12	1.46	2.76	1.54	2.91	0.94	1.78	1.21	2.27
BOD_5, mg/L	288	322	164	351	179	351	179	339	174
TSS, mg/L	277	311	186	338	203	338	203	327	197
Volatile Suspended Solids (VSS), mg/L	257	289	173	314	188	314	188	304	183
Ammonia-N, mg/L	33	37	20	41	22	41	22	39	21
TKN, mg/L	47	54	28	59	31	59	31	57	30
TP, mg/L	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3

Notes:

1. First stage of Eastside Satellite Treatment Facility begins operation in 2026
2. Second stage of Eastside Satellite Treatment Facility begins operation in 2036

3.3 Process Considerations

In addition to meeting the permit requirements, other design criteria were used to evaluate the secondary process design. Those criteria are as follows:

- Mixed Liquor Suspended Solids (MLSS) concentration should not exceed 3,500 mg/L
- RAS ratio does not exceed 100 percent.

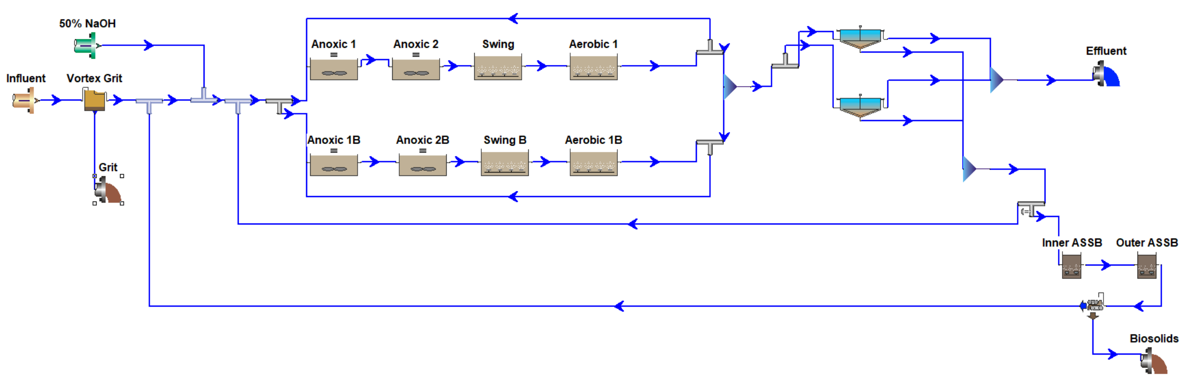
3.4 Process Model Setup

As noted earlier, the Facilities Plan outlined several improvements to the WWTP including the addition of two primary clarifiers and two anaerobic digesters to replace the existing aerated sludge storage basin (ASSB). These improvements will take place sometime between 2025-2032.

To confirm the performance capability of the WWTP during the phased implementation of the project, the flows and loads outlined in **Table 3-2** were evaluated using three different versions of the process models to account for the phased changes to the existing Sandy WWTP as outlined below.

The existing treatment system process model schematic diagram (Model 1) is shown on **Figure 3-3**. The influent screens, effluent filtration, and disinfection are not shown on the schematic. These processes have relatively minor impact on the biological process. For modeling purposes, alkalinity addition is made by feeding in 50 percent sodium hydroxide. This model was used to evaluate performance in 2020 and 2025 prior to the construction of the first stage of the Eastside Satellite Treatment Facility.

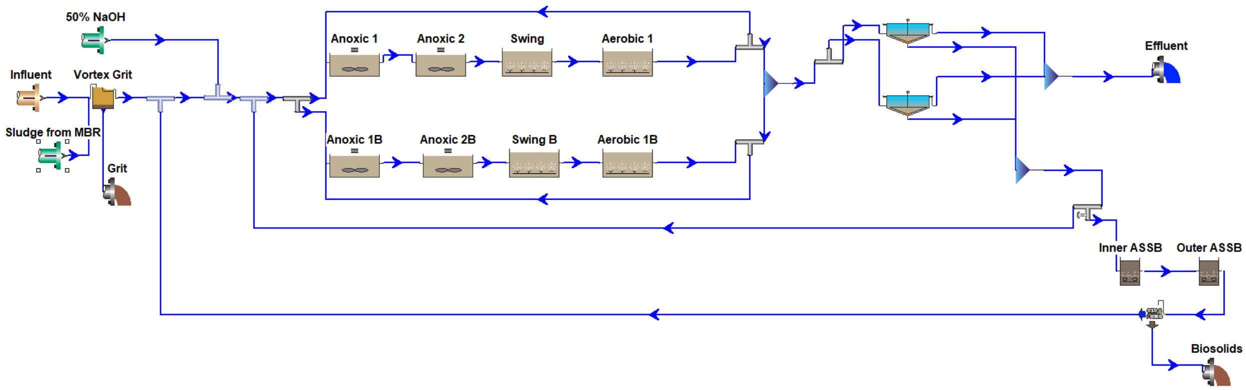
Figure 3-3
Existing Sandy WWTP - Biowin Model Process Schematic (Model 1)



The existing Sandy WWTP is expected to begin receiving waste sludge from the Eastside Satellite Treatment Facility starting in 2026 when the plant begins operation. Therefore, **Figure 3-4** shows the process model schematic diagram for the existing plant after 2026 with the only change being the input of WAS sludge as described on **Table 2-11** from the Eastside Satellite Treatment Facility

(Model 2). This model was used to evaluate performance in 2026 after construction of the Eastside Satellite Treatment Facility.

Figure 3-4
Existing Sandy WWTP with Eastside Satellite Treatment Facility Sludge Input - Biowin Model Process Schematic (Model 2)



Plant improvements at the existing Sandy WWTP are planned sometime between 2025-2032 period depending on observed population growth, as noted previously and in the facilities plan these improvements include expanding the headworks, adding primary clarifiers, modifying the aeration basin to create plug flow, and upgrading the solids processing by constructing two anaerobic digesters. **Figure 3-5** shows the process model schematic diagram for the Sandy WWTP after these improvements are implemented (Model 3). This model was used to evaluate performance in 2040 after stage 2 construction of the Eastside Satellite Treatment Facility.

Figure 3-5
Existing Sandy WWTP Improvements - Biowin Model Process Schematic (Model 3)

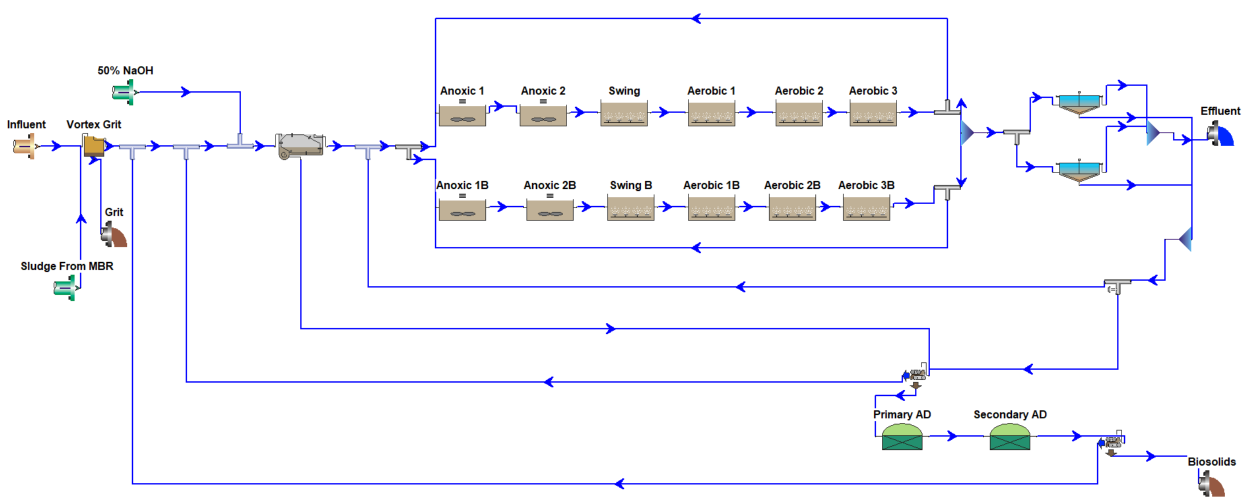


Table 3-3 presents the existing process volumes and depth of the aeration basin for each treatment train used in the process modeling for Model 1 and 2.

Table 3-3
Existing WWTP Aeration Basin Cell Volume Per Train

Cell	Volume, gallons	Average Water Depth, feet
Anoxic 1	37,700	18
Anoxic 2	37,700	18
Aerobic 1	37,700	18
Aerobic 2	257,400	18
Total volume per train	**370,500**	

Table 3-4 presents the proposed process volumes and depth of the aeration basin for each treatment train used in the process modeling for Model 3 based on the installation of baffles in Aerobic 2 Cell to promote plug flow that will lead to improved treatment performance.

Table 3-4
Proposed Aeration Basin Cell Volume Per Train

Cell	Volume, gallons	Average Water Depth, feet
Anoxic 1	37,700	18
Anoxic 2	37,700	18
Aerobic 1	37,700	18
Aerobic 2	85,800	18
Aerobic 3	85,800	18
Aerobic 4	85,800	18
Total volume per train	**370,500**	

3.5 Process Model Simulation Results

Process model simulations were run to determine the plant performance as well as to provide a range of operation requirements for process equipment under a variety of operating conditions. The process model was simulated under MMWWF and MMDWF conditions only because that is the design condition for sizing process equipment for secondary treatment. Peak flow simulations were not modeled because the flow conditions are temporary and steady-state process model simulations would not represent true performance.

The preliminary model simulations were run at steady state with influent characteristics listed in **Table 3-2**, and the results of the simulations are shown below in **Table 3-5**. The complete results from the Biowin model for the existing WWTP are included in **Appendix B**.

As shown in **Table 3-5**, the process model predicts that the City of Sandy WWTP will meet the current permitted monthly average effluent concentration limits under all the projected simulated conditions. Note that the model does not include the effluent filters, so the final effluent TSS and BOD_5 will be improved compared to the model results. The effluent filters do have a capacity limit of 6.0 MGD; therefore, under peak flow conditions some of the flow will not be filtered and the final effluent will be a blend of filtered and un-filtered effluent.

Under most cases, the process modeling indicated the system could not meet the permit pH and ammonia requirements without supplemental alkalinity addition through caustic soda addition. This was modeled by increasing the alkalinity in the influent by feeding in 50 percent caustic soda to the system. Because there is limited data on alkalinity concentrations during the winter, it is possible that the required caustic soda requirement will be more or less.

Table 3-5
Existing Sandy WWTP Process Model Simulation Results

Parameter	2020 ADWF	2020 MMWWF	2020 MMDWF	2025 MMWWF	2025 MMDWF	2026 MMWWF[1]	2026 MMDWF[1]	2040 MMWWF[2]	2040 MMDWF[2]
Flow, MGD	1.12	2.76	1.46	2.76	1.54	1.78	0.94	2.27	1.21
Temperature, °C	22	11	22	11	22	11	22	11	22
Solids Retention Time (SRT), days	7	7	4	7	5	6	6	8	7
MLSS, mg/L	2,155	3,126	2,116	3,367	2,846	2,923	2,866	2,751	3,120
Caustic Soda Addition, gpd	0	300	0	300	100	100	0	150	0
Air Demand per train, scfm[3]	700	1,000	1,000	1,100	1,500	600	800	700	1,100
Secondary Effluent TSS, mg/L	4	14	6	14	6	8	4	10	5
Secondary Effluent BOD_5, mg/L	3	7	4	7	4	4	2	4	2
Secondary Effluent Ammonia-N, mg/L	1	3	7	3	1	2	0.5	2	0.05
Secondary Effluent Total Nitrogen, mg/L	9	9	16	10	14	9	14	15	24
Secondary Effluent pH	6.4	6.6	6.0	6.5	6.3	6.3	6.7	6.0	6.8
Primary Sludge, ppd	0	0	0	0	0	0	0	2,900	2,700
WAS Solids, ppd	1,900	2,70	3,100	3,000	3,500	3,000	3,000	2,600	2,800
ASSB SRT, days	5	5	4	5	3.6	4.4	4.4	-	-
Digester SRT, days	-	-	-	-	-	-	-	65	87
Dewatered Biosolids, ppd	1,300	1,900	2,100	2,000	2,400	2,200	2,200	2,500	2,600

Notes:

1. Stage 1 of Eastside Satellite Treatment Facility begins operation in 2026
2. Stage 2 of Eastside Satellite Treatment Facility and Improvements to the Existing WWTP in Operation in 2040
3. scfm = standard cubic feet per minute

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Section 4

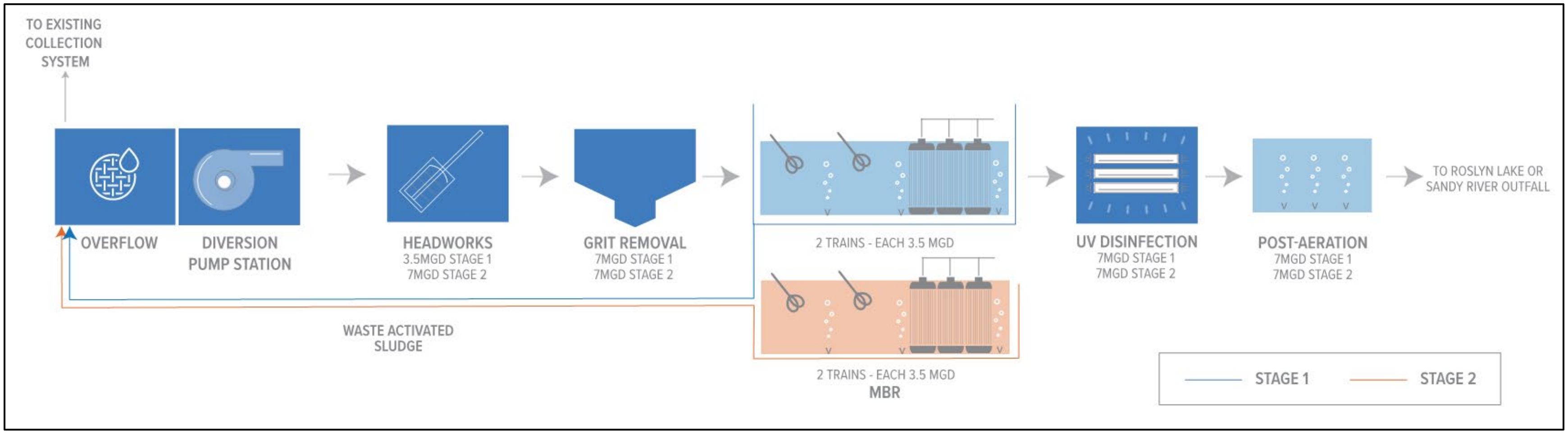
Section 4

Proposed Eastside Satellite Treatment Facility Basis of Design

4.1 Background

As outlined in the 2019 Facilities Plan, a new Eastside Satellite Treatment Facility will be constructed. The facility will be fed with wastewater from the collection system upstream of the plant and from the diversion pump station located on Dubarko Road and constructed over two Stages (Stage 1 and 2). The proposed process schematic is shown in **Figure 3-1**. The facility will consist of headworks with fine screens and grit removal, MBR, UV disinfection and post aeration. Under the first stage of construction, two MBR trains will be constructed in 2026 and the second stage will consist of two additional MBR trains constructed in 2036. **Appendix C** contains a preliminary layout of the diversion pump station in **Drawing C-1** and of the Eastside Satellite Treatment Facility in **Drawing C-2**. All process facilities and equipment will be enclosed in buildings to mitigate noise and odors. The site will also be landscaped including installing of berms and screening to provide a buffer for the surrounding residences.

Figure 4-1
Proposed Eastside Satellite Treatment Facility Process Schematic



4.2 Diversion Pump Station

The proposed diversion pump station site is located near the intersection of Dubarko Road and Ruben Lane. Upstream of the diversion pump station is a junction of a 15-inch, 12-inch and 8-inch sewer line contributing flow from basins 3, 4, 6, 7, 8, 9, and 10. This point in the collection system can capture over fifty percent of the total system flow, providing a cost-effective and flexible flow-management between the Eastside Satellite Treatment Facility and the existing WWTP. The optimal flow rates can be divided between the two treatment facilities.

Drawing C-1 in Appendix C shows one potential configuration to automate and control flow to the diversion pump station which will pump to the Eastside Satellite Treatment Facility. This design is a cost-effective, low maintenance configuration that will also provide operational flexibility using automated gates and stop logs for flow control. As an alternative design, the diversion pump station configuration and controls could be used to split the flow between the two treatment facilities.

The diversion pump station will have an approximate footprint of 25 feet by 50 feet. It will have a similarly sized control building structure and a valve and meter vault on the force main. The pump station will be designed as an expandable triplex pump station with a firm capacity of 3.5 MGD, expandable up to 7.0 MGD. Due to anticipated flows as low as 0.5 MGD in the summer and to make sure the DEQ mandated minimum velocities are attained, a single 12-inch forcemain to the Eastside Satellite Treatment Facility will be constructed initially and a parallel FM installed in the second phase as flows increase. The wet well will be sized for 2040 peak flows. Any flows beyond PIF flow will bypass to existing high overflow to the existing collection system.

Pumps will have VFDs to control flow to the satellite facility. The use of VFDs will allow operators flexibility to pump a larger range of flows. The VFDs will promote proper flushing velocities in the force main by ramping up to a flow rate that creates the minimum required 3.5 feet per second velocity for a short duration to resuspend solids then ramp down to a lower flow rate to manage the number of pump starts and stops per hour. The station will have a backup generator to maintain operation during loss of power.

4.3 Headworks

The headworks facility will consist of two or three fine mechanical screens and a grit chamber. The following section provides the basis of design for these unit processes. It should be noted, the staged construction of the headworks as discussed below is intended to reduce initial capital costs, however there are some operational advantages and efficiencies to building the headworks out to full capacity that should be considered as the project advances to the design stage.

4.3.1 Fine Screen

The fine screen is installed to protect the downstream treatment processes by removing large debris and rags from the influent. To meet pretreatment requirements for the secondary treatment system (MBR), the fine screen needs to have an opening less than 2 millimeters (mm) to remove any debris that could potentially impact the membrane. A total of three screens are recommended for installation. The first two screens would be installed for redundancy at start-up, and the third added in stage 2. Each fine screen will be rated for 3.5 MGD.

4.3.2 Grit Removal System

Removal of grit is important to prevent abrasive grit from damaging pipes and pumps as well as potentially damaging the membranes in the bioreactor. It is important to size the grit system for wet weather flows since this is when the velocities in the collection system are high to scour fine debris and grit. Vortex grit systems remove grit by forcing the flow to form a vortex in a circular chamber that then forces grit to settle quickly to the bottom of the chamber. Grit collected will be removed using a grit pump and sent to a hydrocyclone and grit classifier for washing and compacting before discharging to a dumpster for disposal. The vortex grit system will be rated for 7.0 MGD, the peak flow for stage 2, and will include a bypass channel to allow for the system to be shut down as needed for routine maintenance.

4.4 Secondary Treatment

4.4.1 Membrane Bioreactor

The proposed secondary treatment process at the Eastside Satellite Treatment Facility after the final stage of construction will consist of four parallel aeration basin (AB) trains. Two AB trains will be constructed as part of Stage 1, and the remaining two AB trains will be constructed in Stage 2. Flow to each train will be controlled through weir gates located on the upstream side of the train.

Each train will be configured to operate in the Modified Ludzack-Ettinger Process which consists of an anoxic zone following by an aerobic zone. Each train will consist of a 20,000-gallon anoxic tank and 60,000-gallon aerobic tank. The anoxic zone and the aerobic zone will be divided into two passes by baffle walls to promote plug flow operation. Mixing in the anoxic zones will be achieved through submersible mixers. Flow to the membrane basins will be pumped using feed forward pumps equipped with variable frequency drives that can pump up to 500 percent of the maximum month flow in the train (2,000 gallons per minute [gpm] per pump). The average depth of the aeration basin will be 18 feet.

Each membrane basin is assumed to be approximately 30,000-gallon with two MBR basins per train, but the volume will depend on the membrane supplier requirements based on the design flux rate. RAS will be delivered by gravity through a return feed channel between two aeration basins trains to the head of the anoxic zone. Three waste activated sludge pumps (two duty and one standby) rated up to 40 gpm will be installed as part of Stage 1. The WAS will be pumped in a 6-inch force main to the downstream side of the diversion pump station to send WAS solids to the Sandy WWTP. Flow meters will be installed on the 6-inch WAS pipe to track the sludge volume wasted for operational control. For Stage 2, two additional WAS pumps will be installed for Basin

3 and 4 and the WAS will be discharged into the same 6-inch forcemain as Basin 1 and 2 to be discharged downstream of the diversion pump station.

Four variable speed permeate pumps rated up to 620 gpm will be installed as part of Stage 1. The permeate will pumped through an 18-inch force main equipped with flow meters and will pump the treated effluent through the post aeration system as discussed below and to the outfall at either the Sandy River or Roslyn Lake. Four additional permeate pumps will be installed in Stage 2 when Basin 3 and 4 are installed and connected to the 18-inch force main for discharge.

4.4.2 Aeration Basin Blowers

The air demand for the aeration basin during Stage 1 (excluding air demand for sludge mixing in the membrane tanks) will range between 650 and 1,200 standard cubic feet per minute (scfm) per basin. Therefore, three variable speed blowers (two duty and one standby) will be included that have a max capacity of approximately 1,300 scfm. Two additional variable speed blowers will be installed as part of Stage 2.

For the membrane basin, three air scour blowers with a capacity of approximately 400 scfm will be required in Stage 1 for the membrane tanks to air scour for the membranes and provide air for mixing in the membrane tank. Two additional air scour blowers of the same capacity will be installed as part of Stage 2. The capacity of the membrane tank blowers could change depending on the membrane supplier requirement.

4.5 UV Disinfection System

To save capital and operational cost, the UV disinfection system will be designed to meet two different disinfection scenarios. The first scenario involves discharge in the summer season to Roslyn Lake up to 1.6 MGD which covers some flow events over the 2040 maximum month flow. The second scenario involves discharge to the Sandy River which will include summer and shoulder season storms with flows exceeding 1.6 MGD as well as winter season discharge.

Under Scenario 1, the UV disinfection will be sized to treat summer flows to provide Class A Recycle Water for irrigation or discharge to Roslyn Lake To meet Class A Recycle Water requirements, the effluent “must not exceed a median of 2.2 total coliform organisms per 100 milliliters, based on results of the last seven days that analyses have been completed, and 23 total coliform organisms per 100 milliliters in any single sample” as outlined in OAR 340-55. To meet these criteria, the UV disinfection system will be designed to provide a dose of at least 80 millijoule per centimeter squared (mJ/cm^2). For Scenario 2, the UV disinfection system will be sized to provide a dose of 30 mJ/cm^2 to meet NPDES requirements for discharge to the Sandy River.

Since the permeate pumps from the MBR will be used as the effluent pumps, in-pipe UV disinfection will be used at the site. To provide the flexibility to operate under the two different scenarios, four in-pipe UV units will be provided. The piping and valves will be configured so that four units can be operated either in parallel or in series. For Scenario 1, all four units will be operated in series to provide an 80 mJ/cm^2 for a flow up to 1.6 MGD. For Scenario 2, three units will operate in parallel to provide a 30 mJ/cm^2 dosage for a peak flow of 7.0 MGD.

4.6 Post-Aeration System

To meet dissolved oxygen requirements for discharge to Sandy River based on the anti-degradation analysis, the effluent requires a dissolved oxygen concentration of 6.0 mg/L. Effluent from the MBR will range between 2 and 5 mg/L based on review of performance data from similar facilities. A closed-pipe supplemental aeration system will be installed that is rated to increase the DO from 2 mg/L to 6 mg/L.

4.7 Biological Process Performance Evaluation

A biological process model was developed to evaluate the performance of the proposed MBR. The following sections summarize the process model development and the expected performance of the proposed design.

4.7.1 Estimated WWTP Influent Characteristics and Model Input

The same wastewater characterization values that were collected from May to September 2018 for the existing WWTP as shown on **Table 3-1** will be used for the Eastside Satellite Treatment Facility.

Based on the flows and loads analysis as well as the wastewater characterization data in **Table 3-1**, the influent characteristics used in the process model simulations for the Eastside Satellite Treatment Facility are summarized in **Table 4-1**.

Table 4-1
Eastside Satellite Treatment Facility – Influent Wastewater Characterization Model Input

Model Inputs	2026 ADWF	2026 MMDWF	2026 MMWWF	2040 MMDWF	2040 MMWWF
Flow, MGD	0.46	0.60	1.14	1.21	2.27
BOD_5, mg/L	314	351	179	339	174
TSS, mg/L	302	338	203	327	197
VSS, mg/L	280	314	188	304	183
Ammonia-N, mg/L	35	41	22	39	21
TKN, mg/L	51	59	31	57	30
TP, mg/L	5.3	5.3	5.3	5.3	5.3

4.7.2 Process Considerations

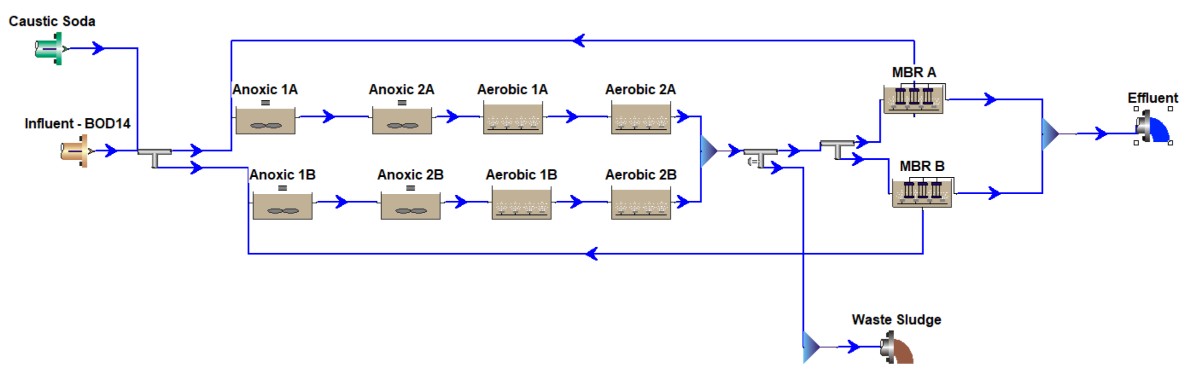
In addition to meeting the permit requirements, other design criteria were used to evaluate the secondary process design. Those criteria are as follows:

- MLSS concentration in aeration basins does not exceed 10,000 mg/L
- RAS ratio does not exceed 600%.

4.7.3 Process Model Setup

Two MBR trains will be constructed under Stage 1 and then another two trains will be constructed in a subsequent stage 2. The treatment system process model schematic diagram (Model 4) for the first stage is shown on **Figure 4-2**. The influent screens, effluent filtration, and disinfection are not shown on the schematic. These processes have relatively minor impact on the biological process. For modeling purposes, alkalinity addition is made by feeding in 50 percent sodium hydroxide. This model was used to evaluate performance in 2026.

Figure 4-2
Stage 1 Eastside Satellite Treatment Facility Biowin Model Process Schematic (Model 4)



The plant will be expanded during around 2036 based upon population growth. The expansion will include the additional of two additional trains. **Figure 4-3** shows the process model schematic diagram for the final build out in 2040 (Model 5). This model was used to evaluate performance in 2040.

Figure 4-3
Stage 2 Eastside Satellite Treatment Facility Biowin Model Process Schematic (Model 5)

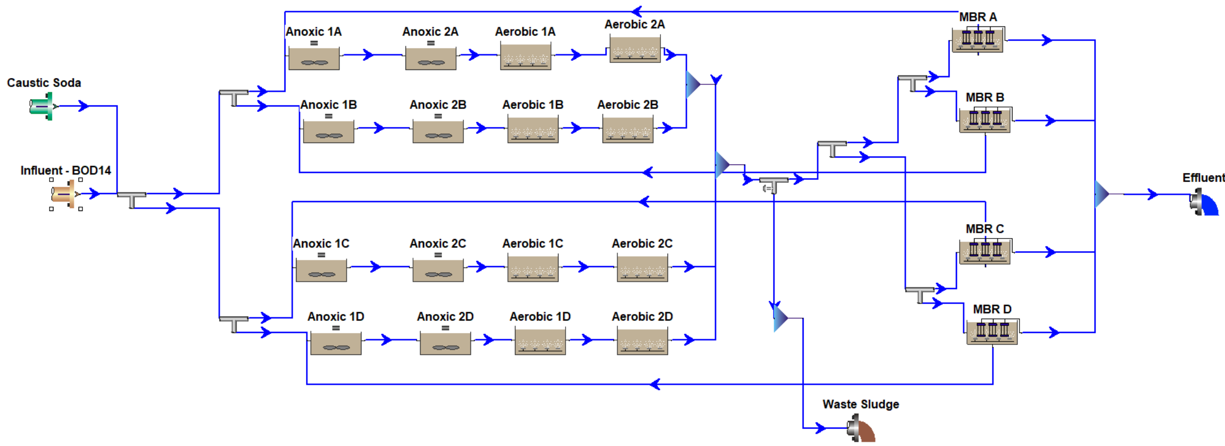


Table 4-2 presents the existing process volumes and depth of the aeration basin for each treatment train used in the process modeling for Model 4 and 5.

Table 4-2
Eastside Satellite Treatment Facility Aeration Basin Cell Volume Per Train

Cell	Volume (gallons)	Average Water Depth (feet)
Anoxic 1	10,000	18
Anoxic 2	10,000	18
Aerobic 1	30,000	18
Aerobic 2	30,000	18
MBR Basin	30,000	TBD[1]
Total volume per train	**110,000**	

Note:

1. Water depth dependent on MBR manufacturer.

4.7.4 Process Model Simulation Results

Process model simulations were run to determine the plant performance as well as to provide a range of operational requirements for process equipment under a variety of conditions. The process model was simulated under MMWWF and MMDWF conditions only because that is the design condition for sizing process equipment for secondary treatment. Peak flow simulations were not modeled because the flow conditions are temporary and steady-state process model simulations would not represent true performance.

The preliminary model simulations were run at steady state with influent characteristics listed in **Table 4-1**, and the results of the simulations are shown below in **Table 4-3**. The complete results from the Biowin model for the proposed Eastside Satellite Treatment Facility are included in **Appendix D**.

As shown in **Table 4-3**, the process model predicts that the proposed secondary treatment process will meet the anticipated permitted monthly average effluent concentration limits listed on **Table 2-2** under all simulation conditions. In our opinion, the model over-predicts the amount of TSS removal from the MBR, but based upon a review of historical data from several MBR facilities, the maximum MBR effluent is 4 mg/L.

The process modeling indicated the system could not meet the permit pH without supplemental alkalinity addition through caustic soda addition. For the modeling, it was assumed that 50 percent caustic soda was added to the system. Because there is limited data on alkalinity concentrations data available, it is possible that the required caustic soda requirement will be more or less.

Table 4-3
Eastside Satellite Treatment Facility – Process Model Simulation Results

Parameter	2026 ADWF	2026 MMWWF	2026 MMDWF	2040 MMWWF	2040 MMDWF
Flow, MGD	0.46	1.14	0.6	2.27	1.21
Temperature, °C	22	11	22	11	22
SRT, days	25	15	15	15	15
MLSS, mg/L	8,300	9,300	8,700	8,700	8,300
50% Caustic Soda Addition, gpd	0	100	100	100	100
Total Air Demand, scfm	1,300	1,800	2,400	3,200	3,800
Secondary Effluent TSS, mg/L	< 1	< 1	< 1	< 1	< 1
Secondary Effluent BOD_5, mg/L	< 1	< 1	< 1	< 1	< 1
Secondary Effluent Ammonia-N, mg/L	0.06	0.3	0.05	0.65	0.06
Secondary Effluent Total Nitrogen, mg/L	11	8	13	8	13
Secondary Effluent pH	6.3	6.4	6.8	6.1	6.5
WAS Solids, ppd	600	1,200	1,100	2,100	2,000

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Section 5

Section 5

Conclusion

5.1 Existing Sandy WWTP Biological Process Analysis

The results of the biological process analysis of the existing Sandy WWTP show that the planned improvements at the Sandy WWTP along with the staged construction of the Eastside Satellite Treatment Facility will result in the facility meeting its permit through 2040 assuming all equipment operates as designed. A summary of the design criteria can be found on **Table 5-1**. The upcoming immediate needs improvements project will improve performance of key unit processes including the aeration system in the aeration basin and the secondary clarifiers that had resulted in permit exceedances. In addition, increased capacity of sodium hydroxide feed system was found to be key for meeting the ammonia permit limit in the process model since nitrifying bacteria are increasingly inhibited by pH levels less than 7. As stated in the Facilities Plan, the phasing of the improvements to the existing Sandy WWTP outlined in Phase 2 of the Facilities Plan should be implemented based on the observation of growth in the community that results in increased flow and load to the WWTP.

Table 5-1
Sandy Wastewater Treatment Plant– Design Criteria

System	Design Criteria	
Headworks Treatment	Current	After Phase 2 Improvements
Mechanical Fine Screen		
Type	Drum Screen	Drum Screen
Quantity	1	2
Opening	¼"	¼"
Capacity, each	6.6 MGD	6.6 MGD
Grit Chamber		
Type	Vortex	Vortex
Quantity	1	1
Process Capacity	7.0 MGD	7.0 MGD
Sodium Hydroxide Feed Pumps		
Quantity	2 (1 duty + 1 standby)	2 (1 duty + 1 standby)
Pump Type	Diaphragm	Diaphragm
Design Flow Rate, each	300 gpd	300 gpd

System	Design Criteria	
Primary Treatment		
Primary Clarifier		
Type	None	Circular
Quantity	-	2
Diameter	-	65 feet
Side Water Depth		15 feet
Secondary Treatment		
Aeration Basin		
Number of Trains	2	2
Total Basin Volume	740,000 gallons	740,000 gallons
Selector Zone Cells (3 per train)	75,000 gallons each	75,000 gallons each
Aerobic Cells (1 per train)	145,000 gallons	145,000 gallons
Side Water Depth	17.8 feet	17.8 feet
Max Design SRT	7 days	8 days
Max Design MLSS	3,400 mg/L	3,100 mg/L
Air Demand at Maximum Month Per Basin	1,500 scfm	1,100 scfm
Process Air Blowers		
Multistage Centrifugal		
Number of Blowers	3	3
Blower Capacity, each	1,350 scfm	1,350 scfm
Rotary Lobe		
Number of Blowers	1	1
Blower Capacity, each	400-1,100 scfm	400-1,1100 scfm
Secondary Clarifier		
Quantity	2	2
Type	Circular	Circular
Diameter	54 feet	54 feet
Side Water Depth	15 feet	15 Feet
Volume	257,000 gallon	257,000 gallon
Capacity	3.5 MGD	3.5 MGD
Surface overflow rate at capacity	1,500 gal/day per ft^2	1,500 gal/day per ft^2
Return Activated Sludge Pump		
Quantity	2	2
Pump Type	Centrifugal	Centrifugal
Design Flow Rate, each	600 gpm	600 gpm
Waste Activated Sludge Pump		
Quantity	2	2
Pump Type	Double Diaphragm	Double Diaphragm
Design Flow Rate, each	260 gpm	260 gpm

System	Design Criteria	
Disinfection		
UV System (By UV Octo 15 May 15)		
Reactor Type	Open Channel	Open Channel
No. of Channels	1	2
Lamp Type	Medium Pressure	Low Pressure
Dosage	30 mJ/ cm^2	30 mJ/ cm^2
Design Capacity, each channel	7.0 MGD	7.0 MGD
Peak Flow Rate	3.5 MGD	14.0 MGD
Disinfection (By 12.5% Sodium Hypochlorite, May 15- Oct 15)		
Hypochlorite Storage Tanks	Two each 1,000 gallons	Two each 1,000 gallons
Sodium Hypochlorite Feed Pumps	2	2
Quantity	2	2
Pump Type	Metering	Metering
Design Flow Rate	5 gallons per hour	5 gallons per hour
Solids Handling		
Aerated Sludge Storage Basins		
Cell No. 1		
Volume	90,000 gallons	-
Side Water Depth	15 feet	-
Cell No. 2		
Volume	180,000 gallons	-
Side Water Depth	15 feet	-
Min Aerobic SRT	4 days	-
Anaerobic Digesters		
Primary Anaerobic Digester		
Volume	-	250,000 gallons
Side Water Depth	-	20 feet
Secondary Anaerobic Digester		
Volume	-	447,000 gallons
Side Water Depth	-	16 feet
Min Anaerobic SRT	-	65 days

5.2 Eastside Satellite Treatment Facility Basis of Design

As outlined in the facilities plan, the Eastside Satellite Treatment Facility will be constructed under two stages. This report provides a basis of design for the unit processes to be constructed including identifying design criteria and redundant equipment requirements. A summary of the design criteria can be found on **Table 5-2**. As part of the analysis, the flows at the Diversion Pump Station were evaluated in the collection system model to confirm that the required wastewater flow was present to divert consistent flow to the Eastside Satellite Treatment Facility.

At the treatment plant, the headworks facility will consist of the three fine screens after Stage 2 construction each with a rated capacity of 3.5 MGD with openings less than 2 mm. A single vortex grit removal system with a rated capacity of 7.0 MGD will be installed in Stage 1. The MBR will consist of a total of four trains. Two trains will be installed during Stage 1 construction and the remaining two trains will be installed under Stage 2. Four in-pipe UV disinfection systems will be installed to disinfect the secondary treated wastewater to discharge to the Sandy River or to meet either Class A Recycle Water standards for irrigation or discharge to Roslyn Lake. Finally, a post-aeration system will be installed to increase the dissolved oxygen to 6 mg/L to meet the discharge effluent requirements that were identified in the preliminary anti-degradation analysis. All process facilities and equipment will be enclosed in buildings to mitigate noise and odors. The site will also be landscaped including installing of berms and screening to provide a buffer for the surrounding residences.

The process model for the Eastside Satellite Treatment Facility found that plant could achieve all effluent goals outlined on Table 2-2, but similarly to the existing Sandy WWTP, sodium hydroxide feed will be important to achieve efficient nitrification for ammonia removal.

Table 5-2
Eastside Satellite Treatment Facility – Design Criteria

System	Design Criteria	
Headworks Treatment	Stage 1	Stage 2
Mechanical Fine Screen		
Type	Drum Screen	Drum Screen
Quantity	2	3
Opening	2 mm	2 mm
Capacity. each	3.5 MGD	3.5 MGD
Grit Chamber		
Type	Vortex	Vortex
Process Capacity	7.5 MGD	7.5 MGD
Secondary Treatment		
Membrane Bioreactor		
Number of Trains	2	4
Total Basin Volume, Per Train	110,000 gallons	110,000 gallons
Anoxic Volume Per Train	20,000 gallons	20,000 gallons
Aerobic Volume Per Train	60,000 gallons	60,000 gallons
Side Water Depth	18 feet	18 feet
No. of MBR Basins Per Train	2	2
MBR Basin Volume, Each	30,000	30,000
Max Design SRT	25 days	25 days
Max Design MLSS	9,500 mg/L	9,500 mg/L
Air Demand at Maximum Month Per Basin	1,200 scfm	1,000 scfm

System	Design Criteria	
Process Air Blowers		
Number	3 (2 duty + 1 standby)	5 (4 duty + 1 standby)
Blower Capacity, each	1,300 scfm	1,300 scfm
Scour Air Blowers		
Number	3 (2 duty + 1 standby)	5(4 duty + 1 standby)
Blower Capacity, each	400 scfm	400 scfm
Feed Forward Pumps		
Quantity	3 (2 duty + 1 standby)	5 (4 duty + 1 standby)
Pump Type	Centrifugal	Centrifugal
Design Flow Rate	2,000 gpm	2,000 gpm
Waste Activated Sludge Pump		
Quantity	3 (2 duty + 1 standby)	5 (4 duty + 1 standby)
Pump Type	Centrifugal	Centrifugal
Design Flow Rate, each	40 gpm	40 gpm
Permeate Pumps		
Quantity	5 (4 duty + 1 standby)	9 (8 duty + 1 standby)
Pump Type	Centrifugal	Centrifugal
Design Flow Rate, each	620 gpm	620 gpm
Caustic Soda Addition Pumps		
Quantity	3 (2 duty + 1 standby)	5 (5 duty + 1 standby)
Pump Type	Diaphragm	Diaphragm
Design Flow Rate, each	100 gpd	100 gpd
Disinfection		
UV System		
Sandy River Discharge		
Reactor Type	In-Pipe	In-Pipe
Lamp Type	Low Pressure High Output	Low Pressure High Output
No. of Units	3 (2 Duty + 1 Standby)	3 (2 Duty + 1 Standby)
UV Unit Configuration	Parallel	Parallel
Dosage	30 mJ/ cm^2	30 mJ/ cm^2
Peak Flow Rate	3.5 MGD	7.0 MGD
Class A Recycle Water		
Reactor Type	In-Pipe	In-Pipe
Lamp Type	Low Pressure High Output	Low Pressure High Output
No. of Units	4 (3 Duty + 1 standby)	4 (3 Duty + 1 standby)
UV Unit Configuration	Series	Series
Dosage	80 mJ/ cm^2	80 mJ/ cm^2
Peak Flow Rate	1.6 MGD	1.6 MGD

System	Design Criteria	
Tertiary Treatment		
Post-Aeration System		
Number of Units	1	1
Design Influent DO	2 mg/L	2 mg/L
Design Effluent DO	6 mg/L	6 mg/L
Peak Design Flow Rate	7.0 MGD	7.0 MGD

Appendix

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APPENDIX A
CITY OF SANDY WWTP NPDES PERMIT

DFQ

Expiration Date: November 30, 2013
Permit Number: 102429 92 CMS 11/27/12
File Number: 78615

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT

Department of Environmental Quality
Northwest Region – Portland Office
2020 SW 4th Ave., Suite 400, Portland, OR 97201
Telephone: (503) 229-5263
Issued pursuant to ORS 468B.050 and The Federal Clean Water Act

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SOURCES COVERED BY THIS PERMIT:

ISSUED TO:
City of Sandy
39250 Pioneer Blvd
Sandy, OR 97005

Type of Waste	Outfall Number	Outfall Location
Treated Wastewater	001	R.M. 2.1
Reclaimed Water Reuse	002	Iseli Nursery Pond IV
Emergency Overflow	003	R.M. 3.4

FACILITY TYPE AND LOCATION:
Activated Sludge
City of Sandy Wastewater Treatment Plant
33400 SE Jarl Road
Boring, OR 97009

Treatment System Class: Level III
Collection System Class: Level II

RECEIVING STREAM INFORMATION:
Basin: Willamette
Sub-Basin: Lower Willamette

Receiving Stream: Tickle Creek
LLID: 1223744453954 2.1 D
County: Clackamas

EPA REFERENCE NO: OR-002657-3
This permit is issued in response to Application No. 977145 received September 1, 2006.
This permit is issued based on the land use findings in the permit record.

[signature] 1/23/10

Greg L. Geist, Manager Water Quality Source Control Section
Northwest Region

Date

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the Permittee is authorized to construct, install, modify, or operate a wastewater collection, treatment, control and disposal system and discharge to public waters adequately treated wastewaters only from the authorized discharge point or points established in Schedule A and only in conformance with all the requirements, limitations, and conditions set forth in the attached schedules as follows:

Page
Schedule A - Waste Discharge Limitations not to be Exceeded 3
Schedule B - Minimum Monitoring and Reporting Requirements 6
Schedule C - ***Not Applicable*** 11
Schedule D - Special Conditions 12
Schedule E - *Not Used (pretreatment not required)*
Schedule F - General Conditions 19

Unless specifically authorized by this permit, by another NPDES or WPCF permit, or by Oregon Administrative Rule, any other direct or indirect discharge of waste is prohibited, including discharge to waters of the state or an underground injection control system.

SCHEDULE A

1. **Waste Discharge Limitations not to be exceeded after permit issuance.**

a. **Outfalls 001 & 003 - Treated Effluent**

(1) May 1 - October 31: No discharge to waters of the State.

(2) November 1 - April 30: No discharge to the waters of the state is permitted at times when ***stream dilution is less than 10.*** Stream dilution is calculated as follows:

Dilution = $(Q_s + Q_e)/Q_e \geq 10$, where
Q_s = Tickle Creek flow measured at gauge, per Schedule B, 1.e (Note7).
Q_e = Effluent flow measured, per Schedule B, 1.b.

Parameter	Average Effluent Concentrations Monthly	Average Effluent Concentrations Weekly	Monthly* Average lb/day	Weekly* Average lb/day	Daily* Maximum lbs
BOD_5	10 mg/L	15 mg/L	125	187	250
TSS	10 mg/L	15 mg/L	125	187	250

* Winter mass loads are based upon the prior permit's average wet weather design flow = 1.5 MGD. The current facility design average dry weather flow (**ADWF**) = **1.25 MGD**; and the design average wet weather flow (**AWWF**) = **1.85 MGD**. The daily mass load limit is suspended on any day in which the flow to the treatment facility exceeds 2.5 MGD (twice the design ADWF).

(3)

Other parameters	Limitations
E. coli Bacteria	Shall not exceed 126 organisms per 100 mL monthly geometric mean. No single sample shall exceed 406 organisms per 100 mL (See Note 1).
pH	Shall be within the range of 6.0 - 9.0
BOD_5 and TSS Removal Efficiency	Shall not be less than 85% monthly average for BOD_5 and 85% monthly for TSS.
Ammonia (NH3-N)	Shall not exceed 10.9 mg/L daily maximum or 3.7 mg/L monthly average.

(4) Regulatory Mixing Zone. No wastes may be discharged or activities conducted that cause or contribute to a violation of water quality standards in OAR 340-041 applicable to the Willamette basin, except as provided for in OAR 340-045-0080 and the following regulatory mixing zone:

The regulatory mixing zone (RMZ) is that portion of Tickle Creek extending 50 feet downstream and 5 feet upstream from the outfall. The zone of initial dilution (ZID) extends in the stream 5 feet from the discharge point.

(5) Chlorine. Chlorine and chlorine compounds must not be used as a disinfecting agent of the treated effluent, and no chlorine residual is allowed in the effluent discharged to the stream.

b. **Outfall 002 - Recycled Wastewater**

(1) No discharge to state waters is permitted. All recycled water shall be distributed on land, for dissipation by evapo-transpiration and controlled seepage by following sound irrigation practices so as to prevent:

a. Prolonged ponding of treated recycled water on the ground surface;

b. Surface runoff or subsurface drainage through drainage tile;

c. The creation of odors, fly and mosquito breeding, or other nuisance conditions;

d. The overloading of land with nutrients, organics, or other pollutant parameters; and

e. Impairment of existing or potential beneficial uses of groundwater.

(2) Prior to land application of the recycled water, it shall receive at least Class B treatment as defined in OAR 340-055:

> Class B recycled water must not exceed a median of 2.2 Total Coliform organisms per 100 milliliters, based on results of the last seven days that analyses have been completed, and 23 Total Coliform organisms per 100 milliliters in any single sample.

(3) Where an irrigation method is used to apply Class B recycled water directly to the soil, there are no setback requirements.

(4) Where sprinkler irrigation is used to apply Class B recycled water, there must be a minimum of 10 feet from the edge of the site used for irrigation and the site property line.

(5) There must be a minimum of 50 feet from the edge of the irrigation site to a water supply source used for human consumption.

(6) Where sprinkler irrigation is used to apply Class B recycled water, the recycled water must not be sprayed within 10 feet of an area where food is being prepared or served, or where a drinking fountain is located.

(7) If aerosols are generated when using recycled water for an industrial, commercial, or construction purpose, the aerosols must not create a public health hazard.

(8) The public and personnel at the use area must be notified that the water used is recycled water and is not safe for drinking. The Recycled Water Use Plan must specify how the notification will be provided.

c. Outfall 003 - Emergency Overflow of Treated Effluent

No discharge to waters of the state is permitted from Outfall 003 when the treatment facility's peak, instantaneous wet weather flow is less than 4.0 MGD.

d. Groundwater

No activities shall be conducted that could cause an adverse impact on existing or potential beneficial uses of groundwater.

NOTES:

1. If a single sample exceeds 406 organisms per 100 mL, then five consecutive re-samples may be taken at four-hour intervals beginning within 28 hours after the original sample was taken. If the log mean of the five re-samples is less than or equal to 126 organisms per 100 mL, a violation shall not be triggered.

SCHEDULE B

1. **Minimum Monitoring and Reporting Requirements**

The Permittee shall monitor the parameters as specified below at the locations indicated. The laboratory used by the Permittee to analyze samples shall have a quality assurance/quality control (QA/QC) program to verify the accuracy of sample analysis. If QA/QC requirements are not met for any analysis, the results shall be included in the report, but not used in calculations required by this permit. When possible, the Permittee shall re-sample in a timely manner for parameters failing the QA/QC requirements, analyze the samples, and report the results.

a. **Influent**

The facility influent sampling location is the following: All influent grab samples, measurements, and composite samples are taken at the Parshall flume upstream of any return flows to the headworks. The Parshall flume is located downstream of the raw screening and grit removal processes. All samples for toxics are taken in the same location.

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Measurement
Flow Meter Calibration	Semi-Annual	Verification (See Note 1)
BOD_5	2/Week	Composite
TSS	2/Week	Composite
pH	3/Week	Grab

b. **Treated Effluent Outfalls 001 & 003**

The facility effluent sampling location is the following: *Effluent grab samples and* measurements are taken at the discharge from the UV disinfection unit. Composite samples and samples for toxics are taken at the same location. Effluent temperature measurements are taken at Outfall 001.

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Measurement
Flow Meter Calibration	Semi-Annual	Verification (See Note 1)
BOD_5	2/Week	Composite
TSS	2/Week	Composite
pH	3/Week	Grab
E. coli	2/Week	Grab (See Note 2)
UV Radiation Intensity	Daily	Reading (See Notes 1 & 3)
NH_3-N	2/Week	Grab

Chlorine Residual	Daily	Grab
Pounds Discharged (BOD_5 and TSS)	2/Week	Daily Maximum Calculation
Pounds Discharged (BOD_5 and TSS)	1/Week	Weekly Average Calculation
Pounds Discharged (BOD_5 and TSS)	Monthly	Monthly Average Calculation
Average Percent Removed (BOD_5 and TSS)	Monthly	Calculation
Metals: As, Cd, Cr, Cu, Pb, Hg, Fe, Ni, Ag, Zn; and Alkalinity & pH.	Quarterly during winter season	24-Hour Composite (Note 4)
Effluent Temperature (°C)	5/Week	Grab (Note 5)
Whole Effluent Toxicity (WET) Testing	See Schedule D, Item #2 to determine sampling frequency.	24-Hour Composite

c. **Biosolids Management**

Item or Parameter	Minimum Frequency	Type of Sample
Sludge analysis including: Total Solids (% dry wt.) Volatile solids (% dry wt.) Biosolids nitrogen for: NH_3-N; NO_3-N; & TKN (% dry wt.) Phosphorus (% dry wt.) Potassium (% dry wt.) pH (standard units) Sludge metals content for: As, Cd, Cu, Hg, Mo, Ni, Pb, Se & Zn, measured as total in mg/kg.	Annually	Composite sample must be representative of the product that is land applied (See Note 6).
Record of locations where biosolids are applied on each ODEQ approved site. Site location maps must be maintained at the treatment facility for review upon request by ODEQ.	Each Occurrence	Date, volume, and map locations where biosolids were applied (See Note 1).
Quantity and type of alkaline product used to stabilize biosolids (when	Each occurrence	Measurement (See Note 1).

required to meet federal pathogen and vector attraction reduction requirements in 40 CFR 503.32(b)(3) and 40 CFR 503.33(b)(6)).		
Initial time when solids that received alkaline agent ascended to pH ≥ 12.	Each batch	Date, time, and actual pH measurement (corrected to standard at 25°C) (Note 1).
2 hours after initial alkaline addition and sustained at pH ≥ 12.	Each batch	Date, time, and actual pH measurement (corrected to standard at 25°C) (Note 1).
24 hours after initial alkaline addition and pH ≥ 11.5 was sustained.	Each batch	Date, time, and actual pH measurement (corrected to standard at 25°C) (Note 1).

d. **<u>Recycled Wastewater Outfall 002</u>***
*Grab samples must be taken at Iseli Nursery at the recycled water forcemain discharge point.

Item or Parameter	Minimum Frequency	Type of Sample
Quantity Irrigated (gallons/day)	Daily	Measurement
Flow Meter Calibration	Annually	Verification (Note 1).
Quantity Chlorine Used	Daily	Measurement
Total Chlorine Residual	Daily	Grab
pH	2/Week	Grab
Total Coliform	3/Week	Grab
Nutrients (TKN, NO_2+NO_3-N, NH_3, Total Phosphorus)	Quarterly	Grab (See Note 1).

e. **<u>Tickle Creek (November 1 – April 30)</u>***

Item or Parameter	Minimum Frequency	Type of Sample
Flow (upstream)	2/Week	Measurement (See Note 7)
Stream Dilution	2/Week	Calculation
<u>Metals</u>*: As, Cd, Cr, Cu, Pb, Fe, Ni, Ag, Zn; & Alkalinity and pH.	Quarterly during winter season	Grab (Note 4)

*Take metal grab samples at least 50 feet upstream of the Outfall 001 discharge point.

2. **Discharge Monitoring Reports (DMRs) - Reporting Procedures**

a. Monitoring results shall be reported on approved DMR forms. The reporting period is the calendar month. Reports must be submitted to the Department's Northwest Region - Portland office by the **15th day** of the following month.

b. DMRs shall identify the name, certificate classification and grade level of each principal operator designated by the permittee as responsible for supervising the wastewater collection and treatment systems during the reporting period. Monitoring reports shall also identify each system classification as found on Page One of this permit.

c. DMRs must list all equipment break-downs and all bypassing events. Additionally, the facility's log book must list break-downs and bypassing events, and describe the reasons and corrective action taken to remedy the situation. The log book must be kept current and be available for ODEQ inspection during site visits.

3. **Annual Report Submittals**

a. I&I Report. The Permittee shall have in place a program to identify and reduce inflow and infiltration (I&I) into the sewage collection system. An annual report shall be submitted to the Department by February 19 each year that details sewer collection maintenance activities to reduce I&I. The report shall state those activities that have been done in the previous year and those activities planned for the following year.

b. Biosolids Handling Report. For any year in which biosolids are land applied, a report must be submitted to the Department by February 19 of the following year that describes solids handling activities for the previous year and includes, but is not limited to, the required information outlined in OAR 340-050-0035(6)(a)-(e).

c. Recycled Water Use Report. By no later than February 19 of each year, the Permittee shall submit to the Department an annual report describing the effectiveness of the recycled water system to comply with approved Recycled Water Use Plan, the rules of Division 055, and the limitations and conditions of this permit applicable to use of recycled water.

***NOTES*:**

1. Mandatory Record Keeping. This data must be recorded in the treatment facility log book, per the specified minimum frequency. All data must be kept current, and be open for review by DEQ staff during site visits &/or inspections.

2. *E. coli* Monitoring. *E. coli* monitoring must be conducted according to any of the following test procedures as specified in **Standard Methods for the Examination of Water and Wastewater, 19th Edition**, or according to any test procedure that has been authorized and approved in writing by the Director or an authorized representative:

Method	Reference	Page	Method Number
mTEC agar, MF	Standard Methods, 18th Edition	9-29	9213 D
NA-MUG, MF	Standard Methods, 19th Edition	9-63	9222 G
Chromogenic Substrate, MPN	Standard Methods, 19th Edition	9-65	9223 B
Colilert QT	Idexx Laboratories, Inc.		

3. UV Radiation Intensity. The intensity of UV radiation passing through the water column will affect the system's ability to kill organisms. To track the reduction in intensity, the UV disinfection system must include a UV intensity meter with a sensor located in the water column at a specified distance from the UV bulbs. This meter will measure the intensity of UV radiation in mWatts-seconds/cm2. The daily UV radiation intensity shall be determined by reading the meter each day. If more than one meter is used, the daily recording will be an average of all meter readings each day. Intensity meter(s) must be calibrated at a frequency recommended by the manufacturer. The manufacturer's UV intensity curves shall be used to determine when UV bulbs must be replaced or cleaned. Record all daily UV intensity readings in the treatment facility's log book. Record any change of UV bulbs. Daily UV intensity readings are required for at least 5 days per week.

4. Metals Testing. Whenever possible, a permittee should always use a test method as indicated 40 CFR Part 136 with a Quantitation Limit (QL) that is lower than the permitted effluent limit or water quality criteria for priority pollutant scans. A list of the analytic methods approved by the department and of the applicable QLs is located in the amended tables for Appendix B: Non-detect Analytical Data and Minimum Practical Quantification Levels, located on the web at: http://www.deq.state.or.us/wq/pubs/imds/rpaammend.pdf. The permittee must ensure that all monitoring analysis reports contain both the QL and detection level of the method as defined below:

   Detection Level: *Same as the* ***"Method Detection Limit"*** *(MDL) derived using 40 CFR 136, Appendix B.*

   Quantitation Limit: *Same as the* ***Method Reporting Limit*** *(MRL). It is the lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that all method-specified sample weights, volumes, and cleanup procedures have been employed.*

Metal	*Symbol*	Nov 2007 Appendix B IMD Quantitation Limit (QL) Required ug/L
Arsenic	As	0.05
Cadmium	Cd	0.1
Chromium	Cr	0.4
Copper	Cu	10

Lead	Pb	5
Nickel	Ni	10
Silver	Ag	1.0
Zinc	Zn	5
Iron	Fe	100
Mercury	Hg	0.01

All metals in terms of "Total Recoverable." ***Effluent and Tickle Creek alkalinities must be measured whenever metal samples are taken.*** *Measure Tickle Creek alkalinity at a location at least 50 feet upstream of the Outfall 001discharge point.*

5. Temperature Measurements. Take daily temperature measurements between the hours of 1400 and 1600. Alternatively use continuous monitoring by Department approved method. When continuous monitoring is used, report the daily maximum temperature on the discharge monitoring report (DMR). After winter season Years 2009-20010 & 20010-2011, temperature measurements are not required.

6. Biosolids. Biosolids composite samples shall be taken from reference areas in the biosolids storage area pursuant to Test Methods for Evaluating Solid Waste, Volume 2; Field Manual, Physical/Chemical Methods, November 1986, Third Edition, Chapter 9. Inorganic pollutant monitoring must be conducted according to Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Second Edition (1982) with Updates I and II and third Edition (1986) with Revision I.

7. Stream Flow. Tickle Creek flow measurements shall be made at the established gauging station that is located approximately one mile upstream of Outfall 001.

SCHEDULE C

Compliance Schedules and Conditions

NOT APPLICABLE

SCHEDULE D

Special Conditions

1. **Biosolids**

a. Biosolids Management Plan. All biosolids must be managed in accordance with the current DEQ approved Biosolids Management Plan (the Plan), site authorization letters issued by DEQ, and land use approval from the designated municipality &/or county. Any changes in biosolids management or application activities that differ significantly from operations specified under the approved Plan require the prior written approval of the DEQ.

b. Biosolids Management Plan Update. Permittee must submit a revised Plan for Department approval within 120 days of permit issuance that reflects actual biosolids treatment, storage, and land application practice.

c. Changes in Biosolids Standards. This permit may be modified to incorporate any applicable standard for biosolids use or disposal promulgated under section 405(d) of the Clean Water Act; if the standard for biosolids use or disposal is more stringent than any requirements for biosolids use or disposal in the permit, or controls a pollutant or practice not limited in this permit.

2. **Whole Effluent Toxicity Testing*.**

On January 2003 the Permittee submitted its "Tickle Creek Outfall Mixing Zone Study." The report was prepared for the City on contract by Curran-McLeod, Incorporated Consulting Engineers. Since the City is only allowed to discharge to Tickle Creek during winter season (November 1 through April 30) each year, the Mixing Zone (MZ) Study focused on worst-case conditions for winter season stream flows. This permit requires the City to maintain a **minimum dilution of 10 when discharging to Tickle Creek per Schedule A, 1.a (2). This dilution criterion was used with the 7-day average low creek flow with a reoccurrence interval of 10-years (**7Q10 low flow = 0.31 m^3/s**) for the MZ analysis. Conductivity measurements were taken to estimate dilution in the zone of initial dilution (ZID) and the MZ. Based on the stream conductivity study, worst-case dilution at 7Q10 low flow was determined to be approximately 1.7 at the ZID boundary and 3.7 at the MZ boundary (MZ Study, P. 13, D.2, Table).*

a. The permittee shall conduct whole effluent toxicity (WET) tests as required in Schedule B of this permit. The Permittee shall conduct whole effluent toxicity (WET) testing prior to application for renewal of this permit. Part E (Toxicity Testing Data) of U.S. EPA Form 2A prescribes WET testing requirements and options.

b. Two sampling options. The facility shall sample once per year over the first four years of the permit. The sampling events and toxicity tests should take place in a different quarter each year (i.e. Year 1, Qtr 1). Alternatively, the facility may choose to conduct all tests within a single year of the permit, in which case, the tests shall be conducted quarterly.

c. Acute Toxicity Testing - Organisms and Protocols

(1) The permittee shall conduct 48-hour static renewal tests with *Ceriodaphnia dubia* (water flea) and 96-hour static renewal tests with *Pimephales promelas* (fathead minnow).

(2) All test methods and procedures shall be in accordance with **Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms**, Fifth Edition, EPA-821-R-02-012 (October 2002). Any deviation of the bioassay procedures outlined in this method shall be submitted in writing to the Department for review and approval prior to use.

(3) Tests shall be conducted on final effluent sample collected a 24-Hour Composite sample. No treatments to the final effluent (i.e. dechlorination, etc), except those included as part of the methodology, shall be performed by the laboratory unless approved by the Department prior to analysis.

(4) Acute tests shall be conducted on a control (0% effluent) and the following dilution series, unless otherwise approved by the Department in writing: 6.25%, 12.5%, 25%, 60%, and 100%.

(5) An acute WET test shall be considered to show toxicity if there is a statistically significant difference in survival between the control and 60% percent effluent.

d. Chronic Toxicity Testing - Organisms and Protocols

(1) The permittee shall conduct tests with: *Ceriodaphnia dubia* (water flea) for reproduction and survival test endpoint, *Pimephales promelas* (fathead minnow) for growth and survival test endpoint and *Raphidocelis subcapitata* (green alga formerly known as *Selanastrum capricornutum*) for growth test endpoint.

(2) All test methods and procedures shall be in accordance with **Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms**, Fourth Edition, EPA-821-R-02-013, October 2002. Any deviation of the bioassay procedures outlined in this method shall be submitted in writing to the Department for review and approval prior to use.

(3) Tests shall be conducted on final effluent samples collected as 24-hour composite samples. No treatments to the final effluent (i.e. dechlorination, etc), except those included as part of the methodology, shall be performed by the laboratory unless approved by the Department prior to analysis.

(4) Chronic tests shall be conducted on a control (0% effluent) and the following dilution series, unless otherwise approved by the Department in writing: 6.25%, 12.5%, 25%, 60%, and 100%.

(5) A chronic WET test shall be considered to show toxicity if the IC_{25} (25% inhibition concentration) occurs at dilutions equal to or less than the dilution that is known to occur at the edge of the mixing zone, i.e. $IC_{25} \leq 25\%$.

e. Dual End-Point Tests –

(1) WET tests may be dual end-point tests in which both acute and chronic end-points can be determined from the results of a single chronic test. The acute end-point shall be based on 48-hours for the *Ceriodaphnia dubia* (water flea) and 96-hours for the *Pimephales promelas* (fathead minnow).

(2) All test methods and procedures shall be in accordance with **Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms**, Fourth Edition, EPA-821-R-02-013 (October 2002). Any deviation of the bioassay procedures outlined in this method shall be submitted in writing to the Department for review and approval prior to use.

(3) Tests shall be conducted on final effluent samples collected as described in item d. (3).

(4) Tests run as dual end-point tests shall be conducted on a control (0% effluent) and the following dilution series, unless otherwise approved by the Department in writing: 6.25%, 12.5%, 25%, 50%, 60%, and 100%.

(5) Toxicity determinations for dual end-point tests shall correspond to the acute, c. (5), and chronic, d. (5), described above.

f. Evaluation of Causes and Exceedances

(1) If any test exhibits toxicity, as defined in sections c. (5) or d. (5) of this permit condition, another toxicity test using the same species and Department approved methodology shall be conducted within two weeks, unless otherwise approved by the Department.

(2) If two consecutive WET test results indicate acute and/or chronic toxicity, as defined in sections c. (5) or d. (5) of this permit condition, the permittee shall immediately notify the Department of the results. The Department will work with the permittee to determine the appropriate course of action to evaluate and address the toxicity.

g. Quality Assurance / Reporting

(1) Quality assurance criteria, statistical analyses, and data reporting for the WET tests shall be in accordance with the EPA documents stated in this condition.

(2) A bioassay laboratory report for each test shall be prepared according to the EPA method documents referenced in this Schedule. This shall include all QA/QC documentation, statistical analysis for each test performed, standard reference toxicant test (SRT) conducted on each species required for the toxicity tests, and completed Chain of Custody forms for the samples including time of sample collection and receipt. Reports shall be submitted to the Department within 45 days of test completion.

(3) The report should include all endpoints measured in the test, i.e. NOEC, LOEC, and IC_{25}.

(4) The permittee shall make available to the Department, on request, the written standard operating procedures they, or the laboratory performing the WET tests, are using for all toxicity tests required by the Department.

h. Reopener

(1) The Department may reopen and modify this permit to include new limitations, monitoring requirements, and/or conditions as determined by the Department to be appropriate, and in accordance with procedures outlined in Oregon Administrative Rules, Chapter 340, Division 45, if:

a. WET testing data indicate acute and/or chronic toxicity.

b. The facility undergoes any process changes.

c. Discharge monitoring data indicate a change in the reasonable potential to exhibit toxicity.

3. **Priority Pollutant Scan.**

The permittee must perform all testing required in Part D of U.S. EPA Form 2A with priority pollutant scans no more than 4 ½ years old. Two of the three scans must be performed no fewer than 4 months and no more than 8 months apart. The effluent samples shall be 24-hour daily composites, except where sampling volatile compounds. In this case, six (6) discrete samples (not less than 100 mL) collected over the operating day are acceptable. The permittee shall take special precautions in compositing the individual grab samples for the volatile organics to insure sample integrity (i.e. no exposure to the outside air). Alternately, the discrete samples collected for volatiles may be analyzed separately and averaged.

Whenever possible, a permittee should always use a test method with a **Quantitation Limit (QL)** that is lower than the permitted effluent limit or water quality criteria for priority pollutant scans. A list of the analytic methods approved by the department and the applicable QLs are located in the amended tables for Appendix B: Non-detect Analytical Data and Minimum Practical Quantification Levels, located on the web at

http://www.deq.state.or.us/wq/pubs/imds/rpaammend.pdf.

The permittee must ensure that all monitoring analysis reports contain both the QL and detection level of the method as defined below:

Detection Level: *Same as the "**Method Detection Limit**" (MDL) derived using 40 CFR 136, Appendix B.*

Quantitation Limit: *Same as the **Method Reporting Limit** (MRL). It is the lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that all method-specified sample weights, volumes, and cleanup procedures have been employed.*

Whenever possible, analysis for silver and arsenic should possess a minimum QL as described below:

- Silver 1.0 µg/L
- Arsenic 0.05 µg/L

4. **Recycled Water Requirements**.
The Permittee shall meet the requirements for use of recycled water under OAR Chapter 340, Division 055, ***Recycled Water Use*** including the following:

a. All recycled water shall be managed in accordance with the approved Recycled Water Use Plan. No substantial changes shall be made in the approved plan without written approval of the Department.

b. Any person having control over the treatment or distribution or both of recycled water may distribute recycled water only for the beneficial purposes described in this rule, and must take all reasonable steps to ensure that the recycled water is used only in accordance with the standards and requirements of the rules of this division (OAR 340-055-0012 (1)).

c. The Permittee shall notify the Department within 24 hours if it is determined that the treated effluent is being used in a manner not in compliance with OAR 340-055. When the Department offices are not open, the permittee shall report the incident of noncompliance to the ***Oregon Emergency Response System*** **(Telephone Number 1-800-452-0311)**.

5. **Recycled Water Use Plan**. The Recycled Water Use Plan must be updated to reflect changes in Sandy's wastewater treatment facility, recycled water transfer system, and irrigation practices. The Plan must reflect changes to OAR Chapter 340, Division 055, ***Recycled Water Use.*** OAR 340-055 was recently revised and the latest addition was posted by the State on June 1, 2008. An updated Recycled Water Use Plan must be submitted to the Department within 120 days of permit issuance. Should revisions be minor, the Permittee may submit an addendum to the Plan by that date.

6. **Operator Certification**. The Permittee shall comply with Oregon Administrative Rules (OAR), Chapter 340, Division 049, "Regulations Pertaining To Certification of Wastewater System Operator Personnel" and accordingly:

a. The Permittee shall have its wastewater system supervised by one or more operators who are certified in a classification and grade level (equal to or greater) that corresponds with the classification (collection and/or treatment) of the system to be supervised as specified on page one of this permit.

Note: **A "supervisor" is defined as the person exercising authority for establishing and executing the specific practice and procedures of operating the system in accordance with the policies of the permittee and requirements of the waste discharge permit. "Supervise" means responsible for the technical operation of a system, which may affect its performance or the quality of the effluent produced. Supervisors are not required to be on-site at all times.**

b. The Permittee's wastewater system may not be without supervision (as required by Special Condition 5.a. above) for more than thirty (30) days. During this period, and at any time that the supervisor is not available to respond on-site (i.e. vacation, sick leave or off-call), the permittee must make available another person who is certified at no less than one grade lower than the system classification.

c. If the wastewater system has more than one daily shift, the Permittee shall have the shift supervisor, if any, certified at no less than one grade lower than the system classification.

d. The Permittee is responsible for ensuring the wastewater system has a properly certified supervisor available at all times to respond on-site at the request of the Permittee and to any other operator.

e. The Permittee shall notify the Department of Environmental Quality in writing within thirty (30) days of replacement or redesignation of certified operators responsible for supervising wastewater system operation. The notice shall be filed with the Water Quality Division, Operator Certification Program, 400 East Scenic Drive, Suite 307, The Dalles, OR 97058. This requirement is in addition to the reporting requirements contained under Schedule B of this permit.

f. Upon written request, the Department may grant the Permittee reasonable time, not to exceed 120 days, to obtain the services of a qualified person to supervise the wastewater system. The written request must include a justification for a time extension, a schedule for recruiting and hiring, the date the system supervisor availability ceased, and the name of the alternate system supervisor(s), as required by 6.b. above.

7. **Notification Requirement**. The Permittee shall notify the DEQ Northwest Region - Portland Office (phone: **(503) 229-5263**) in accordance with the response times noted in the General Conditions (Schedule F) of this permit of any malfunction, so that corrective action can be coordinated between the Permittee and the Department.

8. **Groundwater**. The Permittee shall not be required to perform a hydrogeologic characterization or groundwater monitoring during the term of this permit provided:

   a. The facilities are operated in accordance with the permit conditions, and

   b. There are no adverse groundwater quality impacts (complaints or other indirect evidence) resulting from the facility's operation.

   If warranted at permit renewal, the Department may evaluate the need for a full assessment of the facilities impact on groundwater quality.

9. **Spawning Beds Investigation and Report**. Permittee shall use a qualified fisheries expert to investigate Sandy's regulatory mixing zone in Tickle Creek at Outfall 001 for active spawning during winter discharge season. The investigation shall also evaluate the area and quality of spawning habitat inside the mixing zone. The report must be submitted to the Department by June 1, 2011.

SCHEDULE F

NPDES GENERAL CONDITIONS – DOMESTIC FACILITIES

SECTION A. STANDARD CONDITIONS

1. Duty to Comply with Permit
The permittee must comply with all conditions of this permit. Failure to comply with any permit condition is a violation of Oregon Revised Statutes (ORS) 468B.025 and the federal Clean Water Act and is grounds for an enforcement action. Failure to comply is also grounds for the Department to terminate, modify and reissue, revoke, or deny renewal of a permit.

2. Penalties for Water Pollution and Permit Condition Violations
The permit is enforceable by DEQ or EPA, and in some circumstances also by third-parties under the citizen suit provisions 33 USC §1365. DEQ enforcement is generally based on provisions of state statutes and EQC rules, and EPA enforcement is generally based on provisions of federal statutes and EPA regulations.

ORS 468.140 allows the Department to impose civil penalties up to $10,000 per day for violation of a term, condition or requirement of a permit. The federal Clean Water Act provides for civil penalties not to exceed $32,500 and administrative penalties not to exceed $11,000 per day for each violation of any condition or limitation of this permit.

Under ORS 468.943, unlawful water pollution, if committed by a person with criminal negligence, is punishable by a fine of up to $25,000, imprisonment for not more than one year, or both. Each day on which a violation occurs or continues is a separately punishable offense. The federal Clean Water Act provides for criminal penalties of not more than $50,000 per day of violation, or imprisonment of not more than 2 years, or both for second or subsequent negligent violations of this permit.

Under ORS 468.946, a person who knowingly discharges, places, or causes to be placed any waste into the waters of the state or in a location where the waste is likely to escape into the waters of the state is subject to a Class B felony punishable by a fine not to exceed $200,000 and up to 10 years in prison. The federal Clean Water Act provides for criminal penalties of $5,000 to $50,000 per day of violation, or imprisonment of not more than 3 years, or both for knowing violations of the permit. In the case of a second or subsequent conviction for knowing violation, a person shall be subject to criminal penalties of not more than $100,000 per day of violation, or imprisonment of not more than 6 years, or both.

3. Duty to Mitigate
The permittee must take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment. In addition, upon request of the Department, the permittee must correct any adverse impact on the environment or human health resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the

noncomplying discharge.

4. Duty to Reapply
If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and have the permit renewed. The application must be submitted at least 180 days before the expiration date of this permit.

The Department may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date.

5. Permit Actions
This permit may be modified, revoked and reissued, or terminated for cause including, but not limited to, the following:
a. Violation of any term, condition, or requirement of this permit, a rule, or a statute
b. Obtaining this permit by misrepresentation or failure to disclose fully all material facts
c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge
d. The permittee is identified as a Designated Management Agency or allocated a wasteload under a Total Maximum Daily Load (TMDL)
e. New information or regulations
f. Modification of compliance schedules
g. Requirements of permit reopener conditions
h. Correction of technical mistakes made in determining permit conditions
i. Determination that the permitted activity endangers human health or the environment
j. Other causes as specified in 40 CFR 122.62, 122.64, and 124.5
k. For communities with combined sewer overflows (CSOs):
   (1) To comply with any state or federal law regulation that addresses CSOs that is adopted or promulgated subsequent to the effective date of this permit
   (2) If new information, not available at the time of permit issuance, indicates that CSO controls imposed under this permit have failed to ensure attainment of water quality standards, including protection of designated uses
   (3) Resulting from implementation of the Permittee's Long-Term Control Plan and/or permit conditions related to CSOs.

The filing of a request by the permittee for a permit modification, revocation or reissuance, termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

6. Toxic Pollutants
The permittee must comply with any applicable effluent standards or prohibitions established under Oregon Administrative Rules (OAR) 340-041-0033 and 307(a) of the federal Clean Water Act for toxic pollutants, and with standards for sewage sludge use or disposal established under Section 405(d) of the Clean Water Act, within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

7. Property Rights and Other Legal Requirements
The issuance of this permit does not convey any property rights of any sort, or any exclusive privilege, or authorize any injury to persons or property or invasion of any other private rights, or any infringement of federal, tribal, state, or local laws or regulations.

8. Permit References
Except for effluent standards or prohibitions established under Section 307(a) of the federal Clean Water Act and OAR 340-041-0033 for toxic pollutants, and standards for sewage sludge use or disposal established under Section 405(d) of the Clean Water Act, all rules and statutes referred to in this permit are those in effect on the date this permit is issued.

9. Permit Fees
The permittee must pay the fees required by Oregon Administrative Rules.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance
The permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems that are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

2. Need to Halt or Reduce Activity Not a Defense
For industrial or commercial facilities, upon reduction, loss, or failure of the treatment facility, the permittee must, to the extent necessary to maintain compliance with its permit, control production or all discharges or both until the facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power of the treatment facility fails or is reduced or lost. It is not a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

3. Bypass of Treatment Facilities
   a. Definitions
      (1) "Bypass" means intentional diversion of waste streams from any portion of the treatment facility. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, provided the diversion is to allow essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs b. and c. of this section.
      (2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.
   b. Prohibition of bypass.

(1) Bypass is prohibited and the Department may take enforcement action against a permittee for bypass unless:
  i. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
  ii. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventative maintenance; and
  iii. The permittee submitted notices and requests as required under General Condition B.3.c.

(2) The Department may approve an anticipated bypass, after considering its adverse effects and any alternatives to bypassing, when the Department determines that it will meet the three conditions listed above in General Condition B.3.b.(1).

c. Notice and request for bypass.
  (1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, a written notice must be submitted to the Department at least ten days before the date of the bypass.
  (2) Unanticipated bypass. The permittee must submit notice of an unanticipated bypass as required in General Condition D.5.

4. Upset

a. Definition. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operation error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.

b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of General Condition B.4.c are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
  (1) An upset occurred and that the permittee can identify the causes(s) of the upset;
  (2) The permitted facility was at the time being properly operated;
  (3) The permittee submitted notice of the upset as required in General Condition D.5, hereof (24-hour notice); and,
  (4) The permittee complied with any remedial measures required under General Condition A.3 hereof.

d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

5. Treatment of Single Operational Upset

For purposes of this permit, A Single Operational Upset that leads to simultaneous violations of more than one pollutant parameter will be treated as a single violation. A single operational upset is an exceptional incident that causes simultaneous, unintentional, unknowing (not the result of a knowing act or omission), temporary noncompliance with more than one Clean Water Act effluent discharge pollutant parameter. A single operational upset does not include Clean Water Act violations involving discharge without a NPDES permit or noncompliance to the extent caused by improperly designed or inadequate treatment facilities. Each day of a single operational upset is a violation.

6. Overflows from Wastewater Conveyance Systems and Associated Pump Stations
   a. Definitions
      (1) "Overflow" means any spill, release or diversion of sewage including:
         i. An overflow that results in a discharge to waters of the United States; and
         ii. An overflow of wastewater, including a wastewater backup into a building (other than a backup caused solely by a blockage or other malfunction in a privately owned sewer or building lateral), even if that overflow does not reach waters of the United States.
   b. Prohibition of overflows. Overflows are prohibited. The Department may exercise enforcement discretion regarding overflow events. In exercising its enforcement discretion, the Department may consider various factors, including the adequacy of the conveyance system's capacity and the magnitude, duration and return frequency of storm events.
   c. Reporting required. All overflows must be reported orally to the Department within 24 hours from the time the permittee becomes aware of the overflow. Reporting procedures are described in more detail in General Condition D.5.

7. Public Notification of Effluent Violation or Overflow
   If effluent limitations specified in this permit are exceeded or an overflow occurs that threatens public health, the permittee must take such steps as are necessary to alert the public, health agencies and other affected entities (e.g., public water systems) about the extent and nature of the discharge in accordance with the notification procedures developed under General Condition B.8. Such steps may include, but are not limited to, posting of the river at access points and other places, news releases, and paid announcements on radio and television.

8. Emergency Response and Public Notification Plan
   The permittee must develop and implement an emergency response and public notification plan that identifies measures to protect public health from overflows, bypasses or upsets that may endanger public health. At a minimum the plan must include mechanisms to:
   a. Ensure that the permittee is aware (to the greatest extent possible) of such events;
   b. Ensure notification of appropriate personnel and ensure that they are immediately dispatched for investigation and response;
   c. Ensure immediate notification to the public, health agencies, and other affected public entities (including public water systems). The overflow response plan must identify the public health and other officials who will receive immediate notification;
   d. Ensure that appropriate personnel are aware of and follow the plan and are appropriately trained;
   e. Provide emergency operations; and
   f. Ensure that DEQ is notified of the public notification steps taken.

9. Removed Substances
Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters must be disposed of in such a manner as to prevent any pollutant from such materials from entering waters of the state, causing nuisance conditions, or creating a public health hazard.

SECTION C. MONITORING AND RECORDS

1. Representative Sampling
Sampling and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples must be taken at the monitoring points specified in this permit, and shall be taken, unless otherwise specified, before the effluent joins or is diluted by any other waste stream, body of water, or substance. Monitoring points may not be changed without notification to and the approval of the Department.

2. Flow Measurements
Appropriate flow measurement devices and methods consistent with accepted scientific practices must be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices must be installed, calibrated and maintained to insure that the accuracy of the measurements is consistent with the accepted capability of that type of device. Devices selected must be capable of measuring flows with a maximum deviation of less than ± 10 percent from true discharge rates throughout the range of expected discharge volumes.

3. Monitoring Procedures
Monitoring must be conducted according to test procedures approved under 40 CFR part 136, or in the case of sludge use and disposal, under 40 CFR part 503, unless other test procedures have been specified in this permit.

4. Penalties of Tampering
The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit may, upon conviction, be punished by a fine of not more than $10,000 per violation, imprisonment for not more than two years, or both. If a conviction of a person is for a violation committed after a first conviction of such person, punishment is a fine not more than $20,000 per day of violation, or by imprisonment of not more than four years, or both.

5. Reporting of Monitoring Results
Monitoring results must be summarized each month on a Discharge Monitoring Report form approved by the Department. The reports must be submitted monthly and are to be mailed, delivered or otherwise transmitted by the 15th day of the following month unless specifically approved otherwise in Schedule B of this permit.

6. Additional Monitoring by the Permittee
If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR part 136, or in the case of sludge use and disposal, under 40 CFR

part 503, or as specified in this permit, the results of this monitoring must be included in the calculation and reporting of the data submitted in the Discharge Monitoring Report. Such increased frequency must also be indicated. For a pollutant parameter that may be sampled more than once per day (e.g., Total Chlorine Residual), only the average daily value must be recorded unless otherwise specified in this permit.

7. Averaging of Measurements

Calculations for all limitations that require averaging of measurements must utilize an arithmetic mean, except for bacteria which shall be averaged as specified in this permit.

8. Retention of Records

Records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities shall be retained for a period of at least five years (or longer as required by 40 CFR part 503). Records of all monitoring information including all calibration and maintenance records, all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit and records of all data used to complete the application for this permit shall be retained for a period of at least 3 years from the date of the sample, measurement, report, or application. This period may be extended by request of the Department at any time.

9. Records Contents

Records of monitoring information must include:

a. The date, exact place, time, and methods of sampling or measurements;
b. The individual(s) who performed the sampling or measurements;
c. The date(s) analyses were performed;
d. The individual(s) who performed the analyses;
e. The analytical techniques or methods used; and
f. The results of such analyses.

10. Inspection and Entry

The permittee must allow the Department or EPA upon the presentation of credentials to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;
b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit, and
d. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by state law, any substances or parameters at any location.

11. Confidentiality of Information

Any information relating to this permit that is submitted to or obtained by DEQ is available to the public unless classified as confidential by the Director of DEQ under ORS 468.095. The Permittee may request that information be classified as confidential if it is a trade secret as defined by that statute. The name and address of the permittee, permit applications, permits, effluent data, and information required by

NPDES application forms under 40 CFR 122.21 will not be classified as confidential. 40 CFR 122.7(b).

SECTION D. REPORTING REQUIREMENTS

1. Planned Changes
The permittee must comply with OAR chapter 340, division 52, "Review of Plans and Specifications" and 40 CFR Section 122.41(l) (1). Except where exempted under OAR chapter 340, division 52, no construction, installation, or modification involving disposal systems, treatment works, sewerage systems, or common sewers may be commenced until the plans and specifications are submitted to and approved by the Department. The permittee must give notice to the Department as soon as possible of any planned physical alternations or additions to the permitted facility.

2. Anticipated Noncompliance
The permittee must give advance notice to the Department of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.

3. Transfers
This permit may be transferred to a new permittee provided the transferee acquires a property interest in the permitted activity and agrees in writing to fully comply with all the terms and conditions of the permit and the rules of the Commission. No permit may be transferred to a third party without prior written approval from the Department. The Department may require modification, revocation, and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under 40 CFR Section 122.61. The permittee must notify the Department when a transfer of property interest takes place.

4. Compliance Schedule
Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any compliance schedule of this permit must be submitted no later than 14 days following each schedule date. Any reports of noncompliance must include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirements.

5. Twenty-Four Hour Reporting
The permittee must report any noncompliance that may endanger health or the environment. Any information must be provided orally (by telephone) to DEQ or to the Oregon Emergency Response System (1-800-452-0311) as specified below within 24 hours from the time the permittee becomes aware of the circumstances.

   a. Overflows.

      (1) Oral Reporting within 24 hours.
         i. For overflows other than basement backups, the following information must be reported to the Oregon Emergency Response System (OERS) at 1-800-452-0311. For basement backups, this information should be reported directly to DEQ.
            a) The location of the overflow;

b) The receiving water (if there is one);
c) An estimate of the volume of the overflow;
d) A description of the sewer system component from which the release occurred (e.g., manhole, constructed overflow pipe, crack in pipe); and
e) The estimated date and time when the overflow began and stopped or will be stopped.

ii. The following information must be reported to the Department's Regional office within 24 hours, or during normal business hours, whichever is first:

a) The OERS incident number (if applicable) along with a brief description of the event.

(2) Written reporting within 5 days.

i. The following information must be provided in writing to the Department's Regional office within 5 days of the time the permittee becomes aware of the overflow:

a) The OERS incident number (if applicable);
b) The cause or suspected cause of the overflow;
c) Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the overflow and a schedule of major milestones for those steps;
d) Steps taken or planned to mitigate the impact(s) of the overflow and a schedule of major milestones for those steps; and
e) (for storm-related overflows) The rainfall intensity (inches/hour) and duration of the storm associated with the overflow.

The Department may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

b. Other instances of noncompliance.

(1) The following instances of noncompliance must be reported:

i. Any unanticipated bypass that exceeds any effluent limitation in this permit;
ii. Any upset that exceeds any effluent limitation in this permit;
iii. Violation of maximum daily discharge limitation for any of the pollutants listed by the Department in this permit; and
iv. Any noncompliance that may endanger human health or the environment.

(2) During normal business hours, the Department's Regional office must be called. Outside of normal business hours, the Department must be contacted at 1-800-452-0311 (Oregon Emergency Response System).

(3) A written submission must be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission must contain:

i. A description of the noncompliance and its cause;
ii. The period of noncompliance, including exact dates and times;
iii. The estimated time noncompliance is expected to continue if it has not been corrected;
iv. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance; and
v. Public notification steps taken, pursuant to General Condition B.7

(4) The Department may waive the written report on a case-by-case basis if the oral report has been received

within 24 hours.

6. Other Noncompliance
The permittee must report all instances of noncompliance not reported under General Condition D.4 or D.5, at the time monitoring reports are submitted. The reports must contain:
   a. A description of the noncompliance and its cause;
   b. The period of noncompliance, including exact dates and times;
   c. The estimated time noncompliance is expected to continue if it has not been corrected; and
   d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

7. Duty to Provide Information
The permittee must furnish to the Department within a reasonable time any information that the Department may request to determine compliance with the permit or to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit. The permittee must also furnish to the Department, upon request, copies of records required to be kept by this permit.

   Other Information: When the permittee becomes aware that it has failed to submit any relevant facts or has submitted incorrect information in a permit application or any report to the Department, it must promptly submit such facts or information.

8. Signatory Requirements
All applications, reports or information submitted to the Department must be signed and certified in accordance with 40 CFR Section 122.22.

9. Falsification of Information
Under ORS 468.953, any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, is subject to a Class C felony punishable by a fine not to exceed $100,000 per violation and up to 5 years in prison. Additionally, according to 40 CFR 122.41(k)(2), any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a federal civil penalty not to exceed $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

10. Changes to Indirect Dischargers
The permittee must provide adequate notice to the Department of the following:
   a. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to section 301 or 306 of the Clean Water Act if it were directly discharging those pollutants and;
   b. Any substantial change in the volume or character of pollutants being introduced into the POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

c. For the purposes of this paragraph, adequate notice shall include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

SECTION E. DEFINITIONS

1. *BOD* means five-day biochemical oxygen demand.
2. *CBOD* means five day carbonaceous biochemical oxygen demand
3. *TSS* means total suspended solids.
4. "*Bacteria*" includes but is not limited to fecal coliform bacteria, total coliform bacteria, and E. coli bacteria.
5. *FC* means fecal coliform bacteria.
6. *Total residual chlorine* means combined chlorine forms plus free residual chlorine
7. *Technology based permit effluent limitations* means technology-based treatment requirements as defined in 40 CFR Section 125.3, and concentration and mass load effluent limitations that are based on minimum design criteria specified in OAR Chapter 340, Division 41.
8. *mg/l* means milligrams per liter.
9. *kg* means kilograms.
10. m^3/d means cubic meters per day.
11. *MGD* means million gallons per day.
12. 24-hour *Composite sample* means a sample formed by collecting and mixing discrete samples taken periodically and based on time or flow. The sample must be collected and stored in accordance with 40 CFR Part 136.
13. *Grab sample* means an individual discrete sample collected over a period of time not to exceed 15 minutes.
14. *Quarter* means January through March, April through June, July through September, or October through December.
15. *Month* means calendar month.
16. *Week* means a calendar week of Sunday through Saturday.
17. *POTW* means a publicly owned treatment works.

Schedule F, last update 9.18.2009
GLS: Sandy Permit 08Oct2009.docx
Revised: 22Jan2010

APPENDIX B
EXISTING SANDY WWTP
PROCESS MODEL REPORT

BioWin user and configuration data

Project details

Project name: Unknown **Project ref.: BW1**

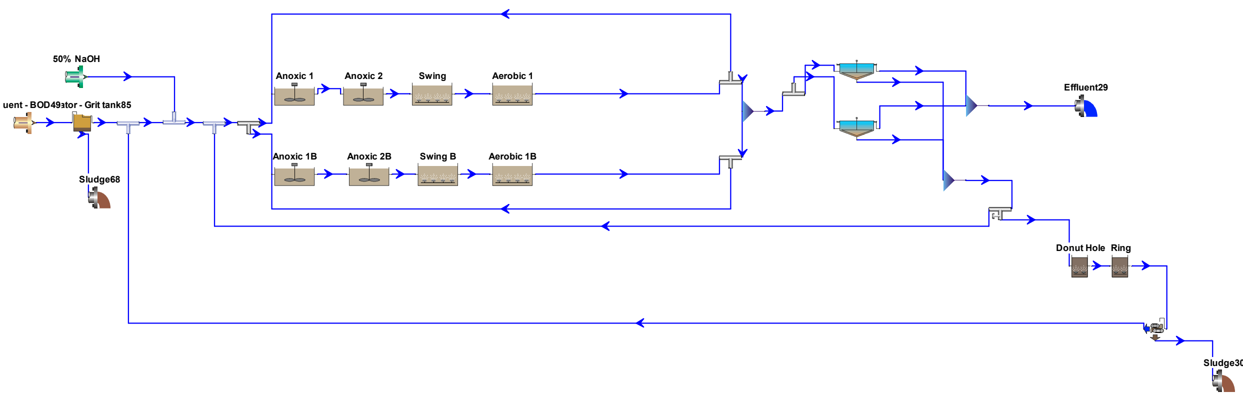
Plant name: Unknown **User name: Jason.Flowers**

Created: 5/18/2018 **Saved: 6/14/2020**

Target SRT: 7.00 days **SRT: **** days**

Temperature: 22.0°C

Flowsheet



Configuration information for all Digester - Aerobic units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Donut Hole	0.0900	802.0834	15.000	182
Ring	0.1800	1604.1668	15.000	363

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Donut Hole	2.0
Ring	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^ 0.25 + k2	k2 in C = k1(PC)^ 0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	Diffuser mounting height	Min. air flow rate per diffuser ft3/min (20C, 1 atm)	Max. air flow rate per diffuser ft3/min (20C, 1 atm)	'A' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2	'B' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2	'C' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2
Donut Hole	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Ring	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0

Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Anoxic 1	0.0377	278.7476	18.080	Un-aerated
Anoxic 2	0.0377	278.7476	18.080	Un-aerated

Swing	0.0377	278.7476	18.080	63
Aerobic 1	0.2574	1903.1735	18.080	431
Anoxic 1B	0.0377	278.7476	18.080	Un-aerated
Anoxic 2B	0.0377	278.7476	18.080	Un-aerated
Swing B	0.0377	278.7476	18.080	63
Aerobic 1B	0.2574	1903.1735	18.080	431

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Anoxic 1	0
Anoxic 2	0
Swing	2.0
Aerobic 1	2.0
Anoxic 1B	0
Anoxic 2B	0
Swing B	2.0
Aerobic 1B	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^ 0.25 + k2	k2 in C = k1(PC)^ 0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	Diffuser mounting height	Min. air flow rate per diffuser ft3/min (20C, 1 atm)	Max. air flow rate per diffuser ft3/min (20C, 1 atm)	'A' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2	'B' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2	'C' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2
Anoxic 1	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Anoxic 2	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Swing	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Aerobic 1	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0

Anoxic 1B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Anoxic 2B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Swing B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Aerobic 1B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0

Configuration information for all Influent - BOD units

Operating data Average (flow/time weighted as required)

Element name	Influent - BOD49
Flow	1.12
BOD - Total Carbonaceous mgBOD/L	288.00
Volatile suspended solids mg/L	257.00
Total suspended solids mg/L	277.00
N - Total Kjeldahl Nitrogen mgN/L	46.00
P - Total P mgP/L	5.30
S - Total S mgS/L	0
N - Nitrate mgN/L	0
pH	7.20
Alkalinity mmol/L	3.00
Metal soluble - Calcium mg/L	11.10
Metal soluble - Magnesium mg/L	3.20
Gas - Dissolved oxygen mg/L	0

Element name	Influent - BOD49
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1410
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1418
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.7082
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0650

Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300
Fcel - Cellulose fraction of unbiodegradable particulate [gCOD/gCOD]	0.5000
Fna - Ammonia [gNH3-N/gTKN]	0.7353
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0700
Fpo4 - Phosphate [gPO4-P/gTP]	0.4717
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0220
Fsr - Reduced sulfur [H2S] [gS/gS]	0
FZbh - Ordinary heterotrophic COD fraction [gCOD/g of total COD]	0.0200
FZbm - Methylotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZao - Ammonia oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZno - Nitrite oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZaao - Anaerobic ammonia oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZppa - Phosphorus accumulating COD fraction [gCOD/g of total COD]	1.000E-4
FZpa - Propionic acetogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZam - Acetoclastic methanogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZhm - Hydrogenotrophic methanogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZso - Sulfur oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZsrpa - Sulfur reducing propionic acetogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZsra - Sulfur reducing acetotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZsrh - Sulfur reducing hydrogenotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Clarifier - Model units

Physical data

Element name	Volume[Mil. Gal]	Area[ft2]	Depth[ft]	Number of layers	Top feed layer	Feed Layers
Model clarifier5	0.2570	2290.0000	15.000	10	6	1
Model clarifier70	0.2570	2290.0000	15.000	10	6	1

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Model clarifier5	Flow paced	50.00 %
Model clarifier70	Flow paced	50.00 %

Element name	Average Temperature	Reactive
Model clarifier5	Uses global setting	No
Model clarifier70	Uses global setting	No

Configuration information for all Separator - Grit tank units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Separator - Grit tank85	4.000E-3	89.1204	6.000

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Separator - Grit tank85	Flowrate [Under]	0.0002642

Element name	Percent removal	Blanket fraction
Separator - Grit tank85	65.00	0.10

Configuration information for all Separator - Dewatering unit units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Separator - Dewatering unit83	Fraction	0.03

Element name	Percent removal
Separator - Dewatering unit83	90.00

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Splitter11	Flow paced	150.00 %
Splitter12	Flow paced	150.00 %
Splitter13	Fraction	0.50
Splitter40	Flowrate [Side]	0.0529285713907653
Splitter32	Fraction	0.50

Configuration information for all Influent - State variable units

Operating data Average (flow/time weighted as required)

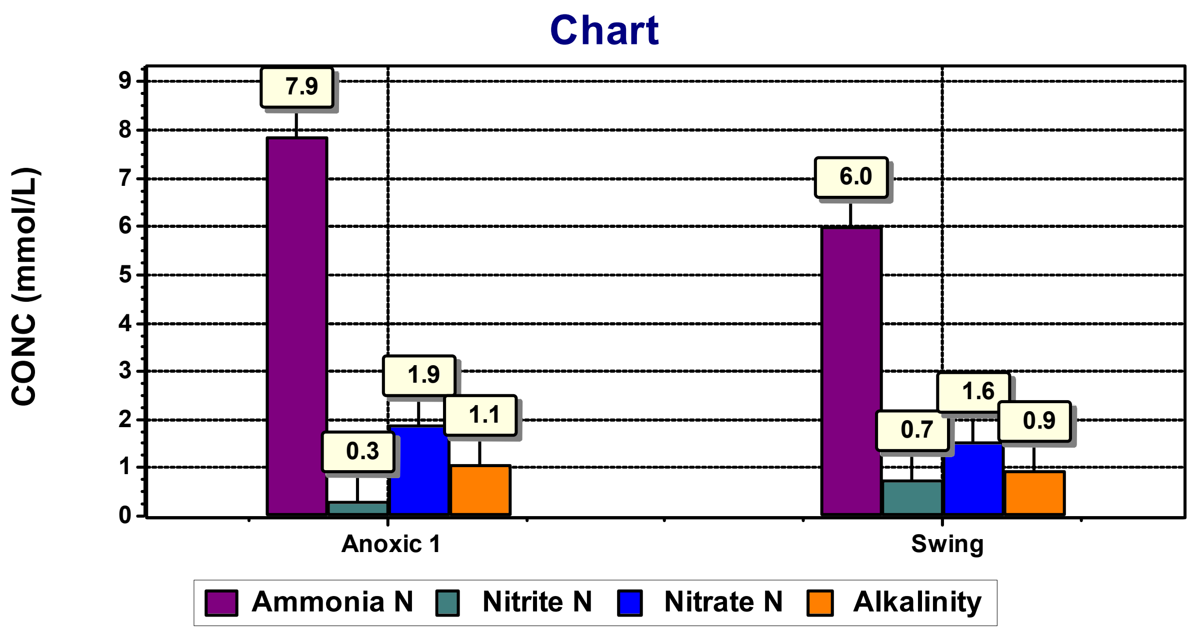
Element name	50% NaOH
Biomass - Ordinary heterotrophic [mgCOD/L]	0
Biomass - Methylotrophic [mgCOD/L]	0
Biomass - Ammonia oxidizing [mgCOD/L]	0
Biomass - Nitrite oxidizing [mgCOD/L]	0
Biomass - Anaerobic ammonia oxidizing [mgCOD/L]	0
Biomass - Phosphorus accumulating [mgCOD/L]	0
Biomass - Propionic acetogenic [mgCOD/L]	0
Biomass - Acetoclastic methanogenic [mgCOD/L]	0
Biomass - Hydrogenotrophic methanogenic [mgCOD/L]	0
Biomass - Endogenous products [mgCOD/L]	0
CODp - Slowly degradable particulate [mgCOD/L]	0
CODp - Slowly degradable colloidal [mgCOD/L]	0
CODp - Degradable external organics [mgCOD/L]	0
CODp - Undegradable non-cellulose [mgCOD/L]	0
CODp - Undegradable cellulose [mgCOD/L]	0
N - Particulate degradable organic [mgN/L]	0
P - Particulate degradable organic [mgP/L]	0
N - Particulate degradable external organics [mgN/L]	0
P - Particulate degradable external organics [mgP/L]	0
N - Particulate undegradable [mgN/L]	0
P - Particulate undegradable [mgP/L]	0
CODp - Stored PHA [mgCOD/L]	0
P - Releasable stored polyP [mgP/L]	0
P - Unreleasable stored polyP [mgP/L]	0
CODs - Complex readily degradable [mgCOD/L]	0
CODs - Acetate [mgCOD/L]	0
CODs - Propionate [mgCOD/L]	0
CODs - Methanol [mgCOD/L]	0
Gas - Dissolved hydrogen [mgCOD/L]	0
Gas - Dissolved methane [mg/L]	0
N - Ammonia [mgN/L]	0
N - Soluble degradable organic [mgN/L]	0
Gas - Dissolved nitrous oxide [mgN/L]	0

N - Nitrite [mgN/L]	0
N - Nitrate [mgN/L]	0
Gas - Dissolved nitrogen [mgN/L]	0
P - Soluble phosphate [mgP/L]	0
CODs - Undegradable [mgCOD/L]	0
N - Soluble undegradable organic [mgN/L]	0
Influent inorganic suspended solids [mgISS/L]	0
Precipitate - Struvite [mgISS/L]	0
Precipitate - Brushite [mgISS/L]	0
Precipitate - Hydroxy - apatite [mgISS/L]	0
Precipitate - Vivianite [mgISS/L]	0
HFO - High surface [mg/L]	0
HFO - Low surface [mg/L]	0
HFO - High with H2PO4- adsorbed [mg/L]	0
HFO - Low with H2PO4- adsorbed [mg/L]	0
HFO - Aged [mg/L]	0
HFO - Low with H+ adsorbed [mg/L]	0
HFO - High with H+ adsorbed [mg/L]	0
HAO - High surface [mg/L]	0
HAO - Low surface [mg/L]	0
HAO - High with H2PO4- adsorbed [mg/L]	0
HAO - Low with H2PO4- adsorbed [mg/L]	0
HAO - Aged [mg/L]	0
P - Bound on aged HMO [mgP/L]	0
Metal soluble - Magnesium [mg/L]	0
Metal soluble - Calcium [mg/L]	0
Metal soluble - Ferric [mg/L]	0
Metal soluble - Ferrous [mg/L]	0
Metal soluble - Aluminum [mg/L]	0
Other Cations (strong bases) [meq/L]	12500.00
Other Anions (strong acids) [meq/L]	0
Gas - Dissolved total CO2 [mmol/L]	0
User defined - UD1 [mg/L]	0
User defined - UD2 [mg/L]	0
User defined - UD3 [mgVSS/L]	0

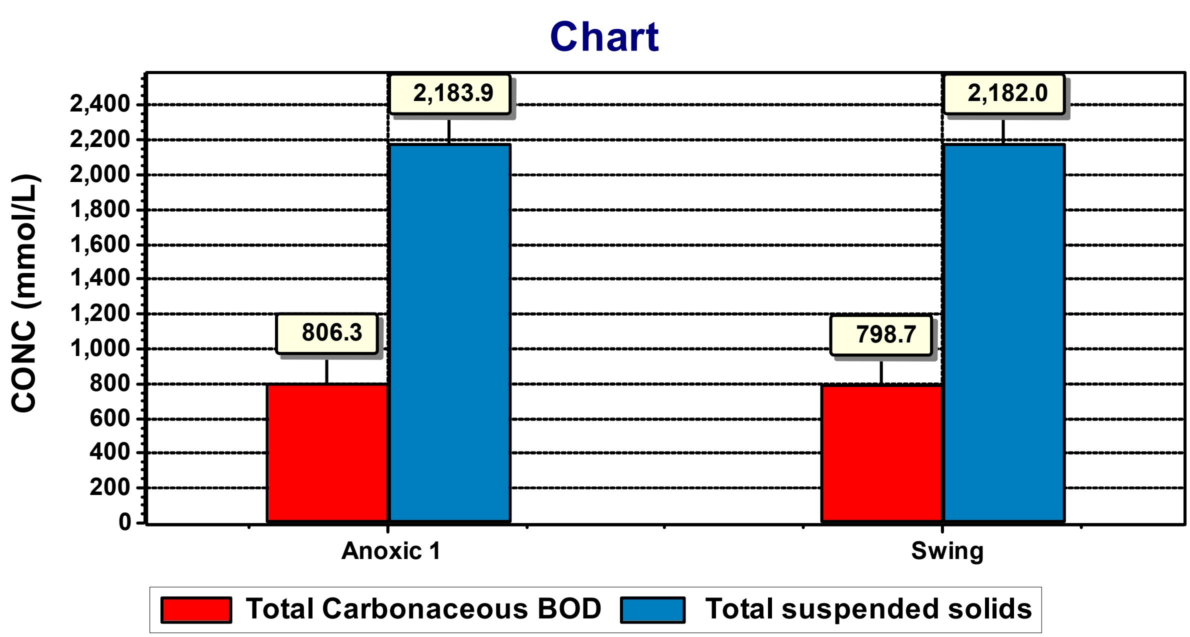
User defined - UD4 [mgISS/L]	0
Biomass - Sulfur oxidizing [mgCOD/L]	0
Biomass - Sulfur reducing propionic acetogenic [mgCOD/L]	0
Biomass - Sulfur reducing acetotrophic [mgCOD/L]	0
Biomass - Sulfur reducing hydrogenotrophic [mgCOD/L]	0
Gas - Dissolved total sulfides [mgS/L]	0
S - Soluble sulfate [mgS/L]	0
S - Particulate elemental sulfur [mgS/L]	0
Precipitate - Ferrous sulfide [mgISS/L]	0
CODp - Adsorbed hydrocarbon [mgCOD/L]	0
CODs - Degradable volatile ind. #1 [mgCOD/L]	0
CODs - Degradable volatile ind. #2 [mgCOD/L]	0
CODs - Degradable volatile ind. #3 [mgCOD/L]	0
CODs - Soluble hydrocarbon [mgCOD/L]	0
Gas - Dissolved oxygen [mg/L]	0
Flow	0

BioWin Album

Album page - Nitrogen species

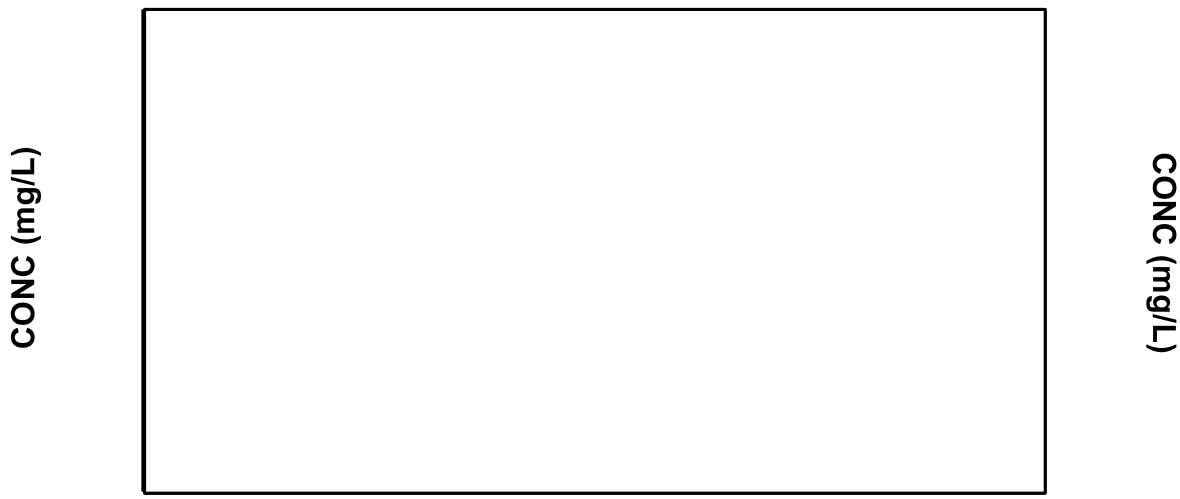


Album page - BOD_TSS



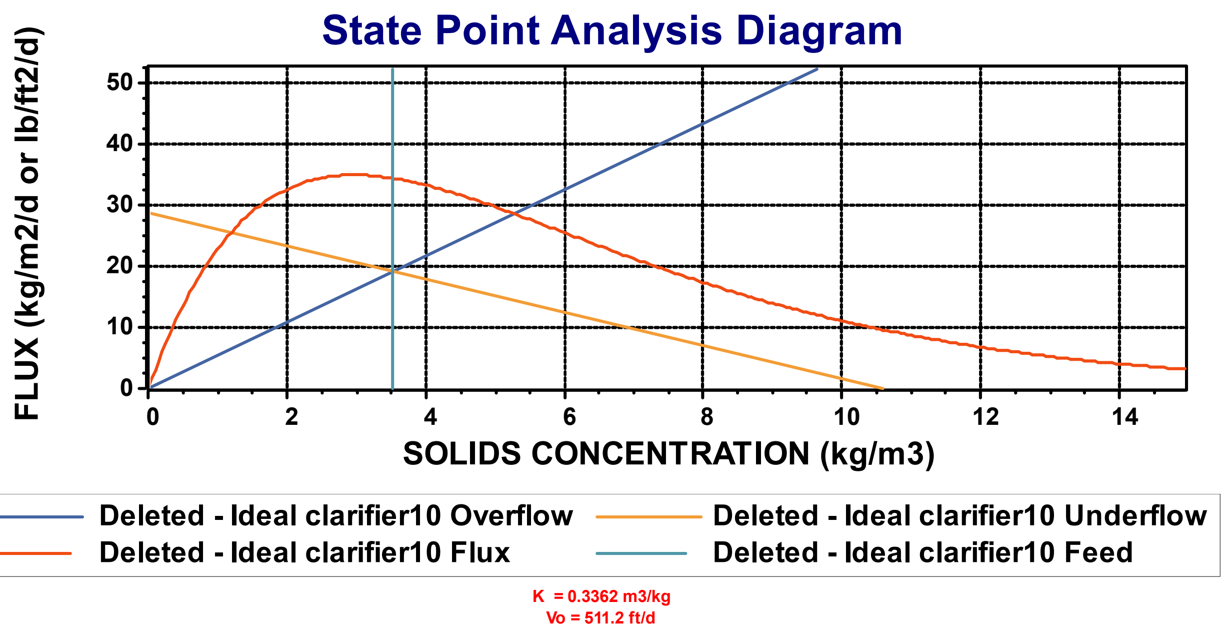
Album page - Page 3

Chart

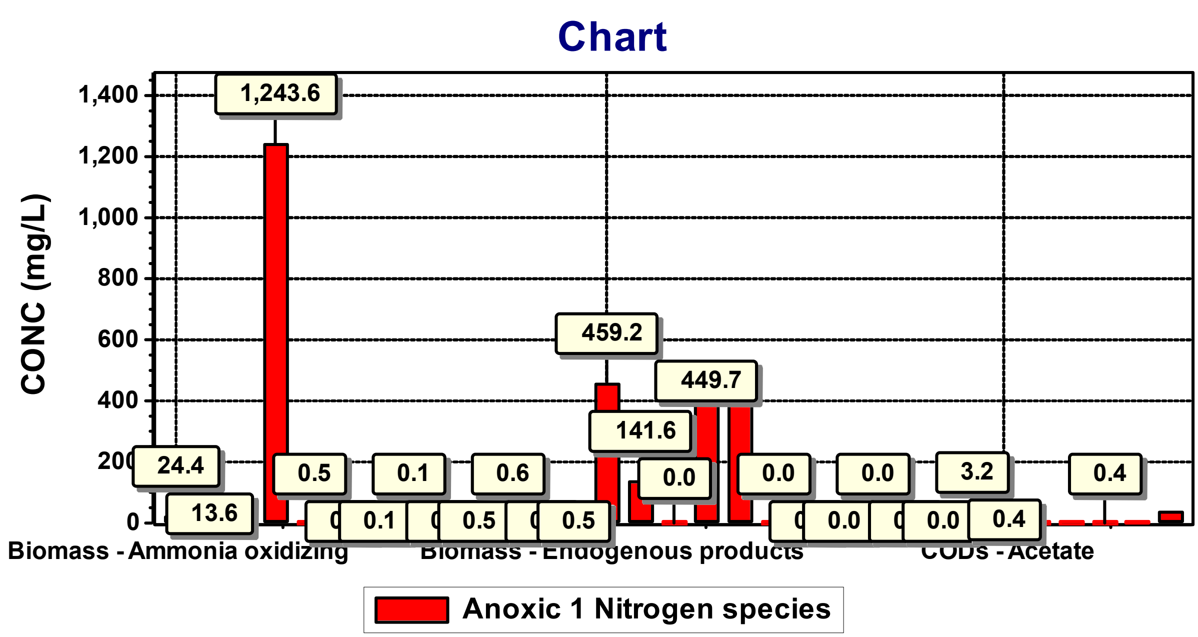


Album page - Page 4

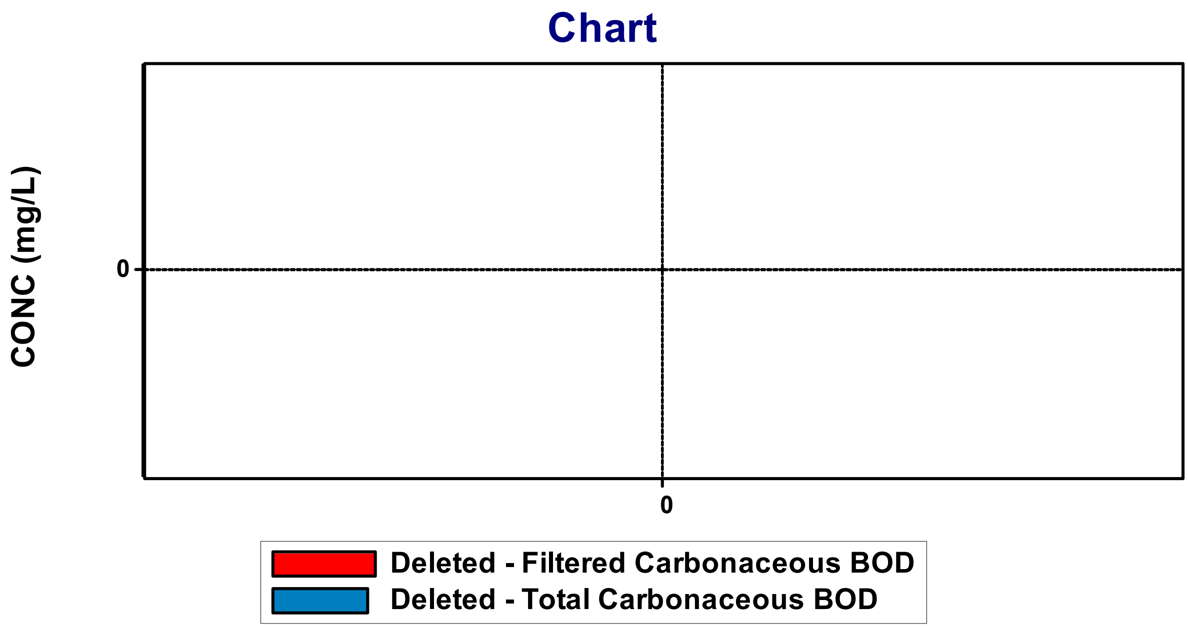
Album page - Page 5



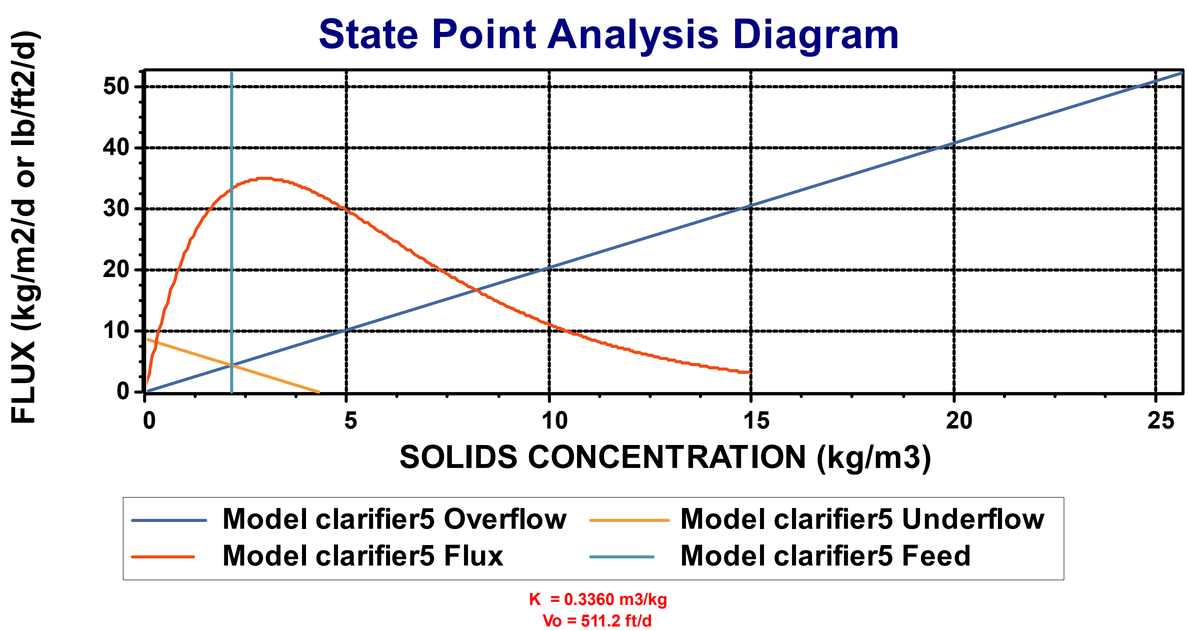
Album page - Page 6



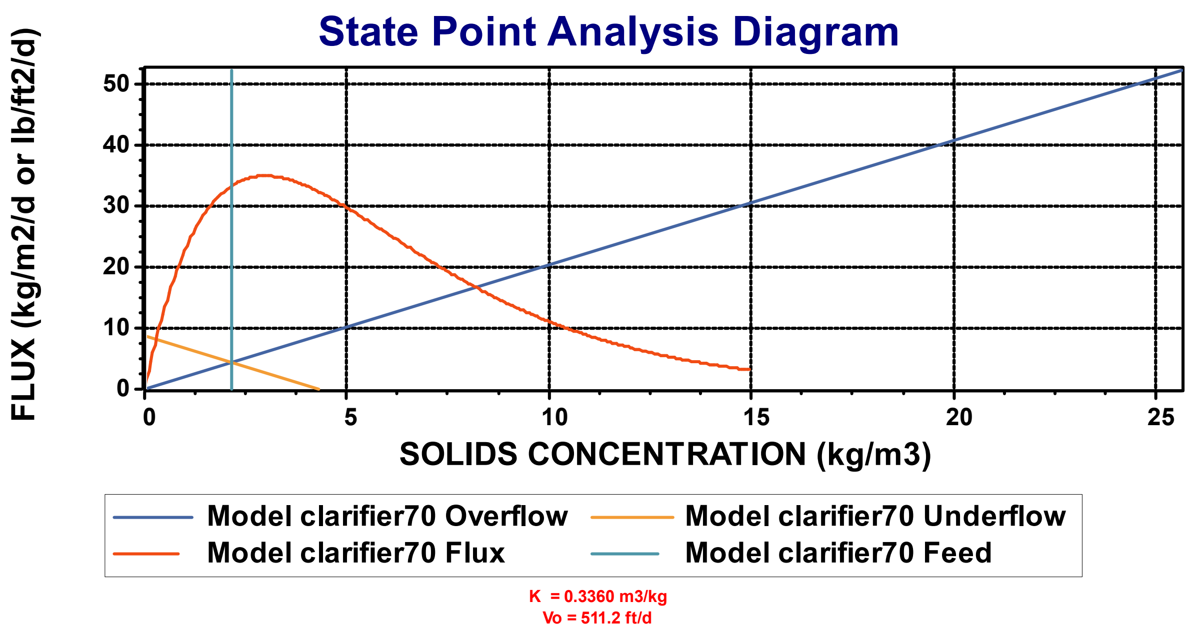
Album page - Page 7



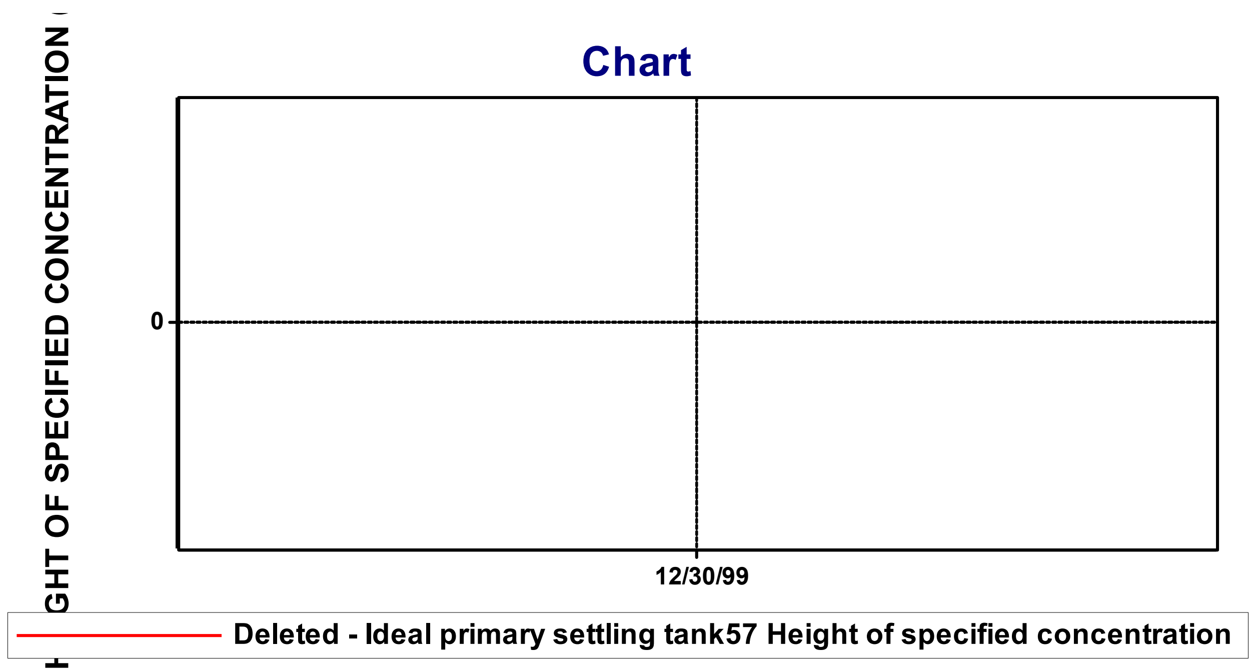
Album page - Page 8



Album page - Page 9



Album page - Page 10



Album page - Page 11

Album page - Page 12

Elements	Liquid volume [Mil. Gal]
Anoxic 1	0.04
Anoxic 2	0.04
Swing	0.04
Aerobic 1	0.26
Anoxic 1B	0.04
Anoxic 2B	0.04
Swing B	0.04
Aerobic 1B	0.26

Album page - Page 13

Elements	Air flow rate [ft3/min (20C, 1 atm)]
Anoxic 1	0
Anoxic 2	0
Swing	166.45
Aerobic 1	538.39
Anoxic 1B	0
Anoxic 2B	0
Swing B	166.45
Aerobic 1B	538.39

Album page - Existing Plant SUmmary

Elements	Flow [mgd]	Temperature [deg. C]	BOD - Total Carbonaceous [mg/L]	BOD - Filtered Carbonaceous [mg/L]	COD - Total [mg/L]	COD - Filtered [mg/L]	Total suspended solids [mg/L]	Volatile suspended solids [mg/L]	pH []	Alkalinity [mmol/L]	N - Total Kjeldahl Nitrogen [mgN/L]	N - Ammonia [mgN/L]	N - Nitrite [mgN/L]	N - Nitrate [mgN/L]	Air flow rate [ft3/min (20C, 1 atm)]	OTR [lb/hr]	OUR - Total [mgO/L/hr]	SOTR [lb/hr]	Alpha [[]]
Influent - BOD49	1.12	22.00	287.97	124.62	600.98	236.60	277.00	257.00	7.20	3.00	46.00	33.82	0	0	-----	-----	-----	-----	-----
Anoxic 1	2.80	22.00	806.26	6.65	2836.06	50.23	2183.89	1966.37	6.38	1.07	167.14	7.87	0.31	1.90	0	0	0	0	0.50
Anoxic 2	2.80	22.00	803.27	2.04	2832.19	43.08	2186.29	1968.69	6.44	1.18	167.14	8.01	0.14	0.66	0	0	0	0	0.50
Swing	2.80	22.00	798.68	1.77	2824.42	41.90	2182.03	1964.04	6.29	0.93	165.58	6.00	0.75	1.55	166.45	15.12	41.86	61.93	0.37
Aerobic 1	2.80	22.00	771.27	1.10	2782.63	40.65	2154.57	1935.49	5.71	0.26	160.92	0.89	0.73	5.93	538.39	60.41	28.12	217.80	0.42
Model clarifier5	0.56	22.00	2.59	1.10	45.98	40.65	4.18	3.76	5.71	0.26	2.68	0.89	0.73	5.93	-----	-----	-----	-----	-----
Model clarifier5 (U)	0.56	22.00	1538.87	1.10	5515.40	40.65	4301.90	3864.49	5.71	0.26	318.93	0.89	0.73	5.93	-----	-----	-----	-----	-----
Model clarifier70	0.56	22.00	2.59	1.10	45.98	40.65	4.18	3.76	5.71	0.26	2.68	0.89	0.73	5.93	-----	-----	-----	-----	-----
Model clarifier70 (U)	0.56	22.00	1538.87	1.10	5515.40	40.65	4301.90	3864.49	5.71	0.26	318.93	0.89	0.73	5.93	-----	-----	-----	-----	-----

Effluent29	1.12	22.00	2.59	1.10	45.98	40.65	4.18	3.76	5.71	0.26	2.68	0.89	0.73	5.93	-----	-----	-----	-----	-----
Donut Hole	0.05	22.00	1082.12	0.70	4862.58	40.08	3796.65	3405.15	4.56	-0.01	293.09	17.02	0.91	26.82	120.28	13.93	18.55	42.23	0.50
Ring	0.05	22.00	599.41	0.72	4177.35	40.13	3258.66	2922.57	4.43	-0.03	265.76	37.58	0.74	49.31	116.62	14.65	9.75	44.40	0.50
Separator - Dewatering unit83	0.05	22.00	62.12	0.72	464.46	40.13	334.22	299.75	4.44	-0.03	62.27	37.58	0.74	49.31	-----	-----	-----	-----	-----
Separator - Dewatering unit83 (U)	0.00	22.00	215553.65	0.72	148979.96	40.13	117311.67	105212.38	4.44	-0.03	8202.18	37.58	0.74	49.31	-----	-----	-----	-----	-----

Album page - New Plant Summary

Elements	BOD - Total Carbonaceous [mg/L]	COD - Filtered [mg/L]	Total suspended solids [mg/L]	Volatile suspended solids [mg/L]	pH []	Alkalinity [mmol/L]	N - Total Kjeldahl Nitrogen [mgN/L]	N - Ammonia [mgN/L]	N - Nitrite [mgN/L]	N - Nitrate [mgN/L]	Air flow rate [ft3/min (20C, 1 atm)]	OTR [lb/hr]	OUR - Total [mgO/L/hr]	SOTR [lb/hr]
Influent - BOD49	287.97	236.60	277.00	257.00	7.20	3.00	46.00	33.82	0	0	-----	-----	-----	-----
Anoxic 1B	806.26	50.23	2183.89	1966.37	6.38	1.07	167.14	7.87	0.31	1.90	0	0	0	0
Anoxic 2B	803.27	43.08	2186.29	1968.69	6.44	1.18	167.14	8.01	0.14	0.66	0	0	0	0

Swing B	798.68	41.90	2182.03	1964.04	6.29	0.93	165.58	6.00	0.75	1.55	166.45	15.12	41.86	61.93
Aerobic 1B	771.27	40.65	2154.57	1935.49	5.71	0.26	160.92	0.89	0.73	5.93	538.39	60.41	28.12	217.80
Model clarifier5	2.59	40.65	4.18	3.76	5.71	0.26	2.68	0.89	0.73	5.93	-----	-----	-----	-----
Model clarifier5 (U)	1538.87	40.65	4301.90	3864.49	5.71	0.26	318.93	0.89	0.73	5.93	-----	-----	-----	-----
Model clarifier70	2.59	40.65	4.18	3.76	5.71	0.26	2.68	0.89	0.73	5.93	-----	-----	-----	-----
Model clarifier70 (U)	1538.87	40.65	4301.90	3864.49	5.71	0.26	318.93	0.89	0.73	5.93	-----	-----	-----	-----
Effluent29	2.59	40.65	4.18	3.76	5.71	0.26	2.68	0.89	0.73	5.93	-----	-----	-----	-----

Global Parameters

Common

Name	Default	Value	
Hydrolysis rate [1/d]	2.1000	2.1000	1.0290
Hydrolysis half sat. [-]	0.0600	0.0600	1.0000
External organics hydrolysis rate [1/d]	2.1000	2.1000	1.0290
External organics hydrolysis half sat. [-]	0.0600	0.0600	1.0000
Anoxic hydrolysis factor [-]	0.2800	0.2800	1.0000
Anaerobic hydrolysis factor (AS) [-]	0.0400	0.0400	1.0000
Anaerobic hydrolysis factor (AD) [-]	0.5000	0.5000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.1500	0.1500	1.0290
Ammonification rate [L/(mgCOD d)]	0.0800	0.0800	1.0290
Assimilative nitrate/nitrite reduction rate [1/d]	0.5000	0.5000	1.0000

Endogenous products decay rate [1/d]	0	0	1.0000

Ammonia oxidizing

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9000	0.9000	1.0720
Substrate (NH4) half sat. [mgN/L]	0.7000	0.7000	1.0000
Byproduct NH4 logistic slope [-]	50.0000	50.0000	1.0000
Byproduct NH4 inflection point [mgN/L]	1.4000	1.4000	1.0000
Denite DO half sat. [mg/L]	0.1000	0.1000	1.0000
Denite HNO2 half sat. [mgN/L]	5.000E-6	5.000E-6	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiHNO2 [mmol/L]	5.000E-3	5.000E-3	1.0000

Nitrite oxidizing

Name	Default	Value	
Max. spec. growth rate [1/d]	0.7000	0.7000	1.0600
Substrate (NO2) half sat. [mgN/L]	0.1000	0.1000	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiNH3 [mmol/L]	0.0750	0.0750	1.0000

Anaerobic ammonia oxidizing

Name	Default	Value	
Max. spec. growth rate [1/d]	0.2000	0.2000	1.1000
Substrate (NH4) half sat. [mgN/L]	2.0000	2.0000	1.0000

Substrate (NO2) half sat. [mgN/L]	1.0000	1.0000	1.0000
Aerobic decay rate [1/d]	0.0190	0.0190	1.0290
Anoxic/anaerobic decay rate [1/d]	9.500E-3	9.500E-3	1.0290
Ki Nitrite [mgN/L]	1000.0000	1000.0000	1.0000
Nitrite sensitivity constant [L / (d mgN)]	0.0160	0.0160	1.0000

BioWin user and configuration data

Project details

Project name: Unknown Project ref.: BW1

Plant name: Unknown User name: Jason.Flowers

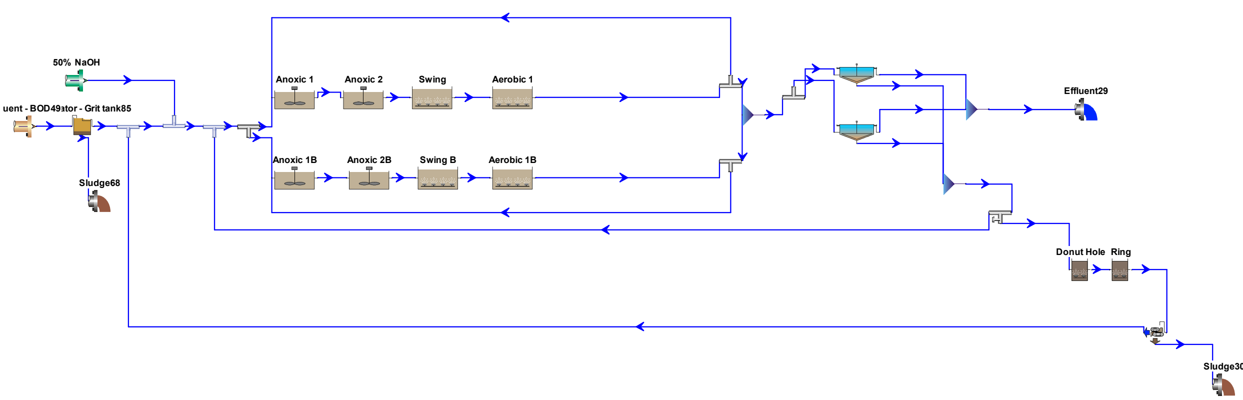
Created: 5/18/2018 Saved: 6/14/2020

Steady state solution

Target SRT: 5.00 days SRT #0: 5.03 days

Temperature: 22.0°C

Flowsheet



Configuration information for all Digester - Aerobic units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Donut Hole	0.0900	802.0834	15.000	182
Ring	0.1800	1604.1668	15.000	363

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Donut Hole	2.0
Ring	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^ 0.25 + k2	k2 in C = k1(PC)^ 0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	Diffuser mounting height	Min. air flow rate per diffuser ft3/min (20C, 1 atm)	Max. air flow rate per diffuser ft3/min (20C, 1 atm)	'A' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2	'B' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2	'C' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2
Donut Hole	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Ring	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0

Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Anoxic 1	0.0377	278.7476	18.080	Un-aerated
Anoxic 2	0.0377	278.7476	18.080	Un-aerated

Swing	0.0377	278.7476	18.080	63
Aerobic 1	0.2574	1903.1735	18.080	431
Anoxic 1B	0.0377	278.7476	18.080	Un-aerated
Anoxic 2B	0.0377	278.7476	18.080	Un-aerated
Swing B	0.0377	278.7476	18.080	63
Aerobic 1B	0.2574	1903.1735	18.080	431

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Anoxic 1	0
Anoxic 2	0
Swing	2.0
Aerobic 1	2.0
Anoxic 1B	0
Anoxic 2B	0
Swing B	2.0
Aerobic 1B	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^ 0.25 + k2	k2 in C = k1(PC)^ 0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	Diffuser mountin g height	Min. air flow rate per diffuser ft3/min (20C, 1 atm)	Max. air flow rate per diffuser ft3/min (20C, 1 atm)	'A' in diffuser pressure drop = A + B*(Qa/Di ff) + C*(Qa/Di ff)^2	'B' in diffuser pressure drop = A + B*(Qa/Di ff) + C*(Qa/Di ff)^2	'C' in diffuser pressure drop = A + B*(Qa/Di ff) + C*(Qa/Di ff)^2
Anoxic 1	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Anoxic 2	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Swing	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Aerobic 1	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0

Anoxic 1B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Anoxic 2B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Swing B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Aerobic 1B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0

Configuration information for all Influent - BOD units

Operating data Average (flow/time weighted as required)

Element name	Influent - BOD49
Flow	1.46
BOD - Total Carbonaceous mgBOD/L	322.50
Volatile suspended solids mg/L	277.00
Total suspended solids mg/L	310.80
N - Total Kjeldahl Nitrogen mgN/L	53.70
P - Total P mgP/L	5.30
N - Nitrate mgN/L	0
pH	7.20
Alkalinity mmol/L	3.00
Metal soluble - Calcium mg/L	11.10
Metal soluble - Magnesium mg/L	3.20
Gas - Dissolved oxygen mg/L	0

Element name	Influent - BOD49
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1410
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1418
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.6725
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0650
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300

Fcel - Cellulose fraction of unbiodegradable particulate [gCOD/gCOD]	0.5000
Fna - Ammonia [gNH3-N/gTKN]	0.7353
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0700
Fpo4 - Phosphate [gPO4-P/gTP]	0.4717
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0220
Fsr - Reduced sulfur [H2S] [gS/gS]	0
FZbh - Ordinary heterotrophic COD fraction [gCOD/g of total COD]	0.0200
FZbm - Methylotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZao - Ammonia oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZno - Nitrite oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZaao - Anaerobic ammonia oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZppa - Phosphorus accumulating COD fraction [gCOD/g of total COD]	1.000E-4
FZpa - Propionic acetogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZam - Acetoclastic methanogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZhm - Hydrogenotrophic methanogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZso - Sulfur oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZsrpa - Sulfur reducing propionic acetogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZsra - Sulfur reducing acetotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZsrh - Sulfur reducing hydrogenotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Clarifier - Model units

Physical data

Element name	Volume[Mil. Gal]	Area[ft2]	Depth[ft]	Number of layers	Top feed layer	Feed Layers
Model clarifier5	0.2570	2290.0000	15.000	10	6	1
Model clarifier70	0.2570	2290.0000	15.000	10	6	1

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Model clarifier5	Flow paced	50.00 %
Model clarifier70	Flow paced	50.00 %

Element name	Average Temperature	Reactive
Model clarifier5	Uses global setting	No
Model clarifier70	Uses global setting	No

Configuration information for all Effluent units

Configuration information for all Separator - Grit tank units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Separator - Grit tank85	4.000E-3	89.1204	6.000

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Separator - Grit tank85	Flowrate [Under]	0.0002642

Element name	Percent removal	Blanket fraction

Separator - Grit tank85	65.00	0.10

Configuration information for all Separator - Dewatering unit units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Separator - Dewatering unit83	Fraction	0.03

Element name	Percent removal
Separator - Dewatering unit83	90.00

Configuration information for all Sludge units

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Splitter11	Flow paced	150.00 %
Splitter12	Flow paced	150.00 %
Splitter13	Fraction	0.50
Splitter40	Flowrate [Side]	0.0740999999259
Splitter32	Fraction	0.50

Configuration information for all Influent - State variable units

Operating data Average (flow/time weighted as required)

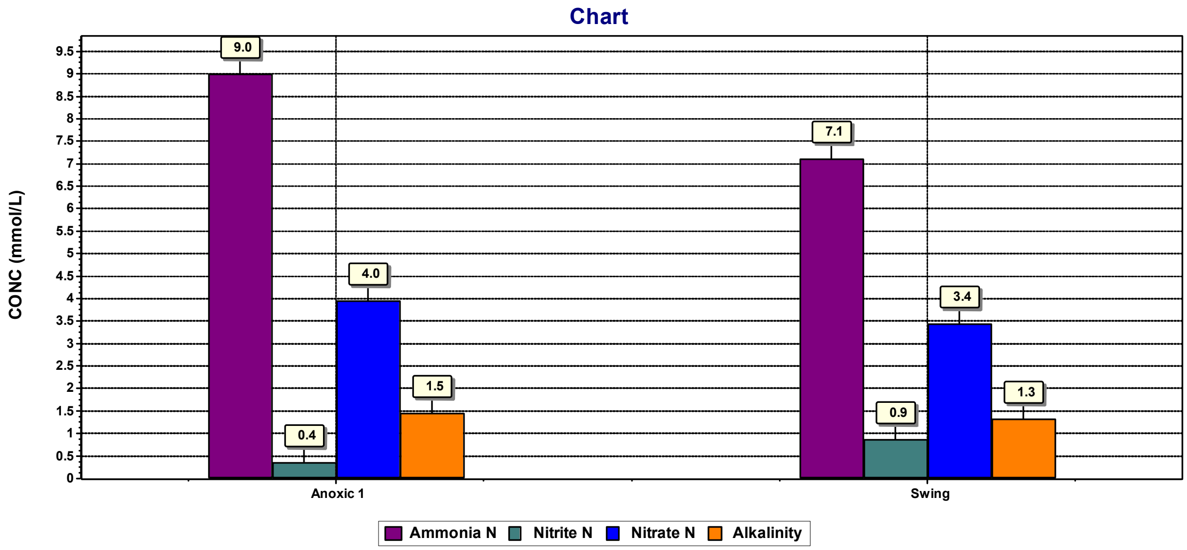
Element name	50% NaOH
Biomass - Ordinary heterotrophic [mgCOD/L]	0
Biomass - Methylotrophic [mgCOD/L]	0
Biomass - Ammonia oxidizing [mgCOD/L]	0
Biomass - Nitrite oxidizing [mgCOD/L]	0
Biomass - Anaerobic ammonia oxidizing [mgCOD/L]	0
Biomass - Phosphorus accumulating [mgCOD/L]	0
Biomass - Propionic acetogenic [mgCOD/L]	0
Biomass - Acetoclastic methanogenic [mgCOD/L]	0
Biomass - Hydrogenotrophic methanogenic [mgCOD/L]	0
Biomass - Endogenous products [mgCOD/L]	0
CODp - Slowly degradable particulate [mgCOD/L]	0
CODp - Slowly degradable colloidal [mgCOD/L]	0
CODp - Degradable external organics [mgCOD/L]	0
CODp - Undegradable non-cellulose [mgCOD/L]	0
CODp - Undegradable cellulose [mgCOD/L]	0
N - Particulate degradable organic [mgN/L]	0
P - Particulate degradable organic [mgP/L]	0
N - Particulate degradable external organics [mgN/L]	0
P - Particulate degradable external organics [mgP/L]	0
N - Particulate undegradable [mgN/L]	0
P - Particulate undegradable [mgP/L]	0
CODp - Stored PHA [mgCOD/L]	0
P - Releasable stored polyP [mgP/L]	0
P - Unreleasable stored polyP [mgP/L]	0
CODs - Complex readily degradable [mgCOD/L]	0
CODs - Acetate [mgCOD/L]	0
CODs - Propionate [mgCOD/L]	0
CODs - Methanol [mgCOD/L]	0

Gas - Dissolved hydrogen [mgCOD/L]	0
Gas - Dissolved methane [mg/L]	0
N - Ammonia [mgN/L]	0
N - Soluble degradable organic [mgN/L]	0
Gas - Dissolved nitrous oxide [mgN/L]	0
N - Nitrite [mgN/L]	0
N - Nitrate [mgN/L]	0
Gas - Dissolved nitrogen [mgN/L]	0
P - Soluble phosphate [mgP/L]	0
CODs - Undegradable [mgCOD/L]	0
N - Soluble undegradable organic [mgN/L]	0
Influent inorganic suspended solids [mgISS/L]	0
Precipitate - Struvite [mgISS/L]	0
Precipitate - Brushite [mgISS/L]	0
Precipitate - Hydroxy - apatite [mgISS/L]	0
Precipitate - Vivianite [mgISS/L]	0
HFO - High surface [mg/L]	0
HFO - Low surface [mg/L]	0
HFO - High with H2PO4- adsorbed [mg/L]	0
HFO - Low with H2PO4- adsorbed [mg/L]	0
HFO - Aged [mg/L]	0
HFO - Low with H+ adsorbed [mg/L]	0
HFO - High with H+ adsorbed [mg/L]	0
HAO - High surface [mg/L]	0
HAO - Low surface [mg/L]	0
HAO - High with H2PO4- adsorbed [mg/L]	0
HAO - Low with H2PO4- adsorbed [mg/L]	0
HAO - Aged [mg/L]	0
P - Bound on aged HMO [mgP/L]	0
Metal soluble - Magnesium [mg/L]	0
Metal soluble - Calcium [mg/L]	0
Metal soluble - Ferric [mg/L]	0
Metal soluble - Ferrous [mg/L]	0
Metal soluble - Aluminum [mg/L]	0
Other Cations (strong bases) [meq/L]	12500.00

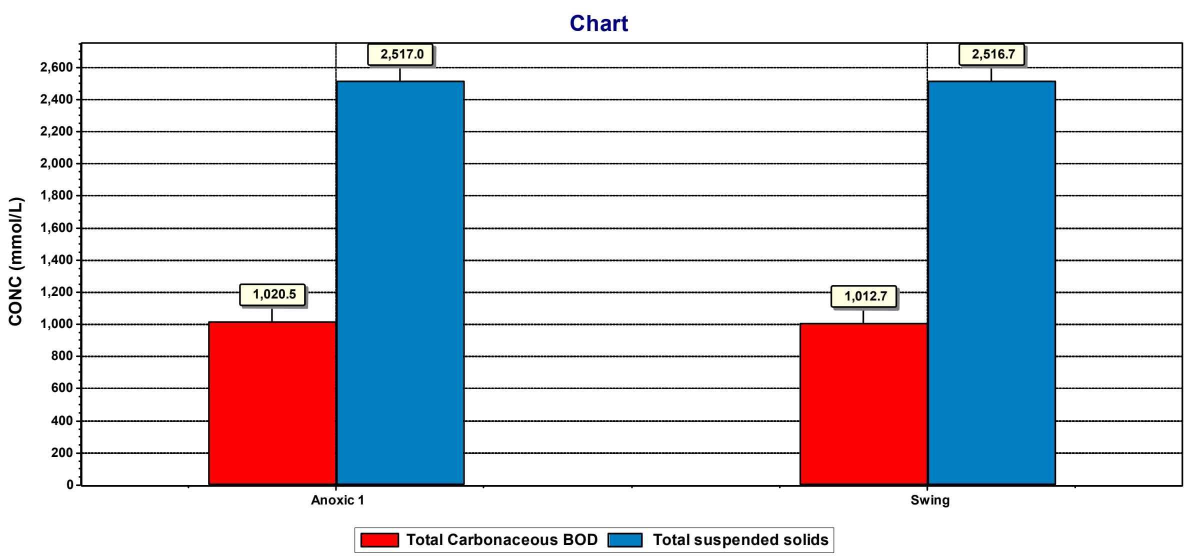
Other Anions (strong acids) [meq/L]	0
Gas - Dissolved total CO2 [mmol/L]	0
User defined - UD1 [mg/L]	0
User defined - UD2 [mg/L]	0
User defined - UD3 [mgVSS/L]	0
User defined - UD4 [mgISS/L]	0
Biomass - Sulfur oxidizing [mgCOD/L]	0
Biomass - Sulfur reducing propionic acetogenic [mgCOD/L]	0
Biomass - Sulfur reducing acetotrophic [mgCOD/L]	0
Biomass - Sulfur reducing hydrogenotrophic [mgCOD/L]	0
Gas - Dissolved total sulfides [mgS/L]	0
S - Soluble sulfate [mgS/L]	0
S - Particulate elemental sulfur [mgS/L]	0
Precipitate - Ferrous sulfide [mgISS/L]	0
CODp - Adsorbed hydrocarbon [mgCOD/L]	0
CODs - Degradable volatile ind. #1 [mgCOD/L]	0
CODs - Degradable volatile ind. #2 [mgCOD/L]	0
CODs - Degradable volatile ind. #3 [mgCOD/L]	0
CODs - Soluble hydrocarbon [mgCOD/L]	0
Gas - Dissolved oxygen [mg/L]	0
Flow	0.0001

BioWin Album

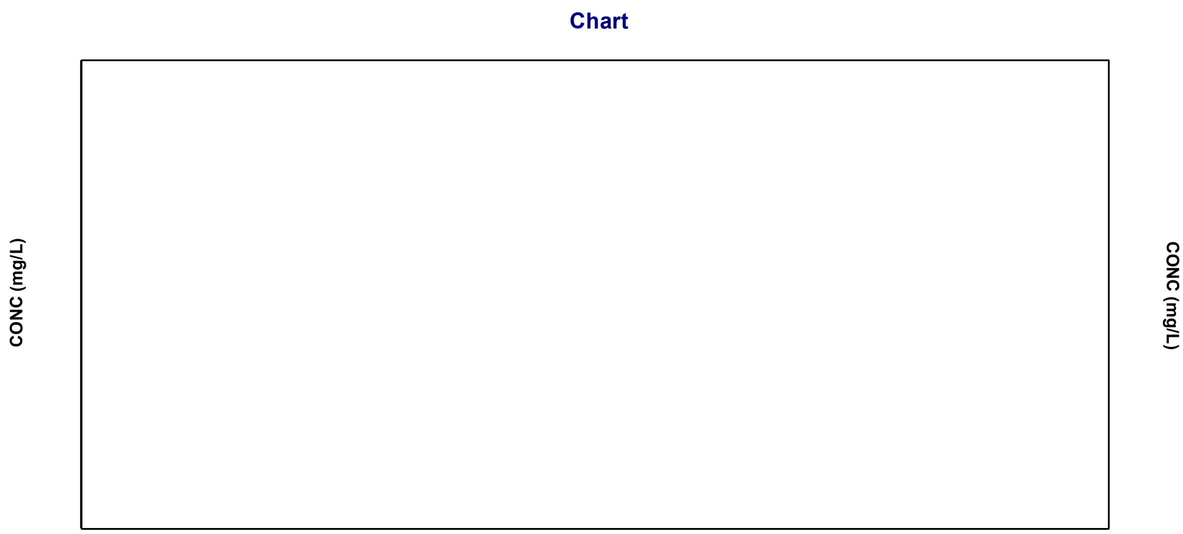
Album page - Nitrogen species



Album page - BOD_TSS



Album page - Page 3



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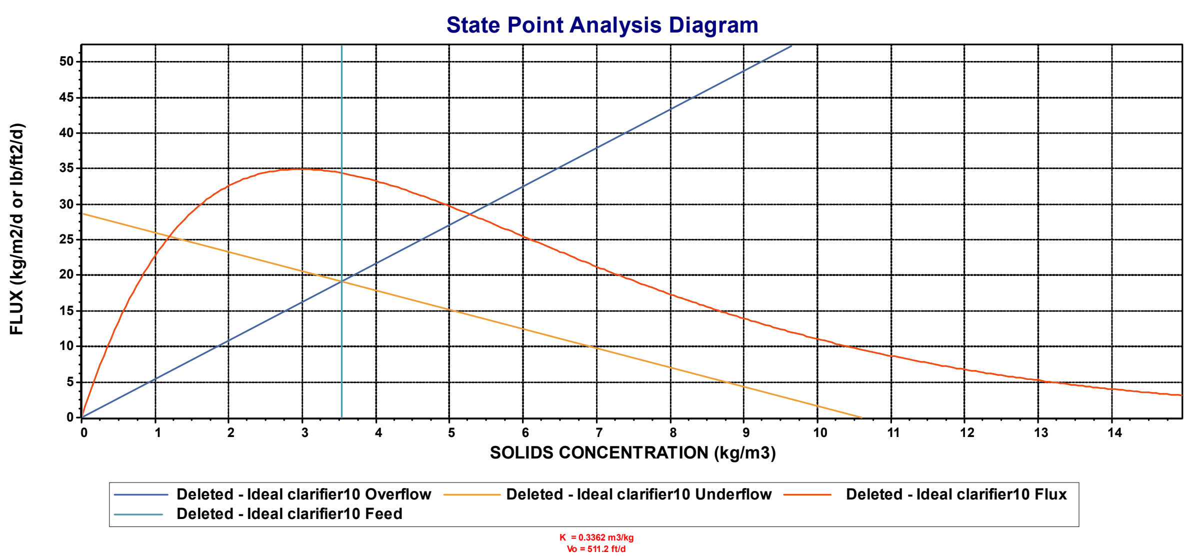
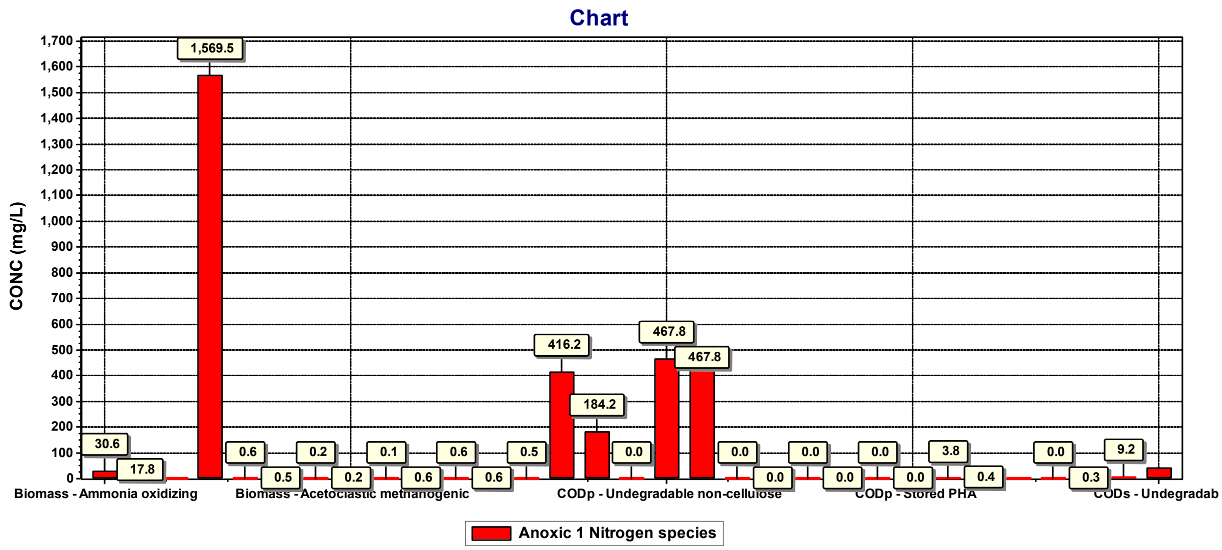
Album page - Page 5



Album page - Page 6



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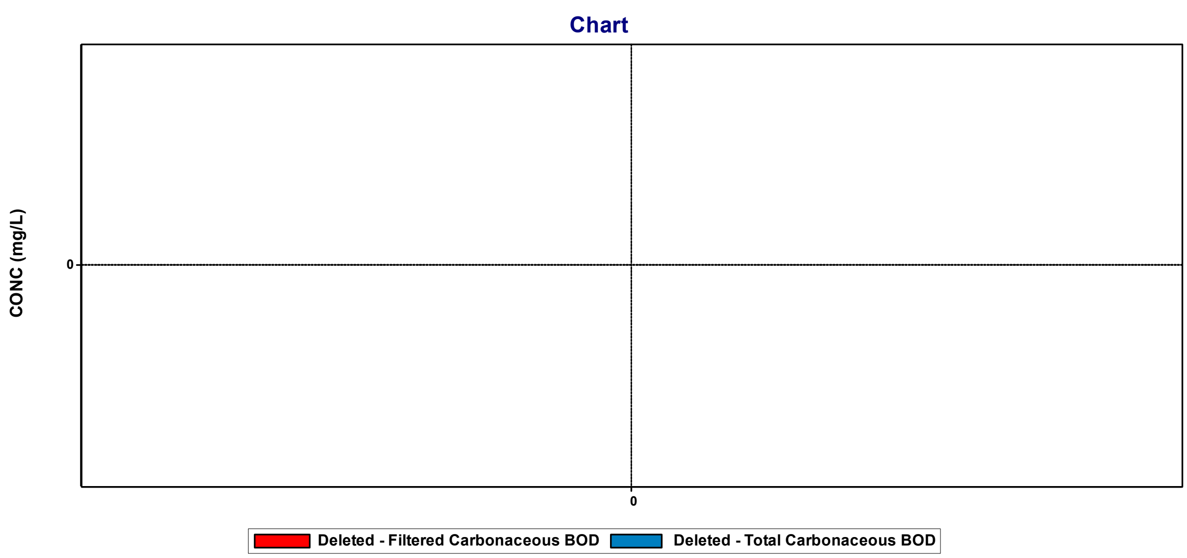

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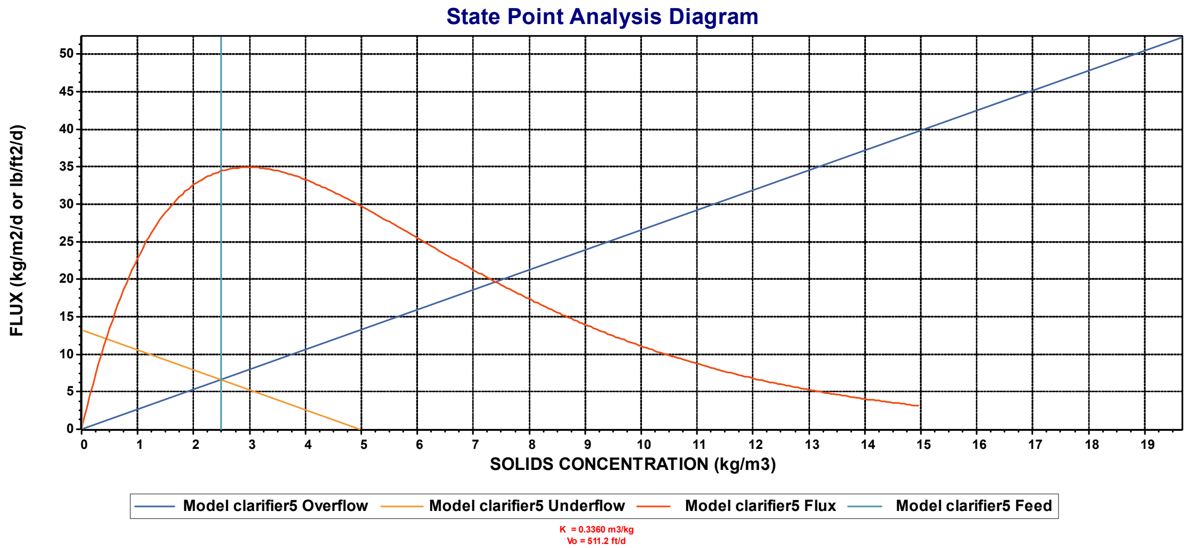

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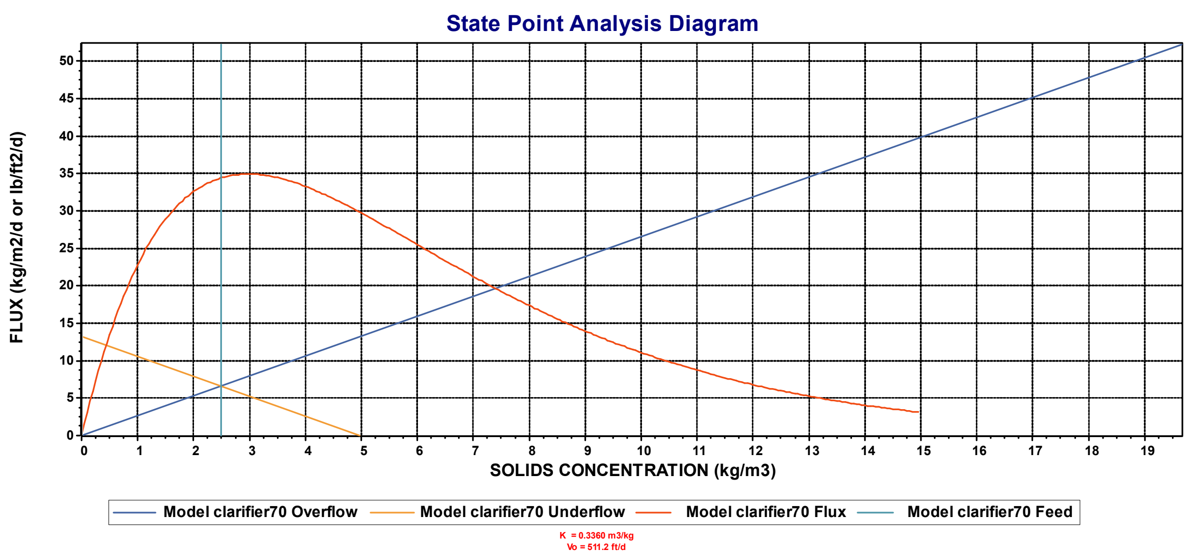

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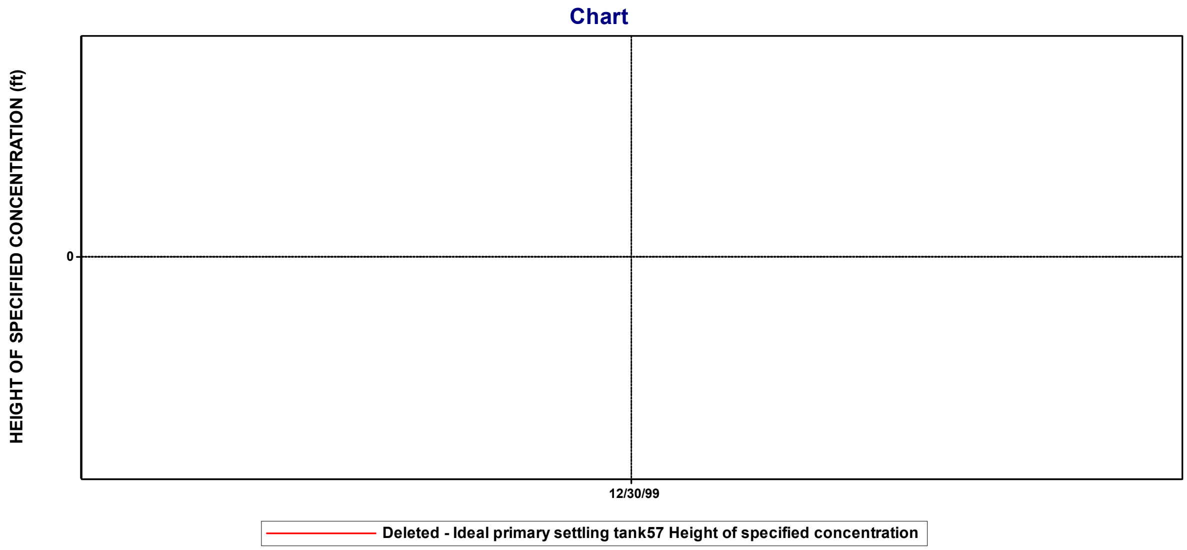

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BioWin user and configuration data

Project details

Project name: Unknown Project ref.: BW1

Plant name: Unknown User name: Jason.Flowers

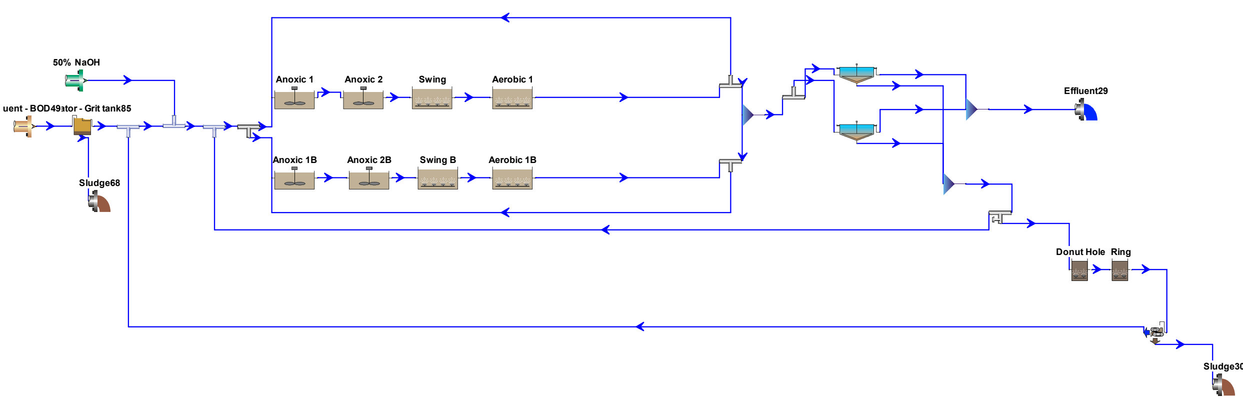
Created: 5/18/2018 Saved: 6/14/2020

Steady state solution

Target SRT: 7.00 days SRT #0: 7.03 days

Temperature: 11.0°C

Flowsheet



Configuration information for all Digester - Aerobic units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Donut Hole	0.0900	802.0834	15.000	182
Ring	0.1800	1604.1668	15.000	363

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Donut Hole	2.0
Ring	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^ 0.25 + k2	k2 in C = k1(PC)^ 0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	Diffuser mounting height	Min. air flow rate per diffuser ft3/min (20C, 1 atm)	Max. air flow rate per diffuser ft3/min (20C, 1 atm)	'A' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2	'B' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2	'C' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2
Donut Hole	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Ring	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0

Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Anoxic 1	0.0377	278.7476	18.080	Un-aerated
Anoxic 2	0.0377	278.7476	18.080	Un-aerated

Swing	0.0377	278.7476	18.080	63
Aerobic 1	0.2574	1903.1735	18.080	431
Anoxic 1B	0.0377	278.7476	18.080	Un-aerated
Anoxic 2B	0.0377	278.7476	18.080	Un-aerated
Swing B	0.0377	278.7476	18.080	63
Aerobic 1B	0.2574	1903.1735	18.080	431

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Anoxic 1	0
Anoxic 2	0
Swing	2.0
Aerobic 1	2.0
Anoxic 1B	0
Anoxic 2B	0
Swing B	2.0
Aerobic 1B	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^ 0.25 + k2	k2 in C = k1(PC)^ 0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	Diffuser mounting height	Min. air flow rate per diffuser ft3/min (20C, 1 atm)	Max. air flow rate per diffuser ft3/min (20C, 1 atm)	'A' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2	'B' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2	'C' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2
Anoxic 1	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Anoxic 2	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Swing	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Aerobic 1	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0

Anoxic 1B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Anoxic 2B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Swing B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Aerobic 1B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0

Configuration information for all Influent - BOD units

Operating data Average (flow/time weighted as required)

Element name	Influent - BOD49
Flow	2.76
BOD - Total Carbonaceous mgBOD/L	164.00
Volatile suspended solids mg/L	166.00
Total suspended solids mg/L	186.00
N - Total Kjeldahl Nitrogen mgN/L	28.00
P - Total P mgP/L	5.30
N - Nitrate mgN/L	0
pH	7.10
Alkalinity mmol/L	2.00
Metal soluble - Calcium mg/L	11.10
Metal soluble - Magnesium mg/L	3.20
Gas - Dissolved oxygen mg/L	0

Element name	Influent - BOD49
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1410
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1418
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.8347
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0650
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300

Fcel - Cellulose fraction of unbiodegradable particulate [gCOD/gCOD]	0.5000
Fna - Ammonia [gNH3-N/gTKN]	0.7353
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0700
Fpo4 - Phosphate [gPO4-P/gTP]	0.4717
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0220
Fsr - Reduced sulfur [H2S] [gS/gS]	0
FZbh - Ordinary heterotrophic COD fraction [gCOD/g of total COD]	0.0200
FZbm - Methylotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZao - Ammonia oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZno - Nitrite oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZaao - Anaerobic ammonia oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZppa - Phosphorus accumulating COD fraction [gCOD/g of total COD]	1.000E-4
FZpa - Propionic acetogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZam - Acetoclastic methanogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZhm - Hydrogenotrophic methanogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZso - Sulfur oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZsrpa - Sulfur reducing propionic acetogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZsra - Sulfur reducing acetotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZsrh - Sulfur reducing hydrogenotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Clarifier - Model units

Physical data

Element name	Volume[Mil. Gal]	Area[ft2]	Depth[ft]	Number of layers	Top feed layer	Feed Layers
Model clarifier5	0.2570	2290.0000	15.000	10	6	1
Model clarifier70	0.2570	2290.0000	15.000	10	6	1

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Model clarifier5	Flow paced	50.00 %
Model clarifier70	Flow paced	50.00 %

Element name	Average Temperature	Reactive
Model clarifier5	Uses global setting	No
Model clarifier70	Uses global setting	No

Configuration information for all Effluent units

Configuration information for all Separator - Grit tank units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Separator - Grit tank85	4.000E-3	89.1204	6.000

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Separator - Grit tank85	Flowrate [Under]	0.0002642

Element name	Percent removal	Blanket fraction

Separator - Grit tank85	65.00	0.10

Configuration information for all Separator - Dewatering unit units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Separator - Dewatering unit83	Fraction	0.03

Element name	Percent removal
Separator - Dewatering unit83	90.00

Configuration information for all Sludge units

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Splitter11	Flow paced	150.00 %
Splitter12	Flow paced	150.00 %
Splitter13	Fraction	0.50
Splitter40	Flowrate [Side]	0.0529285713907653
Splitter32	Fraction	0.50

Configuration information for all Influent - State variable units

Operating data Average (flow/time weighted as required)

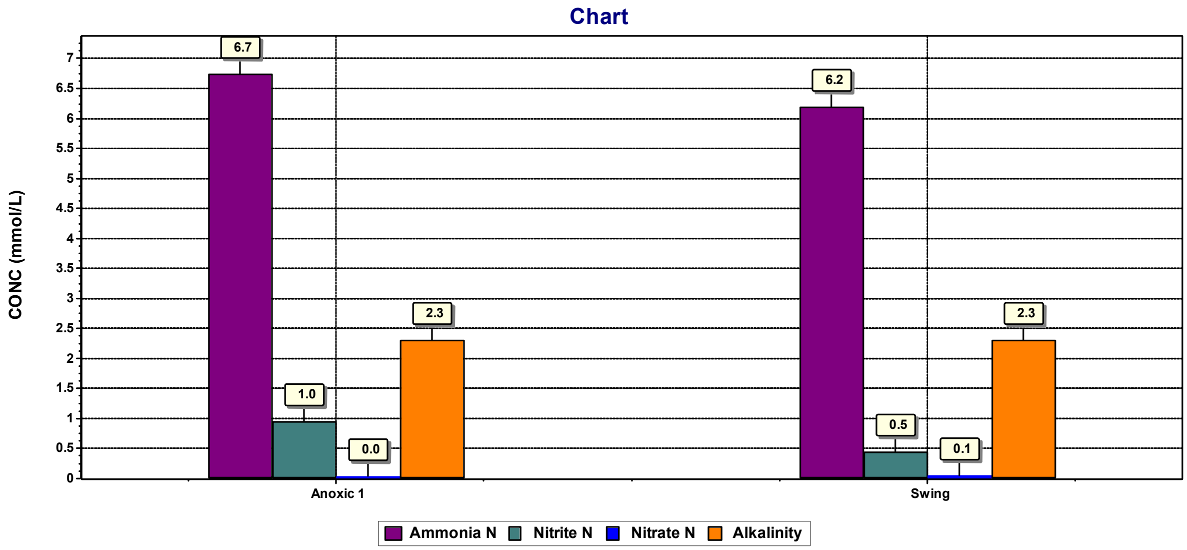
Element name	50% NaOH
Biomass - Ordinary heterotrophic [mgCOD/L]	0
Biomass - Methylotrophic [mgCOD/L]	0
Biomass - Ammonia oxidizing [mgCOD/L]	0
Biomass - Nitrite oxidizing [mgCOD/L]	0
Biomass - Anaerobic ammonia oxidizing [mgCOD/L]	0
Biomass - Phosphorus accumulating [mgCOD/L]	0
Biomass - Propionic acetogenic [mgCOD/L]	0
Biomass - Acetoclastic methanogenic [mgCOD/L]	0
Biomass - Hydrogenotrophic methanogenic [mgCOD/L]	0
Biomass - Endogenous products [mgCOD/L]	0
CODp - Slowly degradable particulate [mgCOD/L]	0
CODp - Slowly degradable colloidal [mgCOD/L]	0
CODp - Degradable external organics [mgCOD/L]	0
CODp - Undegradable non-cellulose [mgCOD/L]	0
CODp - Undegradable cellulose [mgCOD/L]	0
N - Particulate degradable organic [mgN/L]	0
P - Particulate degradable organic [mgP/L]	0
N - Particulate degradable external organics [mgN/L]	0
P - Particulate degradable external organics [mgP/L]	0
N - Particulate undegradable [mgN/L]	0
P - Particulate undegradable [mgP/L]	0
CODp - Stored PHA [mgCOD/L]	0
P - Releasable stored polyP [mgP/L]	0
P - Unreleasable stored polyP [mgP/L]	0
CODs - Complex readily degradable [mgCOD/L]	0
CODs - Acetate [mgCOD/L]	0
CODs - Propionate [mgCOD/L]	0
CODs - Methanol [mgCOD/L]	0

Gas - Dissolved hydrogen [mgCOD/L]	0
Gas - Dissolved methane [mg/L]	0
N - Ammonia [mgN/L]	0
N - Soluble degradable organic [mgN/L]	0
Gas - Dissolved nitrous oxide [mgN/L]	0
N - Nitrite [mgN/L]	0
N - Nitrate [mgN/L]	0
Gas - Dissolved nitrogen [mgN/L]	0
P - Soluble phosphate [mgP/L]	0
CODs - Undegradable [mgCOD/L]	0
N - Soluble undegradable organic [mgN/L]	0
Influent inorganic suspended solids [mgISS/L]	0
Precipitate - Struvite [mgISS/L]	0
Precipitate - Brushite [mgISS/L]	0
Precipitate - Hydroxy - apatite [mgISS/L]	0
Precipitate - Vivianite [mgISS/L]	0
HFO - High surface [mg/L]	0
HFO - Low surface [mg/L]	0
HFO - High with H2PO4- adsorbed [mg/L]	0
HFO - Low with H2PO4- adsorbed [mg/L]	0
HFO - Aged [mg/L]	0
HFO - Low with H+ adsorbed [mg/L]	0
HFO - High with H+ adsorbed [mg/L]	0
HAO - High surface [mg/L]	0
HAO - Low surface [mg/L]	0
HAO - High with H2PO4- adsorbed [mg/L]	0
HAO - Low with H2PO4- adsorbed [mg/L]	0
HAO - Aged [mg/L]	0
P - Bound on aged HMO [mgP/L]	0
Metal soluble - Magnesium [mg/L]	0
Metal soluble - Calcium [mg/L]	0
Metal soluble - Ferric [mg/L]	0
Metal soluble - Ferrous [mg/L]	0
Metal soluble - Aluminum [mg/L]	0
Other Cations (strong bases) [meq/L]	12500.00

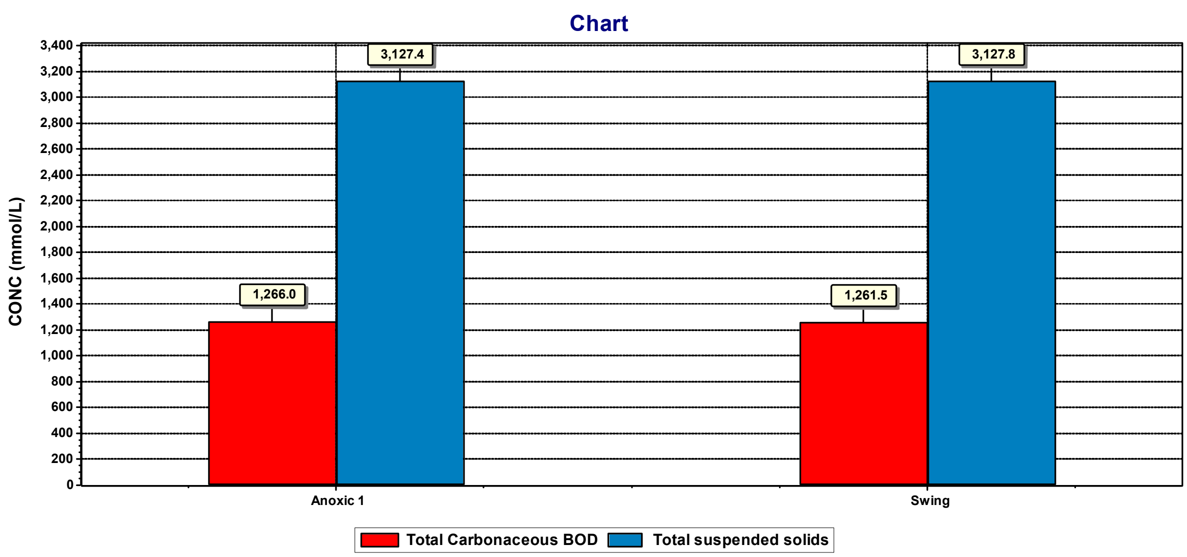
Other Anions (strong acids) [meq/L]	0
Gas - Dissolved total CO2 [mmol/L]	0
User defined - UD1 [mg/L]	0
User defined - UD2 [mg/L]	0
User defined - UD3 [mgVSS/L]	0
User defined - UD4 [mgISS/L]	0
Biomass - Sulfur oxidizing [mgCOD/L]	0
Biomass - Sulfur reducing propionic acetogenic [mgCOD/L]	0
Biomass - Sulfur reducing acetotrophic [mgCOD/L]	0
Biomass - Sulfur reducing hydrogenotrophic [mgCOD/L]	0
Gas - Dissolved total sulfides [mgS/L]	0
S - Soluble sulfate [mgS/L]	0
S - Particulate elemental sulfur [mgS/L]	0
Precipitate - Ferrous sulfide [mgISS/L]	0
CODp - Adsorbed hydrocarbon [mgCOD/L]	0
CODs - Degradable volatile ind. #1 [mgCOD/L]	0
CODs - Degradable volatile ind. #2 [mgCOD/L]	0
CODs - Degradable volatile ind. #3 [mgCOD/L]	0
CODs - Soluble hydrocarbon [mgCOD/L]	0
Gas - Dissolved oxygen [mg/L]	0
Flow	0.0003

BioWin Album

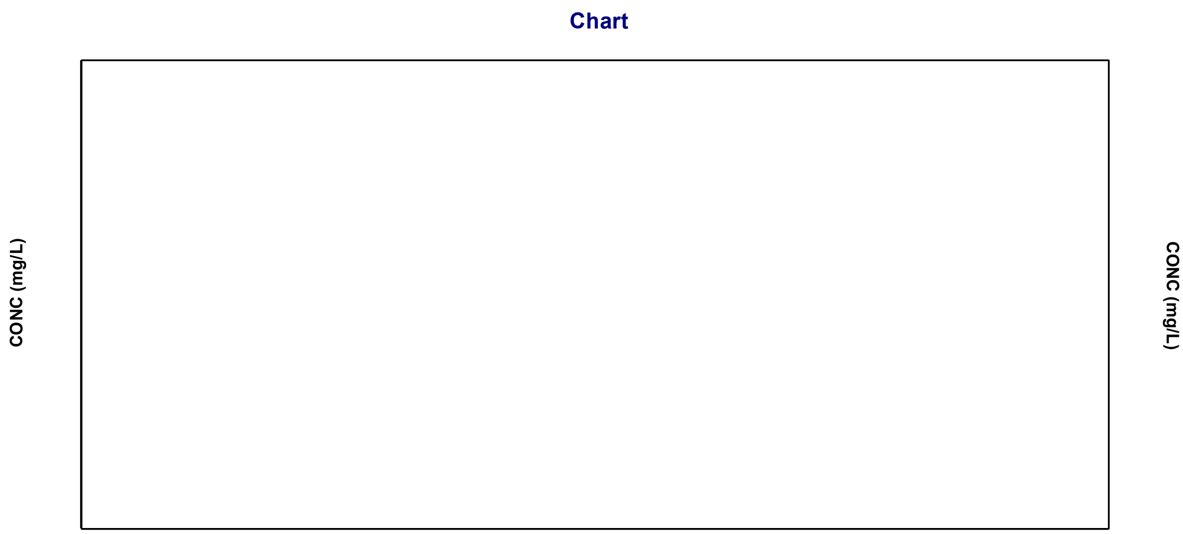
Album page - Nitrogen species



Album page - BOD_TSS



Album page - Page 3



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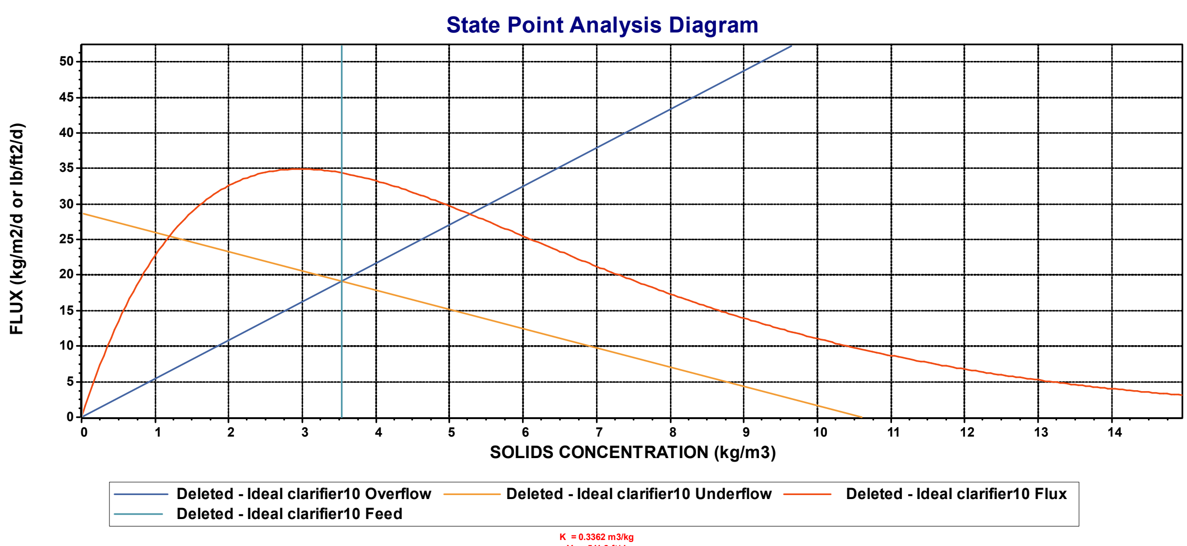
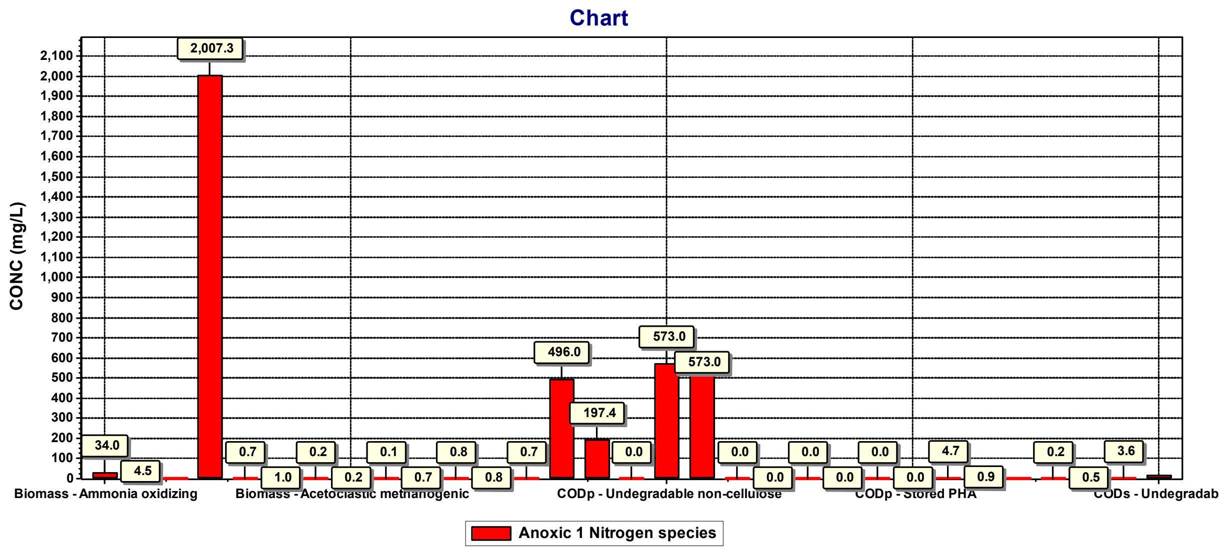


Album page - Page 6



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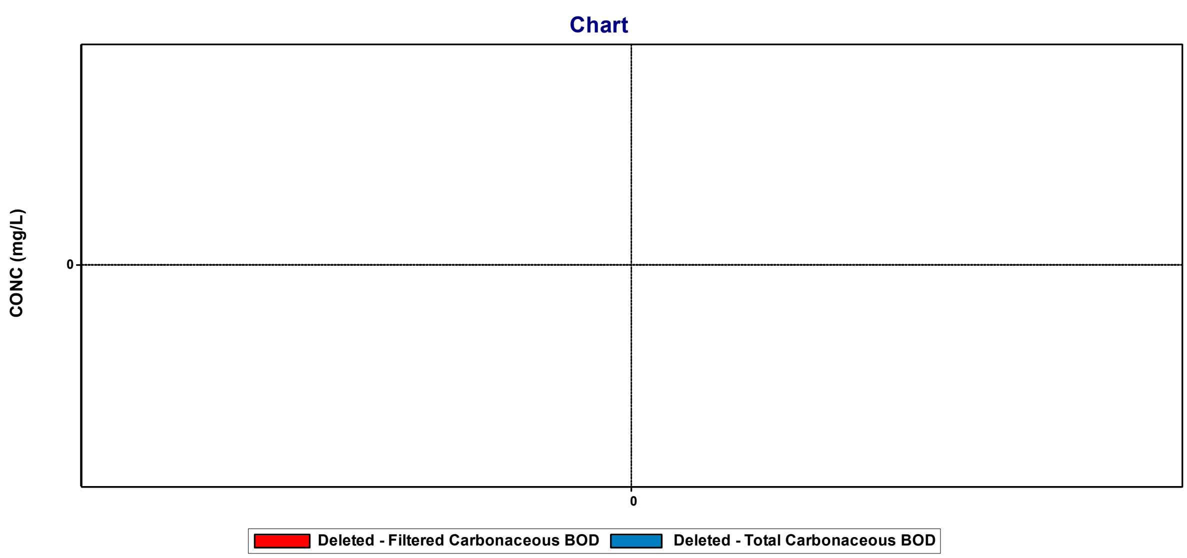
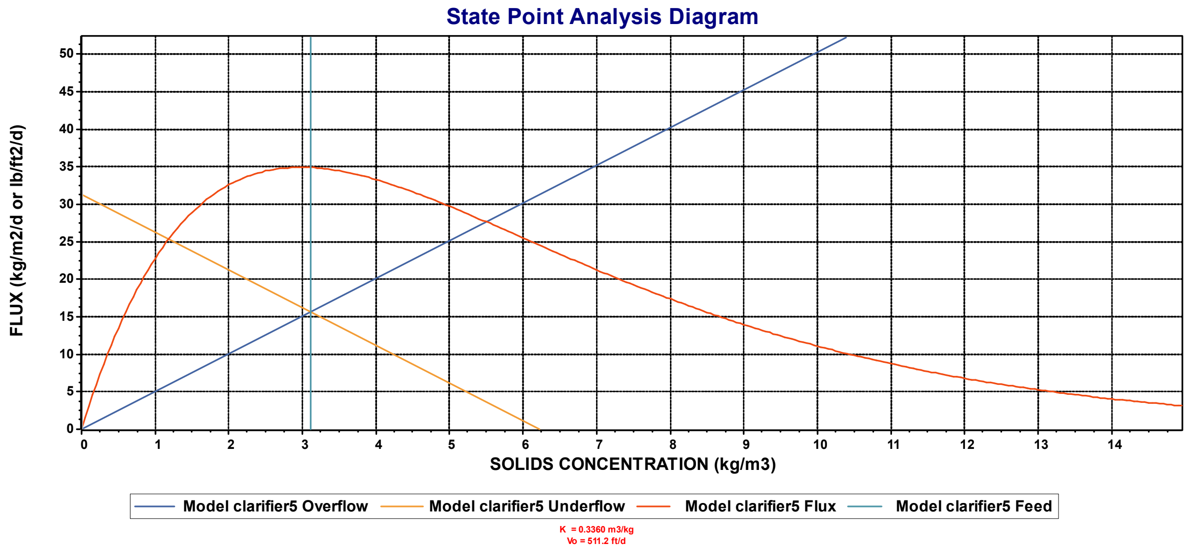
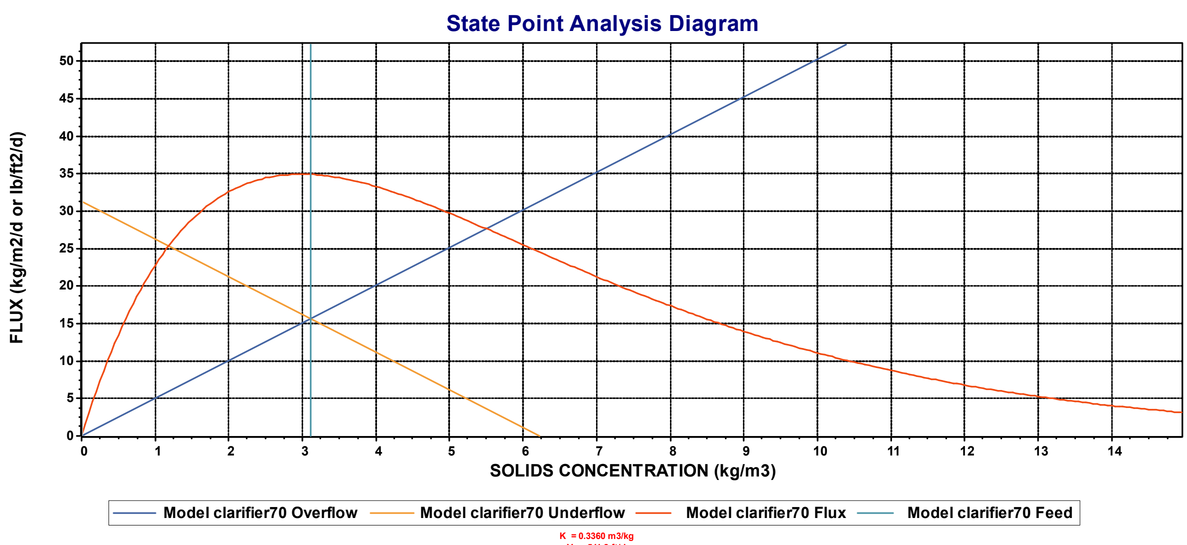


Album page - Page 8



Album page - Page 9



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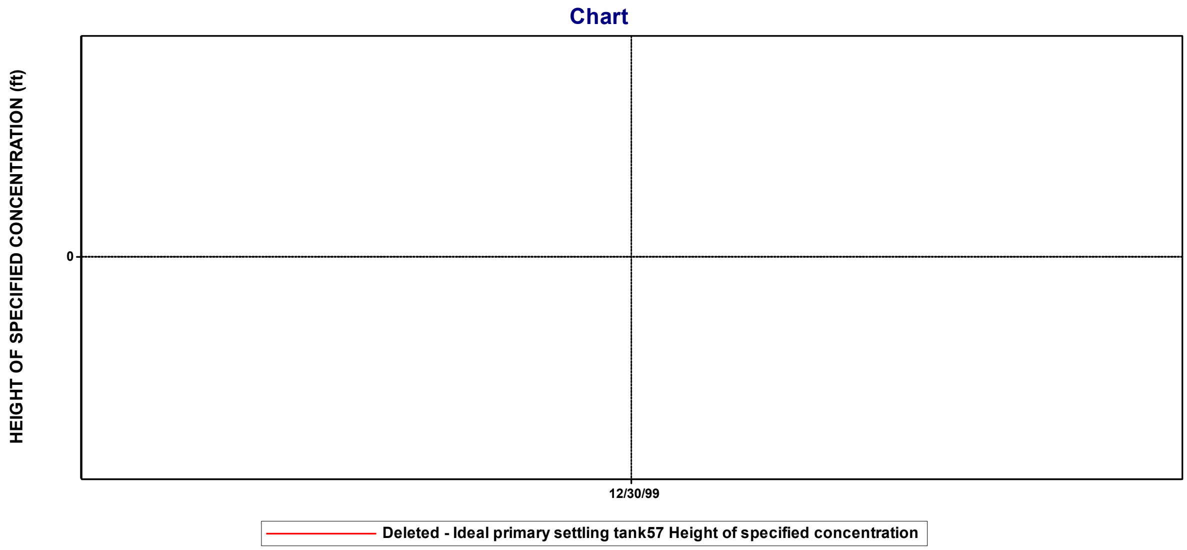

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BioWin user and configuration data

Project details

Project name: Unknown Project ref.: BW1

Plant name: Unknown User name: Jason.Flowers

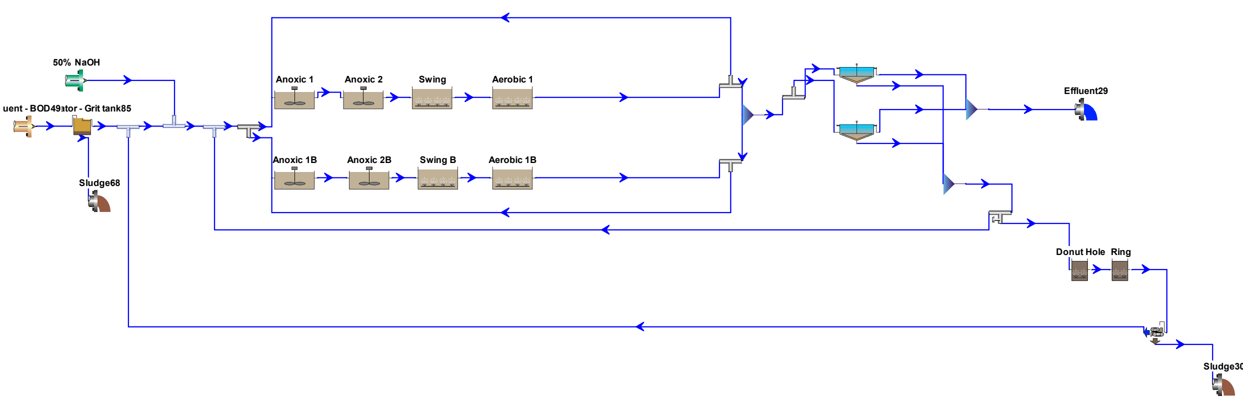
Created: 5/18/2018 Saved: 9/11/2020

Steady state solution

Target SRT: 5.00 days SRT #0: 5.03 days

Temperature: 22.0°C

Flowsheet



Configuration information for all Digester - Aerobic units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Donut Hole	0.0900	802.0834	15.000	182
Ring	0.1800	1604.1668	15.000	363

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Donut Hole	2.0
Ring	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^ 0.25 + k2	k2 in C = k1(PC)^ 0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	Diffuser mounting height	Min. air flow rate per diffuser ft3/min (20C, 1 atm)	Max. air flow rate per diffuser ft3/min (20C, 1 atm)	'A' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2	'B' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2	'C' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2
Donut Hole	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Ring	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0

Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Anoxic 1	0.0377	278.7476	18.080	Un-aerated
Anoxic 2	0.0377	278.7476	18.080	Un-aerated

Swing	0.0377	278.7476	18.080	63
Aerobic 1	0.2574	1903.1735	18.080	431
Anoxic 1B	0.0377	278.7476	18.080	Un-aerated
Anoxic 2B	0.0377	278.7476	18.080	Un-aerated
Swing B	0.0377	278.7476	18.080	63
Aerobic 1B	0.2574	1903.1735	18.080	431

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Anoxic 1	0
Anoxic 2	0
Swing	2.0
Aerobic 1	2.0
Anoxic 1B	0
Anoxic 2B	0
Swing B	2.0
Aerobic 1B	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^ 0.25 + k2	k2 in C = k1(PC)^ 0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	Diffuser mountin g height	Min. air flow rate per diffuser ft3/min (20C, 1 atm)	Max. air flow rate per diffuser ft3/min (20C, 1 atm)	'A' in diffuser pressure drop = A + B*(Qa/Di ff) + C*(Qa/Di ff)^2	'B' in diffuser pressure drop = A + B*(Qa/Di ff) + C*(Qa/Di ff)^2	'C' in diffuser pressure drop = A + B*(Qa/Di ff) + C*(Qa/Di ff)^2
Anoxic 1	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Anoxic 2	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Swing	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Aerobic 1	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0

Anoxic 1B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Anoxic 2B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Swing B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Aerobic 1B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0

Configuration information for all Influent - BOD units

Operating data Average (flow/time weighted as required)

Element name	Influent - BOD49
Flow	1.54
BOD - Total Carbonaceous mgBOD/L	350.00
Volatile suspended solids mg/L	302.00
Total suspended solids mg/L	338.00
N - Total Kjeldahl Nitrogen mgN/L	58.50
P - Total P mgP/L	5.10
S - Total S mgS/L	0
N - Nitrate mgN/L	0
pH	7.10
Alkalinity mmol/L	4.00
Metal soluble - Calcium mg/L	11.10
Metal soluble - Magnesium mg/L	3.20
Gas - Dissolved oxygen mg/L	0

Element name	Influent - BOD49
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1410
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1418
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.6770
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0650

Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300
Fcel - Cellulose fraction of unbiodegradable particulate [gCOD/gCOD]	0.5000
Fna - Ammonia [gNH3-N/gTKN]	0.7353
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0700
Fpo4 - Phosphate [gPO4-P/gTP]	0.4717
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0220
Fsr - Reduced sulfur [H2S] [gS/gS]	0
FZbh - Ordinary heterotrophic COD fraction [gCOD/g of total COD]	0.0200
FZbm - Methylotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZao - Ammonia oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZno - Nitrite oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZaao - Anaerobic ammonia oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZppa - Phosphorus accumulating COD fraction [gCOD/g of total COD]	1.000E-4
FZpa - Propionic acetogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZam - Acetoclastic methanogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZhm - Hydrogenotrophic methanogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZso - Sulfur oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZsrpa - Sulfur reducing propionic acetogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZsra - Sulfur reducing acetotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZsrh - Sulfur reducing hydrogenotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Clarifier - Model units

Physical data

Element name	Volume[Mil. Gal]	Area[ft2]	Depth[ft]	Number of layers	Top feed layer	Feed Layers
Model clarifier5	0.2570	2290.0000	15.000	10	6	1
Model clarifier70	0.2570	2290.0000	15.000	10	6	1

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Model clarifier5	Flow paced	50.00 %
Model clarifier70	Flow paced	50.00 %

Element name	Average Temperature	Reactive
Model clarifier5	Uses global setting	No
Model clarifier70	Uses global setting	No

Configuration information for all Separator - Grit tank units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Separator - Grit tank85	4.000E-3	89.1204	6.000

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Separator - Grit tank85	Flowrate [Under]	0.0002642

Element name	Percent removal	Blanket fraction
Separator - Grit tank85	65.00	0.10

Configuration information for all Separator - Dewatering unit units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Separator - Dewatering unit83	Fraction	0.03

Element name	Percent removal
Separator - Dewatering unit83	90.00

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Splitter11	Flow paced	100.00 %
Splitter12	Flow paced	100.00 %
Splitter13	Fraction	0.50
Splitter40	Flowrate [Side]	0.0740999999259
Splitter32	Fraction	0.50

Configuration information for all Influent - State variable units

Operating data Average (flow/time weighted as required)

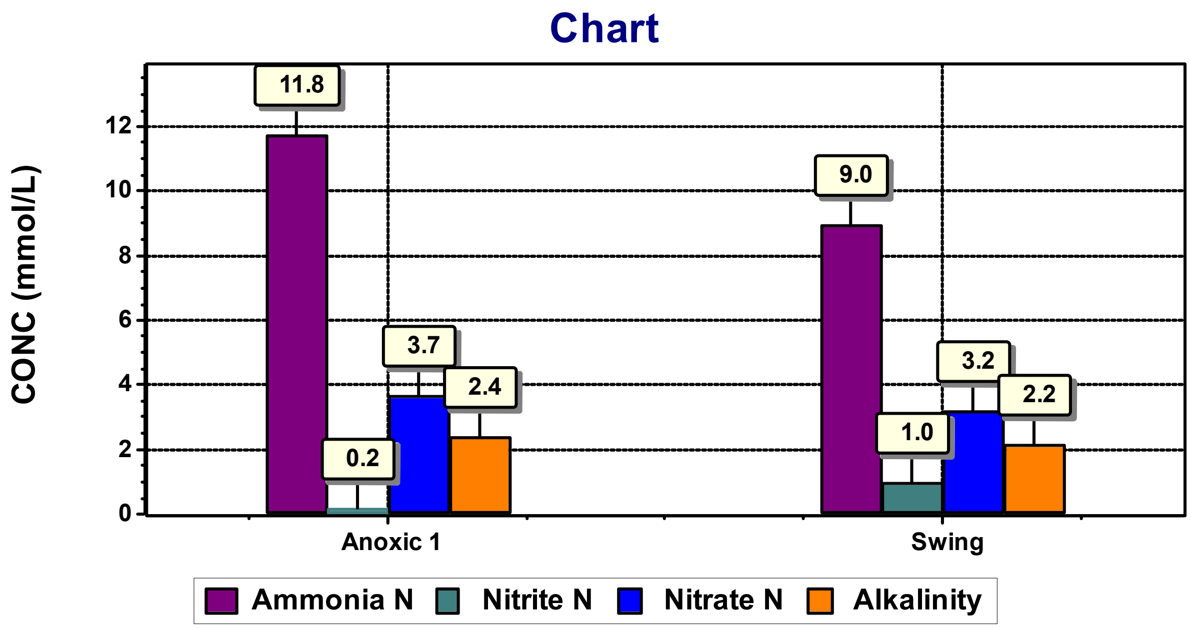
Element name	50% NaOH
Biomass - Ordinary heterotrophic [mgCOD/L]	0
Biomass - Methylotrophic [mgCOD/L]	0
Biomass - Ammonia oxidizing [mgCOD/L]	0
Biomass - Nitrite oxidizing [mgCOD/L]	0
Biomass - Anaerobic ammonia oxidizing [mgCOD/L]	0
Biomass - Phosphorus accumulating [mgCOD/L]	0
Biomass - Propionic acetogenic [mgCOD/L]	0
Biomass - Acetoclastic methanogenic [mgCOD/L]	0
Biomass - Hydrogenotrophic methanogenic [mgCOD/L]	0
Biomass - Endogenous products [mgCOD/L]	0
CODp - Slowly degradable particulate [mgCOD/L]	0
CODp - Slowly degradable colloidal [mgCOD/L]	0
CODp - Degradable external organics [mgCOD/L]	0
CODp - Undegradable non-cellulose [mgCOD/L]	0
CODp - Undegradable cellulose [mgCOD/L]	0
N - Particulate degradable organic [mgN/L]	0
P - Particulate degradable organic [mgP/L]	0
N - Particulate degradable external organics [mgN/L]	0
P - Particulate degradable external organics [mgP/L]	0
N - Particulate undegradable [mgN/L]	0
P - Particulate undegradable [mgP/L]	0
CODp - Stored PHA [mgCOD/L]	0
P - Releasable stored polyP [mgP/L]	0
P - Unreleasable stored polyP [mgP/L]	0
CODs - Complex readily degradable [mgCOD/L]	0
CODs - Acetate [mgCOD/L]	0
CODs - Propionate [mgCOD/L]	0
CODs - Methanol [mgCOD/L]	0
Gas - Dissolved hydrogen [mgCOD/L]	0
Gas - Dissolved methane [mg/L]	0
N - Ammonia [mgN/L]	0
N - Soluble degradable organic [mgN/L]	0
Gas - Dissolved nitrous oxide [mgN/L]	0

N - Nitrite [mgN/L]	0
N - Nitrate [mgN/L]	0
Gas - Dissolved nitrogen [mgN/L]	0
P - Soluble phosphate [mgP/L]	0
CODs - Undegradable [mgCOD/L]	0
N - Soluble undegradable organic [mgN/L]	0
Influent inorganic suspended solids [mgISS/L]	0
Precipitate - Struvite [mgISS/L]	0
Precipitate - Brushite [mgISS/L]	0
Precipitate - Hydroxy - apatite [mgISS/L]	0
Precipitate - Vivianite [mgISS/L]	0
HFO - High surface [mg/L]	0
HFO - Low surface [mg/L]	0
HFO - High with H2PO4- adsorbed [mg/L]	0
HFO - Low with H2PO4- adsorbed [mg/L]	0
HFO - Aged [mg/L]	0
HFO - Low with H+ adsorbed [mg/L]	0
HFO - High with H+ adsorbed [mg/L]	0
HAO - High surface [mg/L]	0
HAO - Low surface [mg/L]	0
HAO - High with H2PO4- adsorbed [mg/L]	0
HAO - Low with H2PO4- adsorbed [mg/L]	0
HAO - Aged [mg/L]	0
P - Bound on aged HMO [mgP/L]	0
Metal soluble - Magnesium [mg/L]	0
Metal soluble - Calcium [mg/L]	0
Metal soluble - Ferric [mg/L]	0
Metal soluble - Ferrous [mg/L]	0
Metal soluble - Aluminum [mg/L]	0
Other Cations (strong bases) [meq/L]	12500.00
Other Anions (strong acids) [meq/L]	0
Gas - Dissolved total CO2 [mmol/L]	0
User defined - UD1 [mg/L]	0
User defined - UD2 [mg/L]	0
User defined - UD3 [mgVSS/L]	0

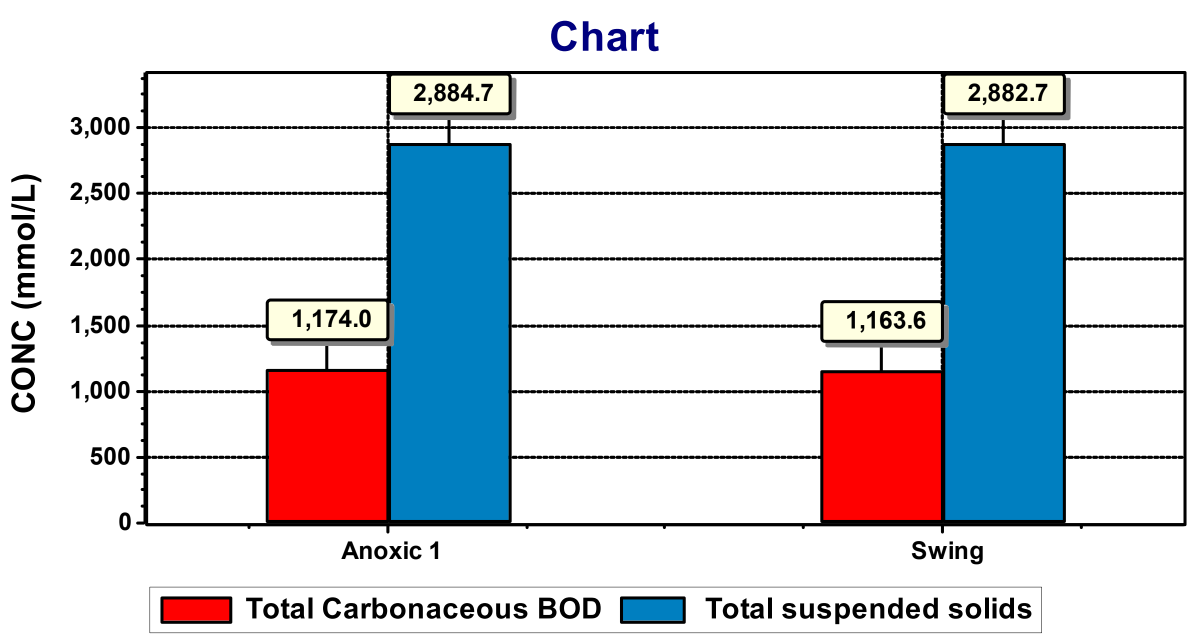
User defined - UD4 [mgISS/L]	0
Biomass - Sulfur oxidizing [mgCOD/L]	0
Biomass - Sulfur reducing propionic acetogenic [mgCOD/L]	0
Biomass - Sulfur reducing acetotrophic [mgCOD/L]	0
Biomass - Sulfur reducing hydrogenotrophic [mgCOD/L]	0
Gas - Dissolved total sulfides [mgS/L]	0
S - Soluble sulfate [mgS/L]	0
S - Particulate elemental sulfur [mgS/L]	0
Precipitate - Ferrous sulfide [mgISS/L]	0
CODp - Adsorbed hydrocarbon [mgCOD/L]	0
CODs - Degradable volatile ind. #1 [mgCOD/L]	0
CODs - Degradable volatile ind. #2 [mgCOD/L]	0
CODs - Degradable volatile ind. #3 [mgCOD/L]	0
CODs - Soluble hydrocarbon [mgCOD/L]	0
Gas - Dissolved oxygen [mg/L]	0
Flow	0.0001

BioWin Album

Album page - Nitrogen species

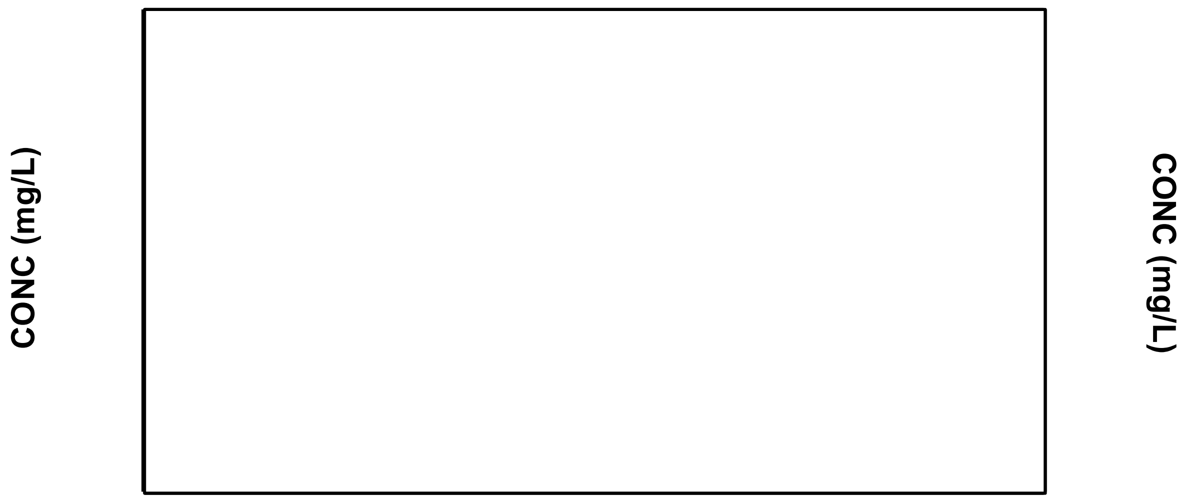


Album page - BOD_TSS



Album page - Page 3

Chart



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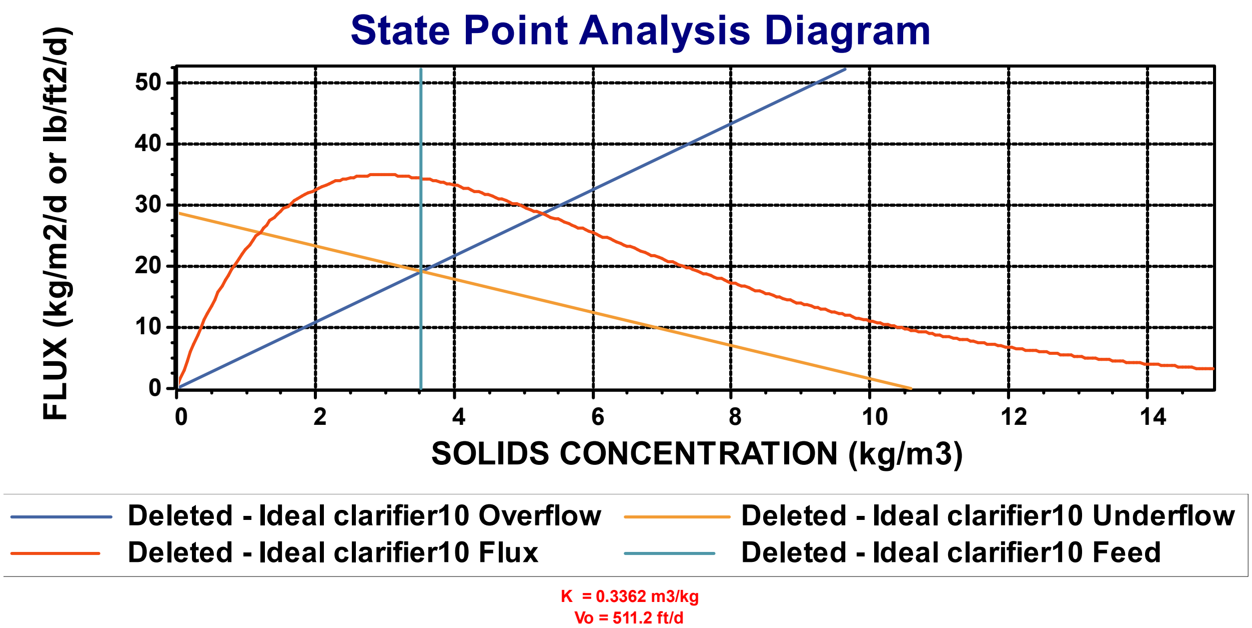
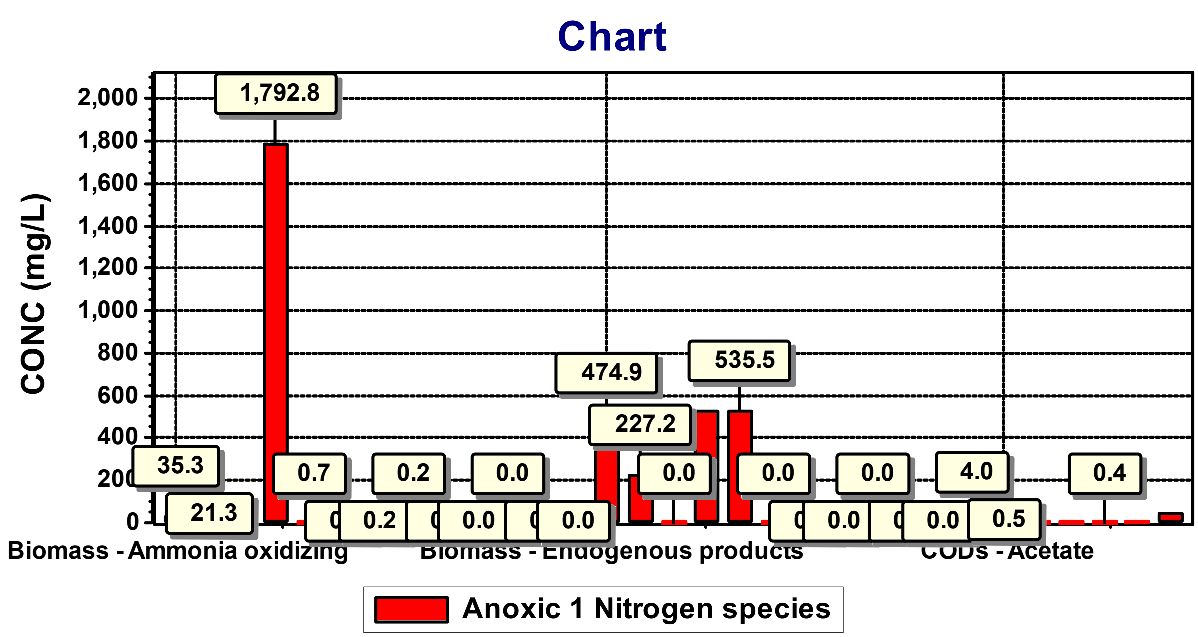
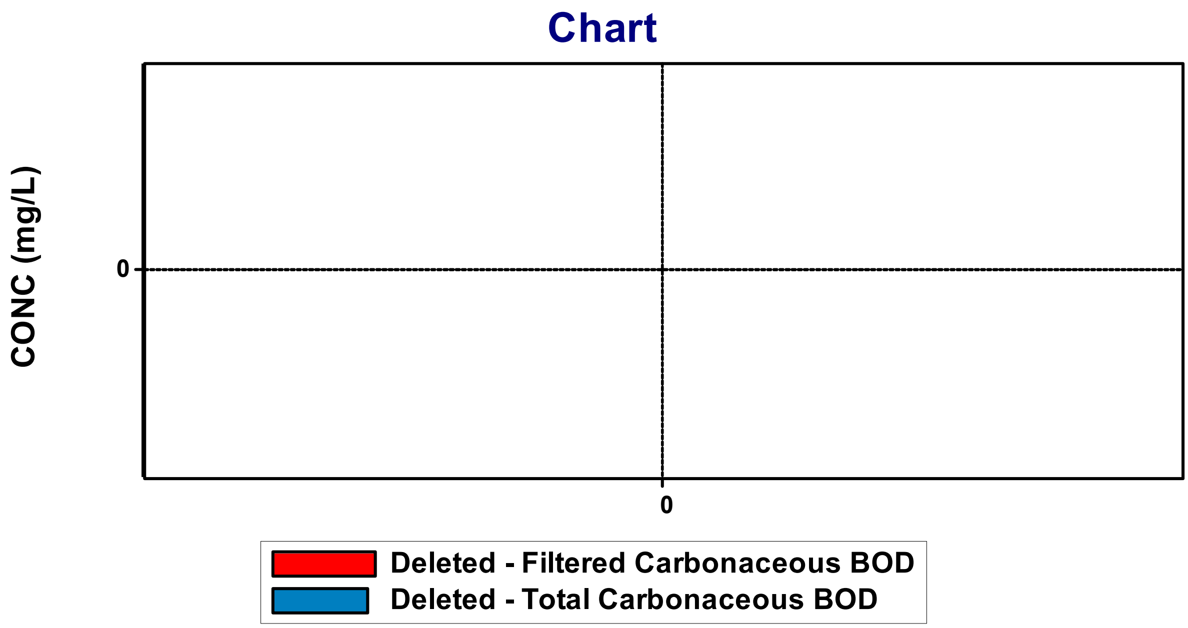
Album page - Page 5



Album page - Page 6



Album page - Page 7



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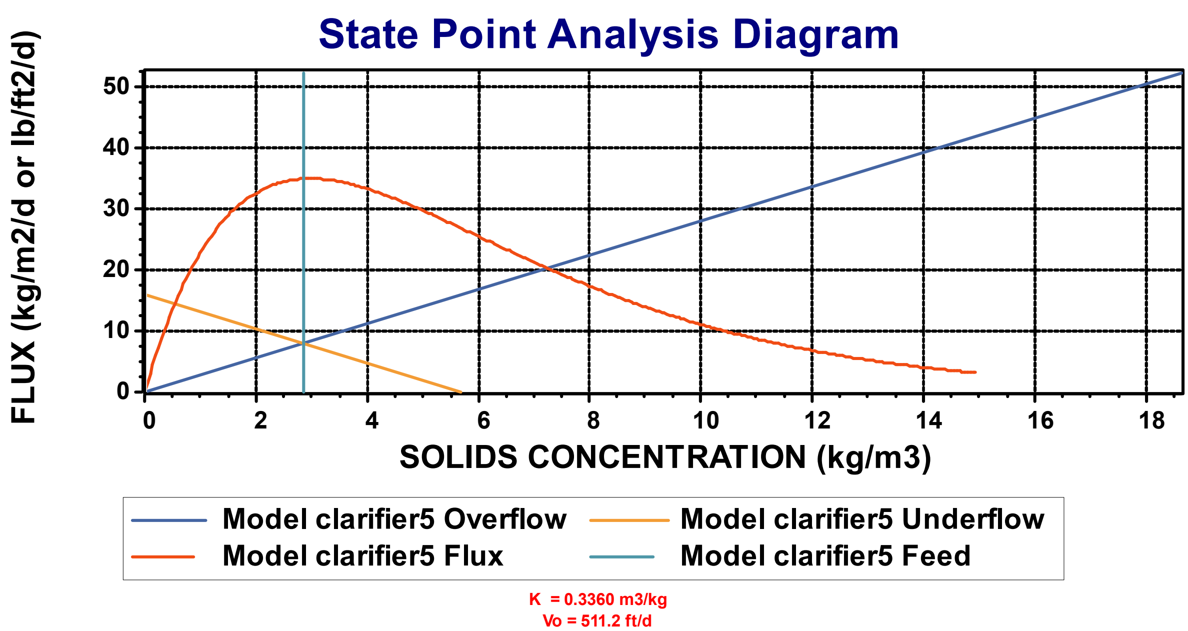
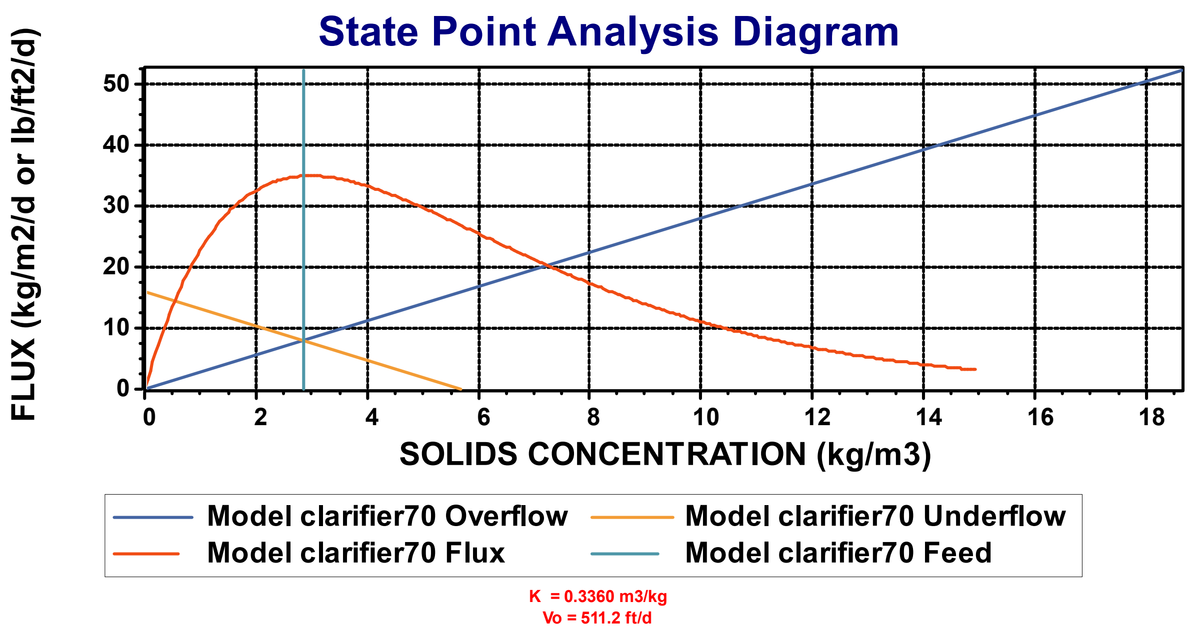
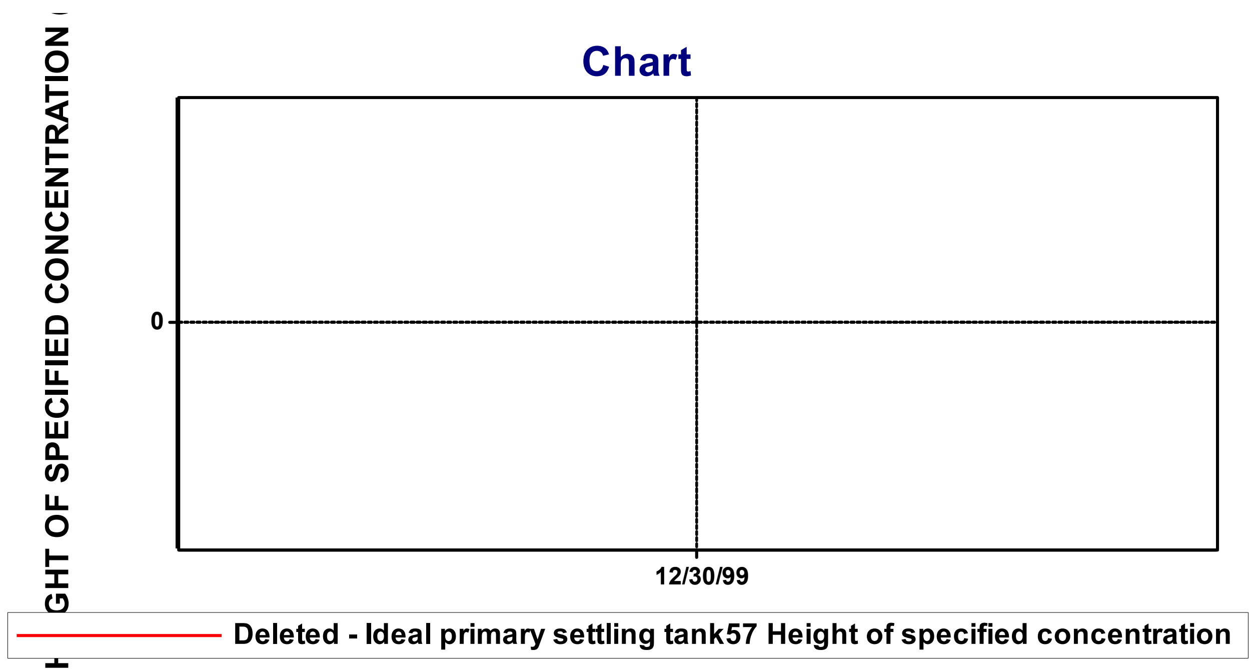


Album page - Page 9



Album page - Page 10



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Album page - Page 12

Elements	Liquid volume [Mil. Gal]
Anoxic 1	0.04
Anoxic 2	0.04
Swing	0.04
Aerobic 1	0.26
Anoxic 1B	0.04
Anoxic 2B	0.04
Swing B	0.04
Aerobic 1B	0.26

Album page - Page 13

Elements	Air flow rate [ft3/min (20C, 1 atm)]
Anoxic 1	0
Anoxic 2	0
Swing	333.95
Aerobic 1	1136.32
Anoxic 1B	0
Anoxic 2B	0
Swing B	333.95
Aerobic 1B	1136.32

Album page - Existing Plant SUmmary

Elements	Flow [mgd]	BOD - Total Carbonaceous [mg/L]	COD - Filtered [mg/L]	Total suspended solids [mg/L]	Volatile suspended solids [mg/L]	pH []	Alkalinity [mmol/L]	N - Total Kjeldahl Nitrogen [mg N/L]	N - Ammonia [mg N/L]	N - Nitrite [mg N/L]	N - Nitrate [mg N/L]	Air flow rate [ft3/min (20 C, 1 atm)]	OTR [lb/hr]	OUR - Total [mg O/L/hr]	SOTR [lb/hr]	Alpha [[]]	Element HRT [hours]
Influent - BOD49	1.54	349.96	302.19	338.00	302.00	7.10	4.00	58.50	43.02	0	0	-----	-----	-----	-----	-----	-----
Anoxic 1	3.08	1174.03	62.40	2884.73	2558.21	6.81	2.40	220.56	11.76	0.18	3.70	0	0	0	0	0.50	0.29
Anoxic 2	3.08	1169.92	51.87	2888.38	2561.71	6.84	2.56	220.56	11.92	0.13	1.79	0	0	0	0	0.50	0.29
Swing	3.08	1163.62	50.37	2882.68	2555.43	6.67	2.19	218.23	8.97	0.97	3.21	333.95	22.93	66.08	114.93	0.30	0.29
Aerobic 1	3.08	1125.31	49.16	2844.28	2514.95	6.34	1.10	210.82	0.59	0.31	10.85	1136.32	98.42	45.82	422.80	0.35	2.01
Model clarifier 5	0.77	3.64	49.16	6.23	5.51	6.34	1.10	2.80	0.59	0.31	10.85	-----	-----	-----	-----	-----	4.01
Model clarifier 5 (U)	0.77	2245.23	49.16	5677.92	5020.50	6.34	1.10	418.51	0.59	0.31	10.85	-----	-----	-----	-----	-----	-----
Model clarifier 70	0.77	3.64	49.16	6.23	5.51	6.34	1.10	2.80	0.59	0.31	10.85	-----	-----	-----	-----	-----	4.01
Model clarifier 70 (U)	0.77	2245.23	49.16	5677.92	5020.50	6.34	1.10	418.51	0.59	0.31	10.85	-----	-----	-----	-----	-----	-----
Effluent29	1.54	3.64	49.16	6.23	5.51	6.34	1.10	2.80	0.59	0.31	10.85	-----	-----	-----	-----	-----	-----
Donut	0.07	1715.88	48.48	5094.69	4486.24	4.62	-0.01	384.18	12.68	0.83	39.10	213.41	23.18	30.86	70.26	0.50	29.15

Hole																	
Ring	0.07	1086.60	48.53	4393.51	3857.01	4.44	-0.03	348.61	39.45	0.67	68.31	229.60	26.73	17.80	81.02	0.50	58.30

Album page - New Plant Summary

Elements	BOD - Total Carbonaceous [mg/L]	COD - Filtered [mg/L]	Total suspended solids [mg/L]	Volatile suspended solids [mg/L]	pH []	Alkalinity [mmol/L]	N - Total Kjeldahl Nitrogen [mgN/L]	N - Ammonia [mgN/L]	N - Nitrite [mgN/L]	N - Nitrate [mgN/L]	Air flow rate [ft3/min (20C, 1 atm)]	OTR [lb/hr]	OUR - Total [mgO/L/hr]	SOTR [lb/hr]
Influent - BOD 49	349.96	302.19	338.00	302.00	7.10	4.00	58.50	43.02	0	0	-----	-----	-----	-----
Anoxic 1B	1174.03	62.40	2884.73	2558.21	6.81	2.40	220.56	11.76	0.18	3.70	0	0	0	0
Anoxic 2B	1169.92	51.87	2888.38	2561.71	6.84	2.56	220.56	11.92	0.13	1.79	0	0	0	0
Swing B	1163.62	50.37	2882.68	2555.43	6.67	2.19	218.23	8.97	0.97	3.21	333.95	22.93	66.08	114.93
Aerobic 1B	1125.31	49.16	2844.28	2514.95	6.34	1.10	210.82	0.59	0.31	10.85	1136.32	98.42	45.82	422.80
Model clarifier5	3.64	49.16	6.23	5.51	6.34	1.10	2.80	0.59	0.31	10.85	-----	-----	-----	-----
Model clarifier5 (U)	2245.23	49.16	5677.92	5020.50	6.34	1.10	418.51	0.59	0.31	10.85	-----	-----	-----	-----
Model clarifier70	3.64	49.16	6.23	5.51	6.34	1.10	2.80	0.59	0.31	10.85	-----	-----	-----	-----
Model clarifier70 (U)	2245.23	49.16	5677.92	5020.50	6.34	1.10	418.51	0.59	0.31	10.85	-----	-----	-----	-----

Effluent29	3.64	49.16	6.23	5.51	6.34	1.10	2.80	0.59	0.31	10.85	-----	-----	-----	-----

Global Parameters

Common

Name	Default	Value	
Hydrolysis rate [1/d]	2.1000	2.1000	1.0290
Hydrolysis half sat. [-]	0.0600	0.0600	1.0000
External organics hydrolysis rate [1/d]	2.1000	2.1000	1.0290
External organics hydrolysis half sat. [-]	0.0600	0.0600	1.0000
Anoxic hydrolysis factor [-]	0.2800	0.2800	1.0000
Anaerobic hydrolysis factor (AS) [-]	0.0400	0.0400	1.0000
Anaerobic hydrolysis factor (AD) [-]	0.5000	0.5000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.1500	0.1500	1.0290
Ammonification rate [L/(mgCOD d)]	0.0800	0.0800	1.0290
Assimilative nitrate/nitrite reduction rate [1/d]	0.5000	0.5000	1.0000
Endogenous products decay rate [1/d]	0	0	1.0000

Ammonia oxidizing

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9000	0.9000	1.0720
Substrate (NH4) half sat. [mgN/L]	0.7000	0.7000	1.0000
Byproduct NH4 logistic slope [-]	50.0000	50.0000	1.0000
Byproduct NH4 inflection point [mgN/L]	1.4000	1.4000	1.0000
Denite DO half sat. [mg/L]	0.1000	0.1000	1.0000
Denite HNO2 half sat. [mgN/L]	5.000E-6	5.000E-6	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290

KiHNO2 [mmol/L]	5.000E-3	5.000E-3	1.0000

Nitrite oxidizing

Name	Default	Value	
Max. spec. growth rate [1/d]	0.7000	0.7000	1.0600
Substrate (NO2) half sat. [mgN/L]	0.1000	0.1000	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiNH3 [mmol/L]	0.0750	0.0750	1.0000

Name	Default	Value	
Max. spec. growth rate [1/d]	0.2000	0.2000	1.1000
Substrate (NH4) half sat. [mgN/L]	2.0000	2.0000	1.0000
Substrate (NO2) half sat. [mgN/L]	1.0000	1.0000	1.0000
Aerobic decay rate [1/d]	0.0190	0.0190	1.0290
Anoxic/anaerobic decay rate [1/d]	9.500E-3	9.500E-3	1.0290
Ki Nitrite [mgN/L]	1000.0000	1000.0000	1.0000
Nitrite sensitivity constant [L / (d mgN)]	0.0160	0.0160	1.0000

Ordinary heterotrophic

Name	Default	Value	
Max. spec. growth rate [1/d]	3.2000	3.2000	1.0290
Substrate half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Anoxic growth factor [-]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000

Aerobic decay rate [1/d]	0.6200	0.6200	1.0290
Anoxic decay rate [1/d]	0.2330	0.2330	1.0290
Anaerobic decay rate [1/d]	0.1310	0.1310	1.0290
Fermentation rate [1/d]	1.6000	1.6000	1.0290
Fermentation half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Fermentation growth factor (AS) [-]	0.2500	0.2500	1.0000
Free nitrous acid inhibition [mol/L]	1.000E-7	1.000E-7	1.0000

Heterotrophic on industrial COD

Name	Default	Value	
Maximum specific growth rate on Ind #1 COD [1/d]	4.3000	4.3000	1.0290
Substrate (Ind #1) half sat. [mgCOD/L]	1.0000	1.0000	1.0000
Inhibition coefficient for Ind #1 [mgCOD/L]	60.0000	60.0000	1.0000
Anaerobic growth factor for Ind #1 [mgCOD/L]	0.0500	0.0500	1.0000
Maximum specific growth rate on Ind #2 COD [1/d]	1.5000	1.5000	1.0290
Substrate (Ind #2) half sat. [mgCOD/L]	30.0000	30.0000	1.0000
Inhibition coefficient for Ind #2 [mgCOD/L]	3000.0000	3000.0000	1.0000
Anaerobic growth factor for Ind #2 [mgCOD/L]	0.0500	0.0500	1.0000
Maximum specific growth rate on Ind #3 COD [1/d]	4.3000	4.3000	1.0290
Substrate (Ind #3) half sat. [mgCOD/L]	1.0000	1.0000	1.0000
Inhibition coefficient for Ind #3 COD [mgCOD/L]	60.0000	60.0000	1.0000
Anaerobic growth factor for Ind #3 [mgCOD/L]	0.0500	0.0500	1.0000
Maximum specific growth rate on adsorbed hydrocarbon COD [1/d]	2.0000	2.0000	1.0290
Substrate (adsorbed hydrocarbon) half sat. [-]	0.1500	0.1500	1.0000
Anaerobic growth factor for adsorbed hydrocarbons [mgCOD/L]	0.0100	0.0100	1.0000
Adsorption rate of soluble hydrocarbons [l/(mgCOD d)]	0.2000	0.2000	1.0000

Methylotrophic

Name	Default	Value

Max. spec. growth rate [1/d]	1.3000	1.3000	1.0720
Methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.0400	0.0400	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0300	0.0300	1.0290
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

Phosphorus accumulating

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9500	0.9500	1.0000
Max. spec. growth rate, P-limited [1/d]	0.4200	0.4200	1.0000
Substrate half sat. [mgCOD(PHB)/mgCOD(Zbp)]	0.1000	0.1000	1.0000
Substrate half sat., P-limited [mgCOD(PHB)/mgCOD(Zbp)]	0.0500	0.0500	1.0000
Magnesium half sat. [mgMg/L]	0.1000	0.1000	1.0000
Cation half sat. [mmol/L]	0.1000	0.1000	1.0000
Calcium half sat. [mgCa/L]	0.1000	0.1000	1.0000
Aerobic/anoxic decay rate [1/d]	0.1000	0.1000	1.0000
Aerobic/anoxic maintenance rate [1/d]	0	0	1.0000
Anaerobic decay rate [1/d]	0.0400	0.0400	1.0000
Anaerobic maintenance rate [1/d]	0	0	1.0000
Sequestration rate [1/d]	4.5000	4.5000	1.0000
Anoxic growth factor [-]	0.3300	0.3300	1.0000

Propionic acetogenic

Name	Default	Value	
Max. spec. growth rate [1/d]	0.2500	0.2500	1.0290
Substrate half sat. [mgCOD/L]	10.0000	10.0000	1.0000
Acetate inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Anaerobic decay rate [1/d]	0.0500	0.0500	1.0290

Aerobic/anoxic decay rate [1/d]	0.5200	0.5200	1.0290

Methanogenic

Name	Default	Value	
Acetoclastic max. spec. growth rate [1/d]	0.3000	0.3000	1.0290
H2-utilizing max. spec. growth rate [1/d]	1.4000	1.4000	1.0290
Acetoclastic substrate half sat. [mgCOD/L]	100.0000	100.0000	1.0000
Acetoclastic methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
H2-utilizing CO2 half sat. [mmol/L]	0.1000	0.1000	1.0000
H2-utilizing substrate half sat. [mgCOD/L]	1.0000	1.0000	1.0000
H2-utilizing methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Acetoclastic propionic inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Acetoclastic anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
Acetoclastic aerobic/anoxic decay rate [1/d]	0.6000	0.6000	1.0290
H2-utilizing anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
H2-utilizing aerobic/anoxic decay rate [1/d]	2.8000	2.8000	1.0290

Sulfur oxidizing

Name	Default	Value	
Maximum specific growth rate (sulfide) [1/d]	0.7500	0.7500	1.0290
Maximum specific growth rate (sulfur) [1/d]	0.1000	0.1000	1.0290
Substrate (H2S) half sat. [mgS/L]	1.0000	1.0000	1.0000
Substrate (sulfur) half sat. [mgS/L]	1.0000	1.0000	1.0000
Anoxic growth factor [-]	0.5000	0.5000	1.0000
Decay rate [1/d]	0.0400	0.0400	1.0290

Sulfur reducing

Name	Default	Value	
Propionic max. spec. growth rate [1/d]	0.5830	0.5830	1.0350
Propionic acid half sat. [mgCOD/L]	295.0000	295.0000	1.0000
Hydrogen sulfide inhibition coefficient [mgS/L]	185.0000	185.0000	1.0000
Sulfate (SO4=) half sat. [mgS/L]	2.4700	2.4700	1.0000
Decay rate [1/d]	0.0185	0.0185	1.0350
Acetotrophic max. spec. growth rate [1/d]	0.6120	0.6120	1.0350
Acetic acid half sat. [mgCOD/L]	24.0000	24.0000	1.0000
Hydrogen sulfide inhibition coefficient [mgS/L]	164.0000	164.0000	1.0000
Sulfate (SO4=) half sat. [mgS/L]	6.4100	6.4100	1.0000
Decay rate [1/d]	0.0275	0.0275	1.0350
Hydrogenotrophic max. spec. growth rate with SO4= [1/d]	2.8000	2.8000	1.0350
Hydrogenotrophic max. spec. growth rate with S [1/d]	0.1000	0.1000	1.0350
Hydrogen half sat. [mgCOD/L]	0.0700	0.0700	1.0000
Hydrogen sulfide inhibition coefficient [mgS/L]	550.0000	550.0000	1.0000
Sulfate (SO4=) half sat. [mgS/L]	6.4100	6.4100	1.0000
Sulfur (S) half sat. [mgS/L]	50.0000	50.0000	1.0000
Decay rate [1/d]	0.0600	0.0600	1.0350

pH

Name	Default	Value
Ordinary heterotrophic low pH limit [-]	4.0000	4.0000
Ordinary heterotrophic high pH limit [-]	10.0000	10.0000
Methylotrophic low pH limit [-]	4.0000	4.0000
Methylotrophic high pH limit [-]	10.0000	10.0000
Autotrophic low pH limit [-]	5.5000	5.5000
Autotrophic high pH limit [-]	9.5000	9.5000
Phosphorus accumulating low pH limit [-]	4.0000	4.0000
Phosphorus accumulating high pH limit [-]	10.0000	10.0000
Ordinary heterotrophic low pH limit (anaerobic) [-]	5.5000	5.5000
Ordinary heterotrophic high pH limit (anaerobic) [-]	8.5000	8.5000

Propionic acetogenic low pH limit [-]	4.0000	4.0000
Propionic acetogenic high pH limit [-]	10.0000	10.0000
Acetoclastic methanogenic low pH limit [-]	5.0000	5.0000
Acetoclastic methanogenic high pH limit [-]	9.0000	9.0000
H2-utilizing methanogenic low pH limit [-]	5.0000	5.0000
H2-utilizing methanogenic high pH limit [-]	9.0000	9.0000

Switches

Name	Default	Value
Ordinary heterotrophic DO half sat. [mgO2/L]	0.1500	0.0500
Phosphorus accumulating DO half sat. [mgO2/L]	0.0500	0.0500
Anoxic/anaerobic NOx half sat. [mgN/L]	0.1500	0.1500
Ammonia oxidizing DO half sat. [mgO2/L]	0.2500	0.2500
Nitrite oxidizing DO half sat. [mgO2/L]	0.5000	0.5000
Anaerobic ammonia oxidizing DO half sat. [mgO2/L]	0.0100	0.0100
Sulfur oxidizing sulfate pathway DO half sat. [mgO2/L]	0.2500	0.2500
Sulfur oxidizing sulfur pathway DO half sat. [mgO2/L]	0.0500	0.0500
Anoxic NO3(->NO2) half sat. [mgN/L]	0.1000	0.1000
Anoxic NO3(->N2) half sat. [mgN/L]	0.0500	0.0500
Anoxic NO2(->N2) half sat. (mgN/L)	0.0100	0.0100
NH3 nutrient half sat. [mgN/L]	5.000E-3	5.000E-3
PolyP half sat. [mgP/mgCOD]	0.0100	0.0100
VFA sequestration half sat. [mgCOD/L]	5.0000	5.0000
P uptake half sat. [mgP/L]	0.1500	0.1500
P nutrient half sat. [mgP/L]	1.000E-3	1.000E-3
Autotrophic CO2 half sat. [mmol/L]	0.1000	0.1000
H2 low/high half sat. [mgCOD/L]	1.0000	1.0000
Propionic acetogenic H2 inhibition [mgCOD/L]	5.0000	5.0000
Synthesis anion/cation half sat. [meq/L]	0.0100	0.0100

Common

Name	Default	Value
Biomass/Endog Ca content (gCa/gCOD)	3.912E-3	3.912E-3
Biomass/Endog Mg content (gMg/gCOD)	3.912E-3	3.912E-3
Biomass/Endog other cations content (mol/gCOD)	5.115E-4	5.115E-4
Biomass/Endog other Anions content (mol/gCOD)	1.410E-4	1.410E-4
N in endogenous residue [mgN/mgCOD]	0.0700	0.0700
P in endogenous residue [mgP/mgCOD]	0.0220	0.0220
Ca content of slowly biodegradabe (gCa/gCOD)	3.912E-3	3.912E-3
Mg content of slowly biodegradabe (gMg/gCOD)	3.700E-4	3.700E-4
Endogenous residue COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Particulate substrate COD:VSS ratio [mgCOD/mgVSS]	1.6327	1.4200
Particulate inert COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.4200
Cellulose COD:VSS ratio [mgCOD/mgVSS]	1.4000	1.4000
External organic COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000
Molecular weight of other anions [mg/mmol]	35.5000	35.5000
Molecular weight of other cations [mg/mmol]	39.0983	39.1000

Ammonia oxidizing

Name	Default	Value
Yield [mgCOD/mgN]	0.1500	0.1500
Denite NO2 fraction as TEA [-]	0.5000	0.5000
Byproduct NH4 fraction to N2O [-]	2.500E-3	2.500E-3
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Nitrite oxidizing

Name	Default	Value
Yield [mgCOD/mgN]	0.0900	0.0900
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Anaerobic ammonia oxidizing

Name	Default	Value
Yield [mgCOD/mgN]	0.1140	0.1140
Nitrate production [mgN/mgBiomassCOD]	2.2800	2.2800
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Ordinary heterotrophic

Name	Default	Value
Yield (aerobic) [-]	0.6660	0.6660
Yield (fermentation, low H2) [-]	0.1000	0.1000
Yield (fermentation, high H2) [-]	0.1000	0.1000
H2 yield (fermentation low H2) [-]	0.3500	0.3500
H2 yield (fermentation high H2) [-]	0	0
Propionate yield (fermentation, low H2) [-]	0	0
Propionate yield (fermentation, high H2) [-]	0.7000	0.7000
CO2 yield (fermentation, low H2) [-]	0.7000	0.7000
CO2 yield (fermentation, high H2) [-]	0	0
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220

Endogenous fraction - aerobic [-]	0.0800	0.0800
Endogenous fraction - anoxic [-]	0.1030	0.1030
Endogenous fraction - anaerobic [-]	0.1840	0.1840
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield (anoxic) [-]	0.5400	0.5400
Yield propionic (aerobic) [-]	0.6400	0.6400
Yield propionic (anoxic) [-]	0.4600	0.4600
Yield acetic (aerobic) [-]	0.6000	0.6000
Yield acetic (anoxic) [-]	0.4300	0.4300
Yield methanol (aerobic) [-]	0.5000	0.5000
Adsorp. max. [-]	1.0000	1.0000
Max fraction to N2O at high FNA over nitrate [-]	0.0500	0.0500
Max fraction to N2O at high FNA over nitrite [-]	0.1000	0.1000

Ordinary heterotrophic on industrial COD

Name	Default	Value
Yield Ind #1 COD (Aerobic) [-]	0.5000	0.5000
Yield Ind #1 COD (Anoxic) [-]	0.4000	0.4000
Yield Ind #1 COD (Anaerobic) [-]	0.0400	0.0400
COD:Mole ratio - Ind #1 COD [gCOD/Mol]	224.0000	224.0000
Yield Ind #2 COD (Aerobic) [-]	0.5000	0.5000
Yield Ind #2 COD (Anoxic) [-]	0.4000	0.4000
Yield Ind #2 COD (Anaerobic) [-]	0.0500	0.0500
COD:Mole ratio - Ind #2 COD [gCOD/Mol]	240.0000	240.0000
Yield on Ind #3 COD (Aerobic) [-]	0.5000	0.5000
Yield on Ind #3 COD (Anoxic) [-]	0.4000	0.4000
Yield on Ind #3 COD (Anaerobic) [-]	0.0400	0.0400
COD:Mole ratio - Ind #3 COD [gCOD/Mol]	288.0000	288.0000
Yield enmeshed hydrocarbons (Aerobic) [-]	0.5000	0.5000
Yield enmeshed hydrocarbons (Anoxic) [-]	0.4000	0.4000
Yield enmeshed hydrocarbons (Anaerobic) [-]	0.0400	0.0400
COD:Mole ratio - Hydrocarbon COD [gCOD/Mol]	336.0000	336.0000

Hydrocarbon COD:VSS ratio [mgCOD/mgVSS]	3.2000	3.2000
Max. hydrocarbon adsorp. ratio [-]	1.0000	1.0000
Yield of Ind #1 on Ind #3 COD (Aerobic) [-]	0	0
Yield of Ind #1 on Ind #3 COD (Anoxic) [-]	0	0
Hydrocarbon Yield on Ind #3 COD (Aerobic) [-]	0	0
Hydrocarbon Yield on Ind #3 COD (Anoxic) [-]	0	0

Methylotrophic

Name	Default	Value
Yield (anoxic) [-]	0.4000	0.4000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Max fraction to N2O at high FNA over nitrate [-]	0.1000	0.1000
Max fraction to N2O at high FNA over nitrite [-]	0.1500	0.1500

Phosphorus accumulating

Name	Default	Value
Yield (aerobic) [-]	0.6390	0.6390
Yield (anoxic) [-]	0.5200	0.5200
Aerobic P/PHA uptake [mgP/mgCOD]	0.9300	0.9300
Anoxic P/PHA uptake [mgP/mgCOD]	0.3500	0.3500
Yield of PHA on Ac sequestration [-]	0.8890	0.8890
N in biomass [mgN/mgCOD]	0.0700	0.0700
N in sol. inert [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous part. [-]	0.2500	0.2500
Inert fraction of endogenous sol. [-]	0.2000	0.2000

P/Ac release ratio [mgP/mgCOD]	0.5100	0.5100
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield of low PP [-]	0.9400	0.9400
Mg to P mole ratio in polyphosphate [mmolMg/mmolP]	0.3000	0.3000
Cation to P mole ratio in polyphosphate [meq/mmolP]	0.1500	0.1500
Ca to P mole ratio in polyphosphate [mmolCa/mmolP]	0.0500	0.0500

Propionic acetogenic

Name	Default	Value
Yield [-]	0.1000	0.1000
H2 yield [-]	0.4000	0.4000
CO2 yield [-]	1.0000	1.0000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Methanogenic

Name	Default	Value
Acetoclastic yield [-]	0.1000	0.1000
Acetoclastic yield on methanol[-]	0.1000	0.1000
H2-utilizing yield [-]	0.1000	0.1000
H2-utilizing yield on methanol [-]	0.1000	0.1000
N in acetoclastic biomass [mgN/mgCOD]	0.0700	0.0700
N in H2-utilizing biomass [mgN/mgCOD]	0.0700	0.0700
P in acetoclastic biomass [mgP/mgCOD]	0.0220	0.0220
P in H2-utilizing biomass [mgP/mgCOD]	0.0220	0.0220
Acetoclastic fraction to endog. residue [-]	0.0800	0.0800
H2-utilizing fraction to endog. residue [-]	0.0800	0.0800

Acetoclastic COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
H2-utilizing COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Sulfur oxidizing

Name	Default	Value
Yield (aerobic) [mgCOD/mgS]	0.5000	0.5000
Yield (Anoxic) [mgCOD/mgS]	0.3500	0.3500
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Sulfur reducing

Name	Default	Value
Yield [mgCOD/mg H2 COD]	0.0712	0.0712
Yield [mgCOD/mg Ac COD]	0.0470	0.0470
Yield [mgCOD/mg Pr COD]	0.0384	0.0384
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

General

Name	Default	Value
Tank head loss per metre of length (from flow) [m/m]	2.500E-3	2.500E-3
BOD calculation rate constant for Xsc degradation [/d]	0.5000	0.5000

BOD calculation rate constant for Xsp (and hydrocarbon) degradation [/d]	0.5000	0.5000
BOD calculation rate constant for Xeo degradation [/d]	0.5000	0.5000

Heating fuel/Chemical Costs

Name	Default	Value
Methanol [$/gal]	1.6656	1.6656
Ferric chloride [$/lb Fe]	0.5307	0.5307
Ferric sulfate [$/lb Fe]	0.3583	0.3583
Ferrous chloride [$/lb Fe]	0.2767	0.2767
Ferrous sulfate [$/lb Fe]	1.0750	1.0750
Aluminum sulfate [$/lb Al]	0.7666	0.7666
Aluminum chloride [$/lb Al]	0.8981	0.8981
Poly Aluminum Chloride (PAC) [$/lb Al]	0.5307	0.5307
Natural gas [$/MMBTU]	3.1652	3.1652
Heating oil [$/gal]	1.8927	1.8927
Diesel [$/gal]	2.6498	2.6498
Custom fuel [$/gal]	3.7854	3.7854
Biogas sale price [$/MMBTU]	2.1101	2.1101

Anaerobic digester

Name	Default	Value
Bubble rise velocity (anaerobic digester) [cm/s]	23.9000	23.9000
Bubble Sauter mean diameter (anaerobic digester) [cm]	0.3500	0.3500
Anaerobic digester gas hold-up factor []	1.0000	1.0000

BioWin user and configuration data

Project details

Project name: Unknown Project ref.: BW1

Plant name: Unknown User name: Jason.Flowers

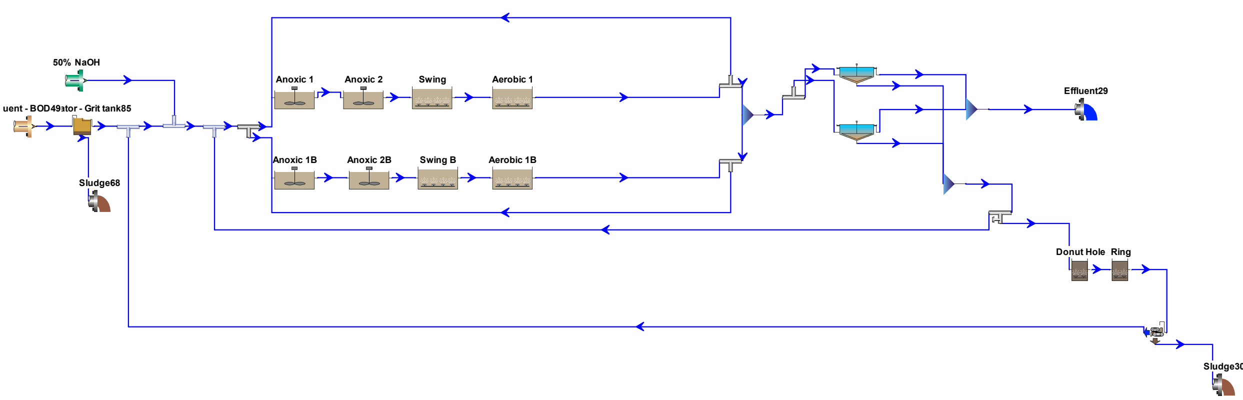
Created: 5/18/2018 Saved: 9/16/2020

Steady state solution

Target SRT: 7.00 days SRT #0: 7.03 days

Temperature: 11.0°C

Flowsheet



Configuration information for all Digester - Aerobic units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Donut Hole	0.0900	802.0834	15.000	182
Ring	0.1800	1604.1668	15.000	363

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Donut Hole	2.0
Ring	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^ 0.25 + k2	k2 in C = k1(PC)^ 0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	Diffuser mounting height	Min. air flow rate per diffuser ft3/min (20C, 1 atm)	Max. air flow rate per diffuser ft3/min (20C, 1 atm)	'A' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2	'B' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2	'C' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2
Donut Hole	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Ring	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0

Configuration information for all Bioreactor units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
Anoxic 1	0.0377	278.7476	18.080	Un-aerated
Anoxic 2	0.0377	278.7476	18.080	Un-aerated

Swing	0.0377	278.7476	18.080	63
Aerobic 1	0.2574	1903.1735	18.080	431
Anoxic 1B	0.0377	278.7476	18.080	Un-aerated
Anoxic 2B	0.0377	278.7476	18.080	Un-aerated
Swing B	0.0377	278.7476	18.080	63
Aerobic 1B	0.2574	1903.1735	18.080	431

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Anoxic 1	0
Anoxic 2	0
Swing	2.0
Aerobic 1	2.0
Anoxic 1B	0
Anoxic 2B	0
Swing B	2.0
Aerobic 1B	2.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^ 0.25 + k2	k2 in C = k1(PC)^ 0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	Diffuser mounting height	Min. air flow rate per diffuser ft3/min (20C, 1 atm)	Max. air flow rate per diffuser ft3/min (20C, 1 atm)	'A' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2	'B' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2	'C' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2
Anoxic 1	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Anoxic 2	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Swing	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Aerobic 1	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0

Anoxic 1B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Anoxic 2B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Swing B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0
Aerobic 1B	1.2400	0.8960	0.8880	0.4413	0.2500	0.2943	5.8858	3.0000	0	0

Configuration information for all Influent - BOD units

Operating data Average (flow/time weighted as required)

Element name	Influent - BOD49
Flow	2.76
BOD - Total Carbonaceous mgBOD/L	179.00
Volatile suspended solids mg/L	188.00
Total suspended solids mg/L	203.00
N - Total Kjeldahl Nitrogen mgN/L	31.00
P - Total P mgP/L	5.30
S - Total S mgS/L	0
N - Nitrate mgN/L	0
pH	7.10
Alkalinity mmol/L	2.00
Metal soluble - Calcium mg/L	11.10
Metal soluble - Magnesium mg/L	3.20
Gas - Dissolved oxygen mg/L	0

Element name	Influent - BOD49
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1410
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1418
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.8753
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0650

Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300
Fcel - Cellulose fraction of unbiodegradable particulate [gCOD/gCOD]	0.5000
Fna - Ammonia [gNH3-N/gTKN]	0.7353
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0700
Fpo4 - Phosphate [gPO4-P/gTP]	0.4717
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0220
Fsr - Reduced sulfur [H2S] [gS/gS]	0
FZbh - Ordinary heterotrophic COD fraction [gCOD/g of total COD]	0.0200
FZbm - Methylotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZao - Ammonia oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZno - Nitrite oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZaao - Anaerobic ammonia oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZppa - Phosphorus accumulating COD fraction [gCOD/g of total COD]	1.000E-4
FZpa - Propionic acetogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZam - Acetoclastic methanogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZhm - Hydrogenotrophic methanogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZso - Sulfur oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZsrpa - Sulfur reducing propionic acetogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZsra - Sulfur reducing acetotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZsrh - Sulfur reducing hydrogenotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Clarifier - Model units

Physical data

Element name	Volume[Mil. Gal]	Area[ft2]	Depth[ft]	Number of layers	Top feed layer	Feed Layers
Model clarifier5	0.2570	2290.0000	15.000	10	6	1
Model clarifier70	0.2570	2290.0000	15.000	10	6	1

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Model clarifier5	Flow paced	50.00 %
Model clarifier70	Flow paced	50.00 %

Element name	Average Temperature	Reactive
Model clarifier5	Uses global setting	No
Model clarifier70	Uses global setting	No

Configuration information for all Separator - Grit tank units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]
Separator - Grit tank85	4.000E-3	89.1204	6.000

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Separator - Grit tank85	Flowrate [Under]	0.0002642

Element name	Percent removal	Blanket fraction
Separator - Grit tank85	65.00	0.10

Configuration information for all Separator - Dewatering unit units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Separator - Dewatering unit83	Fraction	0.03

Element name	Percent removal
Separator - Dewatering unit83	90.00

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Splitter11	Flow paced	100.00 %
Splitter12	Flow paced	100.00 %
Splitter13	Fraction	0.50
Splitter40	Flowrate [Side]	0.0529285713907653
Splitter32	Fraction	0.50

Configuration information for all Influent - State variable units

Operating data Average (flow/time weighted as required)

Element name	50% NaOH
Biomass - Ordinary heterotrophic [mgCOD/L]	0
Biomass - Methylotrophic [mgCOD/L]	0
Biomass - Ammonia oxidizing [mgCOD/L]	0
Biomass - Nitrite oxidizing [mgCOD/L]	0
Biomass - Anaerobic ammonia oxidizing [mgCOD/L]	0
Biomass - Phosphorus accumulating [mgCOD/L]	0
Biomass - Propionic acetogenic [mgCOD/L]	0
Biomass - Acetoclastic methanogenic [mgCOD/L]	0
Biomass - Hydrogenotrophic methanogenic [mgCOD/L]	0
Biomass - Endogenous products [mgCOD/L]	0
CODp - Slowly degradable particulate [mgCOD/L]	0
CODp - Slowly degradable colloidal [mgCOD/L]	0
CODp - Degradable external organics [mgCOD/L]	0
CODp - Undegradable non-cellulose [mgCOD/L]	0
CODp - Undegradable cellulose [mgCOD/L]	0
N - Particulate degradable organic [mgN/L]	0
P - Particulate degradable organic [mgP/L]	0
N - Particulate degradable external organics [mgN/L]	0
P - Particulate degradable external organics [mgP/L]	0
N - Particulate undegradable [mgN/L]	0
P - Particulate undegradable [mgP/L]	0
CODp - Stored PHA [mgCOD/L]	0
P - Releasable stored polyP [mgP/L]	0
P - Unreleasable stored polyP [mgP/L]	0
CODs - Complex readily degradable [mgCOD/L]	0
CODs - Acetate [mgCOD/L]	0
CODs - Propionate [mgCOD/L]	0
CODs - Methanol [mgCOD/L]	0
Gas - Dissolved hydrogen [mgCOD/L]	0
Gas - Dissolved methane [mg/L]	0
N - Ammonia [mgN/L]	0
N - Soluble degradable organic [mgN/L]	0
Gas - Dissolved nitrous oxide [mgN/L]	0

N - Nitrite [mgN/L]	0
N - Nitrate [mgN/L]	0
Gas - Dissolved nitrogen [mgN/L]	0
P - Soluble phosphate [mgP/L]	0
CODs - Undegradable [mgCOD/L]	0
N - Soluble undegradable organic [mgN/L]	0
Influent inorganic suspended solids [mgISS/L]	0
Precipitate - Struvite [mgISS/L]	0
Precipitate - Brushite [mgISS/L]	0
Precipitate - Hydroxy - apatite [mgISS/L]	0
Precipitate - Vivianite [mgISS/L]	0
HFO - High surface [mg/L]	0
HFO - Low surface [mg/L]	0
HFO - High with H2PO4- adsorbed [mg/L]	0
HFO - Low with H2PO4- adsorbed [mg/L]	0
HFO - Aged [mg/L]	0
HFO - Low with H+ adsorbed [mg/L]	0
HFO - High with H+ adsorbed [mg/L]	0
HAO - High surface [mg/L]	0
HAO - Low surface [mg/L]	0
HAO - High with H2PO4- adsorbed [mg/L]	0
HAO - Low with H2PO4- adsorbed [mg/L]	0
HAO - Aged [mg/L]	0
P - Bound on aged HMO [mgP/L]	0
Metal soluble - Magnesium [mg/L]	0
Metal soluble - Calcium [mg/L]	0
Metal soluble - Ferric [mg/L]	0
Metal soluble - Ferrous [mg/L]	0
Metal soluble - Aluminum [mg/L]	0
Other Cations (strong bases) [meq/L]	12500.00
Other Anions (strong acids) [meq/L]	0
Gas - Dissolved total CO2 [mmol/L]	0
User defined - UD1 [mg/L]	0
User defined - UD2 [mg/L]	0
User defined - UD3 [mgVSS/L]	0

User defined - UD4 [mgISS/L]	0
Biomass - Sulfur oxidizing [mgCOD/L]	0
Biomass - Sulfur reducing propionic acetogenic [mgCOD/L]	0
Biomass - Sulfur reducing acetotrophic [mgCOD/L]	0
Biomass - Sulfur reducing hydrogenotrophic [mgCOD/L]	0
Gas - Dissolved total sulfides [mgS/L]	0
S - Soluble sulfate [mgS/L]	0
S - Particulate elemental sulfur [mgS/L]	0
Precipitate - Ferrous sulfide [mgISS/L]	0
CODp - Adsorbed hydrocarbon [mgCOD/L]	0
CODs - Degradable volatile ind. #1 [mgCOD/L]	0
CODs - Degradable volatile ind. #2 [mgCOD/L]	0
CODs - Degradable volatile ind. #3 [mgCOD/L]	0
CODs - Soluble hydrocarbon [mgCOD/L]	0
Gas - Dissolved oxygen [mg/L]	0
Flow	0.0003

BioWin Album

Album page - Nitrogen species