DISCOVERY CLEAN WATER ALLIANCE

Engineering Report for the Ridgefield Treatment Plant Secondary Treatment Process Improvements Project

An Alliance Capital Project delivered by Clark Regional Wastewater District as Administrative Lead for the Discovery Clean Water Alliance

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Prepared for

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Acronyms and Abbreviations

BNR	biological nutrient removal
BOD_5	5-day biochemical oxygen demand
DO	dissolved oxygen
FC	fecal coliform
ft	feet
ft^2	square feet
GMP	good modeling practice
gpd	gallons per day
gpd/ft	gallons per day per foot
GSP	General Sewer Plan
hp	horsepower
lb/d	pounds per day
MCRT	mean cell residence time
mg	milligrams
MG	million gallons
mgd	million gallons per day
mg/L	milligrams per liter
mL	milliliter
mL/g	milliliters per gallon
MLR	mixed liquor recycle
MLSS	mixed liquor suspended solids
MLVSS	mixed liquor volatile suspended solids
NH_3-N	ammonia-nitrogen
NO_2-N	nitrite-nitrogen
NO_3-N	nitrate-nitrogen
NOB	nitrite oxidizing bacteria
NPDES	National Pollutant Discharge Elimination System
ORP	oxidation-reduction potential
PAOs	phosphate accumulating organisms
PO_4-P	orthophosphate-phosphorus
$Pro2D^2$	Professional Process Design & Dynamics
psi	pounds per square inch

RAS	return activated sludge
rpm	revolutions per minute
RTP	Ridgefield Treatment Plant
RTPO	Ridgefield Treatment Plant and Outfall
scfm	standard cubic feet per minute
SEPA	State Environmental Policy Act
STPI	Secondary Treatment Process Improvements
SVI	sludge volume index
TKN	total Kjeldahl nitrogen
TP	total phosphorus
TSS	total suspended solids
VSS	volatile suspended solids
WAS	waste activated sludge

1. Introduction

1.1 Site Description

1.1.1 Discovery Clean Water Alliance

The Discovery Clean Water Alliance (Alliance) legally formed on January 4, 2013. It represents the culmination of several years of evaluation to determine the optimum long-term framework for delivery of regional wastewater transmission and treatment services to the urban growth areas in the central portion of Clark County, Washington. The Alliance serves four Member agencies: City of Battle Ground (Battle Ground), Clark County (County), Clark Regional Wastewater District (District), and the City of Ridgefield (Ridgefield). The Members jointly own and jointly manage regional wastewater assets under Alliance ownership through an interlocal framework established under the State of Washington Joint Municipal Utility Services Act (Revised Code of Washington 39.106).

1.1.2 Owner and Authorized Representative

The Alliance owns the Ridgefield Treatment Plant (RTP) and Clark Regional Wastewater District is the owner of the contributing collection system. The District is responsible for engineering and capital planning, as well as the overall financial and administrative functions of the Alliance. The District is also the Operator of the RTP under contract with the Alliance. The Owner's authorized representative for this facility is Robin Krause. His contact information is as follows:

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1.2 Project Need

The Alliance is responsible for both the condition and the capacity of its assets. This work discusses the capacity of its assets. The RTP has provided reliable wastewater treatment to the City of Ridgefield's service area for decades. Though smaller in capacity than Salmon Creek Treatment Plant (SCTP), ongoing reliable operation of the RTP allows the Alliance to manage capacity within the regional system and maximizes the utility of previous investments by regional sewer ratepayers in wastewater infrastructure. RTP is a secondary treatment facility with ultraviolet light disinfection, operating under National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit No. WA0023272 issued by the Washington State Department of Ecology (Ecology) and Air Discharge Permit No. 00-2316 issued by the Southwest Clean Air Agency. Ecology requires the Alliance to submit a plan and schedule to maintain adequate capacity in its treatment facilities when one of the following two conditions is met:

- Actual flow or actual waste load reaches 85 percent of the rated capacity of the facility for 3 consecutive months, or
- Projected flow or projected waste load will reach the design capacity of the facility within 5 years

Alliance representatives closely monitor influent flows and loads and identified that total suspended solids (TSS) loads exceeded 100 percent of the rated capacity for 3 consecutive months from November 2020 to February 2021. In addition, five-day biochemical oxygen demand (BOD_5) loads also exceeded 100 percent of the permitted influent loading in December 2020.

On April 23, 2021, Ecology provided formal acknowledgment and notification of these triggering criteria via a letter. The District submitted a formal response letter, also dated April 23, 2021, addressing the influent loadings. The District's investigation into the influent loadings concluded with the following findings:

1. Potentially incorrect laboratory results in November and December 2020.
2. Actual elevated loadings of partially stabilized (older) solids and sediments from the collection system that were re-suspended in flatter sewers during wet-weather events from December 2020 to February 2021, after an operational change had been made at the Gee Creek Pump Station.

The District's response provided operational recommendations to address each of these findings. These recommendations were fully implemented beginning in March 2021. As a result, influent loading measurements stabilized and returned to lower levels more consistent with prior influent loading measurements. No similar exceedances have occurred in the years since making these operational changes, which involved more frequent jetting of conveyance piping and regular cleaning of the RTP influent wet well.

Additionally, the District submitted a letter to Ecology, dated May 10, 2021, and included herein as Appendix A, that conveyed a plan and schedule for continuing to maintain plant capacity in accordance with Section S4.B.1 of the RTP NPDES Permit, which is included as Appendix B. The letter stated that the plan to maintain capacity has been previously submitted to Ecology as the General Sewer Plan (GSP) for the District on March 1, 2019. Section 10.1.3 of the GSP included a stepwise plan for incrementally redirecting the Ridgefield collection system flow to the SCTP via the Discovery Corridor Wastewater Transmission System (DCWTS). The implementation of the DCWTS in 2016 created the ability to divert a portion of the flow tributary to the City of Ridgefield collection system and subsequently RTP, to the SCTP. The plan, known as the Ridgefield Flow Diversion Plan, was specifically designed to avoid overloading the RTP.

While there has been significant growth (Figure 1-1) in the City of Ridgefield over the last 7 years, flows to the RTP have remained relatively constant (Figure 1-2) as a result of the implementation of the DCWTS. Due to the completion of several elements of the Ridgefield Flow Diversion Plan, approximately two-thirds of Ridgefield flows are now directed to the SCTP. Solids loading concentrations, in terms of BOD5 and TSS, have increased slightly over this time.

Source: Discovery Clean Water Alliance

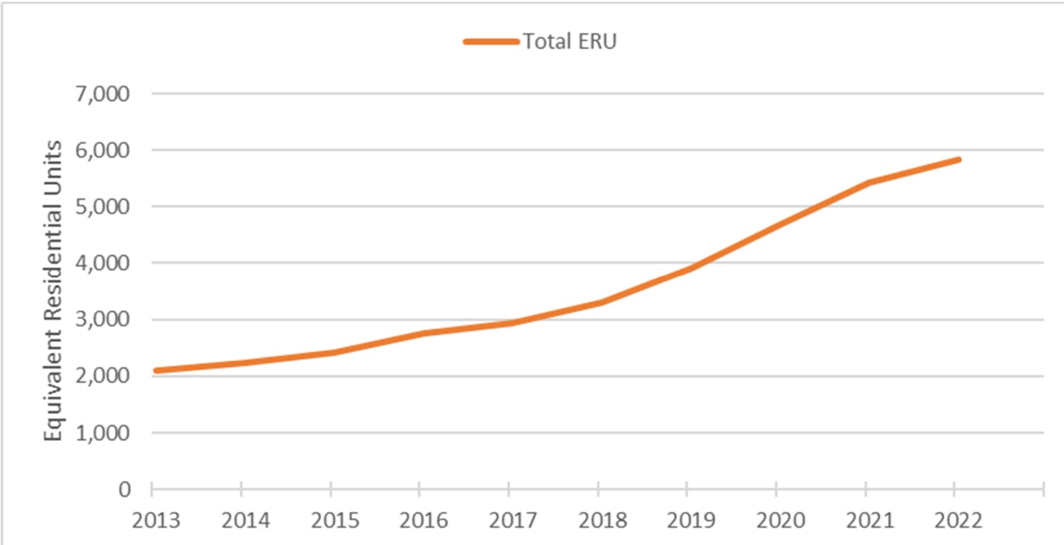

Figure 1-1. City of Ridgefield Historical Equivalent Residential Units (ERUs)

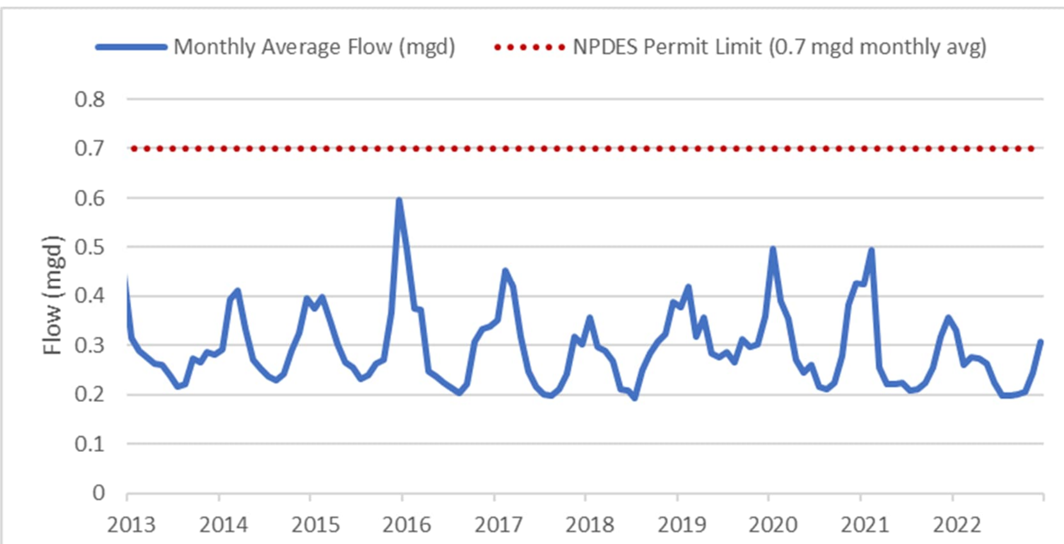

Figure 1-2. RTP Historical Monthly Average Flows

Consistent with the GSP for the District and the Ridgefield Flow Diversion Plan, the Alliance plans to accommodate most of the growth in the Ridgefield service area by increasing treatment capacity at the Alliance's main treatment plant, SCTP, instead of significantly expanding the RTP's capacity to 1.8 million gallons per day (mgd) (Phase 2) or 2.7 mgd (Phase 3) as described in the *City of Ridgefield General Sewer Plan* (Gray & Osborne, 2013). However, the Alliance has identified several improvements to the existing processes at RTP that would increase the flow and load capacity of the plant without extensive changes to the existing footprint. These improvements could be sequenced in phases to reduce their impact on capital investment. This Engineering Report proposes these improvements in order to provide an additional measure of treatment performance beyond the steps that the Alliance has already taken and which are described above.

1.3 Proposed Secondary Treatment Process Improvements

The first phase (1A) of these improvements would ensure that the RTP continues to successfully meet its treatment goals at maximum month flows of 0.7 mgd in the case that loadings to the facility increase over time relative to flows (that is, influent concentrations increase). Phase 1A includes improvements that were originally approved by Ecology as part of the City of Ridgefield Wastewater Treatment Plant Expansion (Phase 1) design documents from July 2000. These improvements are focused on optimizing biological nutrient removal (BNR) in the secondary system at RTP and consist of the following:

- Installation of aeration basin baffles to convert existing complete-mix reactors to plug flow configuration to increase BNR performance
- Relocation of existing mixed liquor recycle (MLR) pumps as well as installation of adjustable frequency drives on these pumps that allow operator adjustment and selection of MLR flowrate
- Installation of additional process instrumentation for optimizing BNR, including oxidation-reduction potential (ORP) probes and ammonia analyzers

The second phase (1B) of the proposed improvements would increase the RTP's capacity from the current maximum month flow of 0.7 mgd up to 0.9 mgd. Phase 1B would consist of the following improvements:

- Conversion of the existing Aerobic Digester 2, which has not been in service since 2016, into a three-zone, anoxic reactor upstream of the existing aeration basins
- Conversion of the anoxic zone in the existing aeration basins to an anoxic/aerobic swing zone with wall-to-wall fine-bubble diffusers

The Phase 1B improvements would increase overall secondary treatment volume and provide optimal functionality to the anoxic zone as recommended in Ecology's *Criteria for Sewage Works Desig*n (2023), which calls for at least three baffled anoxic zones in series.

If approved by Ecology, the Phase 1A and 1B improvements would comprise the scope of the Secondary Treatment Process Improvements (STPI) Project at RTP. The goal of the STPI Project would be to optimize secondary treatment for BNR, while the Alliance's ongoing Ridgefield Flow Diversion Plan continues to manage flows and loads to the RTP.

In support of this effort, an evaluation of the proposed improvements has been performed to demonstrate their contribution to additional plant treatment performance and operations reliability at the RTP. The goal of this evaluation has been to compare existing performance at projected maximum month permitted flow conditions with optimized performance after installation of the proposed upgrades. The evaluation includes a process assessment of the existing aeration system, an analysis of historical wastewater data, calibration/validation of a biological process simulator on existing treatment plant facilities and operation, and an evaluation of proposed process changes using the biological process simulator.

This Engineering Report consists of the following four main sections:

- Description of the RTP and effluent permit limits
- Review of RTP historical data
- Calibration of the biological process simulator based on historical data
- Analysis of existing RTP performance compared with plant performance incorporating proposed improvements using the calibrated process model to determine the most efficient operation configuration with regard to adding additional treatment capacity

1.4 Vicinity Map and Site Plan

The RTP is located at 109 W Division Street, Ridgefield, Washington, 98642. Figures 1-3 and 1-4 present a map of the RTP vicinity and a site map of the RTP facilities, respectively. Proposed improvements, described in Section 1.3 above, will be contained within Aeration Basins 1 and 2 of the secondary treatment system and Aerobic Digester 2, which are shown on the site map in Figure 1-4, and will include some changes to the yard piping layout.

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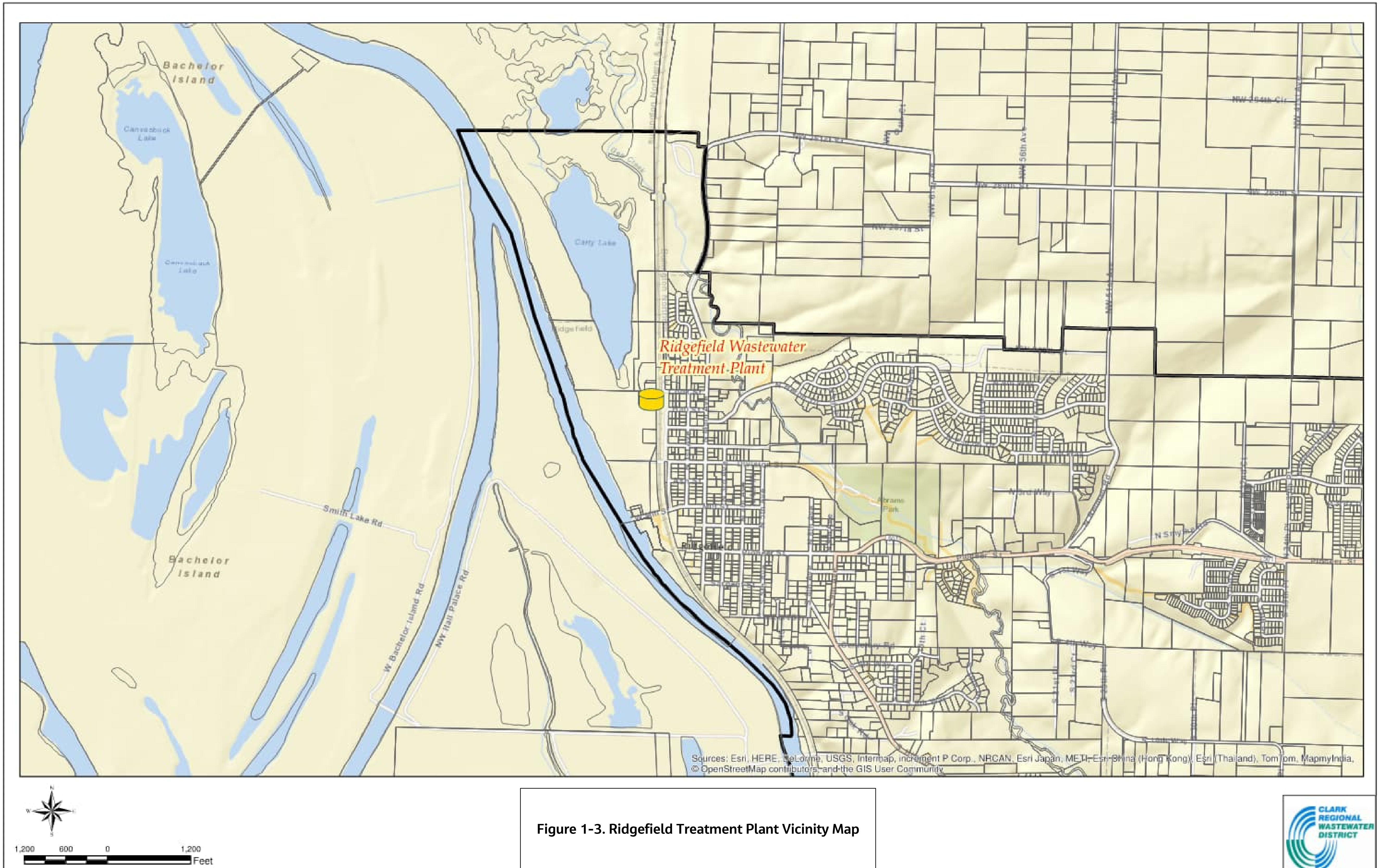

Figure 1-3. Ridgefield Treatment Plant Vicinity Map

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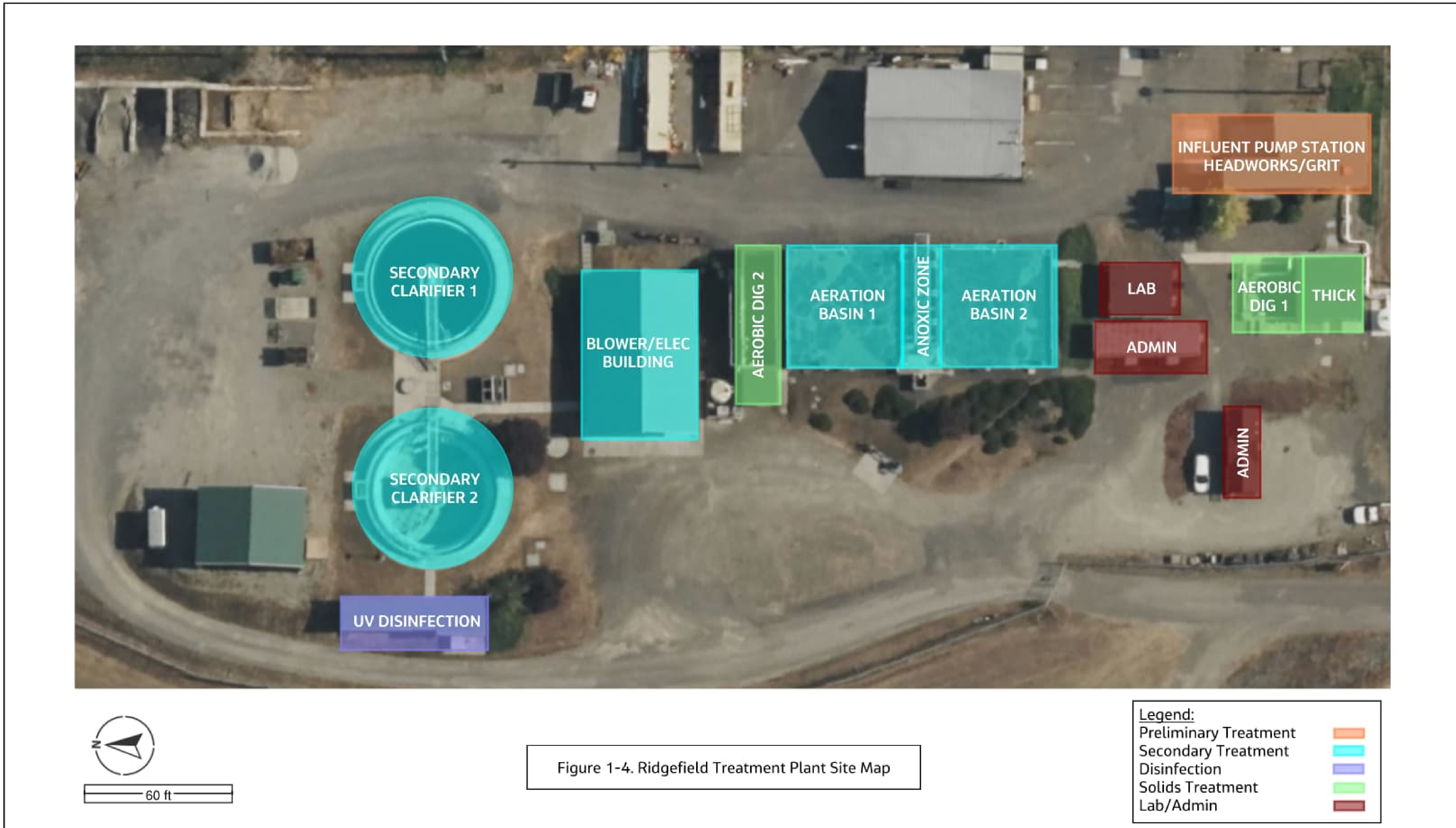

Figure 1-4. Ridgefield Treatment Plant Site Map

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2. Description of Discharge Standards

This section documents the current permitted treatment limits for the RTP and presents background on the historical development of these limits. The current NPDES permit is attached as Appendix B.

In 2007, The City of Ridgefield requested that Ecology revise the NPDES permit for the Ridgefield WWTP based on the City's plans to expand plant capacity at that time. The City then prepared and submitted design plans in accordance with WAC 173-240, and these plans were the basis for the 2009 NPDES permit modification. The 2009 permit modification included higher mass limits for BOD and TSS, as well as new effluent ammonia limits. The effluent limits in the 2009 NPDES permit modification included Phase 1 limits for improvements to bring facility capacity to 0.7 mgd and Phase 2 limits for approved improvements to increase facility capacity to 1.0 mgd. The improvements to increase plant capacity from 0.7 to 1.0 mgd have not been constructed, and the RTP is still operating at the 0.7 mgd Phase 1 limits, which are summarized in Table 2-1.

Table 2-1. RTP Phase 1 Effluent Limits

Parameter	Average Monthly[a]	Average Weekly[a]
Influent flow	Maximum month: 0.7 mgd	--
BOD_5	30 mg/L	45 mg/L
	175 lb/d	263 lb/d
	85 percent removal	
TSS[b]	30 mg/L	45 mg/L
	175 lb/d	263 lb/d
	85 percent removal	
Fecal coliform bacteria	100/100 mL	200/100 mL
pH[c]	Daily minimum is equal to or greater than 6.0 and the daily maximum is less than or equal to 9.0.	
Total ammonia (as N)	1.4 mg/L	Maximum daily: 3.14 mg/L
	8.2 lb/d	

[a] The average monthly and weekly effluent limitations are based on the arithmetic mean of the samples taken with the exception of fecal coliform, which is based on the geometric mean.

[b] The average monthly effluent concentration for BOD5 and Total Suspended Solids shall not exceed 30 mg/L or 15 percent of the respective monthly average influent concentrations, whichever is more stringent.

[c] Indicates the range of permitted values. When pH is continuously monitored, excursions between 5.0 and 6.0, or 9.0 and 10.0 shall not be considered violations provided no single excursion exceeds 60 minutes in length and total excursions do not exceed seven hours and 30 minutes per month. Any excursions below 5.0 and above 10.0 are violations. The instantaneous maximum and minimum pH shall be reported monthly.

lb/d = pounds per day; mg/L = milligrams per liter; mL = milliliter.

In 2014, at the request of the City of Ridgefield and the Alliance, Ecology modified the RTP NPDES permit to include the Alliance as an owner and operator of the RTP. The City's Public Works Department maintains responsibility for the design, construction, operation, and maintenance of all City-owned public infrastructure outside of the RTP.

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3. Background Information

This section provides an overview of the existing environment, demographics, and land use of the RTP, including a description of existing wastewater treatment capacity.

3.1 Existing Environment

The RTP covers 2 acres of land located at 109 W Division Street (Section 24, Township 4 North, Range 1 West in Clark County, Washington) in the City of Ridgefield. The property lies on the northeast bank of Lake River, which is a tributary/oxbow of the Columbia River that runs north along the east side of Bachelor Island (see Figure 1-3).

The outflow currently discharges to Lake River at Latitude: North 45 49' 17.969" and Longitude: West 122 45' 13.665". The existing outfall is located at an elevation of 0.95 foot North American Vertical Datum (NAVD88). Formerly, RTP digested biosolids were hauled to the SCTP, located at 15100 NW McCann Road, Vancouver, Washington; currently, they are hauled to the Three Rivers Regional Wastewater Plant (Three Rivers), located at 467 Fibre Way, Longview, Washington.

Lake River lies immediately west of the RTP and flows northwest to its confluence with the Columbia River approximately 2 miles downstream. The upstream end of Lake River connects to Bachelor Island Slough and the Columbia River approximately 1 mile south of the RTP near the outfall. The Columbia River flows northwest past Bachelor Island approximately 1 mile west of the RTP site. There are no wetlands onsite at the RTP. The nearest wetlands are Freshwater Emergent Wetlands immediately surrounding Carty Lake northwest of the site (U.S. Fish and Wildlife Service National Wetlands Inventory, 2022).

The State Environmental Policy Act (SEPA) Environmental Checklist, attached as Appendix E of this report, provides detailed descriptions of the environmental elements of the proposed project as well as of the RTP facility and site.

3.2 Demographics and Land Use

Topics addressed in this section are the current population of Ridgefield, wastewater treatment techniques, historical plant data, and plant influent.

3.2.1 Current Population

The City of Ridgefield has experienced significant growth, with the population doubling from 4,763 to 10,319 in just 10 years (Census 2010, 2020). Figure 1-1 above illustrates the recent population growth in terms of equivalent residential units.

As summarized in Section 1.2, wastewater flows to the RTP have remained relatively constant as a result of the DCWTS, which diverts a portion of the flow that would otherwise be tributary to RTP instead to SCTP. The Alliance plans to maximize the capacity of the RTP within its existing footprint through the proposed STPI Project and to meet the needs of future service area growth beyond the limits of the STPI Project expansion at the Alliance's primary treatment facility, the SCTP.

3.2.2 Existing Wastewater Treatment

The RTP was built in Ridgefield, Washington, in 1977. Raw wastewater enters the treatment plant headworks consisting of one pump station, one helical screen with an emergency bypass bar screen, vortex grit removal, a Parshall flume for flow measurement, and a distribution structure. The secondary treatment facility consists of one 48,000-gallon anoxic zone and two 174,000-gallon complete-mix aeration basins equipped with fine bubble diffusers, which are followed by two secondary clarifiers. The secondary effluent from the secondary clarifiers is then disinfected by open channel ultraviolet light disinfection equipment. Treated effluent is discharged to the Lake River via the plant outfall pipe. Waste activated sludge (WAS) from the secondary treatment process is sent to one of two aerobic digesters (Aerobic Digester 1). Aerobic Digester 2 has not been in service since 2016. Digested sludge is thickened by a rotary drum thickener and held in a sludge storage basin, prior to being trucked to Three Rivers for further stabilization via mesophilic anaerobic digestion. A process flow schematic for the RTP is shown in Figure 3-1.

All unit processes have been designed with sufficient capacity to meet at least the permitted influent maximum month flow of 0.7 mgd and a peak hour flow of 1.5 mgd. Flow-based capacities of the unit processes at RTP, as well as other relevant design criteria, are presented in Table 3-1. With the upgrades proposed in this report, all unit processes will have sufficient capacity to treat projected maximum flows up to 0.9 mgd based on the reliability and redundancy requirements specified in the *Criteria for Sewage Works Design* (Ecology, 2022).

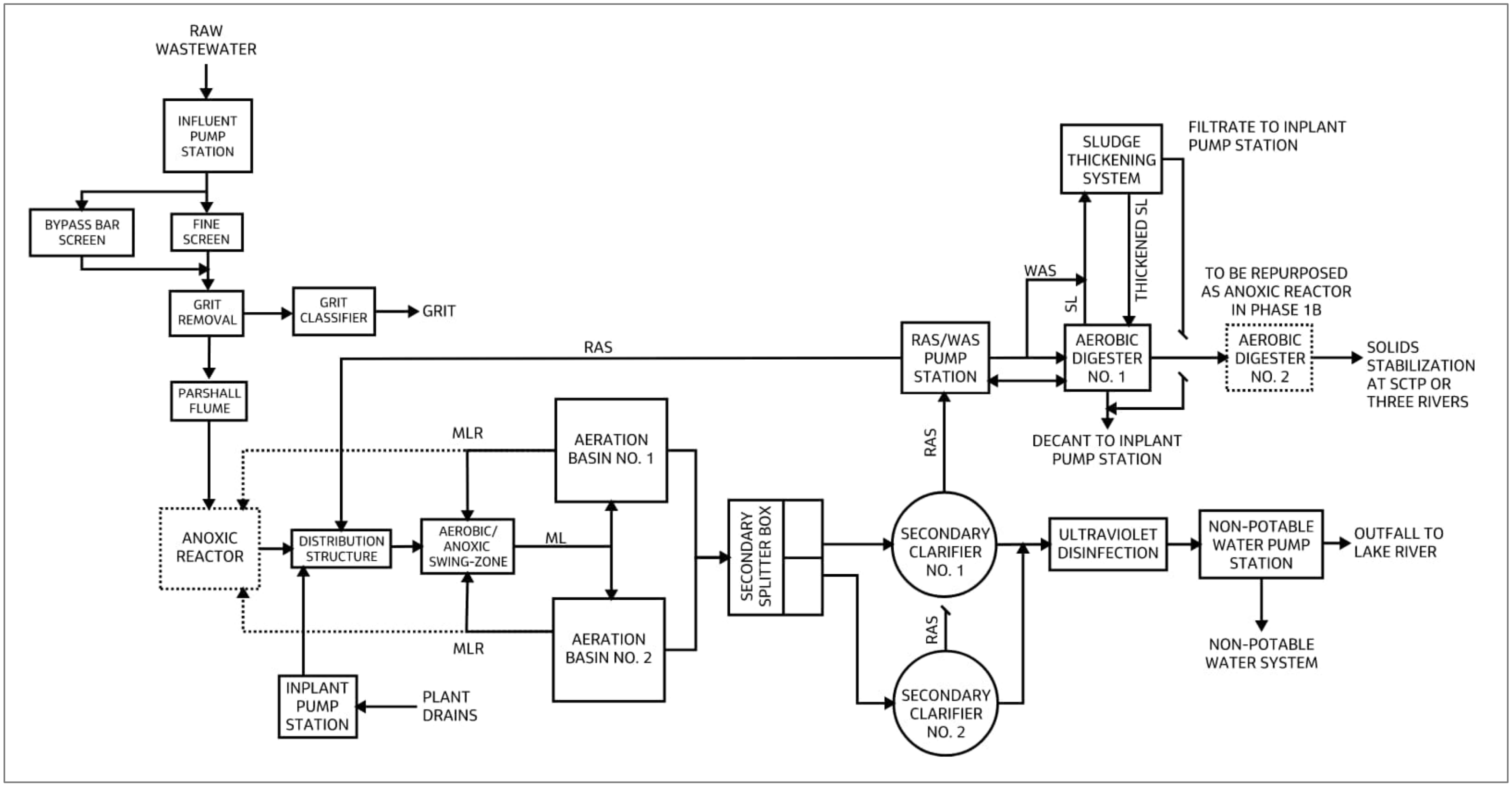

Figure 3-1. RTP Process Flow Schematic

Phase 1B changes to the flow schematic indicated by dotted line.

Table 3-1. Major Equipment Design Data for Secondary Process

Process Element	Design Data
Plant Flow	
Current annual average (2018–2022), mgd	0.29
Maximum month (Current/Phase 1A Design Flow), mgd	0.70
Maximum month (Phase 1B Design Flow), mgd	0.90
Peak hour (Peak Flow), mgd	1.50
Influent Pumps	
Type	Non-clog submersible
Quantity	3
Drive	Variable Speed
Size, hp	7.5
Maximum capacity per pump, gpm	520 @ 29.8 ft
Firm capacity with one out of service, mgd	1.5
Total capacity, mgd	2.25
Influent Screen	
Type	Fine screen (Hycor Helisieve HLS400)
Quantity	1
Screen width, inches	20
Mesh diameter, Inches	0.25
Size, hp	1
Total capacity, mgd	3.5
Bypass Screen	
Type	Manually cleaned bar screen
Quantity	1
Bar spacing, inches	0.75
Screen width, inches	24
Grit Removal	
Grit Removal System	Smith & Loveless Pistagrit
Quantity	1
Type	Vortex
Motor size, hp	0.75
Total capacity, mgd	2.5
Grit Cyclone	520
Quantity	1
Grit Classifier	
Quantity	1
Screw diameter, inches	9
Motor Size, hp	0.75

Table 3-1. Major Equipment Design Data for Secondary Process

Process Element	Design Data
Grit Pump	
Quantity	1
Type	Vortex
Motor Size, hp	7.5
Influent Flow Measurement	
Type	Parshall flume
Size, inches	9
Capacity, mgd	3.3
Anoxic Basin	
Total number of basins	1
Volume, MG	0.047
Side water depth, ft	12
Number of fine pore diffusers in swing-zone	40
Aeration Basins	
Total number of basins	2
Volume, each, MG	0.147
Total volume, total, MG	0.348
Side water depth, ft	12
Number of fine pore diffusers	632
Process Blowers	
Type	Positive displacement
Quantity	4
Maximum capacity per blower, SCFM	800
Discharge pressure, psi	9
Drive	Variable speed
Size, hp	3 × 50 hp, 1 × 100 hp
Firm capacity with largest out of service, scfm	2,400
Total Capacity, scfm	3,900
Mixed Liquor Recycle Pumps	
Type	Submersible
Quantity	2
Maximum capacity per pump, gpm	1,000 @ 18.2 ft
Size, hp	7.5
Secondary Clarifiers	
Number of clarifiers	2
Diameter, ft	50
Surface area, each, ft^2	1,963

Table 3-1. Major Equipment Design Data for Secondary Process

Process Element	Design Data
Sidewater depth, ft	14
Surface overflow rate, gpd/ft^2	
@Design Flow with one clarifier in service	357
@Peak Flow with one clarifier in service	769
Weir loading rates, gpd/ft	
@Design Flow with one clarifier in service	4,879
@Peak Flow with one clarifier in service	10,455
RAS Pump Station	
Return Activated Sludge Pumps	
Type	Horizontal centrifugal (screw induced)
Quantity	3
Drive	Variable speed
Size, hp	3
Maximum capacity per pump, gpm	375@ 13.5 ft
Waste Activated Sludge Pumps	
Type	Vortex
Quantity	2
Drive	Variable speed
Size, hp	3
Maximum capacity per pump, gpm	60@ 22.5 ft
Sludge metering	
RAS	4-inch magnetic flow meter
WAS	3-inch magnetic flow meter
Aerobic Digestion	
Aerobic Sludge Digester 1, MG	0.05
Aerobic Sludge Digester 2, MG	0.064
Aerobic Digester Blower	
Type	Positive displacement
Quantity	1
Maximum Capacity, scfm	350
Discharge Pressure, psi	10
Drive	Variable speed
Size, hp	25
Speed, rpm	1,200
Sludge Storage Basin	
Volume, MG	0.06

Table 3-1. Major Equipment Design Data for Secondary Process

Process Element	Design Data
Ultraviolet Disinfection	
Type	Low pressure open channel
Number of channels	1
Channel width, inches	27
Channel depth, inches	48
Straight channel length, ft	36
Number of banks	3
UV transmittance @ 253.7 nm	65%
Required UV dose, MJ/cm^2	33
Total capacity, mgd	1.93
Effluent disinfection requirement	
Monthly geometric average	100 FC/100 mL
Weekly geometric average	200 FC/100 mL
Effluent Flow Measurement	
Type	V-notch weir
Width, ft	3
Capacity, mgd	5
Effluent Outfall	
Peak hydraulic capacity, mgd	1.50

FC = fecal coliform; ft = feet; ft^2 = square feet; gpd = gallons per day; gpd/ft = gallons per day per foot; gpm = gallons per minute; hp = horsepower; MG = million gallons; psi = pounds per square inch; RAS = return activated sludge; rpm = revolutions per minute; scfm = standard cubic feet per minute.

3.2.2.1 Review of RTP Historical Plant Data

Daily average historical data from January 2018 to December 2022 were obtained for plant influent, primary effluent, mixed liquor, and plant effluent. Parameters reviewed include flow, BOD, TSS, and ammonia-nitrogen (NH_3-N). In addition, daily average data for mixed liquor suspended solids (MLSS) concentration and sludge volume index (SVI) were also reviewed.

3.2.3 Plant Influent

Figure 3-2 presents monthly average influent and effluent flowrate data for the period of January 2018 through December 2021 (no data available for influent flow for first 6 months of 2018). In this figure, influent flowrate data exhibit large discrepancies (up to 31 percent) between influent and effluent flow measurements. The District has determined that the influent flowrate meter readings are not accurate due to flow-conditioning issues at the influent Parshall flume. Field flow testing and monitoring indicated that the effluent flow measurement was more accurate and reliable than the influent flow measurement structure. As a result, RTP uses effluent flow as the primary measure of plant flow for reporting and management purposes. Accordingly, effluent flow rates were also used in this study to estimate loads and to calibrate the mathematical model.

Figure 3-2 shows the estimated monthly average effluent flows during the 3-year period, with the maximum monthly average flow at 0.5 mgd and the minimum monthly average flow at 0.19 mgd. The data indicate seasonal trends in the plant flows, with high flows in January to February and low flows in June to August.

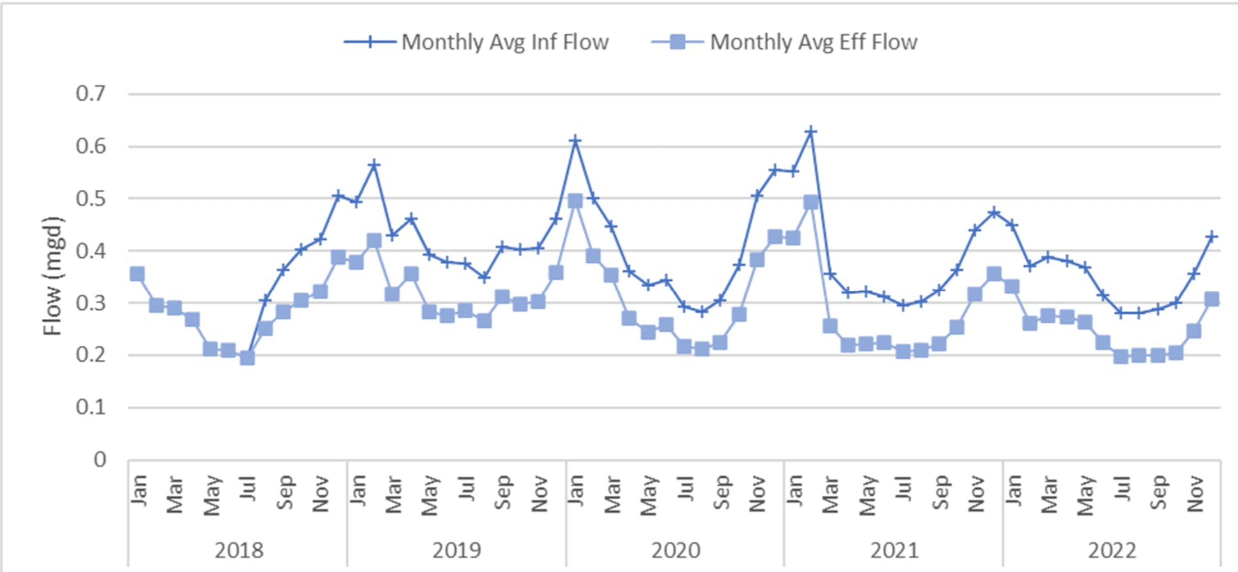

Figure 3-2. Historical Monthly Average Flows (Influent and Effluent)

January 2018 through December 2022

Note: the percentage differences for average monthly influent and effluent flowrate data during 2018 through 2021 were calculated to be up to 31 percent (influent flow measured higher than effluent flow). Influent flow measurement was determined to be inaccurate due to flow-conditioning issues at the influent Parshall flume. Effluent flow measurement was shown to be accurate and is used for compliance and management purposes.

Figure 3-3 shows the monthly average influent BOD and TSS concentrations from January 2018 to December 2022. Figure 3-4 shows the monthly average flows and BOD and TSS loads. In general, monthly average influent loadings do not fluctuate considerably. The data exhibit two periods of significantly higher than average loading, which resulted from solids building up in the collection system and the influent wet well, leading to erroneously high solids measurements, most notably during the period from November 2020 through February 2021. More regular maintenance cleaning of problematic areas of the collection system and influent wet well, as described in Section 1, has resulted in stabilization of influent solids measurements.

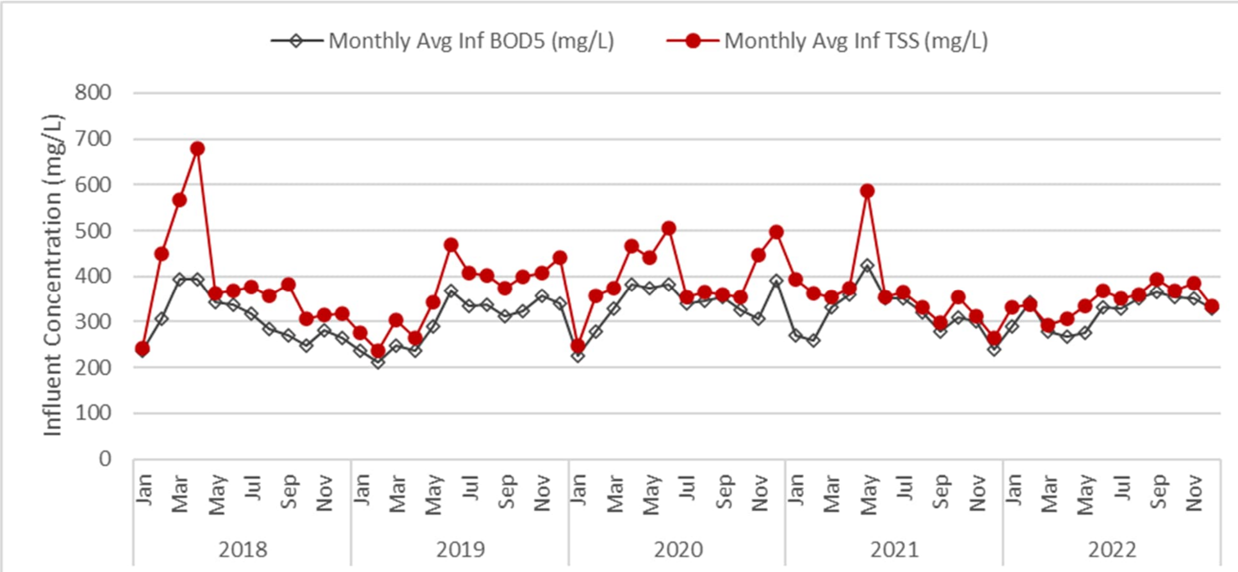

Figure 3-3. Historical Monthly Average Influent BOD and TSS Concentrations

January 2018 through December 2022

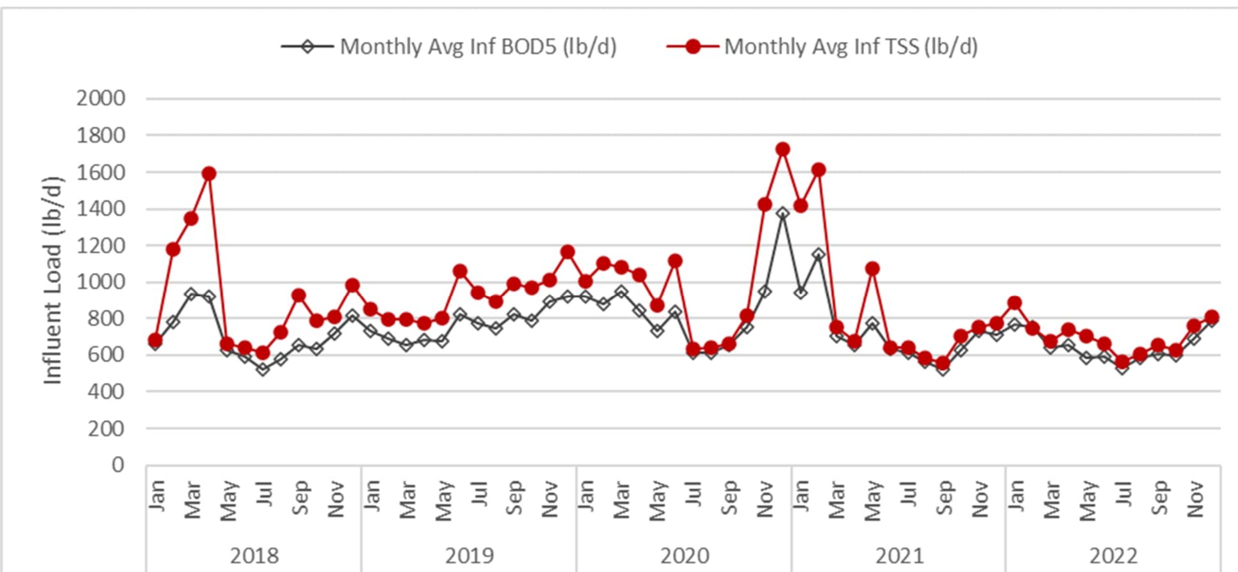

Figure 3-4. Historical Monthly Average Influent BOD and TSS Loads

January 2018 through December 2022

Figure 3-5 presents historical monthly average influent NH_3-N concentrations. A consistent seasonal trend is observed in the data, with higher concentrations in the summer and fall and lower concentrations in the winter and spring. Figure 3-6 shows the corresponding monthly average loadings. Ammonia concentrations are inversely proportional to flow, while ammonia loads are relatively steady.

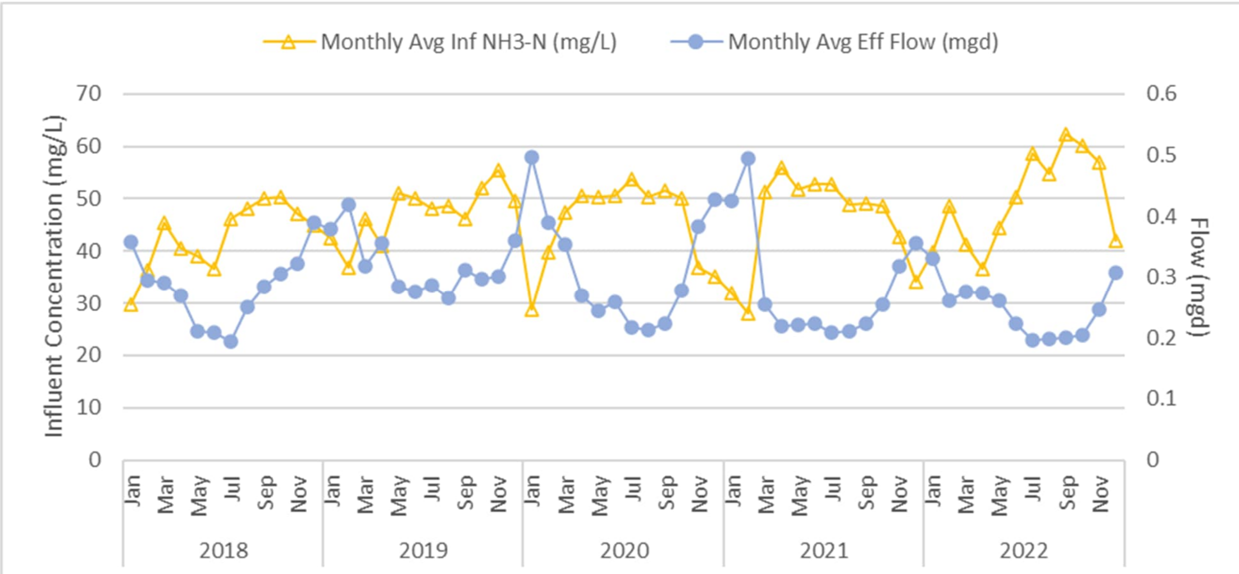

Figure 3-5. Historical Monthly Average Influent Ammonia Concentration and Effluent Flow
January 2018 through December 2022

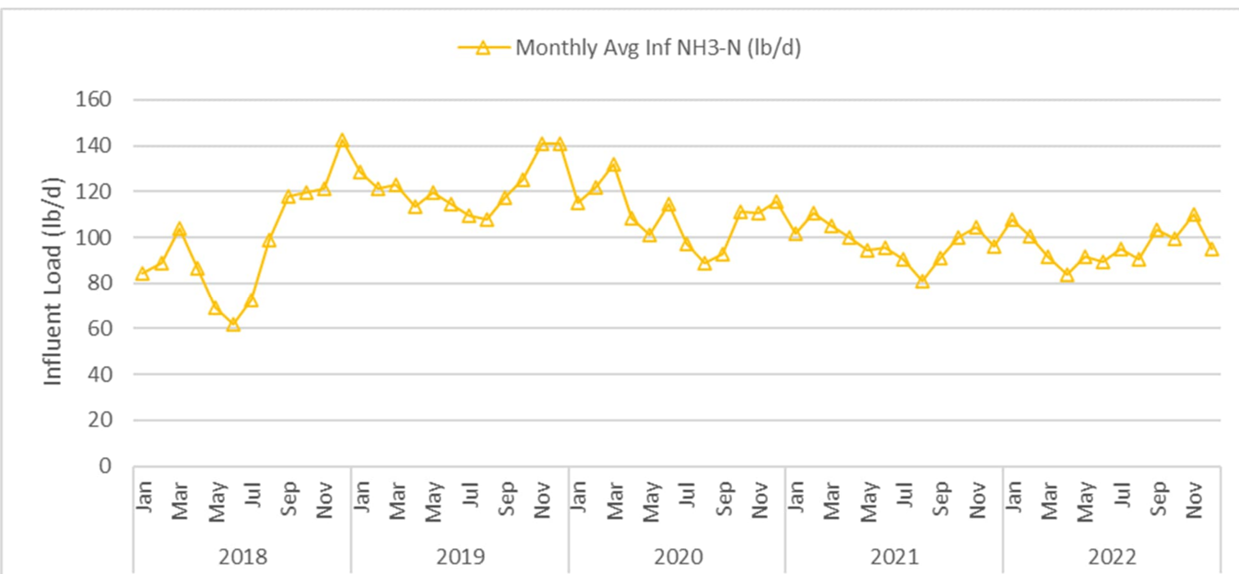

Figure 3-6. Historical Monthly Average Ammonia Loadings
January 2018 through December 2022

3.3 Activated Sludge System

Historical data for the activated sludge systems at the RTP are shown in Figure 3-7, including the mean cell residence time (MCRT) and MLSS concentrations. A seasonal variation in MLSS is apparent due to changes in flow, load, and temperature, which is typical for most plants using MCRT control.

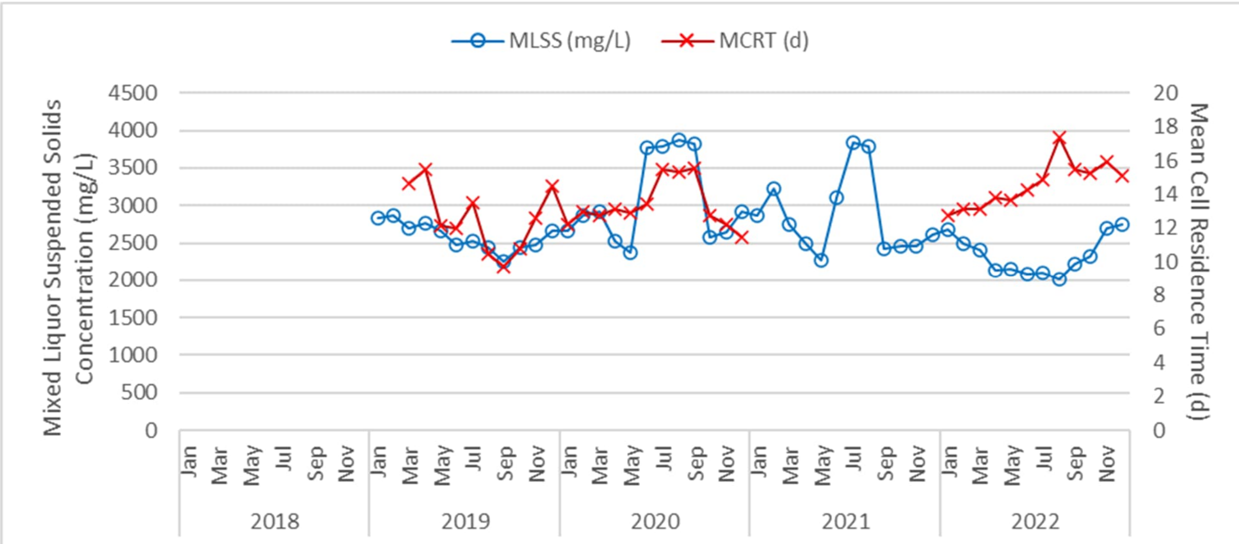

Figure 3-7. Historical Secondary System Monthly Average MLSS and MCRT

January 2018 through December 2022, some data not available for these parameters.

The monthly average MLSS concentration during the 4-year period ranges between 2,000 and 3,900 mg/L, with an average of 2,700 mg/L. MCRT trends with MLSS concentrations, ranging between 9 and 18 days.

Figure 3-8 presents the historical monthly average wasting rate compared to the target rate.

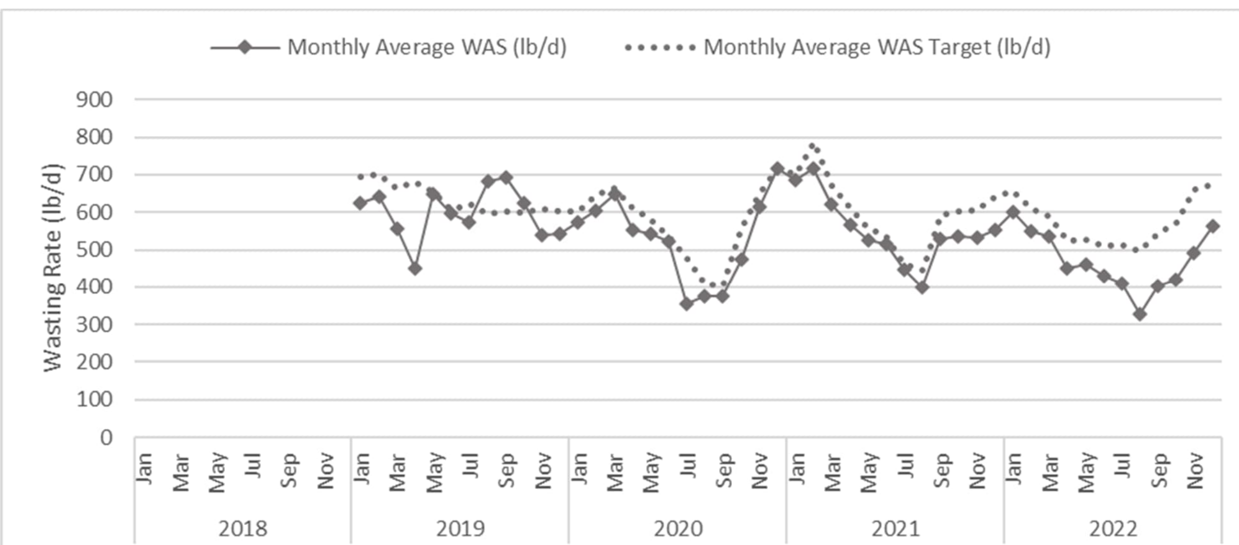

Figure 3-8. Historical Secondary System Monthly Average WAS and WAS Target

January 2018 through December 2022, some data not available for these parameters.

Figure 3-9 shows that the monthly average historical SVI data from the 5-year period (2018 to 2022) ranges from between 49 and 136 milliliters per gram (mL/g), which indicates very well-settling MLSS characteristics. With respect to the daily SVI trend, Figure 3-10 shows the range is between 34 and 172 mL/g.

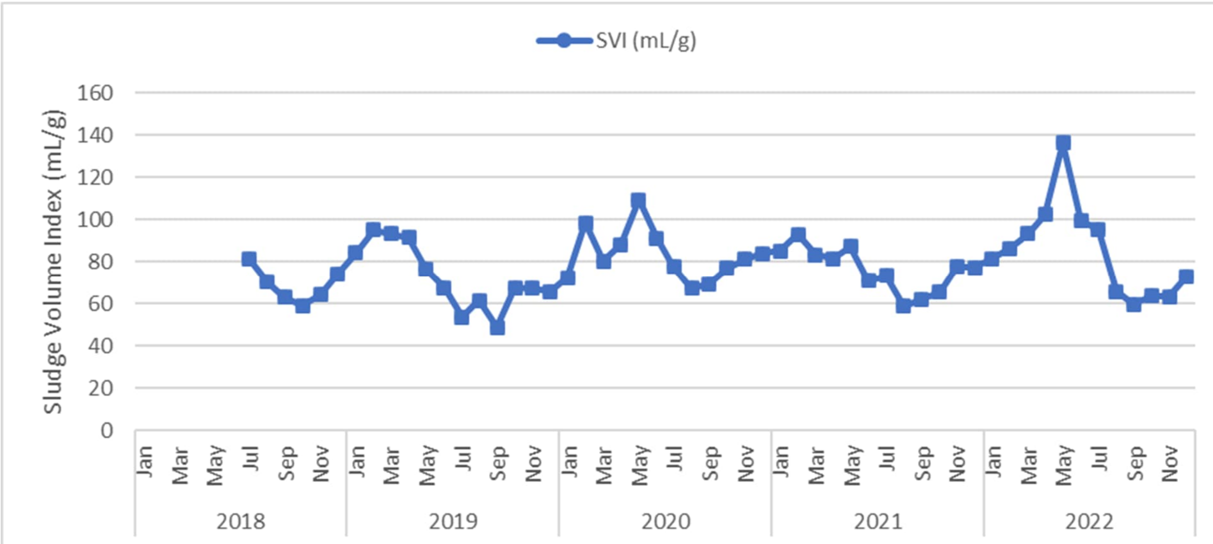

Figure 3-9. Historical Monthly Average Sludge Volume Index (SVI)

January 2018 through December 2022, some data not available for this parameter.

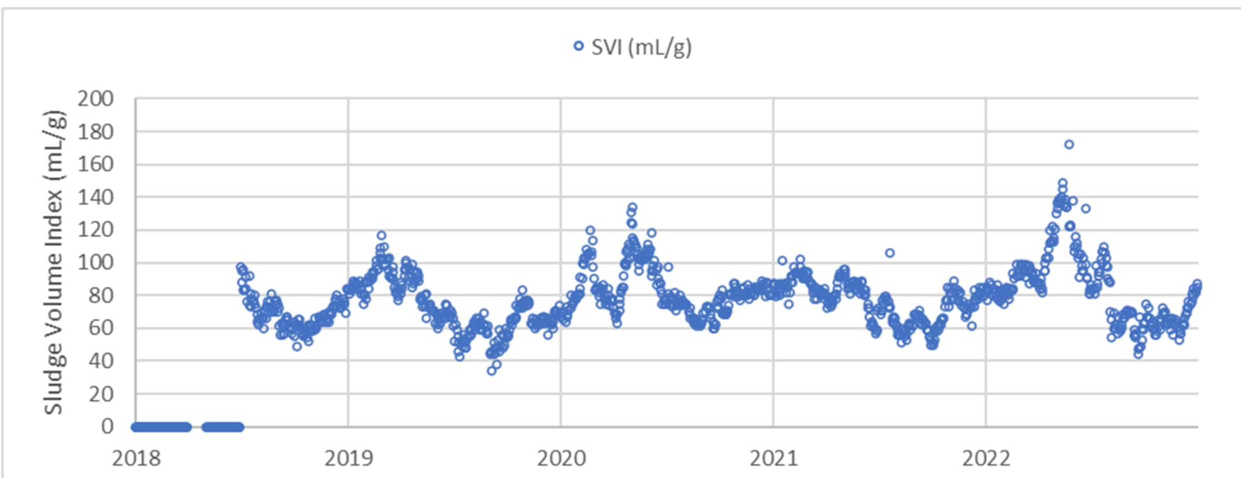

Figure 3-10. Historical Daily Sludge Volume Index

January 2018 through December 2022, some data not available for this parameter.

3.4 Plant Effluent

The RTP has maintained a high-quality effluent that is well within the NPDES permit limits due to operational care and continued investment to maintain adequate plant capacity and reliable condition of assets. RTP performance during the January 2018 to December 2022 period is presented in Figure 3-11 in terms of effluent TSS and BOD concentrations.

Monthly average effluent BOD concentrations were mostly below 7 mg/L, and TSS concentrations were typically below 8 mg/L throughout the period of record. During this 5-year period, there was no instance in which the monthly average BOD and TSS concentrations exceeded the permit limits of 30 mg/L.

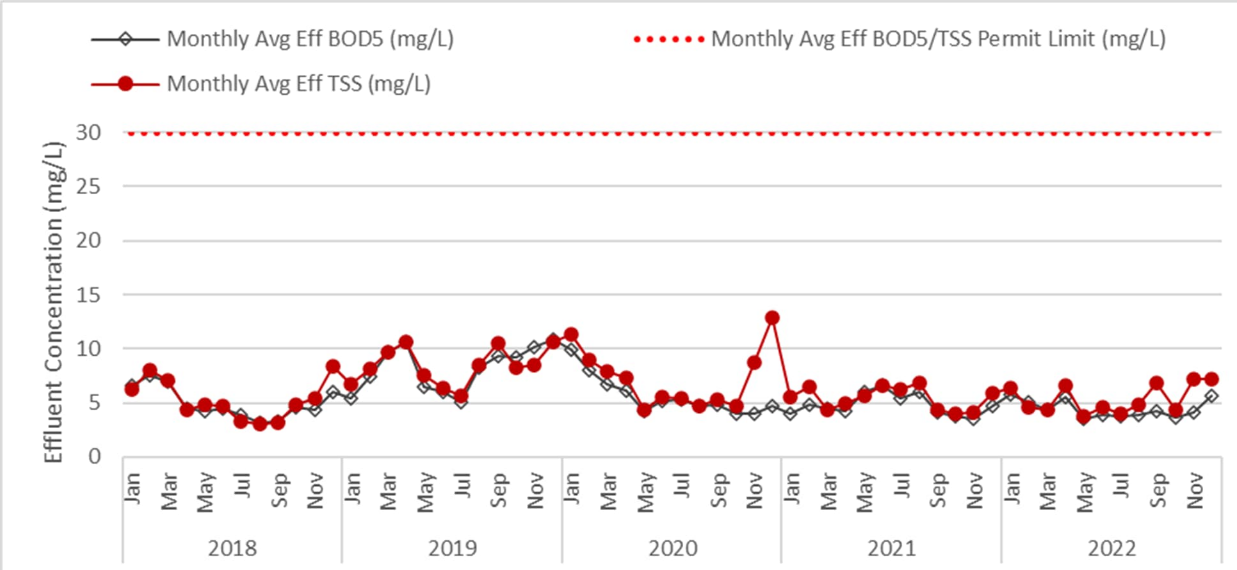

Figure 3-11. Monthly Average Effluent BOD and TSS Concentrations
January 2018 through December 2022

Figure 3-12 shows the overall monthly average BOD and TSS removal efficiencies during the 5-year period, ranging from 91 to 99 percent. Actual removal rates were consistently better than the permit limit minimums for 85 percent removal of BOD and TSS.

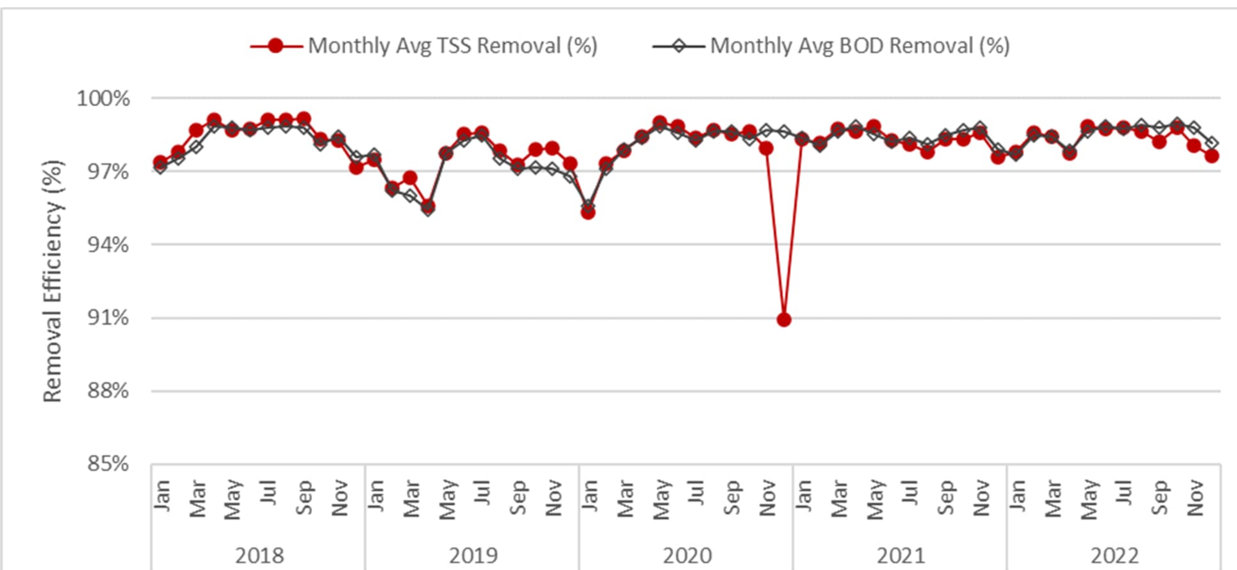

Figure 3-12. Monthly Average Percent BOD and TSS Removals
January 2018 through December 2022

Figure 3-13 shows monthly average effluent NH_3-N concentrations. During the January 2018 to December 2022 period, effluent monthly average NH_3-N concentrations below the 1.4 mg/L permit limit except during the summer of 2021, when concentrations reached 2.75 mg/L. This exceedance was reported and described in the Noncompliance Acknowledgement that RTP issued to Ecology on August 24, 2021, regarding the exceedances of effluent permit limits for fecal coliform and ammonia. The exceedances were due to a plant upset caused by a ruptured caustic soda line and the failure of a containment area drain valve located in the caustic soda contaminated structure preventing containment of the spill.

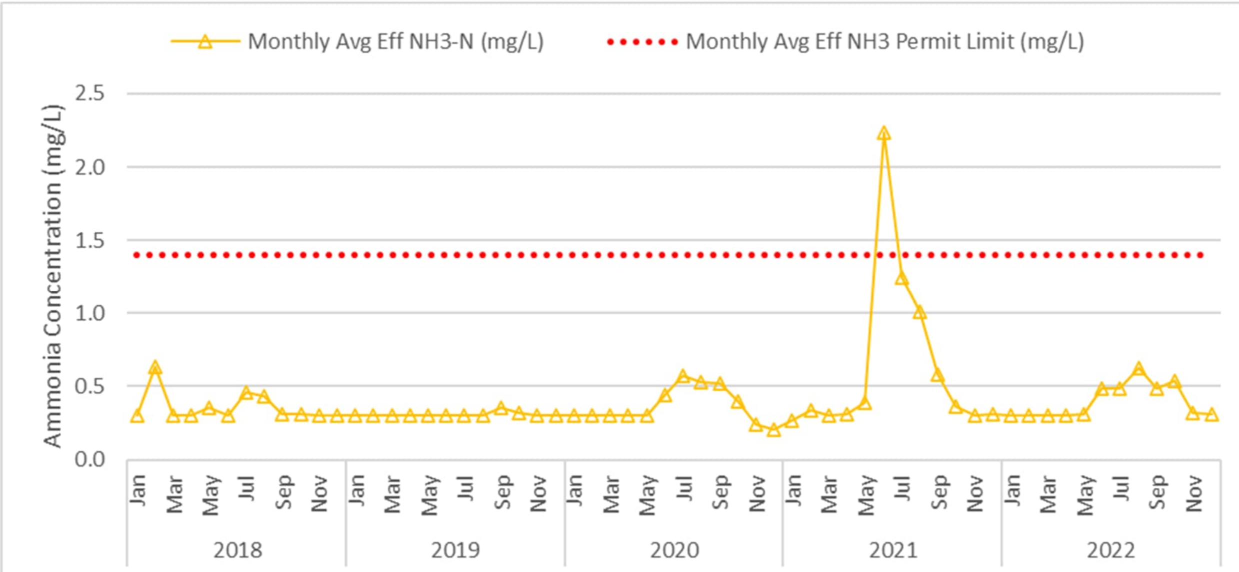

Figure 3-13. Monthly Average Plant Effluent Ammonia

January 2018 through December 2022

Figure 3-14 shows the monthly average effluent alkalinity concentration, which ranged between 86 and 122 milligrams as calcium carbonate per liter. A consistent seasonal trend was observed, with slightly higher concentrations in the early fall and lower concentrations in the winter. Average effluent alkalinity exceeds 100 mg/L, indicating sufficient excess alkalinity for full nitrification. The caustic soda system provides the ability to add alkalinity if influent levels are insufficient to meet process demands.

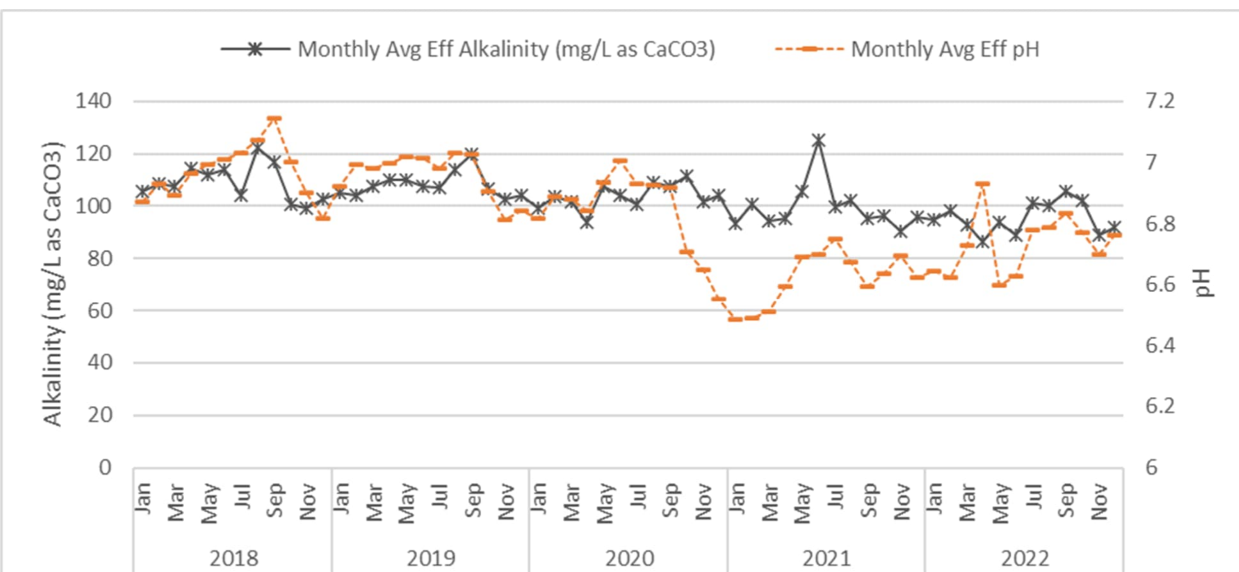

Figure 3-14. Monthly Average Plant Effluent Alkalinity (as $CaCO_3$) and pH

January 2018 through December 2022

4. Biological Process Simulator Development

The proposed improvements to the RTP would convert the existing complete-mix aeration basins to plug flow reactors. While complete-mix reactors are straightforward to simulate with Excel-based algebraic calculations, the mathematics of simulating plug flow basins as complete-mix reactors-in-series requires numerical methods using iterative calculations. In order to evaluate the differences in performance between the RTP's existing complete-mix reactors with the proposed plug flow configuration, a whole-plant model of the RTP was created using an iterative process simulator, Pro2D^2, developed by Jacobs.

Pro2D^2 allows the prediction of complex biological interactions using various mechanistic and empirical models to represent material transformations and pollutant removals in the plant for both liquid and solid process streams. It enables the user to simulate carbonaceous oxidation and the fate of nutrients in activated sludge treatment facilities. The model uses industry-standard computational algorithms presented in *Activated Sludge Models ASM1, ASM2, ASM2d, and ASM3* (Henze, Gujer, Mino, van Loosdrecht; International Water Association Publishing, 2006).

The industry-standard protocol for good modeling practice (GMP) was first developed in 2012 by the International Water Association GMP Task Group (Rieger et al., 2012). In 2014, the Water Environment Federation published *Wastewater Treatment Process Modeling, Manual of Practice No. 31* (WEF MOP 31, 2014), which explains best practices for modeling in detail. This Engineering Report follows the protocol established in WEF MOP 31. The protocol consists of the following five steps:

1. Project Definition
2. Data Collection and Reconciliation
3. Plant Model Set-Up
4. Calibration and Validation
5. Simulation and Results Interpretation

The project definition step begins with formulating a problem statement (project need) and then defining the objectives and requirements for modeling. The second step involves collection of plant data and reconciliation of that data with the stakeholders (as presented in Section 3of this report). The third step consists of building a model that accurately reflects the plant using the appropriate design criteria (as summarized in Table 2-1 above). In the fourth step, the model is calibrated with selected historical data and then validated against other historical data to assess its predictive performance. The final step is then to use the model to analyze the effect of proposed improvements on plant performance.

This section summarizes the model set-up and calibration/validation of the Pro2D^2 biological process simulator used for modeling the activated sludge process at RTP. Following model set-up, a set of calibration runs was performed using detailed wastewater historical data for January 2021, which was identified as a representative high-loading period for plant operations. Model parameters were adjusted to result in good agreement with historical conditions, which was defined by reaching the target "stop criteria" identified in WEF MOP 31. Following calibration of the process model, a set of validation runs was conducted using historical data from January 2020 to determine the accuracy and reliability of the model. The calibrated simulator was subsequently used for modeling the existing and proposed operating scenarios and future conditions to estimate the performance of the RTP.

The following subsections discuss the process model setup and present the results of the model calibration and validation.

4.1 Plant Model Set-up

The process model was developed using the facility design criteria presented in Table 2-1, which were adapted from the record drawings for the City of Ridgefield Wastewater Treatment Plant 0.7 MGD

Upgrade Project (Gray & Osborne, 2006). The process flow diagram of the simulator is shown in Figure 4-1, consisting of the preliminary, secondary, and solids treatment processes. The secondary process node, labeled "PBNR Secondary," incorporates the anoxic and aerobic zones of the bioreactors as well as the secondary clarifiers. The anoxic and aerobic zones were configured as separate cells in the model, since there are baffles separating the zones at RTP. The process flow diagram indicates the capability of the aerobic digester to decant supernatant back to headworks, although the RTP does not operate with supernatant recycle, instead hauling all digested sludge to Three Rivers.

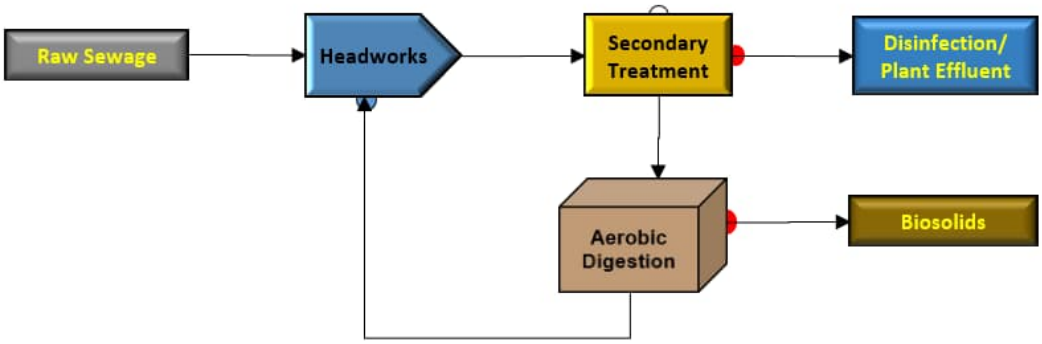

Figure 4-1. RTP Process Flow Schematic in Pro2D^2 Simulator

4.2 Plant Model Calibration

Influent wastewater characteristics and plant operating data from January 2021 were used as the basis for calibrating the process simulator. January 2021 was selected as an appropriate month to use as the basis of model calibration because it represented the highest loading period in recent years.

Table 4-1 summarizes the influent characteristics used in the process setup for the model calibration.

Table 4-1. Influent Wastewater Characteristics for Calibration

Parameter	Units	Historical Data (January 2021 Average)	Model Inputs
Raw Wastewater			
Flow	mgd	0.43	0.43
BOD_5 concentration	mg/L	263	263
BOD_5 loading	lb/d	944	944
TSS concentration	mg/L	394	394
TSS loading	lb/d	1,415	1,415
VSS concentration	mg/L	-	355
VSS loading	lb/d	-	1274
NH_3-N concentration	mg/L	28	28
NH_3-N loading	lb/d	102	102
Alkalinity concentration	mg/L	-	223
Alkalinity loading	lb/d	-	800

Table 4-1. Influent Wastewater Characteristics for Calibration

Parameter	Units	Historical Data (January 2021 Average)	Model Inputs
Aerobic Biological Kinetics			
Heterotrophs			
Maximum specific growth rate (mu max)	d^{-1}		3.2
Half saturation for organics (Ks)	mg-BOD_5/L	-	3
Half saturation for organics (Ks)	mg-BioCOD2/L		5
Autotrophs			
Half saturation for O_2 (KO)	mg-O_2/L		0.5
Maximum Specific Growth Rate (mu max)	d^{-1}	-	0.9
Half Saturation for NH_3-N (KN)	mg-N/L	-	0.7

$CBOD_5$ = carbonaceous 5-day biochemical oxygen demand; MLVSS = mixed liquor volatile suspended solids; NO_2-N = nitrite-nitrogen; NO_3-N = nitrate-nitrogen; TKN = total Kjeldahl nitrogen; TP = total phosphorous; VSS = volatile suspended solids.

RTP operating characteristics during the period are presented in Table 4-2, compared with the predictions of the calibrated model. The differences between the historical data and model predictions are compared with industry-standard acceptable ranges for model calibration stop criteria, as presented in the Water Environment Federation's *Manual of Practice No. 31, Wastewater Treatment Process Modeling,* 2013 (WEF MOP 31). Detailed Pro2D^2 simulator mass balance outputs are provided in Appendix A.

Table 4-2 shows the model closely predicts the effluent BOD_5, TSS, and NH_3 concentrations. Both the model and the historical data indicate near-complete pollutant removal and complete nitrification in the bioreactors. For all target parameters, the model calibration indicated close agreement between the model prediction and plant measurements.

Table 4-2. Historical Plant Performance and Model Calibration Results

Parameter	Units	Historical Data	Model Output	Error	Acceptable Error Range (+/-)[a]
Aeration Basin					
MLSS	mg/L	2,870	2,875	<1%	10%
MLVSS	mg/L	2,327	2,580	10%	--
MLVSS/MLSS	ratio	0.81	0.85	5%	5%
WAS flow	gallon	5,305	5,971	12%	--
RAS TSS	mg/L	15,548	15,513	<1%	--
WAS TSS load	lb/d	725	773	6%	10%
RAS flow	%Q	--	21	--	--
MCRT	day	12	12	0 days	1 day

Table 4-2. Historical Plant Performance and Model Calibration Results

Parameter	Units	Historical Data	Model Output	Error	Acceptable Error Range (+/-)[a]
Effluent Characteristics					
BOD_5	mg/L	4	3	1.0 mg/L	--
TSS	mg/L	5.5	5.5	0.0 mg/L	5.0 mg/L
TKN	mg/L	--	3	--	--
NH_3-N	mg/L	0.3	0.7	0.4 mg/L	1.0 mg/L
NO_3-N	mg/L	--	13	--	--
NO_2-N	mg/L	--	--	--	--
Alkalinity	mg/L	93	96	3%	--

[a] Acceptable Error Range criteria from WEF MOP 31, Table 8.11.

4.3 Plant Model Validation Results

Once calibrated, the accuracy and reliability of the simulator was validated using historical data from January 2020. The goal of the validation step was to ensure that the calibrated model was able to closely match historical data from a different time period without applying any changes to calibrated parameters.

Table 4-3 presents the monthly average influent flow and loading characteristics from January 2020 that were used to validate the calibrated model's performance.

Table 4-3. Influent Wastewater Characteristics for Validation

Parameter	Units	Historical Data (Jan 2020 Average)	Model Inputs
Raw Wastewater			
Flow	mgd	0.50	0.50
BOD concentration	mg/L	221	221
BOD loading	lb/d	917	917
TSS concentration	mg/L	243	243
TSS loading	lb/d	1,007	1,007
VSS/TSS	%	-	90
NH_3-N concentration	mg/L	28	28
NH_3-N loading	lb/d	114	114
Alkalinity concentration	mg/L	-	229
Alkalinity loading	lb/d	-	950

Table 4-3. Influent Wastewater Characteristics for Validation

Parameter	Units	Historical Data (Jan 2020 Average)	Model Inputs
Aerobic Biological Kinetics			
Heterotrophs			
Maximum specific growth rate (mumax)	d^{-1}	-	3.2
Half saturation for organics (Ks)	mg-BOD5/L	-	3
Half saturation for organics (Ks)	mg-BioCOD2/L	-	5
Autotrophs			
Half saturation for O_2 (KO)	mg-O2/L	-	0.5
Maximum specific growth rate (mumax)	d^{-1}	-	0.9
Half saturation for NH_3-N (KN)	mg-N/L	-	0.7

Table 4-4 shows that the model closely predicts the effluent BOD_5, TSS, and NH_3 concentrations. Both the model and the historical data indicate near-complete pollutant removal and complete nitrification in the bioreactors.

Table 4-4. Historical Plant Performance and Model Validation Results

Parameter	Units	Historical Data	Model Output	Error	Acceptable Error Range (+/-)
Aeration Basin					
MLSS	mg/L	2,678	2,731	2%	10%
MLVSS	mg/L	2,326	2,270	-3%	--
MLVSS/MLSS	ratio	0.87	0.83	-4%	5%
WAS flow	gallon	5,120	5,670	10%	--
RAS TSS	mg/L	13,734	14,874	8%	--
WAS TSS load	lb/d	666	704	5%	10%
RAS flow	%Q	-	21%	-	-
MCRT	day	12.2	12.0	0.2 day	1 day
Effluent Characteristics					
BOD_5	mg/L	10	5	5 mg/L	--
TSS	mg/L	11	11	0 mg/L	5 mg/L
TKN	mg/L	--	3	--	--
NH_3-N	mg/L	0.3	0.8	0.5 mg/L	1.0 mg/L
NO_3-N	mg/L	--	16	--	--

Table 4-4. Historical Plant Performance and Model Validation Results

Parameter	Units	Historical Data	Model Output	Error	Acceptable Error Range (+/-)
NO_2-N	mg/L	--	--	--	--
Alkalinity	mg/L	99	95	4 mg/L	--
TP	mg/L	--	1	----	0.5 mg/L

Model output from the validation simulation matches the historical data within all the recommended acceptable error ranges specified in WEF MOP 31, indicating a successful validation. The successful calibration and validation scenarios demonstrated that the simulator was appropriately configured to use as a basis for estimating projected performance at design flows and loads in Section 5, Future Conditions.

5. Future Conditions

As presented above in Section 1, the Alliance is managing future flow increases within the City of Ridgefield with the implementation of the Ridgefield Flow Diversion Plan, which involves diverting flow from the collection system otherwise tributary to RTP instead to the DCWTS and ultimately to the SCTP. Influent flow to the RTP will be managed via the Ridgefield Flow Diversion Plan to remain under the existing NPDES permit limit of 0.7 mgd through the proposed Phase 1A improvements and below 0.9 mgd following Phase 1B improvements.

A peaking factor approach adapted from the Water Environment Federation's *Design of Water Resource Recovery Facilities, Manual of Practice No. 8* (WEF MOP 8) was used to project future BOD_5, TSS, and ammonia loading at the Phase 1A flow of 0.7 mgd and the Phase 1B flow of 0.9 mgd. This approach used the following steps to define future loads based on historical flow and load data:

- Remove outliers (in this case, known outliers from Nov 2020 through Feb 2021 resulting from lab and collection system operational issues referred to in Section 1)
- Develop annual average and monthly average flows and loads from daily average data.
- Determine the maximum monthly, weekly, and daily average flow and loads for each year
- Calculate the maximum-to-average-annual peaking factor for each year (for monthly, weekly, and daily conditions
- Calculate the average peaking factor for all years under all conditions
- Determine growth factor between current conditions and design conditions for Phases 1A and 1B by dividing the current 5-year average maximum month flow by the design maximum month flow
- Multiply the peaking factor by the design average conditions to develop projections

Monthly averages were computed on a calendar-basis rather than a 30-day rolling average to correspond with the historical values reported on the RTP's Discharge Monitoring Reports (DMRs) provided to Ecology. The historical average annual, maximum month, maximum week, and maximum daily averages for flow and BOD_5, TSS, and ammonia loads are presented in Table 5-1.

Table 5-1. Historical Daily Average Data Summary

	Flow (mgd)	BOD_5 (lb/d)	TSS (lb/d)	NH_3 (lb/d)
Average Annual				
2018	0.28	703	859	97
2019	0.32	767	921	122
2020	0.29	779	897	108
2021	0.25	654	698	96
2022	0.25	650	703	97
Average	**0.28**	**711**	**816**	**104**

Table 5-1. Historical Daily Average Data Summary

	Flow (mgd)	BOD_5 (lb/d)	TSS (lb/d)	NH_3 (lb/d)
Maximum Month				
2018	0.39	938	1,349	142
2019	0.40	918	1,167	141
2020	0.50	950	1,119	132
2021	0.36	775	901	105
2022	0.33	791	886	110
Average	**0.39**	**874**	**1,084**	**126**
Maximum Week				
2018	0.46	1,162	2,111	165
2019	0.51	1,189	1,415	157
2020	0.55	1,265	1,896	155
2021	0.42	913	1,101	125
2022	0.47	832	949	142
Average	**0.48**	**1,072**	**1,494**	**149**
Maximum Day				
2018	0.63	1,450	2,439	214
2019	0.68	1,328	1,858	182
2020	0.68	1,439	2,128	191
2021	0.54	1,331	1,330	135
2022	0.60	1,161	1,486	160
Average	**0.63**	**1,342**	**1,848**	**176**

The calculated maximum-to-average annual peaking factors are presented in Table 5-2.

Table 5-2. Flow and Load Peaking Factors

	Flow (mgd)	BOD_5 (lb/d)	TSS (lb/d)	NH_3 (lb/d)
Maximum Month				
2018	1.38	1.33	1.57	1.46
2019	1.24	1.20	1.27	1.16
2020	1.69	1.22	1.25	1.22
2021	1.43	1.19	1.29	1.10
2022	1.33	1.22	1.26	1.14
Average	**1.41**	**1.23**	**1.33**	**1.22**
Maximum Week				
2018	1.63	1.65	2.46	1.70
2019	1.61	1.30	1.21	1.11
2020	1.87	1.33	1.69	1.18
2021	1.67	1.18	1.22	1.19
2022	1.91	1.28	1.35	1.47
Average	**1.74**	**1.35**	**1.59**	**1.33**
Maximum Day				
2018	2.22	2.06	2.84	2.20
2019	2.14	1.73	2.02	1.49
2020	2.32	1.85	2.37	1.77
2021	2.17	2.04	1.90	1.41
2022	2.41	1.79	2.12	1.65
Average	**2.25**	**1.89**	**2.25**	**1.70**

To determine projected conditions, the growth factor between the current 5-year maximum month average flow of 0.39 and the Phase 1A design maximum month flow of 0.7 mgd was calculated, resulting in a value of approximately 1.78. Then, the growth factor between the current 5-year maximum month flow and the Phase 1B design maximum month flow of 0.9 mgd was calculated, resulting in a value of approximately 2.29. Once the growth factors for flow were determined, they were multiplied by current BOD_5, TSS, and ammonia loadings to determine the projected loadings at Phases 1A and 1B. The resulting projections are documented in Table 5-4. This approach assumes that loadings will increase at the same rate as flows. This results in projected load concentrations that are equivalent to current load concentrations.

Table 5-3. Phase 1A and Phase 1B Projected Flows and Loads

	Flow (mgd)	BOD_5 (lb/d)	TSS (lb/d)	NH_3 (lb/d)
Maximum Month				
Current	0.39	874	1,082	126
Phase 1A	0.7	1,555	1,924	225
Phase 1B	0.9	1,999	2,474	289
Maximum Week				
Current	0.48	958	1,295	138
Phase 1A	0.86	1,703	2,302	246
Phase 1B	1.11	2,189	2,960	316
Maximum Day				
Current	0.63	1,345	1,835	177
Phase 1A	1.12	2,391	3,262	315
Phase 1B	1.43	3,074	4,194	405

6. Analysis of Proposed Improvements

6.1 Phase 1A Improvements

Phase 1A improvements are primarily focused on increasing the biological nutrient removal capacity of the existing aeration basins by converting the current complete-mix configuration to a plug-flow configuration by the addition of baffle walls. Also proposed are operability improvements including adjustable frequency drives on the mixed liquor recycle pumps and new instrumentation to measure ammonia, ORP, dissolved oxygen, and total suspended solids to provide real-time information of BNR performance.

Figure 6-1 presents a schematic layout of the existing aeration basins indicating the Phase 1A improvements. Detailed design markups are included in Appendix G, Drawings.

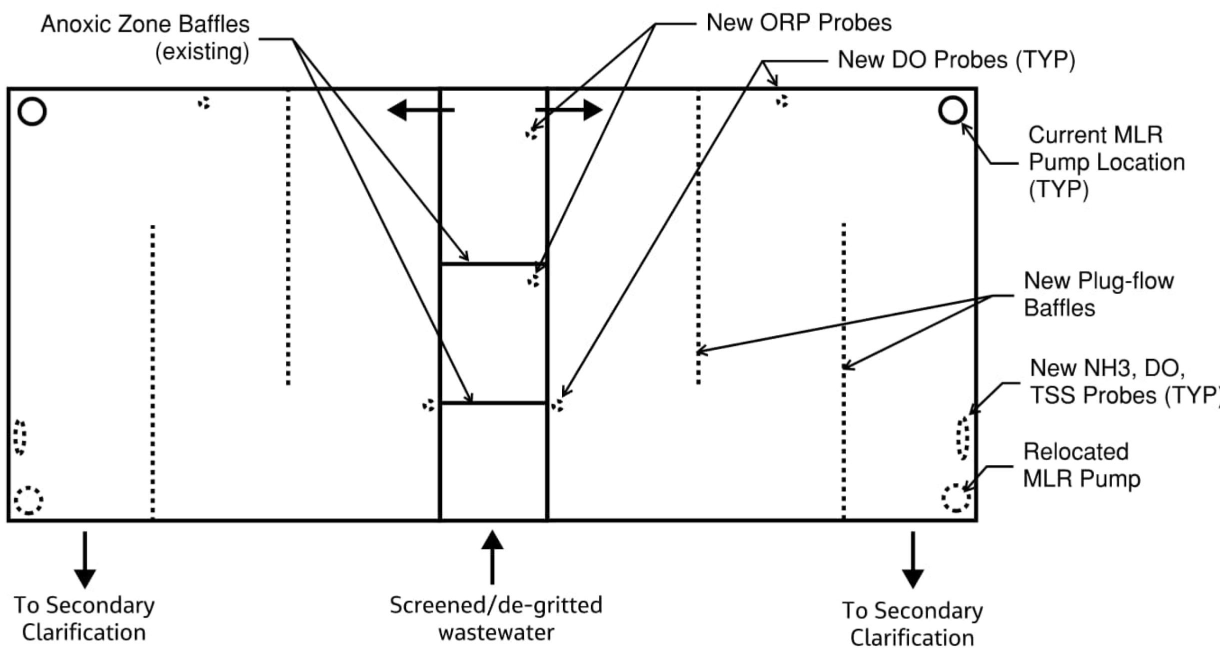

Figure 6-1. Aeration Basin Schematic Layout and Proposed Improvements Shown by Dashed Lines

The plug-flow configuration is widely demonstrated as providing improved ammonia removal compared to a single complete-mix basin. ORP instrumentation will provide real-time information on the condition of the anoxic selectors, and the ammonia probes will give operations staff increased visibility into the health and performance of BNR process. TSS probes will provide instantaneous, “real time” data on mixed liquor suspended solids and biomass inventory. Existing DO probes will be replaced with new equipment. The new instrumentation will allow operations staff to adjust more quickly to changing conditions and take actions such as adjusting caustic soda dosing for alkalinity recovery or adjusting aeration strategy. The improvements will increase the design life of the facilities by providing more efficient BNR performance and more visibility into process conditions.

The performance of the proposed Phase 1A improvements was compared with performance of existing plant infrastructure by applying the maximum month flows and loads to the calibrated process model. The objective was to investigate any process benefits, especially with respect to secondary system capacity, in changing the current complete mix configuration to plug flow configuration.

Table 6-1 summarizes the influent flow and load conditions used to evaluate the performance of the existing complete mix secondary system compared to the proposed plug flow configuration.
As demonstrated in Section 5, when the current 5-year average maximum month loads are extrapolated to the permitted design flow of 0.7 mgd, the design maximum month loads exceed the current monthly average limits of 1,240 pounds per day for BOD_5 and TSS. This reflects the fact that wastewater strength (concentration) has increased in the time period from when the 0.7 mgd capacity was permitted and current conditions.

Table 6-1. Flows and Loadings for Alternative Operating Configuration Scenarios

Parameter	Complete Mix	Plug Flow
Raw Influent [a]		
Flow (mgd)	0.7	0.7
BOD (lb/d)	1,555	1,555
TSS (lb/d)	1,924	1,924
Ammonia (lb/d)	225	225
Temperature (minimum and maximum weekly)	12.5/25	12.5/25

[a] Raw influent flows and loadings based on projected loadings at the maximum month design flow of 0.7 mgd from Section 5.

These influent conditions were then applied to the calibrated process model to compare performance in complete-mix mode to plug flow mode with proposed Phase 1A improvements.

Table 6-2 and 6-3 summarize the results for the alternative operating scenarios at 12.5°C and 25°C, respectively.

Table 6-2. Summary of Alternative Operating Configuration Scenario Analysis/Effluent Characteristics at the Minimum Monthly Temperature of 12.5 degrees Celsius

Parameter	Units	Complete-Mix	Plug Flow	Comments
Aeration Basin				
MLSS[b]	mg/L	3,483	3,301	CSWD max = 3,500 mg/L. RTP demonstrates monthly average MLSS concentrations exceeding 3,500 mg/L at times, but CSWD maximum set as simulation target for conservatism. Plug-flow mode results in greater removal of organic particulates in secondary system, leading to lower MLSS and WAS production compared to complete-mix mode. As a result, plug-flow basin could be operated at slightly higher MCRT.
MLVSS[c]	mg/L	2,915	2,859	
MLVSS/MLSS	ratio	0.85	0.87	
WAS TSS load	lb/d	1,407	1,337	See note above, lower WAS load in plug-flow due to higher organic solids removal in secondary.
MCRT	day	8.0	8.0	See note above, plug-flow mode can be operated at slightly higher MCRT due to reduced MLSS than complete-mix.

Table 6-2. Summary of Alternative Operating Configuration Scenario Analysis/Effluent Characteristics at the Minimum Monthly Temperature of 12.5 degrees Celsius

Parameter	Units	Complete-Mix	Plug Flow	Comments
Nitrification safety factor		2.13	2.12	
Actual oxygen requirement	lb O_2/d	2,573	2,578	
Total required air rate	scfm	1,206	1,135	Firm blower capacity with 1 out-of-service = 2,400 scfm
Secondary Clarification				
Clarifiers in service	No.	1	1	
Clarifier area	ft^2	1,963	1,963	
SVI	mL/g	140	140	Historical maximum month SVI from Figure 3-10
RAS rate	mgd	1.0	1.0	
Surface loading rate	gal/d/ft^2	367	366	
Applied solids flux	lb/d/ft^2	26	24	
Limiting solids flux	lb/d/ft^2	44	44	
Solids loading rate, percent of maximum	%	59%	55%	CSWD recommended solids loading rate, percent of maximum, is 80 percent.
Effluent Characteristics				
BOD_5	mg/L	3	3	
TSS	mg/L	6	6	
TKN	mg/L	4	3	More efficient TKN removal in plug flow basin
NH_3-N	mg/L	1.3	0.3	More efficient NH_3 removal in plug flow basin
NO_3-N	mg/L	15	12	
NO_2-N	mg/L	0	0	
Alkalinity	mg/L	91	96	Improved denitrification performance due to optimization of MLR pumping results in greater effluent alkalinity

CSWD = *Criteria for Sewage Works Design*; gal/d/ft^2 = gallons per day per square foot.

Table 6-3. Summary of Alternative Operating Configuration Scenario Analysis/Effluent Characteristics at the Maximum Monthly Temperature of 25 degrees Celsius

Parameter	Units	Complete-Mix	Plug Flow	Comments
Aeration basin				
MLSS[b]	mg/L	3,224	3,000	CSWD max = 3,500 mg/L. RTP demonstrates monthly average MLSS concentrations exceeding 3,500 mg/L at times, but CSWD maximum set as simulation target for conservatism. Plug-flow mode results in greater removal of organic particulates in secondary system, leading to lower MLSS and WAS production compared to complete-mix mode. As a result, plug-flow basin could be operated at slightly higher MCRT.

Table 6-3. Summary of Alternative Operating Configuration Scenario Analysis/Effluent Characteristics at the Maximum Monthly Temperature of 25 degrees Celsius

Parameter	Units	Complete-Mix	Plug Flow	Comments
MLVSS[c]	mg/L	2,656	2,586	
MLVSS/MLSS	ratio	0.82	0.86	
WAS TSS load	lb/d	1,300	1,213	See note above, lower WAS load in plug-flow due to higher organic solids removal in secondary
MCRT	day	8.0	8.0	See note above, plug-flow mode can be operated at slightly higher MCRT due to reduced MLSS than complete-mix.
Nitrification safety factor		5.85	5.84	
Actual oxygen requirement	lb O_2/d	2,752	2,733	
Total required air rate	scfm	1,232	1,326	Firm blower capacity with 1 out-of-service = 2,400 scfm
Secondary Clarification				
Clarifiers in service	No.	1	1	
Clarifier area	ft^2	1,963	1,963	
SVI	mL/g	140	140	Historical maximum month SVI from Figure 3-10
RAS rate	mgd	1.08	1.08	
Surface loading rate	gal/d/ft^2	366	366	
Applied solids flux	lb/d/ft^2	24	22	
Limiting solids flux	lb/d/ft^2	45	45	
Solids loading rate, percent of maximum	%	53%	50%	CSWD recommended solids loading rate, percent of maximum, is 80 percent.
Effluent Characteristics				
BOD_5	mg/L	2	3	
TSS	mg/L	6	6	
TKN	mg/L	3	2	More efficient TKN removal in plug flow basin
NH_3-N	mg/L	0.4	0.05	More efficient NH_3 removal in plug flow basin
NO_3-N	mg/L	16	11	More efficient NO_3 removal in plug flow basin
NO_2-N	mg/L	0	0	
Alkalinity	mg/L	85	98	Improved denitrification performance due to optimization of MLR pumping results in greater effluent alkalinity

CSWD = *Criteria for Sewage Works Design*; gal/d/ft^2 = gallons per day per square foot.

The results of the comparison between complete-mix and plug flow operation at the maximum month flow and load conditions indicate that the proposed plug flow configuration provides more robust ammonia and BOD_5 removal than the complete-mix mode. At minimum temperature under maximum month conditions, the model indicates that the complete-mix basin is not able to nitrify sufficiently to ensure permit compliance. While operating in plug flow mode, however, the existing basins are predicted to completely nitrify the influent ammonia at both minimum and maximum conditions.

In both scenarios, airflow requirements and secondary clarification capacity would be roughly equal. Predicted total air demand in both scenarios could be met by two of three existing process blowers with one out-of-service at both minimum and maximum temperatures. Secondary clarifier capacity is also sufficient to operate with one clarifier out-of-service at the CSWD maximum recommended MLSS concentration of 3,500 mg/L and the historical maximum month SVI of 109 milliliters per gram. The state point analysis graph of secondary clarifier performance under both scenarios is presented in Figure 6-2.

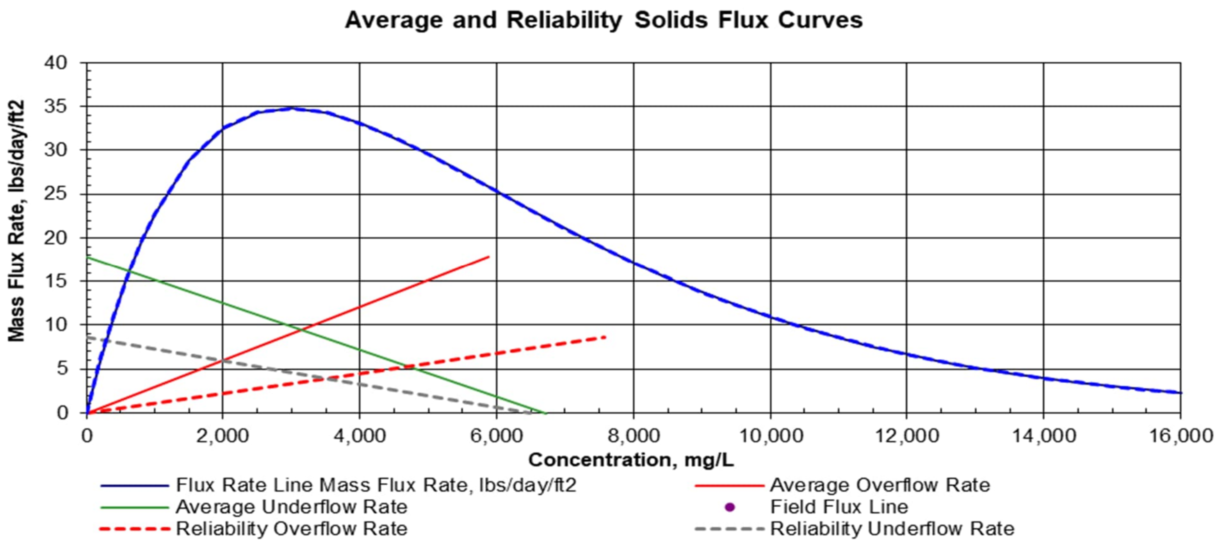

Figure 6-2. Secondary Clarifier State Point Analysis – Phase 1A

Reliability curves illustrate operation with both secondary clarifiers online, and average curves depict operation with a single secondary clarifier online.

The secondary clarifier operating point is shown as the intersection of the solids underflow rate line (in green) and the surface overflow line (in red). The operating point falls well below the settling flux curve (in blue), indicating that the clarifier is operating well below its limiting capacity. In terms of effluent quality, plug flow operation provides a higher level of nitrification with lower effluent BOD_5 and ammonia concentrations.

6.2 Phase 1B Improvements

Phase 2 improvements consist of the conversion of Aerobic Digester No. 2 into a new Anoxic Reactor, with three baffled zones and submersible mixing. Screened and de-gritted raw influent will flow directly from headworks to the anoxic reactor, where RAS and MLR will also be pumped. The effluent from the anoxic reactor will flow to the aeration influent mixing box then to the existing anoxic zones. These will be converted into aeration/anoxic swing zones with wall-to-wall floor-mounted fine bubble diffusers for aeration. The flow will be routed to each aeration basin at the end of the aerobic swing zone.

The additional aerobic volume will increase the plant capacity to treat flows up to 0.9 mgd at maximum month conditions. The anoxic reactor will feature three independent baffled zones that will provide an increase in total anoxic volume compared to the existing system. The swing zone capability will provide additional anoxic volume when loads to the plant are lower, reducing aeration energy expenditure.

Figure 6-3 on the following page presents the plant process flow schematic with proposed changes from Phase 1B improvements.

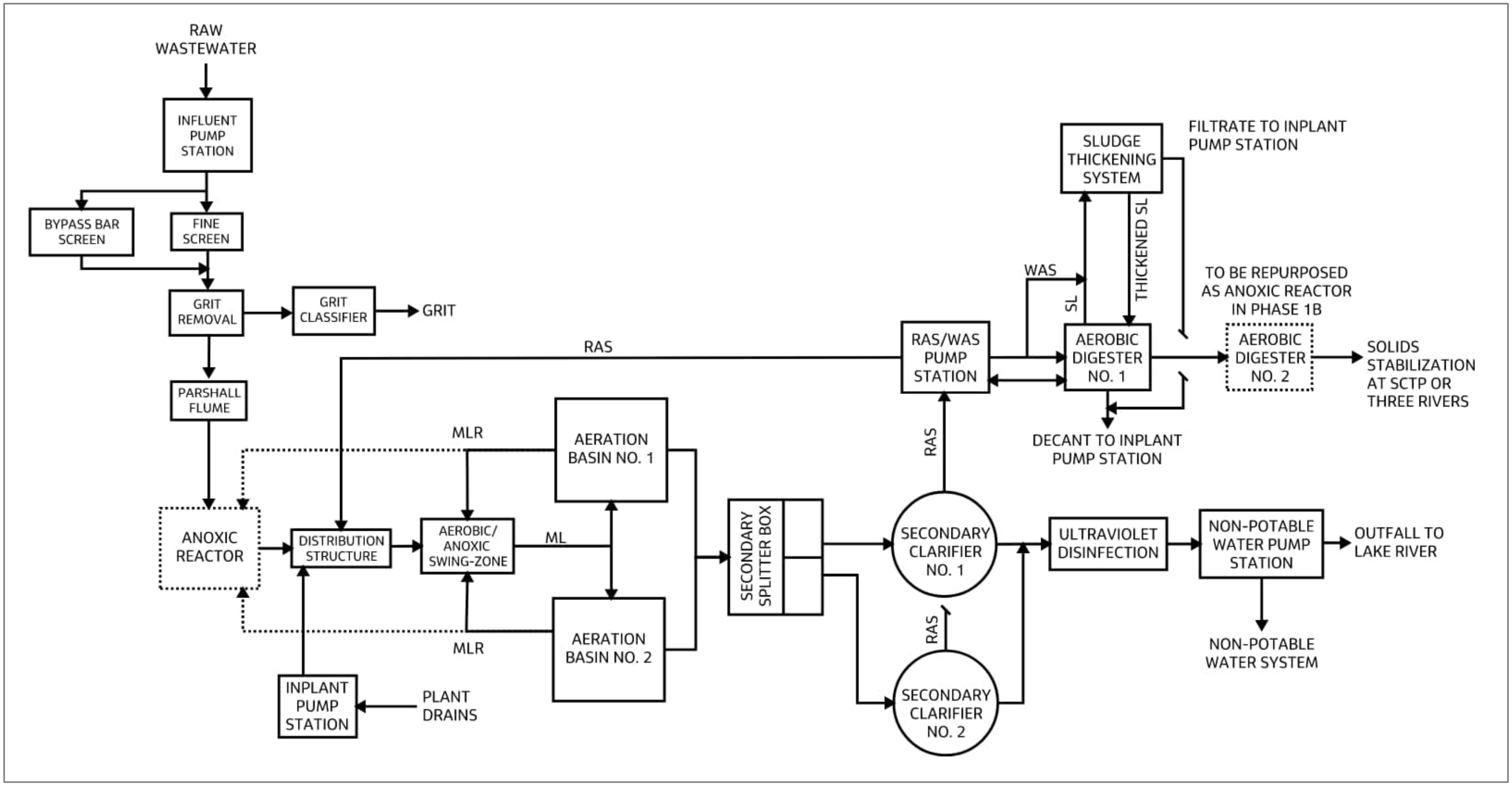

Figure 6-3. Phase 1B Process Flow Schematic

Phase 1B changes to the flow schematic indicated by dotted line.

Table 6-4 summarizes the influent flow and load conditions used to evaluate the performance of the Phase 1B improvements at minimum and maximum weekly temperatures.

Table 6-4. Flows and Loadings for Alternative Operating Configuration Scenarios

Parameter	Complete mix
Raw Influent	
Flow (mgd)	0.9
BOD (lb/d)	1,999
TSS (lb/d)	2,474
Ammonia (lb/d)	289
Temperature (minimum and maximum weekly)	12.5/25

These influent conditions were applied to the calibrated process model to compare performance in complete-mix mode to plug flow mode with proposed Phase 1B improvements.

Table 6-5 summarizes the results for the alternative operating scenarios.

Table 6-5. Summary of Phase 1B Simulation Results at 0.9 mgd Maximum Month Conditions

Parameter	Units	Value at 12.5°C	Value at 25.0°C	Comments
Aeration Basin				
MLSS[b]	mg/L	3,467	3,156	CSWD max = 3,500 mg/L. RTP demonstrates monthly average MLSS concentrations exceeding 3,500 mg/L at times, but CSWD maximum set as simulation target for conservatism.
MLVSS[c]	mg/L	3,000	2,715	
MLVSS/MLSS	ratio	0.87	0.86	
WAS TSS load	lb/d	1,741	1,583	
MCRT	day	7.5	7.5	Optimized basin allows longer MCRT due to better denitrification resulting from rehabilitated MLR pumps. Longer MCRT provides greater nitrification safety factor.
Nitrification safety factor		1.94	5.35	
Actual oxygen requirement	lb O_2/d	3,252	3,467	
Total required air rate	scfm	1,471	1,915	Firm blower capacity with largest out-of-service = 2,400 scfm
Secondary Clarification				
Clarifiers in service	No.	1	1	
Clarifier area	ft^2	1,963	1,963	
SVI	mL/g	140	140	Historical maximum month SVI from Figure 3-10
RAS rate	mgd	1.08	1.08	
Surface loading rate	gal/d/ft^2	470	470	

Table 6-5. Summary of Phase 1B Simulation Results at 0.9 mgd Maximum Month Conditions

Parameter	Units	Value at 12.5°C	Value at 25.0°C	Comments
Applied solids flux	lb/d/ft^2	28	26	
Limiting solids flux	lb/d/ft^2	44	44	
Solids loading rate, percent of maximum	%	64%	59%	CSWD recommended solids loading rate, percent of maximum, is 80 percent.
Effluent Characteristics				
BOD_5	mg/L	3	3	More efficient BOD_5 removal in plug flow basin
TSS	mg/L	6	6	
TKN	mg/L	3	2	More efficient TKN removal in plug flow basin
NH_3-N	mg/L	0.35	0.05	More efficient NH_3 removal in plug flow basin
NO_3-N	mg/L	0	0	
NO_2-N	mg/L	11	11	
Alkalinity	mg/L	109	108	Improved denitrification performance due to optimization of MLR pumping results in greater effluent alkalinity

CSWD = *Criteria for Sewage Works Design*; gal/d/ft^2 = gallons per day per square foot.

The state point analysis graph of the results for secondary clarifier performance is shown in Figure 6-4.

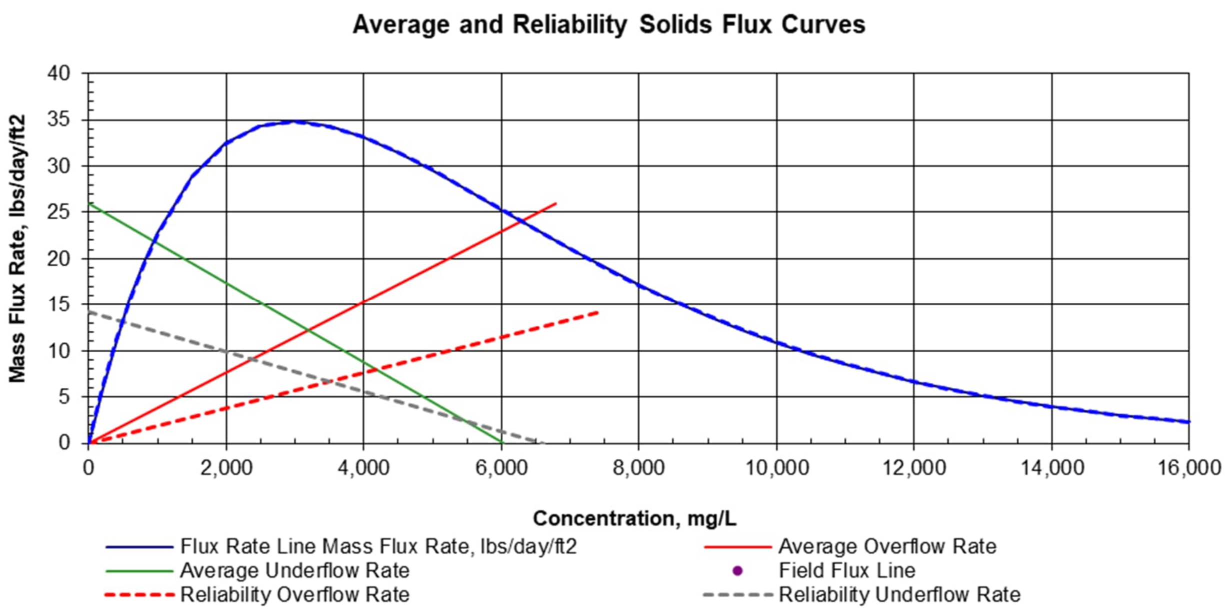

Figure 6-4. Secondary Clarifier State Point Analysis – Phase 1B

The Phase 1B improvements provide sufficient capacity to treat up to 0.9 mgd under maximum month conditions at minimum and maximum weekly conditions while operating with required parameters from the *Criteria for Sewage Works Design*.

6.3 Conclusions and Recommendations

This process assessment and modeling evaluation was conducted for RTP to evaluate the current secondary system performance and determine the optimal operational configuration in terms of ammonia removal at peak flowrate.

The following main conclusions are drawn from the process analyses discussed in this Engineering Report:

- Under current flows and loadings, the system can operate with two aeration basins and one secondary clarifier and meet the effluent ammonia permit limit.
- The Phase 1A improvements to the aeration basin increase ammonia removal performance.
- The Phase 1B improvements increase capacity up to 0.9 mgd at maximum month conditions.
- Operating as a plug-flow basin, the system outperforms the existing complete-mix mode.
- The RTP has sufficient installed aeration blower and secondary clarifier capacity to handle higher projected loads beyond those corresponding with influent flows of 0.7 mgd.

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7. Financial Analysis, Staffing, and Schedule

7.1 Preliminary Cost Estimate and Funding

7.1.1 Preliminary Cost Estimate

This section provides a preliminary estimate of the total project costs for the proposed project based on the Engineering Report recommendations. The estimate assumes costs for all elements expected to be part of the final design.

The cost estimate was prepared as a Class 4 estimate, as defined by the estimate classification system of the Association for the Advancement of Cost Engineering International (formerly known as the American Association of Cost Engineers). Table 7-1 summarizes the confidence ranges of the various classes of estimates, such that the actual cost of construction would fall between the upper and lower bounds of confidence for an estimate of a particular class.

Table 7-1. Cost Estimate Class Categorization

Class of Cost Estimate	Lower Bound of Confidence Range	Upper Bound of Confidence Range
Class 1	-10%	+15%
Class 2	-15%	+20%
Class 3	-20%	+30%
Class 4	-30%	+50%
Class 5	-50%	+100%

Tables 7-2 and 7-3 present the preliminary cost estimate for Phases 1A and 1B of the STPI.

Table 7-2. Phase 1A Preliminary Project Cost Estimate

Component	Cost
Phase 1A Baffles	$110,000
VFD's on MLR Pumps	$24,000
Instrumentation (NH3, DO, ORP, TSS)	$53,000
Electrical Allowance (22%)	$41,000
Installation Factor (60%)	$90,000
Sales Tax (8.4%)	$16,000
General Conditions/Mobilization (11%)	$35,000
Prime Contractor Markups (15%)	$52,000
Bonds & Insurance (2%)	$8,000
Escalation (5% annually for 1 year)	$20,000
Construction Contingency (35%)	$152,000

Table 7-2. Phase 1A Preliminary Project Cost Estimate

Component	Cost
Project Delivery (15%)	$90,000
Project Contingency (0%)	$0
Total Project Cost (rounded)	**$700,000**

Table 7-3. Phase 1B Preliminary Project Cost Estimate

Component	Cost
Sitework	$50,000
Phase 1B Baffles	$64,000
Diffuser System (Swing-Zone)	$55,000
Submersible Mixer (Anoxic Reactor)	$10,000
Mechanical: Valves and Piping	$189,000
Electrical Allowance (22%)	$81,000
Installation Factor (60%)	$190,000
Sales Tax (8.4%)	$110,000
General Conditions/Mobilization (11%)	$70,000
Prime Contractor Markups (15%)	$121,000
Bonds & Insurance (2%)	$15,000
Escalation (5% annually for 5 years)	$234,000
Construction Contingency (45%)	$486,000
Project Delivery (30%)	$470,000
Project Contingency (10%)	$203,000
Total Project Cost (rounded)	**$2,300,000**

7.1.2 Project Funding

The capital expenditures portion of proposed project will be funded as an Alliance Capital Project. The Alliance Capital Project work is funded by a combination of Regional Service Charges and debt proceeds to fund larger capital projects. For this project, it is anticipated that the Alliance will fund the project with local revenue sources to finance the construction-phase portion of the project. The Alliance costs are then allocated to the Alliance Member Agencies, based on the amount of capacity allocation purchased with the project. The allocation of costs for the project is summarized in Table 7-4.

Table 7-4. RTP STPI Project Cost Allocations

Agency	Portion Allocated	Allocation
Battle Ground Share	0.0%	$0
District Share	100%	Phase 1A: $**700,000** Phase 1B: $**2,300,000**
Total Project Cost	100.0%	$3,000,000

The project is anticipated to reduce operating costs at RTP by optimizing aeration system performance via plug-flow operation, reducing MLR pumping during low-flow periods, and providing real-time measurements of ammonia, dissolved oxygen, oxidative-reductive potential, and total suspended solids in the secondary system.

7.2 Staffing Requirements

The proposed improvements are not likely to incur additional staffing needs as they are simply optimizing the performance of an existing unit process, secondary treatment.

7.3 Project Schedule

Construction of Phase 1A is proposed for summer 2024, while Phase 1B will be designed and implemented if capacity triggers are met due to the Ridgefield Diversion Plan being delayed for any reason.

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8. Compliance with Regulatory Requirements

8.1 Permitting and Regulations

In accordance with RCW 90.48.110, all engineering reports, plans, and specifications for new construction or improvements to existing sewage treatment systems shall be submitted to and approved by Ecology before construction may begin. RCW 90.48.110 also allows delegation of this authority to local authorities that meet Ecology's criteria. The District meets Ecology's criteria and has entered into a formal delegation agreement with Ecology. As a result, the District will perform as the delegated authority for certain review and approval responsibilities, as indicated below. The Alliance will serve as State Environmental Policy Act (SEPA) lead agency under its adopted SEPA rules.

For Phase 1A of the proposed project, the Alliance will obtain or perform the following permits and approvals (except where noted):

- Review and approval of the Engineering Report per WAC 173-240-060 by Ecology.
- Review and approval of final Plans and Specifications per WAC 173-240-020(11) and WAC 173-240-070 by the District.
- Review and approval of Construction Quality Assurance Plan per WAC 173-240-020(2) and WAC 173-240-075 by the District.
- Modification of NPDES Permit No. WA0023639 by Ecology.

For Phase 1B, the follow permits and approvals will also be obtained:

- Minor Source Air Discharge Permit from SWCAA, amended for 0.9 mgd flow.
- Shoreline Management Act Shoreline Permit (possible Conditional Use Permit) from the City of Ridgefield.
- Building Permit(s) from the City of Ridgefield.
- Grading and Drainage Permit (including Stormwater Technical Information Report).
- Review and concurrence of archaeological survey by Department of Archaeology and Historic Preservation.
- Environmental Permits including CARA (possible exemption), Geo Hazard, Riparian Habitat Buffer (not likely), and Floodplain.
- Land Use Reviews/Permits including Pre-Application Conference Application, Site Plan Review.
- WDFW Net Ecological Gain requirements.

The Alliance plans to issue a SEPA determination of non-significance (DNS) for the overall RTP STPI Project.

The STPI Project does not have a federal nexus and will not utilize the Clean Water Act State Revolving Fund loan program. Therefore, neither compliance with the National Environmental Policy Act nor the State Environmental Review Process will be required.

8.2 Environmental Impacts

Development of this Engineering Report requires the Alliance to consider environmental values under SEPA. A complete analysis of the environmental effects related to this project is contained in the SEPA document in Appendix E.

8.3 Compliance with Water Quality Standards

The RTP STPI project will improve secondary system performance and reliability to meet the facility's NPDES permit requirements. The improved facility will continue to conform to state and federal water quality standards.

9. Engineering Report Requirements Checklist

For the reviewer's convenience, Table G1-1 Requirements for Engineering Reports, taken from *Criteria for Sewage Works Design*, is included as Table 9-1. The table provides a comprehensive list of the information required for engineering reports and facilities plans and the location where the information is provided. Additional supporting information regarding the RTP service area and treatment facility can be found in the City of Ridgefield General Sewer Plan (Gray & Osborne, 2013).

Table 9-1. Requirements for Engineering Reports

Element	Requirement	Location or Reference
Site Description and Map	Well documented	Figures 1-3, 1-4
Problem Identification	Well documented	Section 1.2 of the Engineering Report
Description of Discharge Standards	Well documented	Section 2 and Appendix B & C
Background Information	Existing Environment: • Water, air, sensitive areas • Floodplains • Shorelines • Wetlands • Endangered species • Public health Demographics and Land Use: • Current Population • Present wastewater treatment • Advanced wastewater treatment need evaluated • Infiltration and inflow studies • Combined sewer overflows • Sanitary surveys for unsewered areas	Section 3 and Appendix E, SEPA Documentation. Further information can be found in the City of Ridgefield General Sewer Plan (2013)
Future Conditions	Demographics and Land Use: • Projected population levels • Appropriateness of population data source, zoning changes • Future domestic and industrial flows, and flow reduction options • Future flows and coding • Reserved capacity • Future environment without project	Sections 1, 3, and 5

Table 9-1. Requirements for Engineering Reports

Element	Requirement	Location or Reference
Alternatives	• List specific alternative categories, including no action • Collection system alternatives • Sludge management/use alternatives • Flow reduction • Costs • Environmental impacts • Public acceptability • Rank order • Recommended alternative	Unit process capacity analysis is discussed in Sections 3 and 5 of the Engineering Report. NA Section 1 and 3 Section 1 Section 7 Section 8 and the City of Ridgefield General Sewer Plan (2013) NA NA Section 6
Final Recommended Alternative	• Site layout • Flow diagram • Sizing • Environmental impacts • Design life • Sludge management • Ability to expand • O&M/staffing needs • Design parameters • Feasibility of implementation	Figure 1-4, Appendix G Figure 3-1, 6-3 Section 6 Section 8 Section 6 Section 3 Section 1 Section 7 Section 3 & 6 Section 7
Financial Analysis	• Costs • User charges • Financial capability • Capital financing plan • Implementation plan	Section 7
Other	• Water quality management plan • SEPA approval • List required permits	Refer to Section 8 of the Engineering Report for information regarding water quality management, SEPA approval and permitting.

NA = not applicable.

Appendix A
Plan and Schedule for Maintaining Plant Capacity (May 10, 2021)

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CLARK REGIONAL WASTEWATER DISTRICT

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May 10, 2021

David J. Knight P.E.
Facility Manager
Southwest Regional Office, Water Quality Program
Washington State Department of Ecology
PO Box 47775
Olympia, WA 98504-7775

RE: Ridgefield Wastewater Treatment Plant (RTP)
National Pollutant Discharge Elimination System (NPDES) Permit No. WA0023272
Plans and Schedule for Maintaining Adequate Capacity per Permit Section S4.B

Dear Mr. Knight:

The Discovery Clean Water Alliance (Alliance) is the owner of the Ridgefield Wastewater Treatment Plant (RTP) and the Clark Regional Wastewater District (District) is the owner of the contributing collection system. The District is also the Administrative Lead for the Alliance and, in this capacity, is responsible for managing capacity in the Alliance-owned facilities. Recently, the District received correspondence from the Department of Ecology (Ecology) regarding influent loadings to the facility over the four-month period November 2020 to February 2021. Most recently, on April 23, 2021, the District received a non-compliance notification from Ecology, which is included as Attachment A.

Specifically, the recent correspondence is related to reported influent total suspended solids (TSS) and biochemical oxygen demand (BOD) levels for the facility. Rich Ludlow, District Operations Director, has discussed the situation with Carl Jones, Ecology Outreach Operator, and submitted a formal response letter, also dated April 23, 2021, addressing the influent loadings. Please note that the District is the Operator of the RTP under contract with the Alliance. The investigation into the influent loadings in Mr. Ludlow's letter concluded with the following findings:

(1) potentially incorrect laboratory results in November and December 2020, and

(2) actual elevated loadings of partially digested (older) solids and sediments from the collection system that were re-suspended in flatter sewers during wet weather events from December 2020 to February 2021, after an operational change had been made at the Gee Creek Pump Station.

Mr. Ludlow's letter provided operational recommendations to address each of these findings. These recommendations, when fully implemented, are expected to restore normal influent loadings to the facility within the permitted values.

Plans for Maintaining Adequate Capacity

However, to ensure full permit compliance, the District, as owner/operator of the RTP's contributing collection system and as Administrative Lead for the Alliance, is providing this letter in accordance with Section S4.B.1 of the RTP NPDES Permit (Attachment B) to convey a plan and a schedule for continuing to maintain capacity, which will prevent the facility from being overloaded.

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Washington State Department of Ecology
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In fact, the plan has been previously submitted to Ecology as the General Sewer Plan (GSP) for the District (District), submitted to Ecology on March 1, 2019. The District GSP includes a stepwise plan for incrementally redirecting the Ridgefield Collection System to flow to the Salmon Creek Treatment Plant (SCTP) in Section 10.1.3. This plan has been specifically designed to avoid overloading the RTP facility. The recent correspondence from Ecology provides an opportunity to report on the elements of the GSP that have already been accomplished and provide an updated schedule on the remaining steps in the plan.

The Ridgefield Flow Diversion Plan (Attachment C) is included in the District's 2017 General Sewer Plan. This plan includes multiple projects through the mid-2030's, which will incrementally redirect wastewater flow from the City of Ridgefield to the Salmon Creek Wastewater Treatment Plant (SCTP) via the Discovery Clean Water Transmission System (DCWTS).

For reference, Section S4.A of the RTP NPDES permit, indicates flow design criteria conditions for the facility. Phase 1 depicts conditions associated with a plant flow rating of 0.7 million gallons per day (mgd) and Phase 2 presents conditions associated with a plant flow rating of 1.0 mgd. The City of Ridgefield previously studied expanding the facility to 1.0 mgd capacity, but ultimately did not implement the project due to the DCWTS construction, which facilitates the redirection of wastewater flow from the RTP to the SCTP.

Summary of RTP Performance

While there has been significant growth (Figure 1) in the City of Ridgefield over the last seven years, flows to the RTP have remained relatively constant (Figure 2), as the District has been implementing elements of the GSP designed to keep the RTP facility from being overloaded. The implementation of the DCWTS project in 2016 created the ability for a portion of the City's flow to be redirected from the RTP to the SCTP, thereby accommodating a large portion of the growth areas within the City. The RTP maximum average monthly flow prior to the implementation of the DCWTS was 0.60 mgd in December 2015, which correlated to a significant rain event. The highest maximum average monthly flow after implementing the DCWTS of 0.50 mgd occurred in January 2020. The RTP has operated well within its permitted flow of 0.70 mgd.

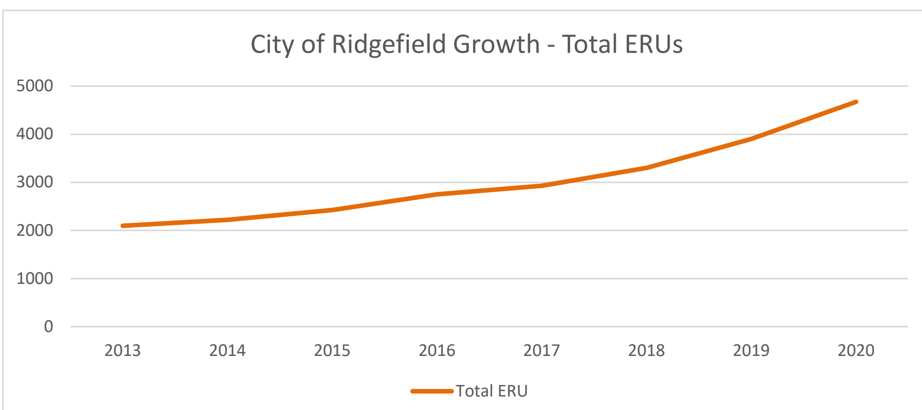

Figure 1

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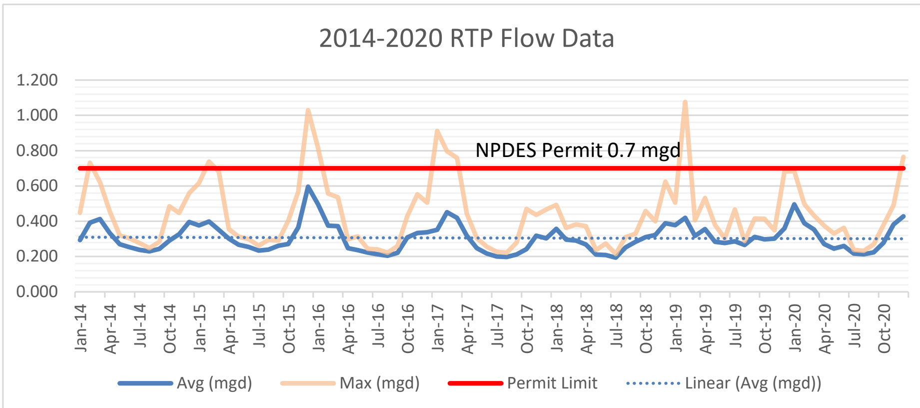

Figure 2

General Sewer Plan

The 2017 District GSP provides specific plans and projects to prevent the RTP from being overloaded, known as the Ridgefield Flow Diversion Plan (Attachment C). The plan depicts work relative to eight facilities (8 steps) that gradually redirect flow from the RTP to the SCTP through the mid-2030s.

Several of these projects have already been completed, which are summarized in **Table 1.** With the recent completion of the Hillhurst Pump Stations Redirect Phase 2 project, approximately 64% of Ridgefield flows are directed to the SCTP.

Implemented Capital Projects – Ridgefield Treatment Plant Flow Diversion			
GSP Step	**Facility**	**Improvement Description**	**Year**
7	Marina Pump Station – Phase 1	Marina Pump Station and Force Main constructed as part of Port of Ridgefield Overpass project, to move flow from the Marina to the RTP.	2015
1	DCWTS – Phase 1	Constructed transmission force mains from Pioneer Pump Station to the Neil Kimsey Pump Station, and force mains to the NE 20th Avenue Trunk System, which ultimately goes to the SCTP.	2016
4	Hillhurst Pump Stations Redirect – Phase 1	Redirection of a portion of the Hillhurst area to Royle Road as part of the Hawks Landing Development.	2016
2	Royle Road Pump Station	Constructed new pump station on Royle Road and force main to Pioneer Canyon Pump Station.	2017
3	Royle Road Trunk Sewer	Constructed new trunk sewer in Royle Road to carry flows from the Hillhurst Area.	2018
4	Hillhurst Pump Stations Redirect – Phase 2	Valving installed in force main system to allow additional flow to be redirected to the SCTP.	2021

Table 1

The District used the GSP Ridgefield Flow Diversion Plan to further define the specific scope and timing of the remaining projects, while monitoring growth and associated capacity needs (see Table 2). The remaining efforts necessary to decommission the RTP, according to the Ridgefield Diversion Plan, will be programmed through the District's annual update to the six-year Capital Improvement Program.

Remaining Capital Projects – Ridgefield Treatment Plant Diversion				
#	**GSP Step**	**Facility**	**Improvement Description**	**Timeline**
1	*	DCWTS – Neil Kimsey Pump Station	Add third and fourth 160 hp pumps; new drives, and new generator; requires bypassing of wet well.	2024
2	**1**	DCWTS – Pioneer Canyon Pump Station	Add 20-inch force main meter and pigging vault.	2024
4	*	DCWTS – Legacy Pump Station	Build parallel 16-inch force main; add flow meter and pigging vault.	2024
3	**2**	Royle Road Pump Station	Add third 70 hp pump, guiderails, soft start, integration.	2028
5	**5**	Midway Pump Station	New pump station meeting District Standards; 12-ft ID wet well; 115 hp pumps.	2029
6	**6**	Gee Creek Pump Station	Replace all pumps with 70 hp; new drives, new generator, replace wet well piping and valves. Assumes new 10-foot ID wet well and maintains existing valve vault.	2030
7	**7**	Marina Pump Station Phase 2	Replace all pumps with 45 hp; new drives, new generator, replace wet well piping and valves, in preparation for redirection.	2031
8	**1**	DCWTS – Neil Kimsey Pump Station	Construct 17,000 LF of 22-in force main.	2032
9	**7**	RTP Trunk Sewer	Construct New 12-inch diameter sewer construction from RTP to Marina Pump Station.	2032
10	**1**	DCWTS – Pioneer Canyon Pump Station	Replace all pumps with 185 hp; new drives, new generator, replace wet well piping and valves	2033

'* Table includes additional capital projects from the GSP but outside (downstream) of the Ridgefield area that are required to serve the Ridgefield area as growth occurs over time.

Table 2

Figure 3 (next page) shows the ultimate DCWTS and City of Ridgefield System Map following completion of the diversion projects.

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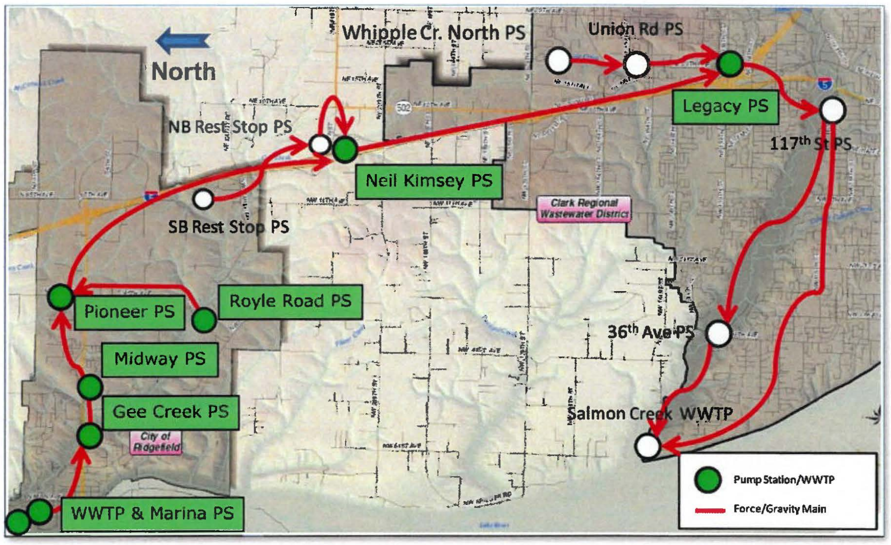


Figure 3 – DCWTS and City of Ridgefield System Map

Summary and Conclusion

The Alliance and District together have a thoughtful, programmatic effort in motion to divert flow from the RTP to the SCTP. Flows to the RTP are currently being managed to ensure flows and loadings at the RTP remain within permitted limits (0.7 mgd), while the City of Ridgefield continues to grow.

Thank you for the opportunity to present the Ridgefield Flow Diversion plan and how it addresses loadings at the RTP. Please feel free to contact me with any questions or clarifications at (360) 993-8815 or hhenderson@crwwd.com.

Sincerely,

Heath H. Henderson, P.E.
Engineering Director (District Engineer)

c: John M. Peterson, P.E., Alliance Executive Director/ District General Manager
Rich Ludlow, District Operations Manager
Vanessa Johnson, District Principal Engineer: Collection and Conveyance
Steve Ogle, Ecology
Pat Bailey, Ecology

Attachments

Attachment A

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

April 23, 2021

Richard Ludlow
Clark Regional Wastewater District
PO Box 8779
Vancouver, WA 98668

RE: Noncompliance Notification for National Pollutant Discharge Elimination System (NPDES) Permit No. WA0023272, Ridgefield Wastewater Treatment Plant

Dear Richard Ludlow:

Your **February 2021** Discharge Monitoring Report (DMR) indicates your influent reached 85 percent of the following design criteria:

Monitoring Parameter	Sample Measurement	Design Criteria
BOD 5-Day	1,149.3 lbs/day	1,348 lbs/day

When influent flows or wasteloads reach 85 percent of any design criteria for three consecutive months or when projected increases will reach the design criteria within five years, the planning and reporting requirements of Section S4 of your NPDES Permit are triggered. Please refer to your permit for information on your obligations under this section.

Your **February 2021** DMR also indicates your influent exceeded the following design criteria:

Monitoring Parameter	Sample Measurement	Design Criteria
Total Suspended Solids	1,611.1 lbs/day	1,348 lbs/day

Exceeding the above design criteria is a violation of your NPDES Permit. You should be aware that violations are subject to enforcement action, including Administrative Orders, to correct the problem and/or Civil Penalties, in accordance with Washington Administrative Code (WAC) 173-220-230.

If you have any questions regarding this matter (or if our information is incorrect), please contact your facility manager, David Knight, at david.j.knight@ecy.wa.gov or by phone at (564) 999-

Attachment A

3589 (cell); or you can contact me at patricia.bailey@ecy.wa.gov or by phone at (360) 870-6297 (cell).

If you need technical assistance, please contact your facility manager or call our technical assistance specialist, Carl Jones, at carl.jones@ecy.wa.gov or by phone at (360) 870-6297 (cell).

Sincerely,

Patricia Bailey
Compliance Officer
Water Quality Program
Southwest Regional Office

PB:CC(0023272)

cc: Timothy Shell, Clark Regional Wastewater District
Permit Compliance File

Attachment B

S4. FACILITY LOADING

A. Design Criteria

Flows or waste loadings of the following design criteria for the permitted treatment facility shall not be exceeded:

Phase 1:

Average flow for the maximum month:	0.70 MGD
BOD_5 loading for maximum month:	1,240 lbs/day
TSS loading for maximum month:	1,240 lbs/day
Ammonia loading for maximum month:	160 lbs/day

Phase 2: (Applicable after acceptance of the Declaration of Completion of Construction of Water Pollution Control Facilities for Phase 2.)

Average flow for the maximum month:	1.0 MGD
BOD_5 loading for maximum month:	1,348 lbs/day
TSS loading for maximum month:	1,348 lbs/day
Ammonia loading for maximum month:	225 lbs/day

B. Plans for Maintaining Adequate Capacity

The Permittee shall submit to Ecology a plan and a schedule for continuing to maintain capacity when:

1. The actual flow or waste load reaches 85 percent of any one of the design criteria in S4.A for three consecutive months; or

2. When the projected increase would reach design capacity within five years,

Whichever occurs first. If such a plan is required, it shall contain a plan and schedule for continuing to maintain capacity. The capacity as outlined in this plan must be sufficient to achieve the effluent limitations and other conditions of this permit. This plan shall address any of the following actions or any others necessary to meet the objective of maintaining capacity.

a. Analysis of the present design including the introduction of any process modifications that would establish the ability of the existing facility to achieve the effluent limits and other requirements of this permit at specific levels in excess of the existing design criteria specified in paragraph A above.

b. Reduction or elimination of excessive infiltration and inflow of uncontaminated ground and surface water into the sewer system.

c. Limitation on future sewer extensions or connections or additional waste loads.

d. Modification or expansion of facilities necessary to accommodate increased flow or waste load.

10.1.3 Ridgefield Flow Diversion Plan

As described in Chapter 2, the District and the Alliance are planning to direct all RUGA flows to the SCTP by 2036. The plan for doing so drives several key projects in the RUGA over the 20-year period. The ultimate decommissioning of the RTP relies on several interdependent sequential projects. The plan for redirecting flows is incremental with growth, such that RTP capacity is adequate within current permit limits without the need for expansion. The Ridgefield Flow Diversion Plan projects are only a portion of the CIP in the RUGA. Some of these projects are not critically dependent on the completion of earlier of projects, but all are ultimately needed to complete the flow redirection.

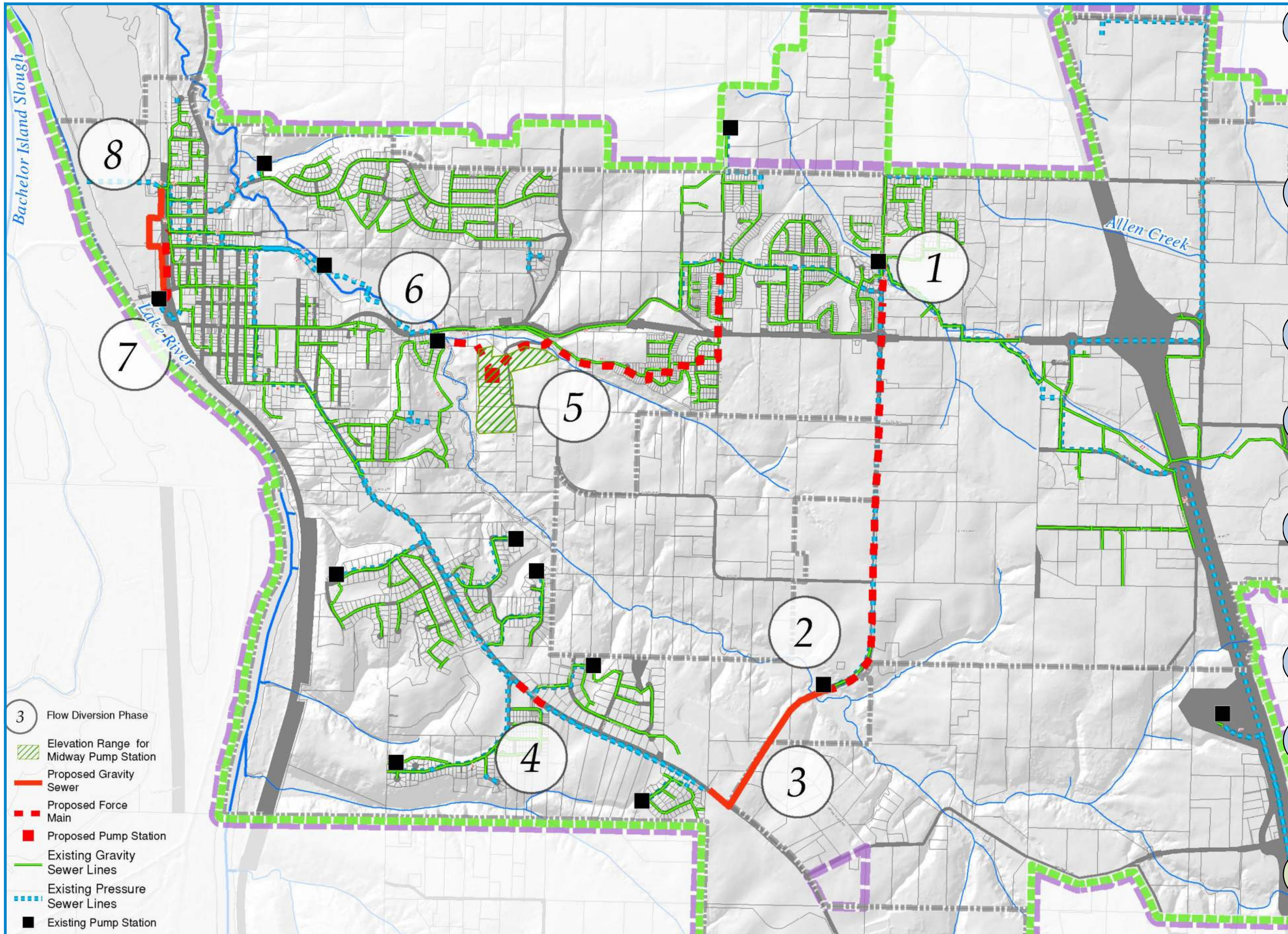
The general sequencing of critical Ridgefield Flow Diversion projects is as follows:

1. Royle Road pump station and force main (constructed in 2017). Capacity upgrades will be necessary to accommodate subsequent development.
2. Royle Road trunk
3. Redirection of the pump stations from the Hillhurst area to the Royle Road pump station
4. Modification to the Pioneer Canyon pump station to accommodate additional flows
5. Construction of the Gee Creek East (aka Midway) pump station and force main
6. Modifications to the Gee Creek pump station and new force main to Midway
7. Modifications and capacity expansion of the Marina pump station, force main and trunk line extension from RTP

The locations and sequencing of the flow diversion projects are presented in Figure 10.1.

Other downstream improvements necessary to receive and convey flows from the RUGA were originally identified in the DCWTS Report. These improvements were studied as part of the 2036 capacity analysis (see Chapter 7). The timing of the improvements has been modified in the CIP, as warranted based upon population and flow forecasts in this Plan. Some of the projects identified in the original DCWTS Report were not warranted in the 20-year planning horizon. However, those projects that were needed to support planned flows have been incorporated into the CIP.

Attachment C



1 – DCWTS			
	2016	Phase-1:	$29 M
	2027	PC PS Ph-2	$ 0.12 M
	2034	NKR FM Ph-2	$ 8.33 M
	2035	PC PS Ph-3	$ 1.59 M
2 – ROYLE ROAD PUMP STATION			
	2017	Phase-1:	$2.52 M
	2027	PS Ph-2	$ 0.19 M
	2032	PS Ph-3	$ 0.57 M
3 – ROYLE ROAD TRUNK SEWER			
	2018	TRUNK	$ 0.55 M ($0.1 M)
4 – HILLHURST PUMP STATIONS RE-DIRECT			
	2016	FM-PH 1	$ 0.10 M
	2019	FM-PH 2	$ 0.36 M
5 – MIDWAY PUMP STATION			
	2017		$0.13 M
	2023	PS Ph-1	$ 0.97 M
	2033	PS Ph-2	$ 3.08 M
6 – GEE CREEK PUMP STATION			
	2028	PH 2	$ 2.26 M
7 – MARINA PUMP STATION			
	2015	PH-1	$0.66 M ($0.26 M)
	2032	PS Ph-2	$ 1.07 M
	2033	TRUNK	$ 1.14 M
8 – TREATMENT PLANT DECOMMISSIONING (Alliance)			
	2031 -2034	RTP	$ 3.70 M

FIGURE 10.1

Ridgefield Flow Diversion

Appendix B
National Pollutant Discharge Elimination System Waste Discharge Permit No. WA0023272

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Issuance Date: June 9, 2011
Effective Date: July 1, 2011
Expiration Date: June 30, 2016

DEPARTMENT OF
ECOLOGY
State of Washington

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT NO. WA0023272

State of Washington
DEPARTMENT OF ECOLOGY
Olympia, Washington 98504-7775

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1251 et seq.

City of Ridgefield

230 Pioneer Street
P.O. Box 608

Ridgefield, WA 98642

Plant Location: West Cook Street	Receiving Water: Lake River
Water Body I.D. No.: Old ID # WA-28-1010, New ID# 1220169456238	Discharge Location: Latitude: 45.82150 Longitude: -122.75402
Plant Type: Activated sludge with secondary clarifier and UV disinfection	

is authorized to discharge in accordance with the special and general conditions that follow.

Steven G. Eberl, P.E.
Acting Southwest Regional Manager
Water Quality Program
Washington State Department of Ecology

TABLE OF CONTENTS

GENERAL CONDITIONS

SUMMARY OF PERMIT REPORT SUBMITTALS

Refer to the Special and General Conditions of this permit for additional submittal requirements.

Permit Section	Submittal	Frequency	First Submittal Date
S1.	Declaration of Completion of Construction	1/permit	When Completed
S3.	Discharge Monitoring Report	Monthly	August 15, 2011
S3.E	Noncompliance Notification	As necessary	
S4.B.	Plans for Maintaining Adequate Capacity	As necessary	
S4.C.	Notification of New or Altered Sources	As necessary	
S4.E.	Infiltration and Inflow Evaluation	Annually	October 15, 2011
S4.F.	Wasteload Assessment	Annually	October 15, 2011
S5.G.	O&M Manual Update/Review Letter	Annually	March 15, 2012
S6.D.	Industrial User Survey	1/permit cycle	June 15, 2015
S8.A.	Acute Toxicity Characterization Data	2/permit (once in summer and once in winter)	September 15, 2014 April 15, 2015
S8.A.	Acute Toxicity Tests Characterization Summary Report	1/permit cycle	September 15, 2015
S8.D	Acute Toxicity: “Causes and Preventative Measures for Transient Events.”	As necessary	
S8.D	Acute Toxicity TI/TRE Plan	As necessary	
S9.A	Chronic Toxicity Characterization Data	2/permit (once in summer and once in winter)	September 15, 2014 April 15, 2015
S9.A	Chronic Toxicity Tests Characterization Summary Report	1/permit cycle	September 15, 2015
S9.D	Chronic Toxicity: “Causes and Preventative Measures for Transient Events”	As necessary	
S9.D	Chronic Toxicity TI/TRE Plan	As necessary	
S10.	Outfall Evaluation	1/permit cycle	October 15, 2013
S11.	Schedule for Installing Alkalinity Addition System	As necessary	Within 90 days of effluent pH <6.0 or <70 mg/L Alkalinity
G1.	Notice of Change in Authorization	As necessary	
G4.	Permit Application for Substantive Changes to the Discharge	As necessary	

Permit Section	Submittal	Frequency	First Submittal Date
G5.	Engineering Report for Construction or Modification Activities	As necessary	
G7.	Application for Permit Renewal	1/permit cycle	January 1, 2016
G21	Notice of Planned Changes	As necessary	
G22	Reporting Anticipated Non-compliance	As necessary	

SPECIAL CONDITIONS

S1. DISCHARGE LIMITS

A. Effluent Limits

All discharges and activities authorized by this permit shall be consistent with the terms and conditions of this permit. The discharge of any of the following pollutants more frequently than, or at a level in excess of, that identified and authorized by this permit shall constitute a violation of the terms and conditions of this permit.

Beginning on the effective date of this permit and lasting through the expiration date the Permittee is authorized to discharge municipal wastewater at the permitted location subject to complying with the following limitations:

PHASE 1[e] EFFLUENT LIMITS[a]: OUTFALL # 001		
Parameter	**Average Monthly**	**Average Weekly**
Biochemical Oxygen Demand[b] (5 day)	30 mg/L 175 lbs/day 85 percent removal	45 mg/L 263 lbs/day
Total Suspended Solids[b]	30 mg/L 175 lbs/day 85 percent removal	45 mg/L 263 lbs/day
Fecal Coliform Bacteria	100/100 mL	200/100 mL
pH[c]	Daily minimum is equal to or greater than 6.0 and the daily maximum is less than or equal to 9.0.	
Parameter	**Average Monthly**	**Maximum Daily[d]**
Total Ammonia (as N)	1.4 mg/L 8.2 lbs/day	3.14 mg/L
[a] The average monthly and weekly effluent limitations are based on the arithmetic mean of the samples taken with the exception of fecal coliform, which is based on the geometric mean.		
[b] The average monthly effluent concentration for BOD_5 and Total Suspended Solids shall not exceed 30 mg/L or 15 percent of the respective monthly average influent concentrations, whichever is more stringent.		
[c] Indicates the range of permitted values. When pH is continuously monitored, excursions between 5.0 and 6.0, or 9.0 and 10.0 shall not be considered violations provided no single excursion exceeds 60 minutes in length and total excursions do not exceed seven hours and 30 minutes per month. Any excursions below 5.0 and above 10.0 are violations. The instantaneous maximum and minimum pH shall be reported monthly.		

[d] The maximum daily effluent limitation is defined as the highest allowable daily discharge. The daily discharge means the discharge of a pollutant measured during a calendar day. For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For other units of measurement, the daily discharge is the average measurement of the pollutant over the day.
[e.] Phase 1 limits apply until the first of the month following receipt of the declaration triggering Phase 2 limits (footnote 'e' in the following table.

PHASE 2[e] EFFLUENT LIMITS[a]: OUTFALL # 001		
Parameter	**Average Monthly**	**Average Weekly**
Biochemical Oxygen Demand[b] (5 day)	30 mg/L 202 lbs/day 85 percent removal	45 mg/L 303 lbs/day
Total Suspended Solids[b]	30 mg/L 202 lbs/day 85 percent removal	45 mg/L 303 lbs/day
Fecal Coliform Bacteria	100/100 mL	200/100 mL
pH[c]	Daily minimum is equal to or greater than 6.0 and the daily maximum is less than or equal to 9.0.	
Parameter	**Average Monthly**	**Maximum Daily[d]**
Total Ammonia (as N)	1.2 mg/L 10 lbs/day	2.9 mg/L

[a] The average monthly and weekly effluent limitations are based on the arithmetic mean of the samples taken with the exception of fecal coliform, which is based on the geometric mean.
[b] The average monthly effluent concentration for BOD_5 and Total Suspended Solids shall not exceed 30 mg/L or 15 percent of the respective monthly average influent concentrations, whichever is more stringent.
[c] Indicates the range of permitted values. When pH is continuously monitored, excursions between 5.0 and 6.0, or 9.0 and 10.0 shall not be considered violations provided no single excursion exceeds 60 minutes in length and total excursions do not exceed seven hours and 30 minutes per month. Any excursions below 5.0 and above 10.0 are violations. The instantaneous maximum and minimum pH shall be reported monthly.
[d] The maximum daily effluent limitation is defined as the highest allowable daily discharge. The daily discharge means the discharge of a pollutant measured during a calendar day. For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For other units of measurement, the daily discharge is the average measurement of the pollutant over the day.
[e.] Phase 2 limits apply on the first day of the month following the receipt by the Department of Ecology of a properly completed Declaration of Completion of Construction of Water Pollution Control Facilities (see Chapter 173-240 WAC for format) for the facilities described in the approved Facility Plan as Phase 2 improvements.

B. Mixing Zone Descriptions

The mixing zone appears to fit the model of the estuary best because of the tide reversals. The maximum boundaries of the mixing zones are therefore defined as:

Chronic boundary extends 200 feet upstream and 200 feet downstream. The width of Lake River is 240 feet wide and the mixing zone is allowed only 25 percent of the width which is 60 feet.

The Acute boundary is 10 percent of the 200-foot value established above, which is a 20-foot radius from the end of the pipe.

S2. MONITORING REQUIREMENTS

A. Monitoring Schedule

Category	Parameter	Units	Sample Point	Minimum Sampling Frequency	Sample Type
Wastewater Influent	BOD_5	mg/L lbs/day	Influent at Headworks past the screening	2/week	24-hour Composite
Wastewater Influent	TSS	mg/L lbs/day	Influent at Headworks past the screening	2/week	24-hour Composite
Wastewater Influent	Total Ammonia as N	mg/L lbs/day	Influent at Headworks past the screening	2/week	Grab
Wastewater Effluent	Flow	MGD	Effluent past the weir	Continuous[a]	Recording
Wastewater Effluent	BOD_5	mg/L lbs/day	Effluent past the weir	2/week	24-hour Composite
Wastewater Effluent	TSS	mg/L lbs/day	Effluent past the weir	2/week	24-hour Composite
Wastewater Effluent	pH	Standard Units	Effluent past the weir	Daily	Grab
Wastewater Effluent	Fecal Coliform	#/100 ml	Effluent past the weir	2/week	Grab
Wastewater Effluent	Total Ammonia as N	mg/L lbs/day	Effluent past the weir	2/week	Grab
Wastewater Effluent	Alkalinity	mg/L as CaCO3	Effluent past the weir	2/week	24-hour Composite

Category	Parameter	Units	Sample Point	Minimum Sampling Frequency	Sample Type
Wastewater Effluent	Temperature[b]	Deg C	Effluent past the weir	Continuous[a]	Recorded
Wastewater Effluent	Nitrite as N	mg/L	Effluent past the weir	Quarterly[d]	Grab
Wastewater Effluent	Nitrate as N	mg/L	Effluent past the weir	Quarterly[d]	Grab
Wastewater Effluent	TKN	mg/L	Effluent past the weir	Quarterly[d]	Grab
Wastewater Effluent	Ortho-phosphate (PO_4)	mg/L	Effluent past the weir	Quarterly[d]	Grab
Wastewater Effluent	Total Phosphorus	mg/L	Effluent past the weir	Quarterly[d]	Grab
Acute Toxicity Testing	Section S9 for details on monitoring (Test 2/year for one year unless a limit is needed in which case testing shall be 2/year each following year)				
Chronic Toxicity Testing	Section S10 for details on monitoring (Test 2/year for one year unless a limit is needed in which case testing shall be 2/year each following year)				

[a] Continuous means uninterrupted except for brief lengths of time for calibration, for power failure, or for unanticipated equipment repair or maintenance. Sampling shall be taken twice daily when continuous monitoring is not possible.

[b] To determine the daily maximum temperature, recorders may be set for reading every half-hour and choosing highest value during the 24-hour period.

[c] Clean sampling techniques are required for all metals sampling to avoid false positive errors. The Permittee should also follow lab testing that uses EPA method 200.8 that specifies the use of Induced Coupled Plasma with Mass Spectrometry (ICP/MS). Mercury shall be tested using EPA method 1631 Revision C (in 40 CFR Part 136).

[d] Quarterly is defined as:
January through March, report with March DMR
April through June, report with June DMR
July through September, report with September DMR
October through December, report with December DMR

B. Sampling and Analytical Procedures

Samples and measurements taken to meet the requirements of this permit shall be representative of the volume and nature of the monitored parameters, including representative sampling of any unusual discharge or discharge condition, including bypasses, upsets, and maintenance-related conditions affecting effluent quality.

Sampling and analytical methods used to meet the monitoring requirements specified in this permit shall conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 Code of Federal Regulations (CFR) Part 136 or to the latest revision of *Standard Methods for the Examination of Water and Wastewater* (APHA), unless otherwise specified in this permit or approved in writing by the Department of Ecology (Ecology).

C. Flow Measurement

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the quantity of monitored flows. The devices shall be installed, calibrated, and maintained to ensure that the accuracy of the measurements are consistent with the accepted industry standard for that type of device. Frequency of calibration shall be in conformance with manufacturer's recommendations and at a minimum frequency of at least one calibration per year. Calibration records shall be maintained for at least three years.

D. Laboratory Accreditation

All monitoring data required by Ecology shall be prepared by a laboratory registered or accredited under the provisions of, *Accreditation of Environmental Laboratories*, Chapter 173-50 Washington Administrative Code (WAC). Flow, temperature, settleable solids, conductivity, pH, and internal process control parameters are exempt from this requirement. Conductivity and pH shall be accredited if the laboratory must otherwise be registered or accredited. Ecology exempts crops, soils, and hazardous waste data from this requirement pending accreditation of laboratories for analysis of these media.

S3. REPORTING AND RECORDKEEPING REQUIREMENTS

The Permittee must monitor and report in accordance with the following conditions. Falsification of information submitted to Ecology is a violation of the terms and conditions of this permit.

A. Reporting

The first monitoring period begins on the effective date of the permit. The Permittee must:

1. Submit monitoring results each month.

2. Summarize, report, and submit monitoring data obtained during each monitoring period on a Discharge Monitoring Report (DMR) form provided, or otherwise approved, by Ecology.

3. Submit DMR forms monthly whether or not the facility was discharging. If the facility did not discharge during a given monitoring period, submit the form as required with the words "NO DISCHARGE" entered in place of the monitoring results.

4. Ensure that DMR forms are postmarked or received by Ecology no later than the 15th day of the month following the completed monitoring period, unless otherwise specified in this permit.

5. Send report(s) to Ecology at:

   Water Quality Permit Coordinator
   Department of Ecology
   Southwest Regional Office
   P.O. Box 47775
   Olympia, WA 98504-7775

All laboratory reports providing data for organic and metal parameters must include the following information: sampling date, sample location, date of analysis, parameter name, CAS number, analytical method/number, method detection limit (MDL), laboratory practical quantitation limit (PQL), reporting units, and concentration detected. Analytical results from samples sent to a contract laboratory must include information on the chain of custody, the analytical method, QA/QC results, and documentation of accreditation for the parameter.

B. Records Retention

The Permittee must retain records of all monitoring information for a minimum of three years. Such information must include all calibration and maintenance records and all original 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. The Permittee must extend this period of retention during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

C. Recording of Results

For each measurement or sample taken, the Permittee must record the following information:

1. The date, exact place, method, and time of sampling or measurement.
2. The individual who performed the sampling or measurement.
3. The dates the analyses were performed.
4. The individual who performed the analyses.
5. The analytical techniques or methods used.
6. The results of all analyses.

D. Additional Monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by Condition S2 of this permit, then the Permittee must include the results of such monitoring in the calculation and reporting of the data submitted in the Permittee's DMR.

E. Reporting Permit Violations

The Permittee must take the following actions when it violates or is unable to comply with any permit condition:

- Immediately take action to stop, contain, and cleanup unauthorized discharges or otherwise stop the noncompliance and correct the problem.
- If applicable, immediately repeat sampling and analysis. Submit the results of any repeat sampling to Ecology within 30 days of sampling.

1. Immediate Reporting

The Permittee must report any failure of the disinfection system immediately to the Department of Ecology's Regional Office 24-hour number listed below:

Southwest Regional Office 360-407-6300

The Permittee must report any failure of the disinfection system, any collection system overflows, or any plant bypass discharging to a waterbody used as a source of drinking water immediately to the Department of Ecology and the Department of Health, Drinking Water Program at the numbers listed below:

Southwest Regional Office	360-407-6300
Department of Health Drinking Water Program	360-521-0323 (business hours) 360-481-4901 (after business hours)

2. Twenty-Four (24)-Hour Reporting

The Permittee must report the following occurrences of noncompliance by telephone, to Ecology at 360-407-6300, within 24 hours from the time the Permittee becomes aware of any of the following circumstances:

a. Any noncompliance that may endanger health or the environment, unless previously reported under subpart 1, above.

b. Any unanticipated **bypass** that exceeds any effluent limitation in the permit (See Part S4.B., “Bypass Procedures”).

c. Any **upset** that exceeds any effluent limitation in the permit (See G.15, “Upset”).

d. Any violation of a maximum daily or instantaneous maximum discharge limitation for any of the pollutants in Section S1.A of this permit.

e. Any overflow prior to the treatment works, whether or not such overflow endangers health or the environment or exceeds any effluent limitation in the permit.

3. Report Within Five Days

The Permittee must also provide a written submission within five days of the time that the Permittee becomes aware of any event required to be reported under subparts 1 or 2, above. The written submission 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.

d. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

e. If the noncompliance involves an overflow prior to the treatment works, an estimate of the quantity (in gallons) of untreated overflow.

4. Waiver of Written Reports

Ecology may waive the written report required in subpart 3, above, on a case-by-case basis upon request if a timely oral report has been received.

5. All Other Permit Violation Reporting

The Permittee must report all permit violations, which do not require immediate or within 24 hours reporting, when it submits monitoring reports for S3.A ("Reporting"). The reports must contain the information listed in paragraph E.3, above. Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply.

6. Report Submittal

The Permittee must submit reports to the address listed in S3.

F. Other Reporting

The Permittee must report a spill of oil or hazardous materials in accordance with the requirements of RCW 90.56.280 and chapter 173-303-145. You can obtain further

instructions at the following website:
http://www.ecy.wa.gov/programs/spills/other/reportaspill.htm.

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to Ecology, it must submit such facts or information promptly.

The Permittee must submit a new application or supplement at least 180 days prior to commencement of discharges, resulting from the activities listed below, which may result in permit violations. These activities include: any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility.

G. Maintaining a Copy of This Permit

The Permittee must keep a copy of this permit at the facility and make it available upon request to Ecology inspectors.

S4. FACILITY LOADING

A. Design Criteria

Flows or waste loadings of the following design criteria for the permitted treatment facility shall not be exceeded:

Phase 1:

Average flow for the maximum month:	0.70 MGD
BOD_5 loading for maximum month:	1,240 lbs/day
TSS loading for maximum month:	1,240 lbs/day
Ammonia loading for maximum month:	160 lbs/day

Phase 2: (Applicable after acceptance of the Declaration of Completion of Construction of Water Pollution Control Facilities for Phase 2.)

Average flow for the maximum month:	1.0 MGD
BOD_5 loading for maximum month:	1,348 lbs/day
TSS loading for maximum month:	1,348 lbs/day
Ammonia loading for maximum month:	225 lbs/day

B. Plans for Maintaining Adequate Capacity

The Permittee shall submit to Ecology a plan and a schedule for continuing to maintain capacity when:

1. The actual flow or waste load reaches 85 percent of any one of the design criteria in S4.A for three consecutive months; or

2. When the projected increase would reach design capacity within five years,

Whichever occurs first. If such a plan is required, it shall contain a plan and schedule for continuing to maintain capacity. The capacity as outlined in this plan must be sufficient to achieve the effluent limitations and other conditions of this permit. This plan shall address any of the following actions or any others necessary to meet the objective of maintaining capacity.

a. Analysis of the present design including the introduction of any process modifications that would establish the ability of the existing facility to achieve the effluent limits and other requirements of this permit at specific levels in excess of the existing design criteria specified in paragraph A above.

b. Reduction or elimination of excessive infiltration and inflow of uncontaminated ground and surface water into the sewer system.

c. Limitation on future sewer extensions or connections or additional waste loads.

d. Modification or expansion of facilities necessary to accommodate increased flow or waste load.

e. Reduction of industrial or commercial flows or waste loads to allow for increasing sanitary flow or waste load.

Engineering documents associated with the plan must meet the requirements of WAC 173-240-060, "Engineering Report," and be approved by Ecology prior to any construction. The plan shall specify any contracts, ordinances, methods for financing, or other arrangements necessary to achieve this objective.

C. Duty to Mitigate

The Permittee is required to 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

D. Notification of New or Altered Sources

The Permittee shall submit written notice to Ecology whenever any new discharge or a substantial change in volume or character of an existing discharge into the Publicly Owned Treatment Works (POTW) is proposed which: (1) would interfere with the operation of, or exceed the design capacity of, any portion of the POTW; (2) is not part of an approved general sewer plan or approved plans and specifications; or (3*)* would be subject to pretreatment standards under 40 CFR Part 403 and Section 307(b) of the Clean Water Act. This notice shall include an evaluation of the POTW's ability to adequately transport and treat the added flow and/or waste load, the quality and volume of effluent to be discharged to the POTW, and the anticipated impact on the Permit tee's effluent [40 CFR 122.42(b)].

E. Infiltration and Inflow Evaluation

1. The Permittee shall conduct an infiltration and inflow evaluation. Refer to the U.S. EPA publication, *I/I Analysis and Project Certification*, available as Publication No. 97-03 at: Publications Office, Department of Ecology, P.O. Box 47600, Olympia, Washington 98504-7600. Plant monitoring records may be used to assess measurable infiltration and inflow.

2. A report shall be prepared which summarizes any measurable infiltration and inflow for the calendar year. If infiltration and inflow have increased by more than 15 percent from that found in the first report based on equivalent rainfall, the report shall contain a plan and a schedule for: (1) locating the sources of infiltration and inflow; and (2) correcting the problem.

3. The report shall be submitted by **October 15, 2011,** and **annually** thereafter.

F. Wasteload Assessment

The Permittee shall conduct an annual assessment of their flow and waste load for the calendar and submit year a report to Ecology by **October 15, 2011**, and **annually** thereafter. The report shall contain the following: an indication of compliance or noncompliance with the permit effluent limitations; a comparison between the existing and design monthly average dry weather and wet weather flows, peak flows, BOD, and total suspended solids loadings; and (except for the first report) the percentage increase in these parameters since the last annual report. The report shall also state the present and design population or population equivalent, projected population growth rate, and the estimated date upon which the design capacity is projected to be reached, according to the most restrictive of the parameters above. The interval for review and reporting may be modified if Ecology determines that a different frequency is sufficient.

S5. OPERATION AND MAINTENANCE

The Permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed to achieve compliance with the terms and 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, which are installed by a Permittee only when the operation is necessary to achieve compliance with the conditions of this permit.

A. Certified Operator

An operator certified for at least a Class II plant by the state of Washington shall be in responsible charge of the day-to-day operation of the wastewater treatment plant. An operator certified for at least a Class I plant shall be in charge during all regularly scheduled shifts.

B. O & M Program

The Permittee shall institute an adequate operation and maintenance program for their entire sewage system. Maintenance records shall be maintained on all major electrical and mechanical components of the treatment plant, as well as the sewage system and pumping stations. Such records shall clearly specify the frequency and type of maintenance recommended by the manufacturer and shall show the frequency and type of maintenance performed. These maintenance records shall be available for inspection at all times.

C. Short-term Reduction

If a Permittee contemplates a reduction in the level of treatment that would cause a violation of permit discharge limitations on a short-term basis for any reason, and such reduction cannot be avoided, the Permittee shall give written notification to Ecology, if possible, 30 days prior to such activities, detailing the reasons for, length of time of, and the potential effects of the reduced level of treatment. This notification does not relieve the Permittee of their obligations under this permit.

D. Electrical Power Failure

The Permittee is responsible for maintaining adequate safeguards to prevent the discharge of untreated wastes or wastes not treated in accordance with the requirements of this permit during electrical power failure at the treatment plant and/or sewage lift stations either by means of alternate power sources, standby generator, or retention of inadequately treated wastes.

The Permittee shall maintain Reliability Class II (EPA 430-99-74-001) at the wastewater treatment plant, which requires a backup power source sufficient to operate all vital components and critical lighting and ventilation during peak wastewater flow conditions, except vital components used to support the secondary processes (i.e., mechanical aerators or aeration basin air compressors) need not be operable to full levels of treatment, but shall be sufficient to maintain the biota.

E. Prevent Connection of Inflow

The Permittee shall strictly enforce their sewer ordinances and not allow the connection of inflow (roof drains, foundation drains, etc.) to the sanitary sewer system.

F. Bypass Procedures

Bypass, which is the intentional diversion of waste streams from any portion of a treatment facility, is prohibited, and Ecology may take enforcement action against a Permittee for bypass unless one of the following circumstances (1, 2, or 3) is applicable.

1. Bypass for essential maintenance without the potential to cause violation of permit limits or conditions.

   Bypass is authorized if it is for essential maintenance and does not have the potential to cause violations of limitations or other conditions of this permit, or adversely impact public health as determined by Ecology prior to the bypass. The Permittee shall submit prior notice, if possible at least 10 days before the date of the bypass.

2. Bypass which is unavoidable, unanticipated and results in noncompliance of this permit.

This bypass is permitted only if:

a. Bypass is unavoidable to prevent loss of life, personal injury, or severe property damage. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.

b. There are no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, stopping production, maintenance during normal periods of equipment downtime (but not if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance), or transport of untreated wastes to another treatment facility.

c. Ecology is properly notified of the bypass as required in Condition S3E of this permit.

3. Bypass which is anticipated and has the potential to result in noncompliance of this permit.

The Permittee shall notify Ecology at least 30 days before the planned date of bypass. The notice shall contain: (1) a description of the bypass and its cause; (2) an analysis of all known alternatives which would eliminate, reduce, or mitigate the need for bypassing; (3) a cost-effectiveness analysis of alternatives including comparative resource damage assessment; (4) the minimum and maximum duration of bypass under each alternative; (5) a recommendation as to the preferred alternative for conducting the bypass; (6) the projected date of bypass initiation; (7) a statement of compliance with State Environmental Policy Act (SEPA); (8) a request for modification of water quality standards as provided for in WAC 173-201A-110, if an exceedance of any water quality standard is anticipated; and (9) steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass.

For probable construction bypasses, the need to bypass is to be identified as early in the planning process as possible. The analysis required above shall be considered during preparation of the engineering report or facilities plan and plans and specifications and shall be included to the extent practical. In cases where the probable need to bypass is determined early, continued analysis is necessary up to and including the construction period in an effort to minimize or eliminate the bypass.

Ecology will consider the following prior to issuing an administrative order for this type bypass:

a. If the bypass is necessary to perform construction or maintenance-related activities essential to meet the requirements of this permit.

b. If there are feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, stopping production, maintenance during normal periods of equipment down time, or transport of untreated wastes to another treatment facility.

c. If the bypass is planned and scheduled to minimize adverse effects on the public and the environment.

After consideration of the above and the adverse effects of the proposed bypass and any other relevant factors, Ecology will approve or deny the request. The public shall be notified and given an opportunity to comment on bypass incidents of significant duration, to the extent feasible. Approval of a request to bypass will be by administrative order issued by Ecology under Revised Code of Washington (RCW) 90.48.120.

G. <u>Operations and Maintenance Manual</u>

The approved Operations and Maintenance Manual shall be kept available at the treatment plant and all operators shall follow the instructions and procedures of this manual.

In addition to requirements of WAC 173-240-080 (1) through (5) the O&M Manual shall include:

1. Emergency procedures for plant shutdown and cleanup in event of wastewater system upset or failure.

2. Wastewater system maintenance procedures that contribute to the generation of process wastewater

3. Any directions to maintenance staff when cleaning, or maintaining other equipment or performing other tasks which are necessary to protect the operation of the wastewater system (e.g., defining maximum allowable discharge rate for draining a tank, blocking all floor drains before beginning the overhaul of a stationary engine.)

4. The treatment plant process control monitoring schedule.

The O&M Manual shall be reviewed by the Permittee at least annually and the Permittee shall confirm this review by letter to Ecology by **March 15, 2012**, and **annually** thereafter. Substantial changes or updates to the O&M Manual shall be submitted to Ecology whenever they are incorporated into the manual.

S6. PRETREATMENT

A. <u>General Requirements</u>

The Permittee shall work with Ecology to ensure that all commercial and industrial users of the POTW are in compliance with the pretreatment regulations promulgated in 40 CFR Part 403 and any additional regulations that may be promulgated under Section 307(b) (pretreatment) and 308 (reporting) of the Federal Clean Water Act.

B. Wastewater Discharge Permit Required

The Permittee shall not allow significant industrial users (SIUs) to discharge wastewater to the Permittee's sewerage system until such user has received a wastewater discharge permit from Ecology in accordance with Chapter 90.48 RCW and Chapter 173-216 WAC, as amended.

C. Identification and Reporting of Existing, New, and Proposed Industrial Users

1. The Permittee shall take continuous, routine measures to identify all existing, new, and proposed SIUs and potential significant industrial users (PSIUs) discharging or proposing to discharge to the Permittee's sewerage system (see Appendix B of Fact Sheet for definitions).

2. Within 30 days of becoming aware of an unpermitted existing, new, or proposed industrial user who may be an SIU, the Permittee shall notify such user by registered mail that, if classified as an SIU, they shall be required to apply to Ecology and obtain a State Waste Discharge Permit. A copy of this notification letter shall also be sent to Ecology within this same 30-day period.

3. The Permittee shall also notify all PSIUs, as they are identified, that if their classification should change to an SIU, they shall be required to apply to Ecology for a State Waste Discharge Permit within 30 days of such change.

D. Industrial User Survey

The Permittee shall complete and submit to Ecology an Industrial User Survey listing all SIUs and PSIUs discharging to the POTW. The survey shall be conducted once during the permit and shall be received by Ecology by **June 15, 2015**. At a minimum, the list of SIUs and PSIUs shall be developed by means of a telephone book search, a water utility billing records search, and a physical reconnaissance of the service area. Information on PSIUs shall at least include: the business name, telephone number, address, description of the industrial process(es), and the known wastewater volumes and characteristics. For assistance with the development of the Industrial User Survey, the Permittee shall refer to Ecology's guidance document entitled "Performing an Industrial User Survey."

E. Duty to Enforce Discharge Prohibitions

1. In accordance with 40 CFR 403.5(a), the Permittee shall not authorize or knowingly allow the discharge of any pollutants into its POTW which cause pass through or interference, or which otherwise violates general or specific discharge prohibitions contained in 40 CFR Part 403.5 or WAC-173-216-060.

2. The Permittee shall not authorize or knowingly allow the introduction of any of the following into their treatment works:

   a. Pollutants which create a fire or explosion hazard in the POTW (including, but not limited to waste streams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 261.21).

b. Pollutants which will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0, or greater than 11.0 standard units, unless the works are specifically designed to accommodate such discharges.

c. Solid or viscous pollutants in amounts that could cause obstruction to the flow in sewers or otherwise interfere with the operation of the POTW.

d. Any pollutant, including oxygen demanding pollutants, (BOD, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the POTW.

e. Petroleum oil, nonbiodegradable cutting oil, or products of mineral origin in amounts that will cause interference or pass through.

f. Pollutants which result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity which may cause acute worker health and safety problems.

g. Heat in amounts that will inhibit biological activity in the POTW resulting in interference but in no case heat in such quantities such that the temperature at the POTW headworks exceeds 40ºC (104ºF) unless Ecology, upon request of the Permittee, approves, in writing, alternate temperature limits.

h. Any trucked or hauled pollutants, except at discharge points designated by the Permittee.

i. Wastewaters prohibited to be discharged to the POTW by the Dangerous Waste Regulations (Chapter 173-303 WAC), unless authorized under the Domestic Sewage Exclusion (WAC 173-303-071).

3. All of the following are prohibited from discharge to the POTW unless approved in writing by Ecology under extraordinary circumstances (such as a lack of direct discharge alternatives due to combined sewer service or the need to augment sewage flows due to septic conditions):

a. Noncontact cooling water in significant volumes.

b. Stormwater, and other direct inflow sources.

c. Wastewaters significantly affecting system hydraulic loading, which do not require treatment, or would not be afforded a significant degree of treatment by the system.

4. The Permittee shall notify Ecology if any industrial user violates the prohibitions listed in this section.

S7. RESIDUAL SOLIDS

Residual solids include screenings, grit, scum, primary sludge, waste activated sludge, and other solid waste. The Permittee shall store and handle all residual solids in such a manner so as to prevent their entry into state ground or surface waters. The Permittee shall not discharge leachate from residual solids to state surface or ground waters.

S8. ACUTE TOXICITY

A. Effluent Characterization

The Permittee shall conduct acute toxicity testing on the final effluent to determine the presence and amount of acute (lethal) toxicity. The two acute toxicity tests listed below shall be conducted on each sample taken for effluent characterization.

Effluent characterization for acute toxicity shall be conducted twice in one year. Acute toxicity testing shall follow protocols, monitoring requirements, and quality assurance/quality control procedures specified in this section. A dilution series consisting of a minimum of five concentrations and a control shall be used to estimate the concentration lethal to 50 percent of the organisms (LC_{50}). The percent survival in 100 percent effluent shall also be reported.

A submittal of the acute toxicity characterization data are due **September 15, 2014,** for the summer sampling and **April 15, 2015,** for the winter sampling. A written report the acute toxicity characterization in the form of a summary report shall be due by **September 15, 2015.**

Acute toxicity tests shall be conducted with the following species and protocols:

1. Fathead minnow, *Pimephales promelas* (96 hour static-renewal test, method: EPA/600/4-90/027F).

2. Daphnid, *Ceriodaphnia dubia*, *Daphnia pulex*, or *Daphnia magna* (48 hour static test, method: EPA/600/4-90/027F). The Permittee shall choose one of the three species and use it consistently throughout effluent characterization.

B. Effluent Limit for Acute Toxicity

The Permittee has an effluent limit for acute toxicity if, after completing one year of effluent characterization, either:

1. The median survival of any species in 100 percent effluent is below 80 percent, or

2. Any one test of any species exhibits less than 65 percent survival in 100 percent effluent.

If an effluent limit for acute toxicity is required by subsection B at the end of one year of effluent characterization, the Permittee shall immediately complete all applicable requirements in subsections C, D, and F.

If no effluent limit is required by subsection B at the end of one year of effluent characterization, then the Permittee shall complete all applicable requirements in subsections E and F.

The effluent limit for acute toxicity is no acute toxicity detected in a test concentration representing the acute critical effluent concentration (ACEC).

In the event of failure to pass the test described in subsection C of this section for compliance with the effluent limit for acute toxicity, the Permittee is considered to be in compliance with all permit requirements for acute whole effluent toxicity as long as the requirements in subsection D are being met to the satisfaction of Ecology.

The ACEC means the maximum concentration of effluent during critical conditions at the boundary of the zone of acute criteria exceedance assigned pursuant to WAC 173-201A-100. The zone of acute criteria exceedance is authorized in Section S1.B of this permit. The ACEC equals 33 percent effluent.

C. Monitoring for Compliance With an Effluent Limit for Acute Toxicity

Monitoring to determine compliance with the effluent limit shall be conducted two times per year for the remainder of the permit term using each of the species listed in subsection A on a rotating basis and performed using at a minimum 100 percent effluent, the ACEC, and a control. The Permittee shall schedule the toxicity tests in the order listed in the permit unless Ecology notifies the Permittee in writing of another species rotation schedule. The percent survival in 100 percent effluent shall be reported for all compliance monitoring.

Compliance with the effluent limit for acute toxicity means no statistically significant difference in survival between the control and the test concentration representing the ACEC. The Permittee shall immediately implement subsection D if any acute toxicity test conducted for compliance monitoring determines a statistically significant difference in survival between the control and the ACEC using hypothesis testing at the 0.05 level of significance (Appendix H, EPA/600/4-89/001). If the difference in survival between the control and the ACEC is less than 10 percent, the hypothesis test shall be conducted at the 0.01 level of significance.

D. Response to Noncompliance With an Effluent Limit for Acute Toxicity

If the Permittee violates the acute toxicity limit in subsection B, the Permittee shall begin additional compliance monitoring within one week from the time of receiving the test results. This additional monitoring shall be conducted weekly for four consecutive weeks using the same test and species as the failed compliance test. Testing shall determine the LC_{50} and effluent limit compliance. The discharger shall return to the original monitoring frequency in subsection C after completion of the additional compliance monitoring.

If the Permittee believes that a test indicating noncompliance will be identified by Ecology as an anomalous test result, the Permittee may notify Ecology that the compliance test result might be anomalous and that the Permittee intends to take only one additional sample for toxicity testing and wait for notification from Ecology before completing the additional monitoring required in this subsection. The notification to

Ecology shall accompany the report of the compliance test result and identify the reason for considering the compliance test result to be anomalous. The Permittee shall complete all of the additional monitoring required in this subsection as soon as possible after notification by Ecology that the compliance test result was not anomalous. If the one additional sample fails to comply with the effluent limit for acute toxicity, then the Permittee shall proceed without delay to complete all of the additional monitoring required in this subsection. The one additional test result shall replace the compliance test result upon determination by Ecology that the compliance test result was anomalous.

If all of the additional compliance monitoring conducted in accordance with this subsection complies with the permit limit, the Permittee shall search all pertinent and recent facility records (operating records, monitoring results, inspection records, spill reports, weather records, production records, raw material purchases, pretreatment records, etc.) and submit a report to Ecology on possible causes and preventive measures for the transient toxicity event which triggered the additional compliance monitoring.

If toxicity occurs in violation of the acute toxicity limit during the additional compliance monitoring, the Permittee shall submit a Toxicity Identification/Reduction Evaluation (TI/RE) plan to Ecology. The TI/RE plan submittal shall be within 60 days after the sample date for the fourth additional compliance monitoring test. If the Permittee decides to forgo the rest of the additional compliance monitoring tests required in this subsection because one of the first three additional compliance monitoring tests failed to meet the acute toxicity limit, then the Permittee shall submit the TI/RE plan within 60 days after the sample date for the first additional monitoring test to violate the acute toxicity limit. The TI/RE plan shall be based on WAC 173-205-100(2) and shall be implemented in accordance with WAC 173-205-100(3).

E. <u>Monitoring When There Is No Permit Limit for Acute Toxicity</u>

The Permittee shall test final effluent once in the last summer and once in the last winter prior to submission of the application for permit renewal. All species used in the initial acute effluent characterization or substitutes approved by Ecology shall be used and results submitted to Ecology as a part of the permit renewal application process.

F. <u>Sampling and Reporting Requirements</u>

1. All reports for effluent characterization or compliance monitoring shall be submitted in accordance with the most recent version of Department of Ecology Publication #WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* in regards to format and content. Reports shall contain bench sheets and reference toxicant results for test methods. If the lab provides the toxicity test data on floppy disk for electronic entry into Ecology's database, then the Permittee shall send the disk to Ecology along with the test report, bench sheets, and reference toxicant results.

2. Testing shall be conducted on 24-hour composite effluent samples or grab samples. Composite samples taken for toxicity testing shall be cooled to 4 degrees Celsius while being collected and shall be sent to the lab immediately upon completion. Grab samples must be shipped on ice to the lab immediately upon collection. If a grab sample is received at the testing lab within one hour after collection, it must have a temperature below 20°C at receipt. If a grab sample is received at the testing lab within 4 hours after collection, it must be below 12°C at receipt. All other samples must be below 8°C at receipt. The lab shall begin the toxicity testing as soon as possible but no later than 36 hours after sampling was ended. The lab shall store all samples at 4°C in the dark from receipt until completion of the test.

3. All samples and test solutions for toxicity testing shall have water quality measurements as specified in Department of Ecology Publication #WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* or most recent version thereof.

4. All toxicity tests shall meet quality assurance criteria and test conditions in the most recent versions of the EPA manual listed in subsection A and the Department of Ecology Publication #WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. If test results are determined to be invalid or anomalous by Ecology, testing shall be repeated with freshly collected effluent.

5. Control water and dilution water shall be laboratory water meeting the requirements of the EPA manual listed in subsection A or pristine natural water of sufficient quality for good control performance.

6. The whole effluent toxicity tests shall be run on an unmodified sample of final effluent.

7. The Permittee may choose to conduct a full dilution series test during compliance monitoring in order to determine dose response. In this case, the series must have a minimum of five effluent concentrations and a control. The series of concentrations must include the ACEC.

8. All whole effluent toxicity tests, effluent screening tests, and rapid screening tests that involve hypothesis testing, and do not comply with the acute statistical power standard of 29 percent as defined in WAC 173-205-020, must be repeated on a fresh sample with an increased number of replicates to increase the power.

S9. CHRONIC TOXICITY

A. <u>Effluent Characterization</u>

The Permittee shall conduct chronic toxicity testing on the final effluent. The two chronic toxicity tests listed below shall be conducted on each sample taken for effluent characterization.

Testing shall be conducted twice in the first year of the permit effective date with one test in the summer and one in the winter. Testing shall be completed and data submitted to Ecology by **September 15, 2014,** for the summer sampling and **April 15, 2015,** for the winter sampling. A summary report of the characterization data is due by **September 15, 2015**.

Effluent testing for chronic toxicity shall be conducted twice in one year. The Permittee shall conduct chronic toxicity testing during effluent characterization on a series of at least five concentrations of effluent in order to determine appropriate point estimates. This series of dilutions shall include the ACEC. The Permittee shall compare the ACEC to the control using hypothesis testing at the 0.05 level of significance as described in Appendix H, EPA/600/4-89/001.

Chronic toxicity tests shall be conducted with the following two species and the most recent version of the following protocols:

Freshwater Chronic Toxicity Test Species		Method
Fathead minnow	*Pimephales promelas*	EPA/600/4-91/002
Water flea	*Ceriodaphnia dubia*	EPA/600/4-91/002

B. Effluent Limit for Chronic Toxicity

After completion of effluent characterization, the Permittee has an effluent limit for chronic toxicity if any test conducted for effluent characterization shows a significant difference between the control and the ACEC at the 0.05 level of significance using hypothesis testing (Appendix H, EPA/600/4-89/001) and shall complete all applicable requirements in subsections C, D, and F.

If no significant difference is shown between the ACEC and the control in any of the chronic toxicity tests, the Permittee has no effluent limit for chronic toxicity and only subsections E and F apply.

The effluent limit for chronic toxicity is no toxicity detected in a test concentration representing the chronic critical effluent concentration (CCEC).

In the event of failure to pass the test described in subsection C, of this section, for compliance with the effluent limit for chronic toxicity, the Permittee is considered to be in compliance with all permit requirements for chronic whole effluent toxicity as long as the requirements in subsection D are being met to the satisfaction of Ecology.

The CCEC means the maximum concentration of effluent allowable at the boundary of the mixing zone assigned in Section S1.B pursuant to WAC 173-201A-100. The CCEC equals 6 percent effluent.

C. Monitoring for Compliance with an Effluent Limit for Chronic Toxicity

Monitoring to determine compliance with the effluent limit shall be conducted twice a year for the remainder of the permit term using each of the species listed in subsection A on a rotating basis and performed using at a minimum the CCEC, the ACEC, and a control. The Permittee shall schedule the toxicity tests in the order listed in the permit unless Ecology notifies the Permittee in writing of another species rotation schedule.

Compliance with the effluent limit for chronic toxicity means no statistically significant difference in response between the control and the test concentration representing the CCEC. The Permittee shall immediately implement subsection D if any chronic toxicity test conducted for compliance monitoring determines a statistically significant difference in response between the control and the CCEC using hypothesis testing at the 0.05 level of significance (Appendix H, EPA/600/4-89/001). If the difference in response between the control and the CCEC is less than 20 percent, the hypothesis test shall be conducted at the 0.01 level of significance.

In order to establish whether the chronic toxicity limit is eligible for removal from future permits, the Permittee shall also conduct this same hypothesis test (Appendix H, EPA/600/4-89/001) to determine if a statistically significant difference in response exists between the ACEC and the control.

D. Response to Noncompliance with an Effluent Limit for Chronic Toxicity

If a toxicity test conducted for compliance monitoring under subsection C determines a statistically significant difference in response between the CCEC and the control, the Permittee shall begin additional compliance monitoring within one week from the time of receiving the test results. This additional monitoring shall be conducted monthly for three consecutive months using the same test and species as the failed compliance test. Testing shall be conducted using a series of at least five effluent concentrations and a control in order to be able to determine appropriate point estimates. One of these effluent concentrations shall equal the CCEC and be compared statistically to the nontoxic control in order to determine compliance with the effluent limit for chronic toxicity as described in subsection C. The discharger shall return to the original monitoring frequency in subsection C after completion of the additional compliance monitoring.

If the Permittee believes that a test indicating noncompliance will be identified by Ecology as an anomalous test result, the Permittee may notify Ecology that the compliance test result might be anomalous and that the Permittee intends to take only one additional sample for toxicity testing and wait for notification from Ecology before completing the additional monitoring required in this subsection. The notification to Ecology shall accompany the report of the compliance test result and identify the reason for considering the compliance test result to be anomalous. The Permittee shall complete all of the additional monitoring required in this subsection as soon as possible after notification by Ecology that the compliance test result was not anomalous. If the one additional sample fails to comply with the effluent limit for chronic toxicity, then the Permittee shall proceed without delay to complete all of the additional monitoring required in this subsection. The one additional test result shall replace the compliance test result upon determination by Ecology that the compliance test result was anomalous.

If all of the additional compliance monitoring conducted in accordance with this subsection complies with the permit limit, the Permittee shall search all pertinent and recent facility records (operating records, monitoring results, inspection records, spill reports, weather records, production records, raw material purchases, pretreatment records, etc.) and submit a report to Ecology on possible causes and preventive measures for the transient toxicity event which triggered the additional compliance monitoring.

If toxicity occurs in violation of the chronic toxicity limit during the additional compliance monitoring, the Permittee shall submit a Toxicity Identification/Reduction Evaluation (TI/RE) plan to Ecology. The TI/RE plan submittal shall be within 60 days after the sample date for the third additional compliance monitoring test. If the Permittee decides to forgo the rest of the additional compliance monitoring tests required in this subsection because one of the first two additional compliance monitoring tests failed to meet the chronic toxicity limit, then the Permittee shall submit the TI/RE plan within 60 days after the sample date for the first additional monitoring test to violate the chronic toxicity limit. The TI/RE plan shall be based on WAC 173-205-100(2) and shall be implemented in accordance with WAC 173-205-100(3).

E. Monitoring When There Is No Permit Limit for Chronic Toxicity

The Permittee shall test final effluent once in the last summer and once in the last winter prior to submission of the application for permit renewal. All species used in the initial chronic effluent characterization or substitutes approved by Ecology shall be used and results submitted to Ecology as a part of the permit renewal application process.

F. Sampling and Reporting Requirements

1. All reports for effluent characterization or compliance monitoring shall be submitted in accordance with the most recent version of Department of Ecology Publication #WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* in regards to format and content. Reports shall contain bench sheets and reference toxicant results for test methods. If the lab provides the toxicity test data on floppy disk for electronic entry into Ecology's database, then the Permittee shall send the disk to Ecology along with the test report, bench sheets, and reference toxicant results.

2. Testing shall be conducted on 24-hour composite effluent samples. Composite samples taken for toxicity testing shall be cooled to 4 degrees Celsius while being collected and shall be sent to the lab immediately upon completion. Grab samples must be shipped on ice to the lab immediately upon collection. If a grab sample is received at the testing lab within one hour after collection, it must have a temperature below 20°C at receipt. If a grab sample is received at the testing lab within 4 hours after collection, it must be below 12°C at receipt. All other samples must be below 8°C at receipt. The lab shall begin the toxicity testing as soon as possible but no later than 36 hours after sampling was ended. The lab shall store all samples at 4°C in the dark from receipt until completion of the test.

3. All samples and test solutions for toxicity testing shall have water quality measurements as specified in Department of Ecology Publication #WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* or most recent version thereof.

4. All toxicity tests shall meet quality assurance criteria and test conditions in the most recent versions of the EPA manual listed in subsection A and the Department of Ecology Publication #WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. If test results are determined to be invalid or anomalous by Ecology, testing shall be repeated with freshly collected effluent.

5. Control water and dilution water shall be laboratory water meeting the requirements of the EPA manual listed in subsection A or pristine natural water of sufficient quality for good control performance.

6. The whole effluent toxicity tests shall be run on an unmodified sample of final effluent.

7. The Permittee may choose to conduct a full dilution series test during compliance monitoring in order to determine dose response. In this case, the series must have a minimum of five effluent concentrations and a control. The series of concentrations must include the ACEC and the CCEC.

8. All whole effluent toxicity tests, effluent screening tests, and rapid screening tests that involve hypothesis testing, and do not comply with the chronic statistical power standard of 39 percent as defined in WAC 173-205-020, must be repeated on a fresh sample with an increased number of replicates to increase the power.

S10. OUTFALL EVALUATION

The Permittee shall inspect, the submerged portion of the outfall line and any future attachments such as a diffuser to document its integrity and continued function. If conditions allow for a photographic verification, it shall be included in the report. By **October 15, 2013**, the inspection report shall be submitted to Ecology.

S11. ALKALINITY ADDITION

Within 90 days of either effluent pH drops below 6.0 or alkalinity falling below 70 mg/L in any two consecutive readings, the Permittee shall provide Ecology with the soonest possible schedule for constructing an alkalinity addition system. This system must be capable of increasing the alkalinity in the aeration basin so that residual alkalinity in the effluent is maintained at or above 100 mg/L and effluent pH is not allowed to drop below 6.0. The Permittee must install and begin using this alkalinity addition system within a year after triggering this requirement.

GENERAL CONDITIONS

G1. SIGNATORY REQUIREMENTS

All applications, reports, or information submitted to Ecology shall be signed and certified.

A. All permit applications shall be signed by either a principal executive officer or a ranking elected official.

B. All reports required by this permit and other information requested by Ecology shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

1. The authorization is made in writing by a person described above and submitted to Ecology.

2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

C. Changes to authorization. If an authorization under paragraph B.2 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph B.2 above must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.

D. Certification. Any person signing a document under this section shall make the following certification:

> I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

G2. RIGHT OF INSPECTION AND ENTRY

The Permittee shall allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

A. To enter upon the premises where a discharge is located or where any records must be kept under the terms and conditions of this permit.

B. To have access to and copy - at reasonable times and at reasonable cost - any records required to be kept under the terms and conditions of this permit.

C. To inspect - at reasonable times - any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.

D. To sample or monitor - at reasonable times - any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G3. PERMIT ACTIONS

This permit may be modified, revoked and reissued, or terminated either at the request of any interested person (including the Permittee) or upon Ecology's initiative. However, the permit may only be modified, revoked and reissued, or terminated for the reasons specified in 40 CFR 122.62, 122.64 or WAC 173-220-150 according to the procedures of 40 CFR 124.5.

A. The following are causes for terminating this permit during its term, or for denying a permit renewal application:

1. Violation of any permit term or condition.

2. Obtaining a permit by misrepresentation or failure to disclose all relevant facts.

3. A material change in quantity or type of waste disposal.

4. A determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations and can only be regulated to acceptable levels by permit modification or termination [40 CFR Part 122.64(3)].

5. A change in any condition that requires either a temporary or permanent reduction, or elimination of any discharge or sludge use or disposal practice controlled by the permit [40 CFR Part 122.64(4)].

6. Nonpayment of fees assessed pursuant to RCW 90.48.465.

7. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.

B. The following are causes for modification but not revocation and reissuance except when the Permittee requests or agrees:

1. A material change in the condition of the waters of the state.

2. New information not available at the time of permit issuance that would have justified the application of different permit conditions.

3. Material and substantial alterations or additions to the permitted facility or activities which occurred after this permit issuance.

4. Promulgation of new or amended standards or regulations having a direct bearing upon permit conditions, or requiring permit revision.

5. The Permittee has requested a modification based on other rationale meeting the criteria of 40 CFR Part 122.62.

6. Ecology has determined that good cause exists for modification of a compliance schedule, and the modification will not violate statutory deadlines.

7. Incorporation of an approved local pretreatment program into a municipality's permit.

C. The following are causes for modification or alternatively revocation and reissuance:

1. Cause exists for termination for reasons listed in A1 through A7 of this section, and Ecology determines that modification or revocation and reissuance is appropriate.

2. Ecology has received notification of a proposed transfer of the permit. A permit may also be modified to reflect a transfer after the effective date of an automatic transfer (General Condition G8) but will not be revoked and reissued after the effective date of the transfer except upon the request of the new Permittee.

G4. REPORTING PLANNED CHANGES

The Permittee shall, as soon as possible, but no later than sixty (60) days prior to the proposed changes, give notice to Ecology of planned physical alterations or additions to the permitted facility, production increases, or process modification which will result in: 1) the permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b); 2) a significant change in the nature or an increase in quantity of pollutants discharged; or 3) a significant change in the Permittee's sludge use or disposal practices. Following such notice, and the submittal of a new application or supplement to the existing application, along with required engineering plans and reports, this permit may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation of the terms and conditions of this permit.

G5. PLAN REVIEW REQUIRED

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications shall be submitted to Ecology for approval in accordance with Chapter 173-240 WAC. Engineering reports, plans, and specifications shall be submitted at least 180 days prior to the planned start of construction unless a shorter time is approved by Ecology. Facilities shall be constructed and operated in accordance with the approved plans.

G6. COMPLIANCE WITH OTHER LAWS AND STATUTES

Nothing in this permit shall be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. DUTY TO REAPPLY

The Permittee shall apply for permit renewal by **January 1, 2016**.

G8. TRANSFER OF THIS PERMIT

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the Permittee shall notify the succeeding owner or controller of the existence of this permit by letter, a copy of which shall be forwarded to Ecology.

A. Transfers by Modification

Except as provided in paragraph (B) below, this permit may be transferred by the Permittee to a new owner or operator only if this permit has been modified or revoked and reissued under 40 CFR 122.62(b)(2), or a minor modification made under 40 CFR 122.63(d), to identify the new Permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

B. Automatic Transfers

This permit may be automatically transferred to a new Permittee if:

1. The Permittee notifies Ecology at least 30 days in advance of the proposed transfer date.

2. The notice includes a written agreement between the existing and new Permittees containing a specific date transfer of permit responsibility, coverage, and liability between them.

3. Ecology does not notify the existing Permittee and the proposed new Permittee of its intent to modify or revoke and reissue this permit. A modification under this subparagraph may also be minor modification under 40 CFR 122.63. If this notice is not received, the transfer is effective on the date specified in the written agreement.

G9. REDUCED PRODUCTION FOR COMPLIANCE

The Permittee, in order to maintain compliance with its permit, shall control production and/or all discharges upon reduction, loss, failure, or bypass of the treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

G10. REMOVED SUBSTANCES

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G11. DUTY TO PROVIDE INFORMATION

The Permittee shall submit to Ecology, within a reasonable time, all information which Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee shall also submit to Ecology upon request, copies of records required to be kept by this permit.

G12. OTHER REQUIREMENTS OF 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G13. ADDITIONAL MONITORING

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G14. PAYMENT OF FEES

The Permittee shall submit payment of fees associated with this permit as assessed by Ecology.

G15. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit shall be deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to $10,000 and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit shall incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to $10,000 for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be deemed to be a separate and distinct violation.

G16. UPSET

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 operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that: 1) an upset occurred and that the Permittee can identify the cause(s) of the upset; 2) the permitted facility was being properly operated at the time of the upset; 3) the Permittee submitted notice of the upset as required in Condition S3.E; and 4) the Permittee complied with any remedial measures required under S4.C of this permit.

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

G17. PROPERTY RIGHTS

This permit does not convey any property rights of any sort, or any exclusive privilege.

G18. DUTY TO COMPLY

The Permittee shall comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G19. TOXIC POLLUTANTS

The Permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G20. PENALTIES FOR 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 shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this Condition, punishment shall be a fine of not more than $20,000 per day of violation, or by imprisonment of not more than four years, or by both.

G21. REPORTING ANTICIPATED NON-COMPLIANCE

The Permittee shall give advance notice to Ecology by submission of a new application or supplement thereto at least 180 days prior to commencement of such discharges, of any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility or activity which may result in noncompliance with permit limits or conditions. Any maintenance of facilities, which might necessitate unavoidable interruption of operation and degradation of effluent quality, shall be scheduled during noncritical water quality periods and carried out in a manner approved by Ecology.

G22. REPORTING OTHER INFORMATION

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to Ecology, it shall promptly submit such facts or information.

G23. COMPLIANCE SCHEDULES

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

APPENDIX A

EFFLUENT CHARACTERIZATION FOR POLLUTANTS
THIS LIST INCLUDES EPA REQUIRED POLLUTANTS (PRIORITY POLLUTANTS) AND SOME ECOLOGY PRIORITY TOXIC CHEMICALS (PBTs)

The following table specifies analytical methods and levels to be used for effluent characterization in NPDES and State waste discharge permits. This appendix specifies effluent characterization requirements of the Department of Ecology unless other methods are specified in the body of this permit.

This permit specifies the compounds and groups of compounds to be analyzed. Ecology may require additional pollutants to be analyzed within a group. The objective of this appendix is to reduce the number of analytical "non-detects" in permit-required monitoring and to measure effluent concentrations near or below criteria values where possible at a reasonable cost. If a Permittee knows that an alternate, less sensitive method (higher DL and QL) from 40 CFR Part 136 is sufficient to produce measurable results in their effluent, that method may be used for analysis.

Pollutant & CAS No. *(if available)*	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
CONVENTIONALS			
Biochemical Oxygen Demand	SM5210-B		2 mg/L
Chemical Oxygen Demand	SM5220-D		10 mg/L
Total Organic Carbon	SM5310-B/C/D		1 mg/L
Total Suspended Solids	SM2540-D		5 mg/L
Total Ammonia (as N)	SM4500-NH3-GH		0.3 mg/L
Flow	Calibrated device		
Dissolved oxygen	4500-OC/OG		0.2 mg/L
Temperature (max. 7-day avg.)	Analog recorder or Use micro-recording devices known as thermistors		0.2º C
pH	SM4500-H^+ B	N/A	N/A
NONCONVENTIONALS			
Total Alkalinity	SM2320-B		5 mg/L as CaCo3
Chlorine, Total Residual	4500 Cl G		50.0
Color	SM2120 B/C/E		10 color unit
Fecal Coliform	SM 9221D/E,9222	N/A	N/A
Fluoride (16984-48-8)	SM4500-F E	25	100
Nitrate-Nitrite (as N)	4500-NO3-E/F/H		100
Nitrogen, Total Kjeldahl (as N)	4500-NH3-C/E/FG		300

Pollutant & CAS No. *(if available)*	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL)[2] *µg/L unless specified***
Ortho-Phosphate (PO_4 as P)	4500- PE/PF	3	10
Phosphorus, Total (as P)	4500-PE/PF	3	10
Oil and Grease (HEM)	1664A	1,400	5,000
Salinity	SM2520-B		3 PSS
Settleable Solids	SM2540 -F		100
Sulfate (as mg/L SO_4)	SM4110-B		200
Sulfide (as mg/L S)	4500-S^2F/D/E/G		200
Sulfite (as mg/L SO_3)	SM4500-SO3B		2000
Total dissolved solids	SM2540 C		20 mg/L
Total Hardness	2340B		200 as CaCO3
Aluminum, Total (7429-90-5)	200.8	2.0	10
Barium Total (7440-39-3)	200.8	0.5	2.0
Boron Total (7440-42-8)	200.8	2.0	10.0
Cobalt, Total (7440-48-4)	200.8	0.05	0.25
Iron, Total (7439-89-6)	200.7	12.5	50
Magnesium, Total (7439-95-4)	200.7	10	50
Molybdenum, Total (7439-98-7)	200.8	0.1	0.5
Manganese, Total (7439-96-5)	200.8	0.1	0.5
Tin, Total (7440-31-5)	200.8	0.3	1.5
METALS, CYANIDE & TOTAL PHENOLS			
Antimony, Total (7440-36-0)	200.8	0.3	1.0
Arsenic, Total (7440-38-2)	200.8	0.1	0.5
Beryllium, Total (7440-41-7)	200.8	0.1	0.5
Cadmium, Total (7440-43-9)	200.8	0.05	0.25
Chromium (hex) dissolved (18540-29-9)	SM3500-Cr EC	0.3	1.2
Chromium, Total (7440-47-3)	200.8	0.2	1.0
Copper, Total (7440-50-8)	200.8	0.4	2.0
Lead, Total (7439-92-1)	200.8	0.1	0.5
Mercury, Total (7439-97-6)	1631E	0.0002	0.0005
Nickel, Total (7440-02-0)	200.8	0.1	0.5
Selenium, Total (7782-49-2)	200.8	1.0	1.0
Silver, Total (7440-22-4)	200.8	0.04	0.2
Thallium, Total (7440-28-0)	200.8	0.09	0.36
Zinc, Total (7440-66-6)	200.8	0.5	2.5
Cyanide, Total (57-12-5)	335.4	2	10
Cyanide, Weak Acid Dissociable	SM4500-CN I	2	10
Phenols, Total	EPA 420.1		50
DIOXIN			
2,3,7,8-Tetra-Chlorodibenzo-P-Dioxin (176-40-16)	1613B	1.3 pg/L	5 pg/L

Pollutant & CAS No. *(if available)*	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL)[2] *µg/L unless specified***
VOLATILE COMPOUNDS			
Acrolein (107-02-8)	624	5	10
Acrylonitrile (107-13-1)	624	1.0	2.0
Benzene (71-43-2)	624	1.0	2.0
Bromoform (75-25-2)	624	1.0	2.0
Carbon tetrachloride (56-23-5)	624/601 or SM6230B	1.0	2.0
Chlorobenzene (108-90-7)	624	1.0	2.0
Chloroethane (75-00-3)	624/601	1.0	2.0
2-Chloroethylvinyl Ether (110-75-8)	624	1.0	2.0
Chloroform (67-66-3)	624 or SM6210B	1.0	2.0
Dibromochloromethane (124-48-1)	624	1.0	2.0
1,2-Dichlorobenzene (95-50-1)	624	1.9	7.6
1,3-Dichlorobenzene (541-73-1)	624	1.9	7.6
1,4-Dichlorobenzene (106-46-7)	624	4.4	17.6
Dichlorobromomethane (75-27-4)	624	1.0	2.0
1,1-Dichloroethane (75-34-3)	624	1.0	2.0
1,2-Dichloroethane (107-06-2)	624	1.0	2.0
1,1-Dichloroethylene (75-35-4)	624	1.0	2.0
1,2-Dichloropropane (78-87-5)	624	1.0	2.0
1,3-dichloropropylene (mixed isomers) (542-75-6)	624	1.0	2.0
Ethylbenzene (100-41-4)	624	1.0	2.0
Methyl bromide (74-83-9) (Bromomethane)	624/601	5.0	10.0
Methyl chloride (74-87-3) (Chloromethane)	624	1.0	2.0
Methylene chloride (75-09-2)	624	5.0	10.0
1,1,2,2-Tetrachloroethane (79-34-5)	624	1.9	2.0
Tetrachloroethylene (127-18-4)	624	1.0	2.0
Toulene (108-88-3)	624	1.0	2.0
1,2-Trans-Dichloroethylene (156-60-5) (Ethylene dichloride)	624	1.0	2.0
1,1,1-Trichloroethane (71-55-6)	624	1.0	2.0
1,1,2-Trichloroethane (79-00-5)	624	1.0	2.0
Trichloroethylene (79-01-6)	624	1.0	2.0
Vinyl chloride (75-01-4)	624/SM6200B	1.0	2.0

Pollutant & CAS No. *(if available)*	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL)[2] *µg/L unless specified***
ACID COMPOUNDS			
2-Chlorophenol (95-57-8)	625	1.0	2.0
2,4-Dichlorophenol (120-83-2)	625	0.5	1.0
2,4-Dimethylphenol (105-67-9)	625	0.5	1.0
4,6-dinitro-o-cresol (534-52-1) (2-methyl-4,6,-dinitrophenol)	625/1625B	1.0	2.0
2,4 dinitrophenol (51-28-5)	625	1.0	2.0
2-Nitrophenol (88-75-5)	625	0.5	1.0
4-nitrophenol (100-02-7)	625	0.5	1.0
Parachlorometa cresol (59-50-7) (4-chloro-3-methylphenol)	625	1.0	2.0
Pentachlorophenol (87-86-5)	625	0.5	1.0
Phenol (108-95-2)	625	2.0	4.0
2,4,6-Trichlorophenol (88-06-2)	625	2.0	4.0
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)			
Acenaphthene (83-32-9)	625	0.2	0.4
Acenaphthylene (208-96-8)	625	0.3	0.6
Anthracene (120-12-7)	625	0.3	0.6
Benzidine (92-87-5)	625	12	24
Benzyl butyl phthalate (85-68-7)	625	0.3	0.6
Benzo(*a*)anthracene (56-55-3)	625	0.3	0.6
Benzo(j)fluoranthene (205-82-3)	625	0.5	1.0
Benzo(r,s,t)pentaphene (189-55-9)	625	0.5	1.0
Benzo(*a*)pyrene (50-32-8)	610/625	0.5	1.0
3,4-benzofluoranthene (Benzo(b)fluoranthene) (205-99-2)	610/625	0.8	1.6
11,12-benzofluoranthene (Benzo(k)fluoranthene) (207-08-9)	610/625	0.8	1.6
Benzo(*ghi*)Perylene (191-24-2)	610/625	0.5	1.0
Bis(*2-chloroethoxy)*methane (111-91-1)	625	5.3	21.2
Bis(*2-chloroethyl*)ether (111-44-4)	611/625	0.3	1.0
Bis(*2-chloroisopropyl*)ether (39638-32-9)	625	0.3	0.6
Bis(*2-ethylhexyl*)phthalate (117-81-7)	625	0.1	0.5
4-Bromophenyl phenyl ether	625	0.2	0.4

Pollutant & CAS No. *(if available)*	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
(101-55-3)			
2-Chloronaphthalene (91-58-7)	625	0.3	0.6
4-Chlorophenyl phenyl ether (7005-72-3)	625	0.3	0.5
Chrysene (218-01-9)	610/625	0.3	0.6
Dibenzo (a,j)acridine (224-42-0)	610M/625M	2.5	10.0
Dibenzo (a,h)acridine (226-36-8)	610M/625M	2.5	10.0
Dibenzo(a-*h*)anthracene (53-70-3)(1,2,5,6-dibenzanthracene)	625	0.8	1.6
Dibenzo(a,e)pyrene (192-65-4)	610M/625M	2.5	10.0
Dibenzo(a,h)pyrene (189-64-0)	625M	2.5	10.0
3,3-Dichlorobenzidine (91-94-1)	605/625	0.5	1.0
Diethyl phthalate (84-66-2)	625	1.9	7.6
Dimethyl phthalate (131-11-3)	625	1.6	6.4
Di-n-butyl phthalate (84-74-2)	625	0.5	1.0
2,4-dinitrotoluene (121-14-2)	609/625	0.2	0.4
2,6-dinitrotoluene (606-20-2)	609/625	0.2	0.4
Di-n-octyl phthalate (117-84-0)	625	0.3	0.6
1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)	1625B	5.0	20
Fluoranthene (206-44-0)	625	0.3	0.6
Fluorene (86-73-7)	625	0.3	0.6
Hexachlorobenzene (118-74-1)	612/625	0.3	0.6
Hexachlorobutadiene (87-68-3)	625	0.5	1.0
Hexachlorocyclopentadiene (77-47-4)	1625B/625	0.5	1.0
Hexachloroethane (67-72-1)	625	0.5	1.0
Indeno(*1,2,3-cd*)Pyrene (193-39-5)	610/625	0.5	1.0
Isophorone (78-59-1)	625	0.5	1.0
3-Methyl cholanthrene (56-49-5)	625	2.0	8.0
Naphthalene (91-20-3)	625	0.3	0.6
Nitrobenzene (98-95-3)	625	0.5	1.0
N-Nitrosodimethylamine (62-75-9)	607/625	2.0	4.0
N-Nitrosodi-n-propylamine (621-64-7)	607/625	0.5	1.0
N-Nitrosodiphenylamine (86-30-6)	625	0.5	1.0

Pollutant & CAS No. ***(if available)***	**Recommended Analytical Protocol**	**Detection (DL)[1]** ***µg/L unless specified***	**Quantitation Level (QL)[2]** ***µg/L unless specified***
Perylene (198-55-0)	625	1.9	7.6
Phenanthrene (85-01-8)	625	0.3	0.6
Pyrene (129-00-0)	625	0.3	0.6
1,2,4-Trichlorobenzene (120-82-1)	625	0.3	0.6
PESTICIDES/PCBs			
Aldrin (309-00-2)	608	0.025	0.05
alpha-BHC (319-84-6)	608	0.025	0.05
beta-BHC (319-85-7)	608	0.025	0.05
gamma-BHC (58-89-9)	608	0.025	0.05
delta-BHC (319-86-8)	608	0.025	0.05
Chlordane (57-74-9)	608	0.025	0.05
4,4'-DDT (50-29-3)	608	0.025	0.05
4,4'-DDE (72-55-9)	608	0.025	0.05[10]
4,4' DDD (72-54-8)	608	0.025	0.05
Dieldrin (60-57-1)	608	0.025	0.05
alpha-Endosulfan (959-98-8)	608	0.025	0.05
beta-Endosulfan (33213-65-9)	608	0.025	0.05
Endosulfan Sulfate (1031-07-8)	608	0.025	0.05
Endrin (72-20-8)	608	0.025	0.05
Endrin Aldehyde (7421-93-4)	608	0.025	0.05
Heptachlor (76-44-8)	608	0.025	0.05
Heptachlor Epoxide (1024-57-3)	608	0.025	0.05
PCB-1242 (53469-21-9)	608	0.25	0.5
PCB-1254 (11097-69-1)	608	0.25	0.5
PCB-1221 (11104-28-2)	608	0.25	0.5
PCB-1232 (11141-16-5)	608	0.25	0.5
PCB-1248 (12672-29-6)	608	0.25	0.5
PCB-1260 (11096-82-5)	608	0.13	0.5
PCB-1016 (12674-11-2)	608	0.13	0.5
Toxaphene (8001-35-2)	608	0.24	0.5

1. Detection level (DL) or detection limit means the minimum concentration of an analyte (substance) that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero as determined by the procedure given in 40 CFR part 136, Appendix B.
2. Quantitation Level (QL) is equivalent to EPA's Minimum Level (ML) which is defined in 40 CFR Part 136 as the minimum level at which the entire GC/MS system must give recognizable mass spectra (background corrected) and acceptable calibration points. These levels were published as proposed in the Federal Register on March 28, 1997.

Appendix C
Factsheet for NPDES Permit WA0023272 City of Ridgefield

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FACT SHEET FOR NPDES PERMIT WA0023272
CITY OF RIDGEFIELD

12/15/2003

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INTRODUCTION

The Federal Clean Water Act (FCWA, 1972, and later modifications, 1977, 1981, and 1987) established water quality goals for the navigable (surface) waters of the United States. One of the mechanisms for achieving the goals of the Clean Water Act is the National Pollutant Discharge Elimination System (NPDES) of permits, which is administered by the Environmental Protection Agency (EPA). The EPA has authorized the state of Washington to administer the NPDES permit program. Chapter 90.48 Revised Code of Washington (RCW) defines the Department of Ecology's (Department) authority and obligations in administering the wastewater discharge permit program.

The regulations adopted by the state include procedures for issuing permits [Chapter 173-220 Washington Administrative Code (WAC)], technical criteria for discharges from municipal wastewater treatment facilities (Chapter 173-221 WAC), water quality criteria for surface and ground waters (Chapters 173-201A and 200 WAC), and sediment management standards (Chapter 173-204 WAC). These regulations require that a permit be issued before discharge of wastewater to waters of the state is allowed. The regulations also establish the basis for effluent limitations and other requirements which are to be included in the permit. One of the requirements (WAC 173-220-060) for issuing a permit under the NPDES permit program is the preparation of a draft permit and an accompanying fact sheet. Public notice of the availability of the draft permit is required at least 30 days before the permit is issued (WAC 173-220-050). The fact sheet and draft permit are available for review (see Appendix A--Public Involvement of the fact sheet for more detail on the Public Notice procedures).

The fact sheet and draft permit have been reviewed by the Permittee. Errors and omissions identified in this review have been corrected before going to public notice. After the public comment period has closed, the Department will summarize the substantive comments and the response to each comment. The summary and response to comments will become part of the file on the permit and parties submitting comments will receive a copy of the Department's response. The fact sheet will not be revised. Comments and the resultant changes to the permit will be summarized in Appendix D--Response to Comments.

GENERAL INFORMATION	
Applicant	City of Ridgefield
Facility Name and Address	Ridgefield Wastewater Treatment Plant West Cook Street Ridgefield, Washington
Type of Treatment:	Activated Sludge
Discharge Location	Lake River Latitude: 45º 49' 18" N Longitude: 122º 45' 09" W.
Water Body ID Number	Old ID # WA-28-1010, New ID # 1220169456238

BACKGROUND INFORMATION

DESCRIPTION OF THE FACILITY

HISTORY

The Ridgefield sewage treatment system was originally constructed in 1959 and has undergone several upgrades since then. The latest upgrade began in 2000. The facility operation had difficulty prior to 2001 when it was discovered by the Department that some staff at the Ridgefield facility were falsifying discharge monitoring records. In the last two years staff have been replaced and the facility appears to be running smoothly.

COLLECTION SYSTEM STATUS

Most of the sewer collection system was installed in 1959 and consists mostly of 8-inch and 6-inch diameter sewer lines with a ten-inch trunk line that delivers wastewater to the treatment plant. There is approximately 26,000 feet of sewer lines in the city. Most of the sewers are constructed of concrete or asbestos cement pipe with rubber o-ring gaskets. The side sewers are constructed of concrete pipe with cold-packed bitumastic joints.

There are two collection system pump stations that serve low elevations adjacent to Lake River and another lift station located in Abrams Park. These lift stations are small serving less than 20 homes. The rest of the system is gravity flow with a lift station located at the treatment plant to provide gravity flow through the plant.

There is a separate collection system for the high school and an adjacent subdivision. These separate systems are not owned and maintained by the city, which can present problems when routine maintenance and solving inflow and infiltration problems. This separate system includes two pump stations in series. The upper pump station serves the high school and is owned by the Ridgefield School District. This separate collection system is connected to the City of Ridgefield’s system by 12,000 feet of force main. The school collection system was built in 1977 and the subdivision collection system was constructed in 1992.

The Port of Ridgefield industrial park has an 8-inch gravity sewer that flows to a pump station and 12,000 feet of force main to the City system. This same pump station serves the golf course facilities and a Washington State Department of Transportation (WSDOT) weigh station.

TREATMENT PROCESSES

The City of Ridgefield uses an activated sludge system followed by secondary clarification and UV-disinfection. A schematic may be found in Appendix C. In more detail, the effluent is first screened at the head works with a centrifugal grit removal system followed by both a HYCOR rotating screen and a floating grease/particle separator. Solids removed with these processes are sent to a dumpster. There is a Parshall flume with an ultrasonic flow meter in this area of the plant along with a 24-hour refrigerated sampling station. Flow enters a selection chamber before entering one of two activated sludge tanks. The selection chamber can have aeration on or off for part of the tank with the aim of increasing food to mass ratio in the selector. The activated sludge tanks are used one at a time for a period of approximately one year while the other tank serves as a backup aeration tank. The flow then enters the one main secondary clarifier. An old clarifier attached to the aeration tanks serves as an emergency back-up. Flow enters a

UV-disinfection channel. There are three banks of UV lights, but only one bank is needed under normal flow. There is another Parshall flume with an ultrasonic flow meter in this area of the plant along with a 24-hour refrigerated sampling station.

There are no industrial users of the system. There are some commercial users at the Port, however, they discharge only domestic sewage from toilets to Ridgefield's system. The town has three restaurants that discharge to the treatment plant. All of the restaurants have grease traps.

The facility is classified as a level II plant which requires an operator of at least level II certification to be in charge of daily operations and operators of level I to operate the plant. There are two operators with level II certification, and one operator with level I certification. The facility is staffed 7:30 a.m. -4:00 p.m., Monday through Friday, with staff on call 24 hours per day and on the weekends.

At this time the State Revolving Fund Loans has been closed out and no other loans or grants are pending.

DISCHARGE OUTFALL

Secondary treated and disinfected effluent is discharged from the facility via a ten-inch outfall into Lake River which is a tributary to the Columbia River. There is no diffuser on the outfall.

RESIDUAL SOLIDS

The treatment facilities remove solids during the treatment of the wastewater at the headworks (grit and screenings), and at the secondary clarifiers, in addition to incidental solids (rags, scum, and other debris) removed as part of the routine maintenance of the equipment. Grit, rags, scum, and screenings are drained and disposed of as solid waste at the local transfer station. Solids removed from the clarifier (including biosolids) are treated in aerobic digesters for thickening and then are trucked to the Salmon Creek WWTP. The Salmon Creek facility land applies biosolids after further treatment.

PERMIT STATUS

The previous permit for this facility was issued on August 12, 1998. The previous permit placed effluent limitations on five-day Biochemical Oxygen Demand (BOD_5), Total Suspended Solids (TSS), pH, Fecal Coliform bacteria, total residual chlorine, and ammonia.

There were several requirements in the previous permit that were never completed. These requirements included conducting a receiving water study, and securing an outfall corridor to the Columbia River. The Permittee has had difficulty in getting permission to cross the wildlife refuge in order to reach the Columbia River as required under the 1998 permit. Because the previous permit anticipated an outfall to the Columbia, a receiving water study in Lake River was not required.

An application for permit renewal was submitted to the Department on February 5, 2003, and accepted by the Department.

SUMMARY OF COMPLIANCE WITH THE PREVIOUS PERMIT

The facility received its last compliance inspection on April 29, 2003. No samples were taken at that time, however, the facility operations and paper work were thoroughly examined. The facility was in good operating condition. A few minor changes were recommended by the inspector.

WASTEWATER CHARACTERIZATION

During the history of the previous permit, the Permittee has not remained in compliance, based on Discharge Monitoring Reports (DMRs) submitted to the Department and inspections conducted by the Department. However, during the last 17 months with upgrades to the plant, new operation and management, the facility has been mostly operating within limits. Therefore, the characterization table shown below only includes data for the 17 month period from November 2001 to March 2003.

Table 1: Effluent Characterization

Parameter	**Averages, 95th Percentiles or Maximum/Minimums**	**Effluent Limits from 1998 Permit**
Flow	0.297 mgd (avg of monthly maximums)	0.5 mgd maximum monthly design flow
pH	6.4 min, 7.5 max	6.0-9.0 limits
Fecal coliform	4/100 ml (95th percentile of monthly geomean) 39/100 ml (95th percentile of weekly geomean) 66/100ml (maximum)	200/100ml monthly 400/100ml weekly
BOD	5 mg/L avg of monthly maximums	30 mg/L avg monthly 45 mg/L avg weekly
TSS	6 mg/L avg of monthly maximums	30 mg/L avg monthly 45 mg/L avg weekly
Ammonia	0.586 mg/L 95th percentile of all summer months in 2000	Optimize plant operation for nitrification and monitor

The flow has been kept below the maximum monthly design flow of 0.5 mgd. An average of the monthly maximum flows was 0.297 mgd. The minimum and maximum pH never violated limits. The fecal coliform was kept well within limits with the use of the new Ultra-Violet (UV) disinfection system. BOD and TSS concentrations were both kept very low. The average of the monthly maximums was 5 mg/L for BOD and 6 mg/L for TSS, whereas the monthly and weekly limits were 30 mg/L and 45 mg/L respectively. The Ammonia was kept below 0.586 mg/L 95 percent of the time. Because the limit for ammonia was narrative, the determination of whether ammonia was a problem will be covered later in this fact sheet. Ammonia will be compared to background in the reasonable potential analysis.

No other toxics were noted in the effluent. No metals have been examined in the past but may be required in the future.

PROPOSED PERMIT LIMITATIONS

Federal and state regulations require that effluent limitations set forth in a NPDES permit must be either technology- or water quality-based. Technology-based limitations for municipal discharges are set by regulation (40 CFR 133, and Chapters 173-220 and 173-221 WAC). Water quality-based limitations are based upon compliance with the Surface Water Quality Standards (Chapter 173-201A WAC), Ground Water Standards (Chapter 173-200 WAC), Sediment Quality Standards (Chapter 173-204 WAC) or the

National Toxics Rule (Federal Register, Volume 57, No. 246, Tuesday, December 22, 1992.) The most stringent of these types of limits must be chosen for each of the parameters of concern. Each of these types of limits is described in more detail below.

The limits in this permit are based in part on information received in the application. The effluent constituents in the application were evaluated on a technology- and water quality-basis. The limits necessary to meet the rules and regulations of the state of Washington were determined and included in this permit. The Department does not develop effluent limits for all pollutants that may be reported on the application as present in the effluent**.** Some pollutants are not treatable at the concentrations reported, are not controllable at the source, are not listed in regulation, and do not have a reasonable potential to cause a water quality violation**.** Effluent limits are not always developed for pollutants that may be in the discharge but not reported as present in the application. In those circumstances the permit does not authorize discharge of the non-reported pollutants. Effluent discharge conditions may change from the conditions reported in the permit application. If significant changes occur in any constituent, as described in 40 Code of Federal Regulations (CFR) 122.42(a), the Permittee is required to notify the Department. The Permittee may be in violation of the permit until the permit is modified to reflect additional discharge of pollutants.

DESIGN CRITERIA

In accordance with WAC 173-220-150 (1)(g), flows or waste loadings shall not exceed approved design criteria.

The design criteria for this treatment facility are taken from 1997 Facility Plan for the facility by Wallis Engineering and are as follows:

Table 2: Design Standards for the Ridgefield WWTP.

Parameter	Design Quantity
Monthly average flow (max. month)	0.5 MGD
Monthly average dry weather flow	Not Available
Instantaneous peak flow	1.50 MGD
BOD_5 influent loading (max. month)	1,083 lbs/day
TSS influent loading (max. month)	1,083 lbs/day
Design population equivalent	4,167

The 1997 facility plan discusses different phases of plant upgrade and applied the phases to the design criteria. The design criteria shown in table 2 were for the "Phase one interim upgrade." A second half of phase-one would boost the maximum monthly flow to 0.75 mgd. However, the facility plan states that this expansion would not take place until the outfall was extended to the Columbia River. The assumption is that Lake River would not be able to take the additional ammonia loading from Ridgefield even with the best operations and equipment at this time. The present population listed on DMRs as 2,170 plus schools and industries.

TECHNOLOGY-BASED EFFLUENT LIMITATIONS

Municipal wastewater treatment plants are a category of discharger for which technology-based effluent limits have been promulgated by federal and state regulations. These effluent limitations are given in 40 CFR Part 133 (federal) and in Chapter 173-221 WAC (state). These regulations are performance standards that constitute all known available and reasonable methods of prevention, control, and treatment for municipal wastewater.

The following technology-based limits for pH, fecal coliform, BOD_5, and TSS are taken from Chapter 173-221 WAC are:

Table 3: Technology-based Limits.

Parameter	Limit
pH:	shall be within the range of 6 to 9 standard units.
Fecal Coliform Bacteria	Monthly Geometric Mean = 200 organisms/100 ml Weekly Geometric Mean = 400 organisms/100 ml
BOD_5 (concentration)	Average Monthly Limit is the most stringent of the following: - 30 mg/L - may not exceed fifteen percent (15%) of the average influent concentration Average Weekly Limit = 45 mg/L
TSS (concentration)	Average Monthly Limit is the most stringent of the following: - 30 mg/L - may not exceed fifteen percent (15%) of the average influent concentration Average Weekly Limit = 45 mg/L

The 1998 permit had a limit for chlorine, but since the disinfection system was replaced with UV. The chlorine limits have been eliminated.

The following technology-based mass limits are based on WAC 173-220-130(3)(b) and 173-221-030(11)(b).

Monthly effluent mass loadings (lbs/day) were calculated as the maximum monthly design flow (0.5 MGD) x Concentration limit (30 mg/L) x 8.34 (conversion factor) = mass limit 125 lbs/day.

The weekly average effluent mass loading is calculated as 1.5 x monthly loading = 188 lbs/day.

SURFACE WATER QUALITY-BASED EFFLUENT LIMITATIONS

In order to protect existing water quality and preserve the designated beneficial uses of Washington's surface waters, WAC 173-201A-060 states that waste discharge permits shall be conditioned such that the discharge will meet established Surface Water Quality Standards. The Washington State Surface Water Quality Standards (Chapter 173-201A WAC) is a state regulation designed to protect the beneficial uses of the surface waters of the state. Water quality-based effluent limitations may be based on an individual waste load allocation (WLA) or on a WLA developed during a basin-wide total maximum daily loading study (TMDL).

NUMERICAL CRITERIA FOR THE PROTECTION OF AQUATIC LIFE

"Numerical" water quality criteria are numerical values set forth in the state of Washington's Water Quality Standards for Surface Waters (Chapter 173-201A WAC). They specify the levels of pollutants allowed in a receiving water while remaining protective of aquatic life. Numerical criteria set forth in the Water Quality Standards are used along with chemical and physical data for the wastewater and receiving water to derive the effluent limits in the discharge permit. When surface water quality-based limits are more stringent or potentially more stringent than technology-based limitations, they must be used in a permit.

NUMERICAL CRITERIA FOR THE PROTECTION OF HUMAN HEALTH

The state was issued 91 numeric water quality criteria for the protection of human health by the U.S. EPA (EPA 1992). These criteria are designed to protect humans from cancer and other disease and are primarily applicable to fish and shellfish consumption and drinking water from surface waters.

NARRATIVE CRITERIA

In addition to numerical criteria, "narrative" water quality criteria (WAC 173-201A-030) limit toxic, radioactive, or deleterious material concentrations below those which have the potential to adversely affect characteristic water uses, cause acute or chronic toxicity to biota, impair aesthetic values, or adversely affect human health. Narrative criteria protect the specific beneficial uses of all fresh (WAC 173-201A-130) and marine (WAC 173-201A-140) waters in the state of Washington.

ANTIDEGRADATION

The state of Washington's Antidegradation Policy requires that discharges into a receiving water shall not further degrade the existing water quality of the water body. In cases where the natural conditions of a receiving water are of lower quality than the criteria assigned, the natural conditions shall constitute the water quality criteria. Similarly, when receiving waters are of higher quality than the criteria assigned, the existing water quality shall be protected. More information on the state Antidegradation Policy can be obtained by referring to WAC 173-201A-070.

The Department has reviewed existing records and is unable to determine if ambient water quality is either higher or lower than the designated classification criteria given in Chapter 173-201A WAC; therefore, the Department will use the designated classification criteria for this water body in the proposed permit. The discharges authorized by this proposed permit should not cause a loss of beneficial uses.

CRITICAL CONDITIONS

Surface water quality-based limits are derived for the waterbody's critical condition, which represents the receiving water and waste discharge condition with the highest potential for adverse impact on the aquatic biota, human health, and existing or characteristic water body uses.

MIXING ZONES

The Water Quality Standards allow the Department to authorize mixing zones around a point of discharge in establishing surface water quality-based effluent limits. Both "acute" and "chronic" mixing zones may be authorized for pollutants that can have a toxic effect on the aquatic environment near the point of discharge. The concentration of pollutants at the boundary of these mixing zones may not exceed the numerical criteria for that type of zone. Mixing zones can only be authorized for discharges that are receiving all known, available, and reasonable methods of prevention, control and treatment (AKART) and in accordance with other mixing zone requirements of WAC 173-201A-100.

The National Toxics Rule (EPA, 1992) allows the chronic mixing zone to be used to meet human health criteria.

DESCRIPTION OF THE RECEIVING WATER

The facility discharges to Lake River which is designated as a Class A receiving water in the vicinity of the outfall. There do not appear to be any nearby point source outfalls within a mile of the Ridgefield outfall. Nearby non-point sources of pollutants may include livestock operations on tributaries that feed Lake River. There are no such operations within one mile of the Ridgefield outfall. Vancouver Lake receives a fair about of urban runoff which may contribute to problems in Lake River. To the west of Lake River in the vicinity of the outfall and to several miles up and down the river is a national wildlife refuge.

Characteristic uses of Class A fresh water include the following: water supply (domestic, industrial, agricultural); stock watering; fish migration; fish rearing, spawning and harvesting; wildlife habitat; primary contact recreation; sport fishing; boating and aesthetic enjoyment; commerce and navigation.

Water quality of this class shall meet or exceed the requirements for all or substantially all uses.

SURFACE WATER QUALITY CRITERIA

Applicable criteria are defined in Chapter 173-201A WAC for aquatic biota. In addition, U.S. EPA has promulgated human health criteria for toxic pollutants (EPA 1992). Criteria for this discharge are summarized below:

Fecal Coliforms	100 organisms/100 ml maximum geometric mean
Dissolved Oxygen	8 mg/L minimum
Temperature	18 degrees Celsius maximum or incremental increases above background
pH	6.5 to 8.5 standard units
Turbidity	less than 5 NTUs above background
Toxics	No toxics in toxic amounts (see Appendix C for numeric criteria for toxics of concern for this discharge)

There are currently no TMDL studies that have been conducted for Lake River. However, the water in Lake River has serious limitations as pointed out in the Department's Environmental Assessment Program data base listing for Lake River. There has been very limited sampling of Lake River near Ridgefield (results are shown in Appendix C). There was sampling conducted from October 1991 through September 1992 for conventional parameters and metals. The Permittee conducted limited sampling for temperature and pH from 1998 through 2001, and fecal coliform, ammonia, and BOD_5 in 2002 and 2003. The Lake River summer pH had a 90^{th} percentile of 8.43 standard units, the summer temperature had a 90^{th} percentile of 20.53ºC, and the fecal coliform had a 90^{th} percentile of 116 org./100 ml. The Permittee will be required to conduct a water quality study and do a Priority Pollutant Scan for metals during the next permit.

CONSIDERATION OF SURFACE WATER QUALITY-BASED LIMITS FOR NUMERIC CRITERIA

Pollutant concentrations in the proposed discharge exceed water quality criteria with technology-based controls which the Department has determined to be AKART. A mixing zone is authorized in accordance with the geometric configuration, flow restriction, and other restrictions for mixing zones in Chapter 173-201A WAC and are defined as follows:

> The dilution factors of effluent to receiving water that occur within these zones have been determined from the analysis shown in the 1997 Facility Plan, Appendix I. A more thorough mixing zone/dilution analysis will need to be conducted using dye tracers to confirm the presence of an eddy, quantify dilution and set a basis for computer modeling, e.g., PLUMES dilution model.

The dilution factors determined in the Facility plan used the best information available at the time. However, the permit requirements to do another mixing study reflects our findings that there is a lot of uncertainty in the flow conditions of Lake River with the current reversals from back flooding from the Columbia River.:

	Acute	Chronic
Aquatic Life	3.0:1	17.0:1

Pollutants in an effluent may affect the aquatic environment near the point of discharge (near field) or at a considerable distance from the point of discharge (far field). Toxic pollutants, for example, are near-field pollutants--their adverse effects diminish rapidly with mixing in the receiving water. Conversely, a pollutant such as BOD is a far-field pollutant whose adverse effect occurs away from the discharge even after dilution has occurred. Thus, the method of calculating water quality-based effluent limits varies with the point at which the pollutant has its maximum effect.

The derivation of water quality-based limits also takes into account the variability of the pollutant concentrations in both the effluent and the receiving water.

The critical condition for Lake River was discussed in the 1997 Facility Plan. Because the Lake River Channel is influenced by the flows on the Columbia River, a 7Q10 low flow is not realistic. Lake River had an average flow rate of 357 cfs and a cross section of approximately 2,000 SF at low river stage. This low stage is an attempt to estimate the minimum flow. The ambient background data used for this permit includes the following (from Wallis Engineering, 1997):

Parameter	Value used
low stage flow	267 cfs (357 cfs avg high)
Velocity	0.28 – 2.0 ft/sec (flow reversals possible)
Cross section	2000 square feet
Width	240 feet
Temperature	20.53 ^{o} C (90th percentile)
pH (high)	8.43 (90th percentile)
Dissolved Oxygen	8.6 mg/L (min from 1992 data)
Total Ammonia-N	0.13 mg/L (highest value used from winter data)
Fecal Coliform	15/100 ml geometric mean
	116/100 ml 90th percentile (from 11/02-1/03)
All Metals	0.0 (No samples. Assumed to be below detection)

BOD_5--Under critical conditions there is no predicted violation of the Water Quality Standards for Surface Waters. Therefore, the technology-based effluent limitation for BOD_5 was placed in the permit.

The impact of BOD on the receiving water was modeled using The Streeter Phelps DOsag model at critical condition and with the technology-based effluent limitation for BOD_5 described under “Technology-Based Effluent Limitations” above (30mg/l BOD). The calculations used to determine dissolved oxygen impacts are shown in Appendix C. The model showed a final dissolved oxygen value of 8.43 which is drop of 0.17 mg/L using the most conservative estimates and based on the best information of ambient conditions at the present time. The final dissolved oxygen value is well above the water quality criteria of 8.0 mg/L.

Temperature and pH--The impact of the discharge on the temperature of the receiving water was modeled by simple mixing analysis at critical condition. The receiving water temperature at the critical condition is 20.53ºC and the effluent temperature is 19.44ºC. The effluent temperature is based on two years of summer data from 1998 and 1999. Effluent temperature has not been measured since 1999. The predicted resultant temperature at the boundary of the chronic mixing zone is 20.47ºC. The calculations may be found in Appendix C, PHMIX.

Because the effluent temperature was above the water quality criteria of 18ºC in both the effluent and the receiving water, there is concern of a possible water quality standards violation. It is not clear if the increased background temperature is a natural occurrence or caused by human actions. Until a TMDL is conducted, it will be assumed that the ambient temperature is higher than the natural condition. If this higher ambient temperature is a natural condition, then a 0.3ºC increase above background may be allowed. We assume that if the background temperature is above the water quality criteria then the effluent needs to meet the water quality criteria at the end of the pipe. Because the temperature information is old and the facility has undergone changes, the effluent temperature may be different now. It is likely, however, that the new clarifier and UV disinfection heat up the effluent rather than cool it down. There is also the possibility that the 1000-foot long pipe from the tail of the facility to Lake River will cool the effluent slightly over this distance.

The permit will recommend more frequent and accurate temperature measurements over the life of the next permit. Continuous temperature monitors (commonly known as tidbits) should be placed in Lake River upstream of the outfall and in the effluent as close as possible to the end of the outfall. The temperature should be monitored from May through October and maximum daily temperatures reported.

The impact of pH was modeled using the calculations from EPA, 1988. The input variables were dilution factor 17, upstream temperature 20.53ºC, upstream pH 8.43, upstream alkalinity 53 (as mg $CaCO_3$/L taken from Columbia River data), effluent temperature 19.44ºC, effluent pH of 7.5 and effluent alkalinity 150 (as mg $CaCO_3$/L estimate based on similar facilities).

Under critical conditions there is no predicted violation of the Water Quality Standards for pH. Therefore, the technology-based effluent limitations for pH was placed in the permit.

Fecal coliform—The maximum fecal coliform value in the effluent for the last three years was 66 org./100 ml. Because the background fecal coliform is higher than the water quality standard of 100 org./100 ml, the Permittee will receive a water quality limit for fecal coliform of 100 org./100 ml for the monthly limit and 200 org./100ml for the weekly limit. This should be fairly equivalent to the water quality standards criteria for Class A waters which is a geometric mean of 100 org/100ml and not more than 10% of samples above 200 org./100 ml. Because the facility has not exceeded 66 org./100 ml in three years of operation, it does not appear that the facility will have difficulty meeting the water quality limit.

Toxic Pollutants--Federal regulations (40 CFR 122.44) require NPDES permits to contain effluent limits for toxic chemicals in an effluent whenever there is a reasonable potential for those chemicals to exceed the surface water quality criteria. This process occurs concurrently with the derivation of technology-based effluent limits. Facilities with technology-based effluent limits defined in regulation are not exempted from meeting the Water Quality Standards for Surface Waters or from having surface water quality-based effluent limits.

A reasonable potential analysis for ammonia (See Appendix C) was conducted to determine whether or not effluent limitations would be required in this permit and found no potential. The determination of the reasonable potential for ammonia to exceed the water quality criteria was evaluated with procedures given in EPA, 1991 (Appendix C) at the critical condition. The critical condition in this case occurs during the summer months. The parameters used in the critical condition modeling are as follows: acute dilution factor 3, chronic dilution factor 17, receiving water temperature 20.5ºC, and receiving water pH of 8.43. No other background pollutants have been measured.

No metals have been tested in the effluent. The Department policy is to conduct a priority pollutant scan on facilities with activated sludge systems that are the size of Ridgefield's. However, instead of a full priority pollutant scan which would examine the influent, effluent, and sludge, we are recommending a scan of heavy metals in the effluent and the receiving water. The scan for metals should be conducted once in the winter and once in the summer before the end of the permit cycle. To make sure that metals are sampled using the best “clean methods” and avoid false positives, the Permittee should follow EPA method 200.8 for sampling metals that specifies the use of Induced Coupled Plasma with Mass Spectrometry (ICP/MS). The permit will require testing of the metals listed in 40 CFR Part 122, Table III, which includes the following:

Metals and other toxic pollutants specified in 40 CFR Part 122, Appendix D, Table III

Antimony	Total
Arsenic	Total
Beryllium	Total
Cadmium	Total
Chromium	Total
Copper	Total
Lead	Total
Mercury	Total
Nickel	Total
Selenium	Total
Thallium	Total
Zinc	Total
Cyanide	Total
Phenols	Total

Mercury should be tested using EPA method 1631 Revision C which may be found in 40 CFR Part 136. This method for mercury has a minimum detection level of 0.5 ppt.

No valid ambient background data was available for any other pollutant. A determination of reasonable potential using zero for background should result in no reasonable potential. The Permittee is required in section S2 of the proposed permit to collect background concentrations of the metals listed above near the point of discharge. This information may result in a permit modification or limits in the next renewal.

Water quality criteria for metals in Chapter 173-201A WAC are based on the dissolved fraction of the metal.

The Permittee may provide data clearly demonstrating the seasonal partitioning of the dissolved metal in the ambient water in relation to an effluent discharge. Metals criteria may be adjusted on a site-specific basis when data is available clearly demonstrating the seasonal partitioning in the ambient water in relation to an effluent discharge.

Metals criteria may also be adjusted using the water effects ratio approach established by USEPA, as generally guided by the procedures in USEPA Water Quality Standards Handbook, December 1983, as supplemented or replaced.

WHOLE EFFLUENT TOXICITY

The Water Quality Standards for Surface Waters require that the effluent not cause toxic effects in the receiving waters. Many toxic pollutants cannot be detected by commonly available detection methods. However, toxicity can be measured directly by exposing living organisms to the wastewater in laboratory tests and measuring the response of the organisms. Toxicity tests measure the aggregate toxicity of the whole effluent, and therefore this approach is called whole effluent toxicity (WET) testing. Some WET tests measure acute toxicity and other WET tests measure chronic toxicity.

Acute toxicity tests measure mortality as the significant response to the toxicity of the effluent. Dischargers who monitor their wastewater with acute toxicity tests are providing an indication of the potential lethal effect of the effluent to organisms in the receiving environment.

Chronic toxicity tests measure various sublethal toxic responses such as retarded growth or reduced reproduction. Chronic toxicity tests often involve either a complete life cycle test of an organism with an extremely short life cycle or a partial life cycle test on a critical stage of one of a test organism's life cycles. Organism survival is also measured in some chronic toxicity tests.

In accordance with WAC 173-205-040, the Permittee's effluent has been determined to have the potential to contain toxic chemicals. The proposed permit contains requirements for whole effluent toxicity testing as authorized by RCW 90.48.520 and 40 CFR 122.44 and in accordance with procedures in Chapter 173-205 WAC. The proposed permit requires the Permittee to conduct toxicity testing for one year in order to characterize both the acute and chronic toxicity of the effluent.

If acute or chronic toxicity is measured during effluent characterization at levels that, in accordance with WAC 173-205-050(2)(a), have a reasonable potential to cause receiving water toxicity, then the proposed permit will set a limit on the acute or chronic toxicity. The proposed permit will then require the Permittee to conduct WET testing in order to monitor for compliance with either an acute toxicity limit, a chronic toxicity limit, or both an acute and a chronic toxicity limit. The proposed permit also specifies the procedures the Permittee must use to come back into compliance if the limits are exceeded.

Accredited WET testing laboratories have the proper WET testing protocols, data requirements, and reporting format. Accredited laboratories are knowledgeable about WET testing and capable of calculating an NOEC, LC_{50}, EC_{50}, IC_{25}, etc. All accredited labs have been provided the most recent version of the Department of Ecology Publication # WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* which is referenced in the permit. Any Permittee interested in receiving a copy of this publication may call the Department Publications Distribution Center (360)

407-7472 for a copy. The Department recommends that Permittees send a copy of the acute or chronic toxicity sections(s) of their permits to their laboratory of choice.

When the WET tests during effluent characterization indicate that no reasonable potential exists to cause receiving water toxicity, the Permittee will not be given WET limits but will be required to use rapid screening tests to assure toxicity doesn't appear. If a rapid screening test indicates that toxicity has appeared, the Permittee will investigate immediately and take appropriate action.

If the Permittee makes process or material changes which, in the Department's opinion, results in an increased potential for effluent toxicity, then the Department may require additional effluent characterization in a regulatory order, by permit modification, or in the permit renewal. Toxicity is assumed to have increased if WET testing conducted in response to rapid screening tests fails to meet the performance standards in WAC 173-205-020 "whole effluent toxicity performance standard."

HUMAN HEALTH

Washington’s water quality standards now include 91 numeric health-based criteria that must be considered in NPDES permits. These criteria were promulgated for the state by the U.S. EPA in its National Toxics Rule (Federal Register, Volume 57, No. 246, Tuesday, December 22, 1992).

The Department has determined that the applicant's discharge is unlikely to contain chemicals regulated for human health based on existing data or knowledge. The discharge will be re-evaluated for impacts to human health at the next permit reissuance.

A determination of the discharge's potential to cause an exceedance of the water quality standards was conducted as required by 40 CFR 122.44(d). The reasonable potential determination was evaluated with procedures given in the Technical Support Document for Water Quality-Based Toxics Control (EPA/505/2-90-001) and the Department's Permit Writer's Manual (Ecology Publication 92-109, July, 1994). The determination indicated that the discharge has no reasonable potential to cause a violation of water quality standards, thus an effluent limit is not warranted.

COMPARISON OF EFFLUENT LIMITS WITH THE EXISTING PERMIT ISSUED AUGUST 12, 1998

Parameter	**Existing Limits**		**Proposed Limits**	
	Monthly Limits	**Weekly Limits**	**Monthly Limits**	**Weekly Limits**
BOD, and TSS	30 mg/L 88 lbs/day (interim) 125 lbs/day (final) and 85% removal	45 mg/L 132 lbs/day (interim) 188 lbs/day (final)	30 mg/L 125 lbs/day and 85% removal	45 mg/L 188 lbs/day
Fecal Coliform Bacteria	200/100 ml	400/100 ml	100/100 ml (geomean)	200/100ml (geomean)
pH	Shall not be outside the range 6.0 to 9.0		Shall not be outside the range 6.0 to 9.0	
Total Residual	Minimized (interim)		Not applicable	

Chlorine	Not applicable (final)	
Ammonia (NH3-N)	Optimize plant operation for nitrification and monitor	No limit

The final limits shown above in the 1998 permit were to become final after the submittal of the Declaration of Construction of Water Pollution Control Facilities and lasting through the expiration date of the permit.

MONITORING REQUIREMENTS

Monitoring, recording, and reporting are required (WAC 173-220-210 and 40 CFR 122.41) to verify that the treatment process is functioning correctly and the effluent limitations are being achieved.

Monitoring for oil and grease and metals is being required to further characterize the effluent. Metals that need to be examined are those listed in 40 CFR Part 122, appendix D, table III. These metals are listed above under the discussion of Toxic Pollutants. These pollutants could have a significant impact on the quality of the surface water.

Monitoring of sludge quantity and quality is necessary to determine the appropriate uses of the sludge. Sludge monitoring is required by the current state and local solid waste management program and also by EPA under 40 CFR 503.

The monitoring schedule is detailed in the proposed permit under Condition S.2. Specified monitoring frequencies take into account the quantity and variability of discharge, the treatment method, past compliance, significance of pollutants, and cost of monitoring. The required monitoring frequency is consistent with agency guidance given in the current version of the Department's *Permit Writer's Manual* (July 1994) for an activated sludge facility that is less than 2.0 MGD average design flow.

LAB ACCREDITATION

With the exception of certain parameters the permit requires all monitoring data to be prepared by a laboratory registered or accredited under the provisions of Chapter 173-50 WAC, *Accreditation of Environmental Laboratories*. The laboratory at this facility is accredited for general chemistry which includes BOD/COD, total residual chlorine, dissolved oxygen, pH, and solids, total suspended. Ammonia and fecal coliform must be tested in a different laboratory and are currently being tested at the Salmon Creek laboratory.

OTHER PERMIT CONDITIONS

REPORTING AND RECORDKEEPING

The conditions of S3 are based on the authority to specify any appropriate reporting and recordkeeping requirements to prevent and control waste discharges (WAC 173-220-210).

PREVENTION OF FACILITY OVERLOADING

Overloading of the treatment plant is a violation of the terms and conditions of the permit. To prevent this from occurring, RCW 90.48.110 and WAC 173-220-150 require the Permittee to take the actions detailed in proposed permit requirement S.4 to plan expansions or modifications before existing capacity is reached and to report and correct conditions that could result in new or increased discharges of pollutants. Condition S.4 restricts the amount of flow.

OPERATION AND MAINTENANCE (O&M)

The proposed permit contains Condition S.5 as authorized under RCW 90.48.110, WAC 173-220-150, Chapter 173-230 WAC, and WAC 173-240-080. It is included to ensure proper operation and regular maintenance of equipment, and to ensure that adequate safeguards are taken so that constructed facilities are used to their optimum potential in terms of pollutant capture and treatment.

RESIDUAL SOLIDS HANDLING

To prevent water quality problems the Permittee is required in permit Condition S7 to store and handle all residual solids (grit, screenings, scum, sludge, and other solid waste) in accordance with the requirements of RCW 90.48.080 and State Water Quality Standards.

The final use and disposal of sewage sludge (biosolids) from this facility is regulated by U.S. EPA under 40 CFR 503, and by the Department under Chapter 70.95J RCW and Chapter 173-308 WAC. The WWTP as a biosolids generator, is required to obtain coverage under the General Statewide Permit for Biosolids Management. The disposal of other solid waste is under the jurisdiction of the Clark County Health Department.

PRETREATMENT

Federal and State Pretreatment Program Requirements

Under the terms of the addendum to the "Memorandum of Understanding between Washington Department of Ecology and the United States Environmental Protection Agency, Region 10" (1986), the Department has been delegated authority to administer the Pretreatment Program [i.e., act as the Approval Authority for oversight of delegated Publicly Owned Treatment Works (POTWs)]**.** Under this delegation of authority, the Department has exercised the option of issuing wastewater discharge permits for significant industrial users discharging to POTWs which have not been delegated authority to issue wastewater discharge permits.

There are a number of functions required by the Pretreatment Program which the Department is delegating to such POTWs because they are in a better position to implement the requirements (e.g. tracking the number and general nature of industrial dischargers to the sewerage system). The requirements for a Pretreatment Program are contained in Title 40, part 403 of the Code of Federal Regulations. Under the requirements of the Pretreatment Program [40 CFR 403.8(f)(1)(iii)], the Department is required to approve, condition, or deny new discharges or a significant increase in the discharge for existing significant industrial users (SIUs) [40 CFR 403.8 (f)(1)(i)].

The Department is responsible for issuing State Waste Discharge Permits to SIUs and other industrial users of the Permittee's sewer system. Industrial dischargers must obtain these permits from the Department prior to the Permittee accepting the discharge [WAC 173-216-110(5)] (Industries discharging wastewater that is similar in character to domestic wastewater are not required to obtain a permit. Such dischargers should contact the Department to determine if a permit is required.). Industrial dischargers need to apply for a State Waste Discharge Permit 60 days prior to commencing discharge. The conditions contained in the permits will include any applicable conditions for categorical discharges, loading limitations included in contracts with the POTW, and other conditions necessary to assure compliance with State water quality standards and biosolids standards.

The Department requires this POTW to fulfill some of the functions required for the Pretreatment Program in the NPDES permit (e.g., tracking the number and general nature of industrial dischargers to the sewage system). The POTW's NPDES permit will require that all SIUs currently discharging to the POTW be identified and notified of the requirement to apply for a wastewater discharge permit from the Department. None of the obligations imposed on the POTW relieve an industrial or commercial discharger of its primary responsibility for obtaining a wastewater discharge permit (if required), including submittal of engineering reports prior to construction or modification of facilities [40 CFR 403.12(j) and WAC 173-216-070 and WAC 173-240-110, et seq.].

Wastewater Permit Required

RCW 90.48 and WAC 173-216-040 require SIUs to obtain a permit prior to discharge of industrial waste to the Permittee's sewerage system. This provision prohibits the POTW from accepting industrial wastewater from any such dischargers without authorization from the Department.

Requirements for Routine Identification and Reporting of Industrial Users

The NPDES permit requires non-delegated POTWs to " take continuous, routine measures to identify all existing, new, and proposed SIUs and potential significant industrial users (PSIUs) discharging to the Permittee's sewerage system." Examples of such routine measures include regular review of business tax licenses for existing businesses and review of water billing records and existing connection authorization records. System maintenance personnel can also be diligent during performance of their jobs in identifying and reporting as-yet unidentified industrial dischargers. Local newspapers, telephone directories, and word-of-mouth can also be important sources of information regarding new or existing discharges. The POTW is required to notify an industrial discharger, in writing, of their responsibilities regarding application for a state waste discharge permit and to send a copy of the written notification to the Department. The Department will then take steps to solicit a State waste discharge permit application.

Submittal of List of Industrial Users

This provision requires the POTW to submit once per permit cycle a list of existing and proposed SIUs and PSIUs. This requirement is intended to update the Department on the status of industrial users in the POTW's service area, without requiring the POTW to go through the process of performing a formal Industrial User Survey. This provision is normally applied to POTWs not serving industrial or commercial users. Although this permit does not require performance of an Industrial User Survey, the Permittee is nevertheless required under the previous section, to take adequate continuous routine measures to identify existing and new industrial discharges.

Duty to Enforce Discharge Prohibitions

This provision prohibits the POTW from authorizing or permitting an industrial discharger to discharge certain types of waste into the sanitary sewer. The first portion of the provision prohibits acceptance of pollutants which cause pass-through or interference. The definitions of pass through and interference are in Appendix B of the fact sheet..

The second portion of this provision prohibits the POTW from accepting certain specific types of wastes, namely those which are explosive, flammable, excessively acidic, basic, otherwise corrosive, or obstructive to the system. In addition wastes with excessive BOD, petroleum based oils, or which result in toxic gases are prohibited to be discharged. The regulatory basis for these prohibitions is 40 CFR Part 403, with the exception of the pH provisions which are based on WAC 173-216-060.

The third portion of this provision prohibits certain types of discharges unless the POTW receives prior authorization from the Department. The discharges include cooling water in significant volumes, stormwater and other direct inflow sources, and wastewaters significantly affecting system hydraulic loading, which do not require treatment.

Support by the Department for Developing Partial Pretreatment Program by POTW

The Department has committed to providing technical and legal assistance to the Permittee in fulfilling these joint obligations, in particular assistance with developing an adequate sewer use ordinance, notification procedures, enforcement guidelines, and developing local limits and inspection procedures.

EFFLUENT MIXING STUDY

The Department has estimated the amount of mixing of the discharge within the authorized mixing zone to determine the potential for violations of the Water Quality Standards for Surface Waters (Chapter 173-201A WAC). Condition S8 of this permit requires the Permittee to more accurately determine the mixing characteristics of the discharge. Mixing will be measured or modeled under conditions specified in the permit to assess whether assumptions made about dilution will protect the receiving water quality outside the allotted dilution zone boundary. As noted earlier in this fact sheet, the dilution is based on assumptions about Lake River that should be confirmed or disproved through an actual mixing study. Very little is known about tide reversals, and low flow conditions in Lake River and likely cannot be shown without dye studies. The dilution ratios determined for this fact sheet were fairly small.

The modeling should be re-run with the assumption of a diffuser at the end of the now 10" pipe. The modeling should be done after the on-site dilution mixing study has been conducted. A previous dilution modeling showed that adding a six-inch constriction to the outfall should improve the dilution. A tide-flex diffuser or multi-port diffuser should be modeled with the new assumptions gained from the dye study. If the modeling shows the diffuser improves dilution, recommendations should be made for installing a diffuser.

A review of study plans by the Department will be required prior the Permittee's consultants conducting a study.

OUTFALL EVALUATION

Proposed permit Condition S12 requires the Permittee to conduct an outfall inspection and submit a report detailing the findings of that inspection once during the permit. The purpose of the inspection is to determine the condition of the discharge pipe and diffusers (if added) and to determine if sediment is accumulating in the vicinity of the outfall.

GENERAL CONDITIONS

General Conditions are based directly on state and federal law and regulations and have been standardized for all individual municipal NPDES permits issued by the Department.

PERMIT ISSUANCE PROCEDURES

PERMIT MODIFICATIONS

The Department may modify this permit to impose numerical limitations, if necessary to meet Water Quality Standards, Sediment Quality Standards, or Ground Water Standards, based on new information obtained from sources such as inspections, effluent monitoring, outfall studies, and effluent mixing studies.

The Department may also modify this permit as a result of new or amended state or federal regulations.

RECOMMENDATION FOR PERMIT ISSUANCE

This proposed permit meets all statutory requirements for authorizing a wastewater discharge, including those limitations and conditions believed necessary to protect human health, aquatic life, and the beneficial uses of waters of the state of Washington. The Department proposes that this permit be issued for five years.

REFERENCES FOR TEXT AND APPENDICES

Environmental Protection Agency (EPA)

1992. National Toxics Rule. Federal Register, V. 57, No. 246, Tuesday, December 22, 1992.

1991. Technical Support Document for Water Quality-based Toxics Control. EPA/505/2-90-001.

1988. Technical Guidance on Supplementary Stream Design Conditions for Steady State Modeling. USEPA Office of Water, Washington, D.C.

1985. Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water. EPA/600/6-85/002a.

1983. Water Quality Standards Handbook. USEPA Office of Water, Washington, D.C.

Metcalf and Eddy.

1991. Wastewater Engineering, Treatment, Disposal, and Reuse. Third Edition.

Tsivoglou, E.C., and J.R. Wallace.

1972. Characterization of Stream Reaeration Capacity. EPA-R3-72-012. (Cited in EPA 1985 op.cit.)

Wallis Engineering.

1997. Facility Plan for the City of Ridgefield, Washington. Final. WE660D

Washington State Department of Ecology.

Laws and Regulations(http://www.ecy.wa.gov/laws-rules/index.html)

Permit and Wastewater Related Information (http://www.ecy.wa.gov/programs/wq/wastewater/index.html

Washington State Department of Ecology.

1994. Permit Writer's Manual. Publication Number 92-109

Water Pollution Control Federation.

1976. Chlorination of Wastewater.

Wright, R.M., and A.J. McDonnell.

1979. In-stream Deoxygenation Rate Prediction. Journal Environmental Engineering Division, ASCE. 105(EE2). (Cited in EPA 1985 op.cit.)

APPENDIX A--PUBLIC INVOLVEMENT INFORMATION

The Department has tentatively determined to reissue a permit to the applicant listed on page 1 of this fact sheet. The permit contains conditions and effluent limitations which are described in the rest of this fact sheet.

Public notice of application was published on July 14, 2002, and July 21, 2002, in the *Columbian* to inform the public that an application had been submitted and to invite comment on the reissuance of this permit.

The Department will publish a Public Notice of Draft (PNOD) on October 29, 2003, in the *Columbian* to inform the public that a draft permit and fact sheet are available for review. Interested persons are invited to submit written comments regarding the draft permit. The draft permit, fact sheet, and related documents are available for inspection and copying between the hours of 8:00 a.m. and 5:00 p.m. weekdays, by appointment, at the regional office listed below. Written comments should be mailed to:

Water Quality Permit Administrator
Department of Ecology
Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775.

Any interested party may comment on the draft permit or request a public hearing on this draft permit within the 30-day comment period to the address above. The request for a hearing shall indicate the interest of the party and the reasons why the hearing is warranted. The Department will hold a hearing if it determines there is a significant public interest in the draft permit (WAC 173-220-090). Public notice regarding any hearing will be circulated at least 30 days in advance of the hearing. People expressing an interest in this permit will be mailed an individual notice of hearing (WAC 173-220-100).

Comments should reference specific text followed by proposed modification or concern when possible. Comments may address technical issues, accuracy and completeness of information, the scope of the facility's proposed coverage, adequacy of environmental protection, permit conditions, or any other concern that would result from issuance of this permit.

The Department will consider all comments received within 30 days from the date of public notice of draft indicated above, in formulating a final determination to issue, revise, or deny the permit. The Department's response to all significant comments is available upon request and will be mailed directly to people expressing an interest in this permit.

Further information may be obtained from the Department by telephone, (360) 407-6554, or by writing to the address listed above.

This permit and fact sheet were written by Eric Schlorff.

APPENDIX B--GLOSSARY

Acute Toxicity--The lethal effect of a pollutant on an organism that occurs within a short period of time, usually 48 to 96 hours.

AKART-- An acronym for “all known, available, and reasonable methods of prevention, control, and treatment”.

Ambient Water Quality--The existing environmental condition of the water in a receiving water body.

Ammonia--Ammonia is produced by the breakdown of nitrogenous materials in wastewater. Ammonia is toxic to aquatic organisms, exerts an oxygen demand, and contributes to eutrophication. It also increases the amount of chlorine needed to disinfect wastewater.

Average Monthly Discharge Limitation --The highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month (except in the case of fecal coliform). The daily discharge is calculated as the average measurement of the pollutant over the day.

Average Weekly Discharge Limitation -- The highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week. The daily discharge is calculated as the average measurement of the pollutant over the day.

Best Management Practices (BMPs)--Schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the State. BMPs include treatment systems, operating procedures, and practices to control: plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. BMPs may be further categorized as operational, source control, erosion and sediment control, and treatment BMPs.

BOD_5--Determining the Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of organic material present in an effluent that is utilized by bacteria. The BOD_5 is used in modeling to measure the reduction of dissolved oxygen in a receiving water after effluent is discharged. Stress caused by reduced dissolved oxygen levels makes organisms less competitive and less able to sustain their species in the aquatic environment. Although BOD is not a specific compound, it is defined as a conventional pollutant under the federal Clean Water Act.

Bypass--The intentional diversion of waste streams from any portion of a treatment facility.

CBOD5 – The quantity of oxygen utilized by a mixed population of microorganisms acting on the nutrients in the sample in an aerobic oxidation for five days at a controlled temperature of 20 degrees Celsius, with an inhibitory agent added to prevent the oxidation of nitrogen compounds. The method for determining CBOD5 is given in 40 CFR Part 136.

Chlorine--Chlorine is used to disinfect wastewaters of pathogens harmful to human health. It is also extremely toxic to aquatic life.

Chronic Toxicity--The effect of a pollutant on an organism over a relatively long time, often 1/10 of an organism's lifespan or more. Chronic toxicity can measure survival, reproduction or growth rates, or other parameters to measure the toxic effects of a compound or combination of compounds.

Clean Water Act (CWA)--The Federal Water Pollution Control Act enacted by Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, 97-117; USC 1251 et seq.

Combined Sewer Overflow (CSO)--The event during which excess combined sewage flow caused by inflow is discharged from a combined sewer, rather than conveyed to the sewage treatment plant because either the capacity of the treatment plant or the combined sewer is exceeded.

Compliance Inspection - Without Sampling--A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations.

Compliance Inspection - With Sampling--A site visit to accomplish the purpose of a Compliance Inspection - Without Sampling and as a minimum, sampling and analysis for all parameters with limits in the permit to ascertain compliance with those limits; and, for municipal facilities, sampling of influent to ascertain compliance with the percent removal requirement. Additional sampling may be conducted.

Composite Sample--A mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing a minimum of four discrete samples. May be "time-composite"(collected at constant time intervals) or "flow-proportional" (collected either as a constant sample volume at time intervals proportional to stream flow, or collected by increasing the volume of each aliquot as the flow increased while maintaining a constant time interval between the aliquots.

Construction Activity--Clearing, grading, excavation and any other activity which disturbs the surface of the land. Such activities may include road building, construction of residential houses, office buildings, or industrial buildings, and demolition activity.

Continuous Monitoring –Uninterrupted, unless otherwise noted in the permit.

Critical Condition--The time during which the combination of receiving water and waste discharge conditions have the highest potential for causing toxicity in the receiving water environment. This situation usually occurs when the flow within a water body is low, thus, its ability to dilute effluent is reduced.

Dilution Factor--A measure of the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. Expressed as the inverse of the effluent fraction e.g., a dilution factor of 10 means the effluent comprises 10% by volume and the receiving water 90%.

Engineering Report--A document which thoroughly examines the engineering and administrative aspects of a particular domestic or industrial wastewater facility. The report shall contain the appropriate information required in WAC 173-240-060 or 173-240-130.

Fecal Coliform Bacteria--Fecal coliform bacteria are used as indicators of pathogenic bacteria in the effluent that are harmful to humans. Pathogenic bacteria in wastewater discharges are controlled by disinfecting the wastewater. The presence of high numbers of fecal coliform bacteria in a water body can indicate the recent release of untreated wastewater and/or the presence of animal feces.

Grab Sample--A single sample or measurement taken at a specific time or over as short period of time as is feasible.

Industrial User-- A discharger of wastewater to the sanitary sewer which is not sanitary wastewater or is not equivalent to sanitary wastewater in character.

Industrial Wastewater--Water or liquid-carried waste from industrial or commercial processes, as distinct from domestic wastewater. These wastes may result from any process or activity of industry, manufacture, trade or business, from the development of any natural resource, or from animal operations such as feed lots, poultry houses, or dairies. The term includes contaminated storm water and, also, leachate from solid waste facilities.

Infiltration and Inflow (I/I)--"Infiltration" means the addition of ground water into a sewer through joints, the sewer pipe material, cracks, and other defects. "Inflow" means the addition of precipitation-caused drainage from roof drains, yard drains, basement drains, street catch basins, etc., into a sewer.

Interference -- A discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal and;

Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to subtitle D of the SWDA), sludge regulations appearing in 40 CFR Part 507, the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act.

Major Facility--A facility discharging to surface water with an EPA rating score of > 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

Maximum Daily Discharge Limitation--The highest allowable daily discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. The daily discharge is calculated as the average measurement of the pollutant over the day.

Method Detection Level (MDL)--The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is above zero and is determined from analysis of a sample in a given matrix containing the analyte.

Minor Facility--A facility discharging to surface water with an EPA rating score of < 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

Mixing Zone--A volume that surrounds an effluent discharge within which water quality criteria may be exceeded. The area of the authorized mixing zone is specified in a facility's permit and follows procedures outlined in State regulations (Chapter 173-201A WAC).

National Pollutant Discharge Elimination System (NPDES)--The NPDES (Section 402 of the Clean Water Act) is the Federal wastewater permitting system for discharges to navigable waters of the United States. Many states, including the State of Washington, have been delegated the authority to issue these permits. NPDES permits issued by Washington State permit writers are joint NPDES/State permits issued under both State and Federal laws.

Pass through -- A discharge which exits the POTW into waters of the–State in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation), or which is a cause of a violation of State water quality standards.

pH--The pH of a liquid measures its acidity or alkalinity. A pH of 7 is defined as neutral, and large variations above or below this value are considered harmful to most aquatic life.

Potential Significant Industrial User--A potential significant industrial user is defined as an Industrial User which does not meet the criteria for a Significant Industrial User, but which discharges wastewater meeting one or more of the following criteria:

a. Exceeds 0.5 % of treatment plant design capacity criteria and discharges <25,000 gallons per day or;

b. Is a member of a group of similar industrial users which, taken together, have the potential to cause pass through or interference at the POTW (e.g. facilities which develop photographic film or paper, and car washes).

The Department may determine that a discharger initially classified as a potential significant industrial user should be managed as a significant industrial user.

Quantitation Level (QL)-- A calculated value five times the MDL (method detection level).

Significant Industrial User (SIU)--

1) All industrial users subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N and;

2) Any other industrial user that: discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blow-down wastewater); contributes a process wastestream that makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the Control Authority* on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement (in accordance with 40 CFR 403.8(f)(6)).

Upon finding that the industrial user meeting the criteria in paragraph 2, above, has no reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement, the Control Authority* may at any time, on its own initiative or in response to a petition received from an industrial user or POTW, and in accordance with 40 CFR 403.8(f)(6), determine that such industrial user is not a significant industrial user.

*The term "Control Authority" refers to the Washington State Department of Ecology in the case of non-delegated POTWs or to the POTW in the case of delegated POTWs.

State Waters--Lakes, rivers, ponds, streams, inland waters, underground waters, salt waters, wetlands, and all other surface waters and watercourses within the jurisdiction of the state of Washington.

Stormwater--That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a storm water drainage system into a defined surface water body, or a constructed infiltration facility.

Technology-based Effluent Limit--A permit limit that is based on the ability of a treatment method to reduce the pollutant.

Total Suspended Solids (TSS)--Total suspended solids are the particulate materials in an effluent. Large quantities of TSS discharged to a receiving water may result in solids accumulation. Apart from any toxic effects attributable to substances leached out by water, suspended solids may kill fish, shellfish, and other aquatic organisms by causing abrasive injuries and by clogging the gills and respiratory passages of various aquatic fauna. Indirectly, suspended solids can screen out light and can promote and maintain the development of noxious conditions through oxygen depletion.

Upset--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 operational error, improperly designed treatment facilities, lack of preventative maintenance, or careless or improper operation.

Water Quality-based Effluent Limit--A limit on the concentration or mass of an effluent parameter that is intended to prevent the concentration of that parameter from exceeding its water quality criterion after it is discharged into a receiving water.

APPENDIX C--TECHNICAL CALCULATIONS

Several of the Excel® spreadsheet tools used to evaluate a discharger's ability to meet Washington State water quality standards can be found on the Department's homepage at (http://www.ecy.wa.gov/programs/wq/wastewater/index.html

This spreadsheet calculates the reasonable potential to exceed state water quality standards for a small number of samples. The procedure and calculations are done per the procedure in Technical Support Document for Water Quality-based Toxics Control, U.S. EPA, March, 1991 (EPA/505/2-90-001) on page 56. User input columns are shown with red headings. Corrected formulas in col G and H on 5/98 (GB)

				State Water Quality Standard		Max concentration at edge of...		
Parameter	Metal Criteria Translator as decimal	Metal Criteria Translator as decimal	Ambient Concentration (metals as dissolved)	Acute	Chronic	Acute Mixing Zone	Chronic Mixing Zone	LIMIT REQ'D?
	Acute	Chronic	ug/L	ug/L	ug/L	ug/L	ug/L	
Ammonia	1.00	1.00	130.0000	2100.0000	340.0000	300.25	160.04	NO

CALCULATIONS

Effluent percentile value		Max effluent conc. measured (metals as total recoverable)	Coeff Variation		# of samples	Multiplier	Acute Dil'n Factor	Chronic Dil'n Factor	
	Pn	*ug/L*	*CV*	*s*	*n*				COMMENTS
0.95	0.933	590.00	0.60	0.55	43	1.09	3	17	

Calculation Of Ammonia Concentration and Criteria for fresh water.

Based on EPA Quality Criteria for Water (EPA 400/5-86-001) and WAC 173-201A. Revised 1-5-94 (corrected total ammonia criterion). Revised 3/10/95 to calculate chronic criteria in accordance with EPA Memorandum from Heber to WQ Stds Coordinators dated July 30, 1992.

INPUT

1. Ambient Temperature (deg C; 0<T<30)	20.5
2. Ambient pH (6.5<pH<9.0)	8.43
3. Acute TCAP (Salmonids present- 20; absent- 25)	20
4. Chronic TCAP (Salmonids present- 15; absent- 20)	15

OUTPUT

1. Intermediate Calculations:	
Acute FT	1.00
Chronic FT	1.41
FPH	1.00
RATIO	14
pKa	9.38
Fraction Of Total Ammonia Present As Un-ionized	10.0018%
2. Un-ionized Ammonia Criteria	
Acute (1-hour) Un-ionized Ammonia Criterion (ug NH3/L)	260.0
Chronic (4-day) Un-ionized Ammonia Criterion (ug NH3/L)	42.0
3. Total Ammonia Criteria:	
Acute Total Ammonia Criterion (mg NH3+ NH4/L)	2.6
Chronic Total Ammonia Criterion (mg NH3+ NH4/L)	0.4
4. Total Ammonia Criteria expressed as Nitrogen:	
Acute Ammonia Criterion as mg N	2.1
Chronic Ammonia Criterion as N	0.34

Lake River Ambient Conditions from City of Ridgefield

DATE	FECAL COLIFORM	NH3-N	BOD
10/1/02			3.3
11/5/2002	10	0.06	1
11/7/2002	16	0.04	1
11/12/2002	1		1.1
11/14/2002	44	0.107	1
11/19/2002	43	0.017	1
11/21/2002	1	0.001	1.2
11/26/2002	23	0.001	
12/3/2002	27	0.06	
12/5/2002	48	0.001	0.51
12/10/2002	33	0.001	1.02
12/12/2002	35	0.02	2.1
12/17/2002		0.04	2.2

12/19/2002	108	0.03	0
12/25/2002		0.001	0.8
12/26/2002	74	0.13	
12/27/2002	92		1.4
1/2/2003	1	0.06	1.4
1/3/2003	1	0.06	
1/7/2003	120	0.09	1
1/9/2003	66	0.07	1
1/14/2003	366	0.09	1
1/16/2003	136	0.08	1.3
1/21/2003	2.3	0.04	1
1/23/2003	1	0.04	1
1/28/2003	3	0.03	1
1/31/2003	1	0.05	1.1
	geomean	max value	
	15.13415	0.13	
	90th percentile	90th percentile	90th percentile
	116.4	0.09	1.89

Streeter-Phelps analysis of critical dissolved oxygen sag.

Based on Lotus File DOSAG2.WK1 Revised 19-Oct-93

INPUT	
1. EFFLUENT CHARACTERISTICS	
Discharge (cfs): (0.5 mgd):	0.77
CBOD5 (mg/L):	30
NBOD (mg/L):	13
Dissolved Oxygen (mg/L):	2
Temperature (deg C):	18
2. RECEIVING WATER CHARACTERISTICS	
Upstream Discharge (cfs):	267
Upstream CBOD5 (mg/L):	1.9
Upstream NBOD (mg/L):	0.81
Upstream Dissolved Oxygen (mg/L):	8.6
Upstream Temperature (deg C):	20.53
Elevation (ft NGVD):	25
Downstream Average Channel Slope (ft/ft):	0.00088
Downstream Average Channel Depth (ft):	8.3

Downstream Average Channel Velocity (fps): 1.05

3. REAERATION RATE (Base e) AT 20 deg C (day^-1): 3.57

Reference	Applic. Vel (fps)	Applic. Dep (ft)	Suggested Values
Churchill	1.5 - 6	2 - 50	0.35
O'Connor and Dobbins	.1 - 1.5	2 - 50	0.56
Owens	.1 - 6	1 - 2	0.44
Tsivoglou-Wallace	.1 - 6	.1 - 2	3.83

4. BOD DECAY RATE (Base e) AT 20 deg C (day^-1): 0.67

Reference	Suggested Value
Wright and McDonnell, 1979	0.67

OUTPUT

1. INITIAL MIXED RIVER CONDITION

CBOD5 (mg/L):	2.0
NBOD (mg/L):	0.8
Dissolved Oxygen (mg/L):	8.6
Temperature (deg C):	20.5

2. TEMPERATURE ADJUSTED RATE CONSTANTS (Base e)

Reaeration (day^-1):	3.61
BOD Decay (day^-1):	0.69

3. CALCULATED INITIAL ULTIMATE CBODU AND TOTAL BODU

Initial Mixed CBODU (mg/L):	2.9
Initial Mixed Total BODU (CBODU + NBOD, mg/L):	3.7

4. INITIAL DISSOLVED OXYGEN DEFICIT

Saturation Dissolved Oxygen (mg/L):	8.991
Initial Deficit (mg/L):	0.41

5. TRAVEL TIME TO CRITICAL DO CONCENTRATION (days): 0.35

6. DISTANCE TO CRITICAL DO CONCENTRATION (miles): 6.05

7. CRITICAL DO DEFICIT (mg/L): 0.56

8. CRITICAL DO CONCENTRATION (mg/L):	8.43

Calculation of pH of a mixture of two flows. Based on the procedure in EPA's DESCON program (EPA, 1988. Technical Guidance on Supplementary Stream Design Conditions for Steady State Modeling. USEPA Office of Water, Washington D.C.)

Based on Lotus File PHMIX2.WK1 Revised 19-Oct-93

INPUT

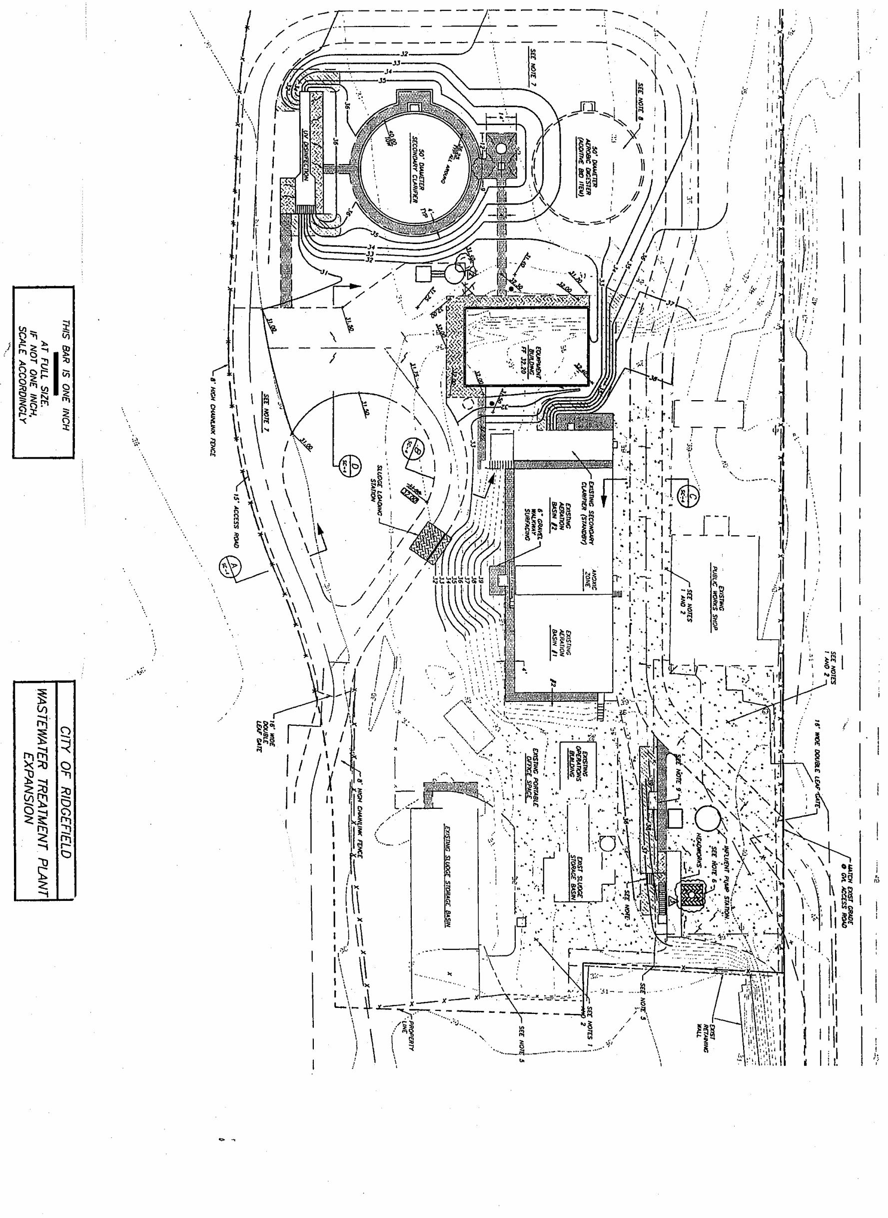
1. DILUTION FACTOR AT MIXING ZONE BOUNDARY	17.000
1. UPSTREAM/BACKGROUND CHARACTERISTICS	
Temperature (deg C):	20.53
pH:	8.43
Alkalinity (mg CaCO3/L):	53.00
2. EFFLUENT CHARACTERISTICS	
Temperature (deg C):	19.44
pH:	7.50
Alkalinity (mg CaCO3/L):	150.00

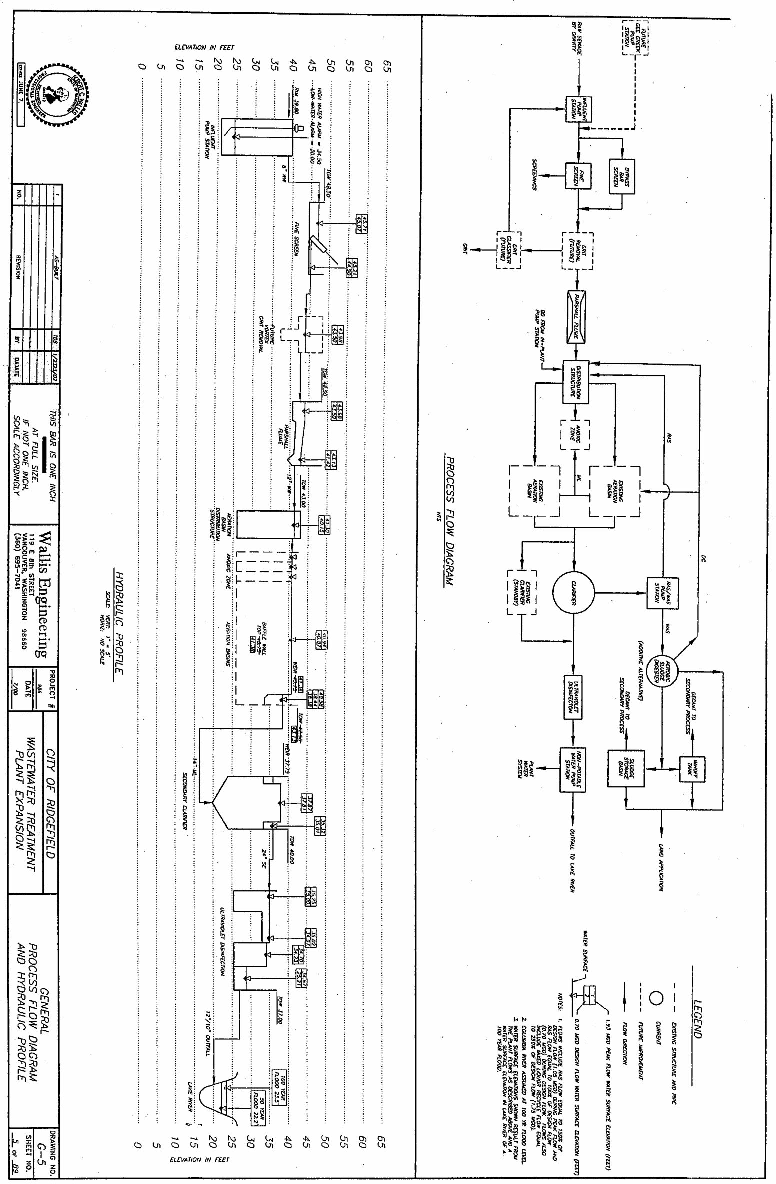
OUTPUT

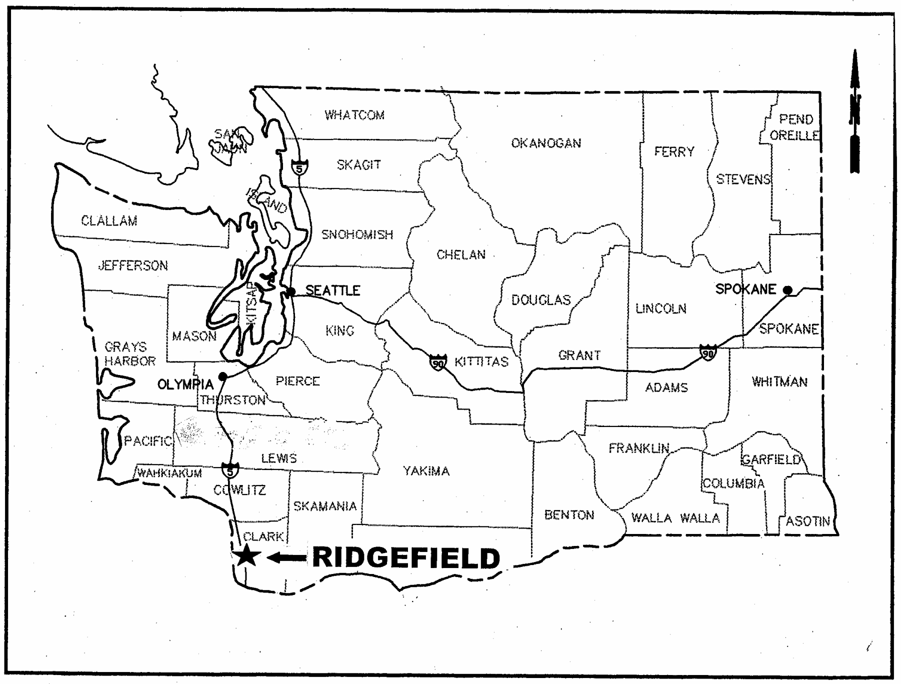
1. IONIZATION CONSTANTS	
Upstream/Background pKa:	6.38
Effluent pKa:	6.39
2. IONIZATION FRACTIONS	
Upstream/Background Ionization Fraction:	0.99
Effluent Ionization Fraction:	0.93
3. TOTAL INORGANIC CARBON	
Upstream/Background Total Inorganic Carbon (mg CaCO3/L):	53.47
Effluent Total Inorganic Carbon (mg CaCO3/L):	161.54

4. CONDITIONS AT MIXING ZONE BOUNDARY

Temperature (deg C):	20.47
Alkalinity (mg CaCO3/L):	58.71
Total Inorganic Carbon (mg CaCO3/L):	59.83
pKa:	6.38
pH at Mixing Zone Boundary:	8.10


THIS BAR IS ONE INCH AT FULL SIZE. IF NOT ONE INCH, SCALE ACCORDINGLY
CITY OF RIDGEFIELD
WASTEWATER TREATMENT PLANT EXPANSION


PROCESS FLOW DIAGRAM
HYDRAULIC PROFILE
LEGEND
Wallis Engineering
CITY OF RIDGEFIELD
WASTEWATER TREATMENT PLANT EXPANSION
GENERAL PROCESS FLOW DIAGRAM AND HYDRAULIC PROFILE
G-5



VICINITY MAP
NOT TO SCALE

APPENDIX D--RESPONSE TO COMMENTS

Comments from the City of Ridgefield, November 20, 2003, with responses from the Department

Comment 1:

Special Conditions S1 and S4 list limit for BOD, TSS, and flow based upon information from the 1997 Facility Plan rather than the actual expanded plant design criteria. During the final design process, a lot of effort was made to size new facilities to optimize future expansion possibilities. This resulted in changes from the criteria outlined in the facility plan. An entire series of Design Memoranda (24 total) were prepared during the design, which were shared with DOE and which summarized the construction plans that were approved by DOE. A reduced-size copy of construction plans sheet G-4 is enclosed for reference.

Response 1:

Plans and Specifications are reviewed for conformity with an approved Facility Plan. This review is intended to evaluate whether the plans describe a facility sufficient to meet the minimum criteria for sizing and reliability in the facility plan. Slight increases to component sizes in the Plans and Specifications are not sufficient, by themselves, to increase the facility plan's rated capacity. Figure 11 of the approved Final Facilities Plan approved February 27, 1997, shows the "Proposed 0.5 MGD interim expansion" designed for a maximum monthly flow of 0.5 MGD. The facility does not include a discharge to the Columbia River. This discharge to the Columbia River is necessary for the facility to exceed 0.5 MGD. Figure 11A of the same Facilities Plan shows the same facility with the outfall and pump station necessary for discharge to the Columbia River and a capacity of 0.75 MGD for the maximum monthly average flow. There are no additional treatment components. Page 9-7 of the plan explains why: "To reduce the debt requirements, an interim upgrade is proposed which would correct the serious deficiencies that exist at the plant, and provide nitrification so that the current outfall to Lake River could be utilized for several more years." This upgrade is for 0.5 MGD as shown on Figure 11 but does not meet the Department requirement of discharging to the Columbia River, which is needed to increase the discharge to 0.7 MGD.

NOTE: Why the plan shows 0.7 MGD, not 0.75 MGD once they discharge to the Columbia -- Both of these plans were to include the 55-foot diameter clarifier of Figures 10 and 10A. The Referenced sheet G-4 shows a clarifier of only 50-foot in diameter was installed. A 55-foot diameter clarifier has a 21 percent larger surface area than a 50-foot clarifier. Since clarifiers are sized on surface area, this may explain why sheet G-4 shows only a 0.7 MGD capacity instead of a 0.75 MGD capacity. While the Department may accept the 0.7 MGD capacity (a seven percent decrease in capacity from the 0.75 MGD capacity planned for phase I) this highlights the need for Ridgefield to revise their Facility Plans more frequently when such changes are made. Further, Page 8-6 of the approved Facility Plan expresses the intention to use the other existing clarifier, clarifier #2 as a redundant clarifier to satisfy reliability requirements during the first phase. A recent Department inspection found that this reliability does not currently exist. One clarifier was converted to sludge digestion and the other was retrofitted and is in use, rather than being kept in standby condition. This change created the need to construct an additional clarifier to meet redundancy requirements at the same time as the discharge to the Columbia.

It should also be noted that other alternatives for final effluent disposition exist—including water reuse. However, such a change in plans would require an amendment of the existing General Sewer Plan/Facility Plan and review and approval by the Departments of Ecology and Health to ensure that the requirement of the state's reclaimed water standards are met.

Comment 2:

The City requests that the new permit be based on these criteria that reflect the actual treatment plant rather than the outdated Facility Plan data. The BOD and TSS limits should be 175 lbs/day and 263 lbs/day average monthly and weekly, respectively, and the average flow for the maximum month should be 0.70 mgd.

Response 2:

The City has only constructed the interim upgrade portion of the phase I facility, a phase noted to achieve a 0.5 MGD capacity. The City has yet to accomplish the construction of the outfall to the Columbia River necessary to realize full phase I capacity. Because of that lack of outfall to the Columbia, the City continues to discharge to a point that requires a higher degree of treatment. This correspondingly reduces the POTWs capacity to 0.5 MGD (MMA). While sheet G-4 is inconsistent with the Facility Plan in that it recognizes a 0.7 MGD flow at the end of construction, it is not unusual for plans and specifications to report the hydraulic capacity of components that will be accomplished when other actions are also completed. In this case, the Facility Plan clarifies that the 0.7 MGD flow capacity will be achieved when the outfall to the Columbia River is constructed. It is, however, important that the plans reflect that this was a downgrade from 0.75 MGD previously anticipated at the completion of phase I. If the new criteria showed a 0.75 MGD capacity when the outfall line to the Columbia is completed, this should be lowered to 0.70 MGD based on this comment and the evidence provided.

Comment 3:

The City asks that the mixing zone analysis Plan of Study required in S8.A be submitted for review a month later (March 15, 2004, instead of February 15, 2004).

Response 3:

The due date will be changed to May 15, 2004, to allow adequate time after permit issuance.

Comment 4:

The City asks that the Effluent Mixing Report required in S8.B be submitted for review two months later (January 15, 2005, instead of November 15, 2004).

Response 4:

This change in date is acceptable and will be made.

Comment 5:

The City asks the Design Criteria on page 5 of the Fact Sheet be updated to meet with their understanding of the design criteria.

Response 5:

The only appropriate change is to downgrade full phase I capacity from 0.75 MGD to 0.70 MGD, if the discharge is to the Columbia. Until discharge is removed from Lake River, the capacity must be held at 0.5 MGD. The rationale for not changing the capacity of the facility at its current discharge point is included in the response to items 1 and 2 above. Furthermore the lack of clarifier redundancy would also be critical to this decision and is further necessary to realize full phase I capacity.

Comment 6:

The Description of the Receiving Water section on page 7 of the Fact Sheet should also describe the conditions occurring upstream in the Whipple Creek, Salmon Creek, and Burnt Bridge Creek basins, and Vancouver Lake with its flushing channel from the Columbia River. It should be noted that these upstream conditions have a major and substantial impact on the quality of Lake River before it reaches the City's outfall. A realistic assessment should be made of these conditions as they relate to the potential impact from the City's treatment plant effluent as the required treatment levels are established. To establish standardized requirements at considerable public expense based on a general assumption of some beneficial result when such is improbable is not in the public's interest. Further study may be conducted in the future through a TMDL. However, no TMDL is scheduled for these waters at this time and may not reveal anything new or different for the Ridgefield discharge.

Response 6:

The permit fact sheet includes information important to permit decisions. It is not intended to capture all the data that may be relevant to a water cleanup plan or other more involved study of the ambient environment. While such information as the City describes may be important to such a plan it is not relevant to the development of an NPDES permit–only the receiving water conditions and the effluent quality needed to prevent further degradation of the ambient environment are evaluated.

Appendix D
Process Calculations

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Appendix D - Process Calculations

Facility Operating Parameters						Project
Item		**Value**			**Value**	**Notes**
Influent Wastewater	(Metric)	(Metric)	(Metric=US*k)	(US)	(US)	
Flow	m3/day			MG/day		
Average		1,628	3,785.44		0.43	January 2021 Historical MM Avg
Carbonaceous Five-Day Biochemical Oxygen Demand (CBOD5)						
Design Average Concentration	mg/L	263	1.00	mg/L	263	
Design Average Mass Loading	kg/day	428	0.45	lb/day	944	January 2021 Historical MM Avg
Total Suspended Solids (TSS)						
Design Average Concentration	mg/L	394	1.00	mg/L	394	
Design Average Mass Loading	kg/day	642	0.45	lb/day	1,415	January 2021 Historical MM Avg
Volatile Suspended Solids (VSS)						
Percent VSS	%	90%	1.00	%	90%	
Design Average Concentration	mg/L	355	1.00	mg/L	355	
Design Average Mass Loading	kg/day	578	0.45	lb/day	1,274	
Total Kjeldahl Nitrogen (TKN as N)						
Design Average Concentration	mg/L	44	1.00	mg/L	44	
Design Average Mass Loading	kg/day	71	0.45	lb/day	157	Assuming TKN = 0.65*NH3
Ammonia-Nitrogen (NH3-N as N)						
Design Average Concentration	mg/L	28	1.00	mg/L	28	
Design Average Mass Loading	kg/day	46	0.45	lb/day	102	January 2021 Historical MM Avg
Total Phosphorus (as P)						
Design Average Concentration	mg/L	8	1.00	mg/L	8	
Design Average Mass Loading	kg/day	13	0.45	lb/day	29	
Alkalinity (as CaCO3)						
Design Average Concentration	mg/L	223	1.00	mg/L	223	
Design Average Mass Loading	kg/day	363	0.45	lb/day	800	
Hydrogen Sulfide (H2S)						
Design Average Concentration	mg/L	6	1.00	mg/L	6	
Design Average Mass Loading	kg/day	10	0.45	lb/day	22	
Chemical Addition:						
Select the Metal Salt (if used) Ferric Chloride				2		
Wastewater Temperature						
Raw Sewage Temperature	oC	14	1.00	oC	14.00	
Plant Elevation	meters	15	3.28	feet	50	
Ambient Atmospheric Pressure	kPa	101	6.89	psia	14.6694	
Is the Temperature Model Used? No						
N/A	oC	21	Special	oF	70	
N/A	kph	8	0.62	mph	5	
N/A	%	60%	1.00	%	60%	
N/A	%	50%	1.00	%	50%	
N/A	degrees	45	1.00	degrees	45	
N/A	Date	12/22/23	1.00	Date	12/22/23	
Biological Process - PBNR: Main						
Total SRT (anaerobic + anoxic + aerobic)	days	12.00	1.00	days	12.00	RTP includes secondary clarifier blanket in MCRT calculations
System pH		7.20	1.00		7.20	
Nitrifier Minimum Aerobic SRT (SRT_{min})	days	3.02	1.00	days	3.02	
Aerobic SRT	days	10.65	1.00		10.65	
Nitrification Safety Factor		3.53	1.00		3.53	
DO	mg/L	2.00	1.00	mg/L	2.00	
Temperature in the Biological Process	oC	14	1.00	oC	14	
SVI	mL/g	85	1.00	mL/g	85	
Biosolids Production Rates						
Net Yield (mg TSS/mg BOD_5)	mg/mg	0.82	1.00	lb/lb	0.82	
Volatile Fraction	%	86%	1.00	%	86%	
Active Fraction	%	44%	1.00	%	44%	
Nitrifier Fraction	%	1%	1.00	%	1%	
Nitrogen Content, N/VSS	%	4%	1.00	%	4%	
Phosphorus Content, P/VSS	%	2%	1.00	%	2%	
Process Oxygen Requirements - Minus MBR Tank (if used)						
Carbonaceous AOR/BOD5 - wt/wt	kg/kg	1.19	1.00	lb/lb	1.19	
Total AOR/BOD% - wt/wt	kg/kg	1.53	1.00	lb/lb	1.53	
AOR (wt/day)	kg/day	654	0.45	lb/day	1,442	
AOR	mg/L-hr	18	1.00	mg/L-hr	18	
Bioreactor With Secondary Clarifier		1				
Total Bioreactor Volume	m3	1,495	3,785.44	MG	0.3950	2
HRT	hr	22.05	1.00	hr	22.05	
% non-aerobic	%	11%	1.00		11%	
% aerobic	%	89%	1.00		89%	
Average MLSS Concentration	mg/L	2,883	1.00	mg/L	2,883	
No Media Reactors Included AKI K1/K3						
Bulk Specific Surface Area (Biofilm Active)	m2/m3	No Media	3.28	ft2/ft3	No Media	
Bulk Liquid Volume Displacement	-	No Media	1.00	-	No Media	
Allow Biofilm Carriers to Flow Between Unit Processes? No						
Bioreactor Clarifier						
Total Area	m2	182	0.09	sq.ft.	1,963	1
Overflow Rate	m/day	9	0.04	gpd-sq.ft.	219	# of SC online
Estimated Peak Overflow Rate	m/day	18	0.04	gpd-sq.ft.	438	
Effluent TSS	mg/L	6	1.00	mg/L	5.5	5-20 mg/L
Underflow Rate						
Average Flow Ratio	%	21%	1.00		21%	RAS flow/Influent flow
Average Rate	m/day	2	0.04	gpd-sq.ft.	46	
RAS Concentration	mg/L			mg/L		
Average		15,505	1.00		15,505	want to match with observed RAS concer
Diurnal Peak (From Solids Flux)		5,343	1.00		5,343	
Solids Loading Rate	kg/m2-day	32	4.88	lb/day-sq.ft.	7	
Estimated Peak Solids Loading Rate (from Solid Flux Sheet)	kg/m2-day	112	4.88	lb/day-sq.ft.	23	
Estimated Limiting Solids Loading Rate	kg/m2-day	55	4.88	lb/day-sq.ft.	11	
Estimated Peak Limitied Solids Loading Rate (from Solid Flux Sheet)	kg/m2-day	280	4.88	lb/day-sq.ft.	57	
Return sludge rate at which limiting solids rate can be achieved						
RAS Flow Rate	m3/day	#NULL!	3,785.00	MGD	#NULL!	
Percent of Influent to Bioreactor	%	#NULL!		%	#NULL!	
No Membrane Bioreactor Selected GE/Zenon						
Calculate Based on Flux or # of Modules? Flux	lmh	27	1.70	gfd	16	
Design Membrane Net Flux Rate	lmh	27.40	1.70	gfd	16	
Minimum Required Membrane Area	m2	2,441	10.76	ft2	26,272	
Membrane Module Area	m2	34	10.76	ft2	370	
Number of Modules		71			71	
Air Rate per Module	Nm3/hr	3	1.70	scfm	2.03	
Percent of Time Membrane Air Scour is on		100%			100%	
Total Membrane Air Scour Rate	Nm3/hr	245	1.70	scfm	144	
Force MBR DO to Match Air Rate? No						
Effluent TSS	mg/L	1.00	1.00	mg/L	1.00	
Chemical Compound Applied before Secondary Clarifier		2				
Chemical Added? No						
Chemical Type		Ferric Chloride	1.00		Ferric Chloride	
Chemical Dosage (as chemical)	kg/day	91	0.45	lb/day	200	
Chemical Dosage (mg chemical/L treated)	mg/L	N/A	1.00	mg/L	N/A	
Molar Ratio Dosage Applied (M+:PO4-P)		23	1.00		N/A	
Effluent PO4-P	kg/day	0	0.45	lb/day	N/A	
Effluent PO4-P	mg/L	0.25	1.00	mg/L	N/A	
Aerobic Digestion: Dig						
Aerobic Digestion? Yes		TRUE				
Volume	m3	189	3,785.00	MG	0.05	
SRT (Days)	day	8.37	1.00	day	8.37	
Temperature in the Aerobic Digester	o C	27		o C	27	
Estimated Temperature in Aerobic Digester	o C	21		o C	21	
DO during Aerobic Phase (mg/L)	mg-O2/l	2.00	1.00	mg-O2/l	2.00	
% denitrification	%	50%	1.00	%	50%	
Anoxic Cycle Time	hrs/day	8.00	1.00	hrs/day	8.00	
Average DO in Digester (mg/L)	mg-O2/L	1.33	1.00	mg-O2/L	1.33	
Volatile Solids Loading - wt VSS/vol-day	kg/(m3-day)	1.59	16.06	lb/ft3-day	0.10	
Volatile Solids Reduction	%	23.50%	1.00	%	23.50%	
Total Solids Reduction	%	23.02%	1.00	%	23.02%	
Influent Solids Concentration	%	1.55%		%	1.55%	
Effluent Solids Concentration	%	1.19%		%	1.19%	
Is alkalinity limiting in the aerobic digester?		yes			yes	
SOUR mg-O2/(g-VSS.hour) at 20 oC	mg/(g-hour)	2.08	1.00	mg/(g-hour)	2.08	
SOUR mg-O2/(g-TSS.hour) at 20 oC	mg/(g-hour)	1.77	1.00	mg/(g-hour)	1.77	
Decanting						
Is Decanting being done? No		FALSE				
Digester HRT	days	8.37	1.00	days	8.37	
Target SRT	days	70.00	1.00	days	70.00	
Average Decant Flow	m3/d	0.00	0.00	GPD	0	
Average Decant Effluent TSS	mg/L	500	1.00	mg/L	500	

Mass Balance for Calibration Conditions - Jan 2021

Constituent	Raw Wastewater (RW)	Dig Aerobic Digester Decant (ADD)	Main Recycle Influent (Recyl)	Main Recycled Stream (Recycle)	Main Combined Recycle Effluent (RecyE)	Main Bioreactor Influent (BI)	Main Secondary Clarifier Influent (SI)	Main Secondary Clarifier Effluent (SE)	Plant Effluent (PLE)	Main WAS	Dig Aerobic Digester Influent (ADI)	Dig Aerobic Digester Effluent (ADE)	Biosolids to Disposal
Flow (gallons/day)	430,000	0	430,000	0	430,000	430,000	520,300	424,029	424,029	5,971	5,971	5,971	5,971
Carbonaceous BOD_5 (lbs/day)	944	0	944	0	944	944	5,204	9	9	322	322	126	126
Particulate	414	0	414	0	414	414	144	0	0	9	9	0	0
Heterotrophs	336	0	336	0	336	336	3,777	6	6	234	234	68	68
Methanol Degraders	1	0	1	0	1	1	8	0	0	0	0	0	0
AOBs	1	0	1	0	1	1	92	0	0	6	6	3	3
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	1	1	1,043	2	2	65	65	49	49
PHA	0	0	0	0	0	0	138	0	0	9	9	6	6
Filtrate	192	0	192	0	192	192	2	1	1	0	0	0	0
COD (lbs/day)	2,278	0	2,278	0	2,278	2,278	16,550	141	141	1,018	1,018	795	795
Particulate Bio	744	0	744	0	744	744	258	0	0	16	16	0	0
Particulate Non-Bio	56	0	56	0	56	56	876	1	1	54	54	54	54
Decay Prod Aer/Anx	339	0	339	0	339	339	7,918	12	12	490	490	545	545
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotrophs	452	0	452	0	452	452	5,084	8	8	315	315	92	92
Methanol Degraders	1	0	1	0	1	1	11	0	0	1	1	0	0
AOBs	1	0	1	0	1	1	136	0	0	8	8	4	4
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	1	1	1,924	3	3	119	119	90	90
PHA	0	0	0	0	0	0	202	0	0	13	13	9	9
Soluble Bio	214	0	214	0	214	214	4	3	3	0	0	0	0
VFA	82	0	82	0	82	82	1	0	0	0	0	0	0
Colloidal Bio	197	0	197	0	197	197	0	0	0	0	0	0	0
Soluble Non-Bio	114	0	114	0	114	114	138	112	112	2	2	2	2
Colloidal Non-Bio	76	0	76	0	76	76	0	0	0	0	0	0	0
TSS (lbs/day)	1,299	0	1,299	0	1,299	1,299	12,483	19	19	773	773	595	595
Biodegradable	681	0	681	0	681	681	213	0	0	13	13	0	0
Non-Biodegradable	-16	0	-16	0	-16	-16	-257	0	0	-16	-16	-16	-16
Inorganic Particles	10	0	10	0	10	10	160	0	0	10	10	10	10
Decay Prod Aer/Anx	265	0	265	0	265	265	6,195	10	10	384	384	426	426
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Hydroxide	2	0	2	0	2	2	39	0	0	2	2	2	2
Metal Absorbed Phosphate	0	0	0	0	0	0	38	0	0	2	2	2	2
Heterotrophs	354	0	354	0	354	354	3,978	6	6	246	246	72	72
Methanol Degraders	1	0	1	0	1	1	8	0	0	1	1	0	0
AOBs	1	0	1	0	1	1	106	0	0	7	7	3	3
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	1	1	1,505	2	2	93	93	70	70
PHA	0	0	0	0	0	0	121	0	0	8	8	7	7
Poly-P	0	0	0	0	0	0	375	1	1	23	23	18	18
VSS (lbs/day)	1,274	0	1,274	0	1,274	1,274	10,705	17	17	663	663	507	507
Biodegradable	674	0	674	0	674	674	191	0	0	12	12	0	0
Non-Biodegradable	39	0	39	0	39	39	-232	0	0	-14	-14	-14	-14
Decay Prod Aer/Anx	239	0	239	0	239	239	5,576	9	9	345	345	384	384
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Hydroxide	1	0	1	0	1	1	10	0	0	1	1	1	1
Heterotrophs	318	0	318	0	318	318	3,580	6	6	222	222	64	64
Methanol Degraders	1	0	1	0	1	1	8	0	0	0	0	0	0
AOBs	1	0	1	0	1	1	95	0	0	6	6	3	3
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	1	1	1,355	2	2	84	84	63	63
PHA	0	0	0	0	0	0	121	0	0	8	8	7	7
TKN (lbs/day)	157	0	157	0	157	157	924	11	11	57	57	51	51
NH_3-N (lbs-N/day)	102	0	102	0	102	102	3	3	3	0	0	3	3
Particulate Bio Org N	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-Bio Part Org N	0	0	0	0	0	0	0	0	0	0	0	3	3
Decay Prod Aer/Anx	21	0	21	0	21	21	480	1	1	30	30	33	33
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotrophs	27	0	27	0	27	27	308	0	0	19	19	6	6

Methanol Degraders	0	0	0	0	0	0	1	0	0	0	0	0	0
AOBs	0	0	0	0	0	0	8	0	0	1	1	0	0
NOBs	0	0	0	0	0	0	0	0	0	0	0	0	0
PAOs	0	0	0	0	0	0	116	0	0	7	7	5	5
Non-Bio Soluble Org. N	7	0	7	0	7	7	8	7	7	0	0	0	0
Non-Bio Colloidal Org. N	0	0	0	0	0	0	0	0	0	0	0	0	0
Soluble Bio Org N	0	0	0	0	0	0	0	0	0	0	0	0	0
Colloidal Bio Org N	0	0	0	0	0	0	0	0	0	0	0	0	0
NO_2-N (lbs-N/day)	0	0	0	0	0	0	0	0	0	0	0	0	0
NO_3-N (lbs-N/day)	0	0	0	0	0	0	56	46	46	1	1	5	5
Total Nitrogen (lbs-N/day)	157	0	157	0	157	157	980	56	56	57	57	55	55
TP (lbs-P/day)	29	0	29	0	29	29	439	2	2	27	27	27	27
Bio Particulate	7	0	7	0	7	7	2	0	0	0	0	0	0
Non-Bio Particulate	0	0	0	0	0	0	6	0	0	0	0	1	1
Decay Prod Aer/Anx	7	0	7	0	7	7	158	0	0	10	10	11	11
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Absorbed	0	0	0	0	0	0	12	0	0	1	1	1	1
Heterotrophs	9	0	9	0	9	9	102	0	0	6	6	2	2
Methanol Degraders	0	0	0	0	0	0	0	0	0	0	0	0	0
AOBs	0	0	0	0	0	0	3	0	0	0	0	0	0
NOBs	0	0	0	0	0	0	0	0	0	0	0	0	0
PAOs	0	0	0	0	0	0	38	0	0	2	2	2	2
Poly-P	0	0	0	0	0	0	116	0	0	7	7	5	5
Ortho-PO4	6	0	6	0	6	6	1	1	1	0	0	5	5
Alkalinity (lbs/day as $CaCO_3$)	800	0	800	0	800	800	416	339	339	5	5	0	0
H_2S (lbs/day)	22	0	22	0	22	22	0	0	0	0	0	0	0
Temperature (°C)	14	27	14	27	14	14	14	14	14	14	14	27	27
BOD_5 (mg/L)	263	#DIV/0!	263	#DIV/0!	263	263	1,198	3	3	6,465	6,465	2,527	2,527
COD (mg/L)	635	#DIV/0!	635	#DIV/0!	635	635	3,811	40	40	20,423	20,423	15,963	15,963
TSS (mg/L)	362	#DIV/0!	362	#DIV/0!	362	362	2,875	6	5.50	15,513	15,513	11,941	11,941
VSS (mg/L)	355	#DIV/0!	355	#DIV/0!	355	355	2,465	5	5	13,303	13,303	10,177	10,177
TKN (mg-N/L)	44	#DIV/0!	44	#DIV/0!	44	44	213	3	3	1,137	1,137	1,014	1,014
NH_3-N (mg-N/L)	28	#DIV/0!	28	#DIV/0!	28	28	1	1	0.7	1	1	59	59
NO_2-N (mg/L)	0	#DIV/0!	0	#DIV/0!	0	0	0	0	0	0	0	0	0
NO_3-N (mg-N/L)	0	#DIV/0!	0	#DIV/0!	0	0	13	13	13	13	13	98	98
Total Nitrogen (mg/L)	44	#DIV/0!	44	#DIV/0!	44	44	226	16	16	1,150	1,150	1,112	1,112
TP (mg-P/L)	8	#DIV/0!	8	#DIV/0!	8	8	101	0	0.4	544	544	544	544
Alkalinity (mg/L as $CaCO_3$)	223	#DIV/0!	223	#DIV/0!	223	223	96	96	96	96	96	0	0
H_2S (mg/L)	6	#DIV/0!	6	#DIV/0!	6	6	0	0	0	0	0	0	0

Appendix D - Process Calculations

PBNRMain Plant | Pro2D2 Process Design System | 12/22/2023 3:17 PM
Pro2D2_1_08_Ridgefield_Calib_Jan-2021_rev5.xlsm

Select Operating Units for Physical Plant Definition	
Metric (M) or US (U)	U

Biological Model	#N/A
Standard	No

Aeration Data		
Aeration Basin Side Water Depth	12	feet
Maximum Water Temperature:	14.00	°C
BETA Correctional Factor:	0.95	
Plant Altitude:	50	feet

Definition of the Physical Plant		
How many reactors (up to 42)	3	
Solids Retention Time (SRT)	12.00	Days
Average Total Flow Rate (not incl OtherInf)	0.43	mgd
RAS Ratio (% of Plant Influent)	21%	
	0.09	mgd
Waste Loc: (A)ll Reactors, Clarifier (U)/F or Reactor #	U	

PRO2D2	
% Aerobic	89%
% Anoxic	11%
Nitrification S.F.	3.53
Total Volume gallons	395,000
RAS Return DO - mg/L	0.00

Est. Diffuser Design (Sanitaire Membranes)		
Design Condition	Ave	
Est. Diffuser Air Rate	1.5	scfm/diffuser
Peaking Capability	267%	
Estimated SOTE	22%	

System Configuration			Reactor									
Component	Units	TOTAL	#1	#2	#3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Reactor Volume	gallons	395,000	23,500	23,500	348,000							
Fraction	% of Total		6%	6%	88%	0%	0%	0%	0%	0%	0%	0%
O_2 Specification Method			DO	DO	DO	DO	DO	DO	DO	DO	DO	DO
DO or Ammonia (Dyn ABAC) or Air Rate or AOR	mg/L or lbs/hr or scfm		0.00	0.00	2.00							
Oxygen Mass Transfer, Kla (ASMN)	1/day		1	1	127	1	1	1	1	1	1	1
Empty Bed Media Fill Fraction	dimensionless											
Biofilm Density	g COD/m3											
Biofilm Thickness	microns											
External Diffusion Layer Thickness	microns											
Number of Biofilm Layers (for Dynamics)	#											
Net Specific Surface Area	m2/m3		No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media
Net Liquid Volume Displacement	%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bulk Liquid Volume	gallons	395,000	23,500	23,500	348,000	0	0	0	0	0	0	0
Reactor Feed												
Raw Feed	% of Total	100%	100%									
RAS	% of Total RAS	100%	100%									
Recirculation	% of Raw Feed		0%									
From Reactor	(Enter Number)											

Appendix D - Process Calculations

Summary Information					
Total MLSS Inventory	**9,505**	lbs	Total COD Removed	2,137	lbs/day
Total MLVSS Inventory	8,176	lbs	Food Applied to MLSS Inventory Ratio	0.19	COD/MLSS
MIxed Liquor VSS	86%		Aeration Information		
Total Required WAS Rate	**792**	lbs MLSS/day	Total AOR	1,442	lbs O2/day
or	681	lbs MLVSS/day	Total SOR	3,433	lbs O2/day
Observed Mass Yield	0.84	lbs MLSS/lb BOD	Total Required Air Rate	465	scfm

Standard Model Component Concentrations			Feed	RAS	#1	#2	#3	#N/A	#N/A	#N/A	#N/A
Enter Reactor Number to use this Column of Data for the Original Guess					1	2	3	4	5	6	7
S_{O2}	Dissolved Oxygen	mg O_2/L	0.00	0.00	0.00	0.00	2.00				
S_F	Soluble Fermentable Substrates	mg COD/L	59.68	0.85	13.51	3.49	0.85				
S_A	Soluble Fermentation Products	mg COD/L	22.85	0.13	31.01	57.18	0.13				
S_I	Soluble Inerts	mg COD/L	31.74	31.74	31.74	31.74	31.74				
S_{NH4}	Soluble Ammonia N	mg N/L	28.40	0.73	24.57	25.94	0.73				
S_{N2}	Dissolved Nitrogen Gas	mg N/L	0	12	4	4	12				
S_{NO3}	Soluble Nitrate/Nitrite N	mg N/L	0.00	12.87	0.06	0.00	12.87				
S_{PO4}	Soluble Inorganic Phosphorus	mg P/L	1.57	0.25	18.90	25.29	0.25				
S_{ALK}	Alkalinity	moles/m^3	4.46	1.92	3.77	3.35	1.92				
X_I	Inert Particulates	mg COD/L	15	1,089	202	202	202				
X_S	Slowly Biodegradable Substrate	mg COD/L	284	321	278	269	59				
X_H	Heterotrophic Organisms	mg COD/L	126	6,318	1,183	1,160	1,171				
X_{PAO}	Phosphate Accumulating Organisms	mg COD/L	0	2,390	414	413	443				
X_{PP}	Polyphosphate	mg P/L	0.02	144.45	7.44	1.48	26.77				
X_{PHA}	PAO Storage Products	mg COD/L	0.03	251.63	88.23	103.00	46.63				
X_{AUT}	Autotrophic Organisms	mg COD/L	1	169	29	29	31				
X_{ISS}	Inorganic Particles	mg/L	3	199	37	37	37				
X_{MeOH}	Metal Hydroxides	mg/L	1	6	0	0	1				
X_{MeP}	Metal Phosphates	mg/L	0	82	17	17	15				
S_M	Methanol	mg COD/L	0.00	0.00	0.00	0.00	0.00				
X_{M1}	Group 1 Methanol Degraders	mg COD/L	0	3	1	1	1				
X_{M2}	Group 2 Methanol Degraders	mg COD/L	0	10	2	2	2				
X_E	Aerobic/Anoxic Decay Products	mg COD/L	94	9,840	1,788	1,790	1,823				
	MLSS	**mg/L**	**406**	**15,505**	**2,975**	**2,939**	**2,873**				
	MLVSS	mg/L	362	13,293	2,612	2,598	2,463				
	Oxygen Uptake Rate	mg O_2/(L-hr)			1	1	20				
	Nitrate Uptake Rate	mg NO_3-N/(L-day)			49	2	11				
	Ammonia Uptake Rate	mg NH_4-N/(L-day)			-22	-30	38				
				Alkalinity Limited?							
Reactor Information											
	Active Reactor Volume	gallons		395,000	23,500	23,500	348,000	0	0	0	0
	Reactor Sidewater Depth	feet		12	12	12	12	12	12	12	12
	AOR, Biological	lbs O2/day			7	7	1,390	0	0	0	0
	AOR, H2S	lbs O2/day		43	0	0	43	0	0	0	0
	AOR, Liquid	lbs O2/day			0	0	9	0	0	0	0
	Total AOR	lbs O2/day			0	0	1,442	0	0	0	0
	Aeration Alpha Value				0.82	0.82	0.69	0.83	0.83	0.83	0.83
	Fouling Factor				0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Alpha F				0.65	0.65	0.55	0.66	0.66	0.66	0.66
	Oxygen Concentration in Supplied Gas	Volume Percent			21%	21%	21%	21%	21%	21%	21%
	Oxygen Concentration in Supplied Gas	Mass Percent			23%	23%	23%	23%	23%	23%	23%
	Nitrogen Concentration in Supplied Gas	Volume Percent			78%	78%	78%	78%	78%	78%	78%
	CO2 Concentration in Supplied Gas	Volume Percent			0.00%	0.00%	0.04%	0.04%	0.04%	0.04%	0.04%
	Argon Concentration in Supplied Gas	Volume Percent			0.93%	0.93%	0.93%	0.93%	0.93%	0.93%	0.93%
	Standard Density of Supplied Gas	lbs/ft3			0.0752	0.0752	0.0752	0.0752	0.0752	0.0752	0.0752
	SOR/AOR Ratio				0.00	0.00	2.38	0.00	0.00	0.00	0.00
	SOR	lbs O2/day			0	0	3,433	0	0	0	0
	Number of Diffusers	Total		426	0	0	426	0	0	0	0
	SOTE				0%	0%	100%	0%	0%	0%	0%
	Required Air Rate	SCFM	Min Mixing		0	0	137	0	0	0	0
	Required Mixing Air @ 0.12 scfm/ft2	SCFM	0.12	scfm/ft2	0	0	465	0	0	0	0
	Max Air per Tank at Design Condition	SCFM			239	239	3,546	0	0	0	0
	Is Required Diffuser Density Too High?										
Flow Balance											
	Raw Feed into Reactor	mgd	0.43		0.43						
	Flow from Previous Reactor	mgd				0.52	0.52				
	Recirculation Into Reactor	mgd									
	From Reactor				(0)	(0)	(0)				
	RAS Into Reactor	mgd		0.09	0.09						
	Other Flows Into Reactor	mgd	0.00								
	Effluent From Reactor	mgd			0.52	0.52	0.52				
	Waste Activated Sludge	mgd		0.0061							

Facility Operating Parameters						Project
Item		**Value**			**Value**	**Notes**
Influent Wastewater	(Metric)	(Metric)	(Metric=US*k)	(US)	(US)	
Flow	m3/day			MG/day		
Average		1,879	3,785.44		0.50	January 2020 Historical MM Avg
Carbonaceous Five-Day Biochemical Oxygen Demand (CBOD5)						
Design Average Concentration	mg/L	221	1.00	mg/L	221	
Design Average Mass Loading	kg/day	416	0.45	lb/day	917	January 2020 Historical MM Avg
Total Suspended Solids (TSS)						
Design Average Concentration	mg/L	243	1.00	mg/L	243	
Design Average Mass Loading	kg/day	457	0.45	lb/day	1,007	January 2020 Historical MM Avg
Volatile Suspended Solids (VSS)						
Percent VSS	%	90%	1.00	%	90%	
Design Average Concentration	mg/L	219	1.00	mg/L	219	
Design Average Mass Loading	kg/day	411	0.45	lb/day	906	
Total Kjeldahl Nitrogen (TKN as N)						
Design Average Concentration	mg/L	42	1.00	mg/L	42	
Design Average Mass Loading	kg/day	80	0.45	lb/day	175	Assuming TKN = 0.65*NH3
Ammonia-Nitrogen (NH3-N as N)						
Design Average Concentration	mg/L	28	1.00	mg/L	28	
Design Average Mass Loading	kg/day	52	0.45	lb/day	114	January 2020 Historical MM Avg
Total Phosphorus (as P)						
Design Average Concentration	mg/L	8	1.00	mg/L	8	
Design Average Mass Loading	kg/day	15	0.45	lb/day	33	
Alkalinity (as CaCO3)						
Design Average Concentration	mg/L	229	1.00	mg/L	229	
Design Average Mass Loading	kg/day	431	0.45	lb/day	950	
Hydrogen Sulfide (H2S)						
Design Average Concentration	mg/L	6	1.00	mg/L	6	
Design Average Mass Loading	kg/day	11	0.45	lb/day	25	
Chemical Addition:						
Select the Metal Salt (if used) Ferric Chloride					2	
Wastewater Temperature						
Raw Sewage Temperature	oC	14	1.00	oC	13.64	
Plant Elevation	meters	15	3.28	feet	50	
Ambient Atmospheric Pressure	kPa	101	6.89	psia	14.6694	
Is the Temperature Model Used? No						
N/A	oC	21	Special	oF	70	
N/A	kph	8	0.62	mph	5	
N/A	%	60%	1.00	%	60%	
N/A	%	50%	1.00	%	50%	
N/A	degrees	45	1.00	degrees	45	
N/A	Date	12/22/23	1.00	Date	12/22/23	
Biological Process - PBNR: Main						
Total SRT (anaerobic + anoxic + aerobic)	days	12.00	1.00	days	12.00	RTP includes secondary clarifier blanket i
System pH		7.20	1.00		7.20	
Nitrifier Minimum Aerobic SRT (SRT_{min})	days	3.12	1.00	days	3.12	
Aerobic SRT	days	10.64	1.00		10.64	
Nitrification Safety Factor		3.41	1.00		3.41	
DO	mg/L	2.00	1.00	mg/L	2.00	
Temperature in the Biological Process	oC	14	1.00	oC	14	
SVI	mL/g	85	1.00	mL/g	85	
Biosolids Production Rates						
Net Yield (mg TSS/mg BOD_5)	mg/mg	0.77	1.00	lb/lb	0.77	
Volatile Fraction	%	83%	1.00	%	83%	
Active Fraction	%	44%	1.00	%	44%	
Nitrifier Fraction	%	1%	1.00	%	1%	
Nitrogen Content, N/VSS	%	4%	1.00	%	4%	
Phosphorus Content, P/VSS	%	3%	1.00	%	3%	
Process Oxygen Requirements - Minus MBR Tank (if used)						
Carbonaceous AOR/BOD5 - wt/wt	kg/kg	1.19	1.00	lb/lb	1.19	
Total AOR/BOD% - wt/wt	kg/kg	1.67	1.00	lb/lb	1.67	
AOR (wt/day)	kg/day	695	0.45	lb/day	1,532	
AOR	mg/L-hr	19	1.00	mg/L-hr	19	
Bioreactor With Secondary Clarifier		1				
Total Bioreactor Volume	m3	1,495	3,785.44	MG	0.3950	2
HRT	hr	19.10	1.00	hr	19.10	
% non-aerobic	%	11%	1.00		11%	
% aerobic	%	89%	1.00		89%	
Average MLSS Concentration	mg/L	2,726	1.00	mg/L	2,726	
No Media Reactors Included AKI K1/K3						
Bulk Specific Surface Area (Biofilm Active)	m2/m3	No Media	3.28	ft2/ft3	No Media	
Bulk Liquid Volume Displacement	-	No Media	1.00	-	No Media	
Allow Biofilm Carriers to Flow Between Unit Processes? No						
Bioreactor Clarifier						
Total Area	m2	182	0.09	sq.ft.	1,963	1
Overflow Rate	m/day	10	0.04	gpd-sq.ft.	253	
Estimated Peak Overflow Rate	m/day	21	0.04	gpd-sq.ft.	506	
Effluent TSS	mg/L	12	1.00	mg/L	11.5	5-20 mg/L
Underflow Rate						
Average Flow Ratio	%	21%	1.00		21%	RAS flow/Influent flow
Average Rate	m/day	2	0.04	gpd-sq.ft.	53	
RAS Concentration	mg/L			mg/L		
Average		14,830	1.00		14,830	want to match with observed RAS concer
Diurnal Peak (From Solids Flux)		5,403	1.00		5,403	
Solids Loading Rate	kg/m2-day	35	4.88	lb/day-sq.ft.	7	
Estimated Peak Solids Loading Rate (from Solid Flux Sheet)	kg/m2-day	113	4.88	lb/day-sq.ft.	23	
Estimated Limiting Solids Loading Rate	kg/m2-day	61	4.88	lb/day-sq.ft.	13	
Estimated Peak Limitied Solids Loading Rate (from Solid Flux Sheet)	kg/m2-day	280	4.88	lb/day-sq.ft.	57	
Return sludge rate at which limiting solids rate can be achieved						
RAS Flow Rate	m3/day	#NULL!	3,785.00	MGD	#NULL!	
Percent of Influent to Bioreactor	%	#NULL!		%	#NULL!	
No Membrane Bioreactor Selected GE/Zenon						
Calculate Based on Flux or # of Modules? Flux	lmh	27	1.70	gfd	16	
Design Membrane Net Flux Rate	lmh	27.30	1.70	gfd	16	
Minimum Required Membrane Area	m2	2,834	10.76	ft2	30,507	
Membrane Module Area	m2	34	10.76	ft2	370	
Number of Modules		82			82	
Air Rate per Module	Nm3/hr	3	1.70	scfm	2.03	
Percent of Time Membrane Air Scour is on		100%			100%	
Total Membrane Air Scour Rate	Nm3/hr	283	1.70	scfm	166	
Force MBR DO to Match Air Rate? No						
Effluent TSS	mg/L	1.00	1.00	mg/L	1.00	
Chemical Compound Applied before Secondary Clarifier		2				
Chemical Added? No						
Chemical Type		Ferric Chloride	1.00		Ferric Chloride	
Chemical Dosage (as chemical)	kg/day	91	0.45	lb/day	200	
Chemical Dosage (mg chemical/L treated)	mg/L	N/A	1.00	mg/L	N/A	
Molar Ratio Dosage Applied (M+:PO4-P)		7	1.00		N/A	
Effluent PO4-P	kg/day	1	0.45	lb/day	N/A	
Effluent PO4-P	mg/L	0.27	1.00	mg/L	N/A	
Aerobic Digestion: Dig						
Aerobic Digestion? Yes		TRUE				
Volume	m3	189	3,785.00	MG	0.05	
SRT (Days)	day	8.82	1.00	day	8.82	
Temperature in the Aerobic Digester	o C	27		o C	27	
Estimated Temperature in Aerobic Digester	o C	21		o C	21	
DO during Aerobic Phase (mg/L)	mg-O2/l	2.00	1.00	mg-O2/l	2.00	
% denitrification	%	50%	1.00	%	50%	what is aerobic digester aeration strategy?
Anoxic Cycle Time	hrs/day	8.00	1.00	hrs/day	8.00	
Average DO in Digester (mg/L)	mg-O2/L	1.33	1.00	mg-O2/L	1.33	
Volatile Solids Loading - wt VSS/vol-day	kg/(m3-day)	1.40	16.06	lb/ft3-day	0.09	
Volatile Solids Reduction	%	24.27%	1.00	%	24.27%	
Total Solids Reduction	%	23.45%	1.00	%	23.45%	
Influent Solids Concentration	%	1.49%		%	1.49%	
Effluent Solids Concentration	%	1.14%		%	1.14%	
Is alkalinity limiting in the aerobic digester?		yes			yes	
SOUR mg-O2/(g-VSS.hour) at 20 oC	mg/(g-hour)	2.08	1.00	mg/(g-hour)	2.08	
SOUR mg-O2/(g-TSS.hour) at 20 oC	mg/(g-hour)	1.71	1.00	mg/(g-hour)	1.71	
Decanting						
Is Decanting being done? No		FALSE				
Digester HRT	days	8.82	1.00	days	8.82	
Target SRT	days	70.00	1.00	days	70.00	
Average Decant Flow	m3/d	0.00	0.00	GPD	0	
Average Decant Effluent TSS	mg/L	500	1.00	mg/L	500	

Appendix D - Process Calculations

Mass Balance for Validation Conditions -- Jan 2020

Constituent	Raw Wastewater (RW)	Dig Aerobic Digester Decant (ADD)	Main Recycle Influent (Recyl)	Main Recycled Stream (Recycle)	Main Combined Recycle Effluent (RecyE)	Main Bioreactor Influent (BI)	Main Secondary Clarifier Influent (SI)	Main Secondary Clarifier Effluent (SE)	Plant Effluent (PLE)	Main WAS	Dig Aerobic Digester Influent (ADI)	Dig Aerobic Digester Effluent (ADE)	Biosolids to Disposal
Flow (gallons/day)	496,290	0	496,290	0	496,290	496,290	600,511	490,620	490,620	5,670	5,670	5,670	5,670
Carbonaceous BOD_5 (lbs/day)	917	0	917	0	917	917	5,777	21	21	297	297	115	115
Particulate	481	0	481	0	481	481	174	1	1	9	9	0	0
Heterotrophs	239	0	239	0	239	239	4,056	14	14	209	209	59	59
Methanol Degraders	1	0	1	0	1	1	11	0	0	1	1	0	0
AOBs	1	0	1	0	1	1	137	0	0	7	7	3	3
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	1	1	1,235	4	4	63	63	47	47
PHA	0	0	0	0	0	0	164	1	1	8	8	6	6
Filtrate	194	0	194	0	194	194	2	2	2	0	0	0	0
COD (lbs/day)	2,101	0	2,101	0	2,101	2,101	16,525	164	164	844	844	637	637
Particulate Bio	864	0	864	0	864	864	312	1	1	16	16	0	0
Particulate Non-Bio	40	0	40	0	40	40	722	2	2	37	37	37	37
Decay Prod Aer/Anx	241	0	241	0	241	241	7,168	25	25	369	369	419	419
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotrophs	322	0	322	0	322	322	5,459	19	19	281	281	79	79
Methanol Degraders	1	0	1	0	1	1	14	0	0	1	1	0	0
AOBs	1	0	1	0	1	1	201	1	1	10	10	4	4
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	1	1	2,277	8	8	117	117	87	87
PHA	0	0	0	0	0	0	240	1	1	12	12	9	9
Soluble Bio	198	0	198	0	198	198	4	3	3	0	0	0	0
VFA	76	0	76	0	76	76	0	0	0	0	0	0	0
Colloidal Bio	182	0	182	0	182	182	0	0	0	0	0	0	0
Soluble Non-Bio	105	0	105	0	105	105	127	104	104	1	1	1	1
Colloidal Non-Bio	70	0	70	0	70	70	0	0	0	0	0	0	0
TSS (lbs/day)	987	0	987	0	987	987	13,688	47	47	704	704	539	539
Biodegradable	520	0	520	0	520	520	187	1	1	10	10	0	0
Non-Biodegradable	21	0	21	0	21	21	391	1	1	20	20	20	20
Inorganic Particles	-1	0	-1	0	-1	-1	0	0	0	0	0	0	0
Decay Prod Aer/Anx	189	0	189	0	189	189	5,609	19	19	288	288	328	328
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Hydroxide	3	0	3	0	3	3	263	1	1	14	14	14	14
Metal Absorbed Phosphate	0	0	0	0	0	0	257	1	1	13	13	13	13
Heterotrophs	252	0	252	0	252	252	4,271	15	15	220	220	62	62
Methanol Degraders	1	0	1	0	1	1	11	0	0	1	1	0	0
AOBs	1	0	1	0	1	1	157	1	1	8	8	3	3
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	1	1	1,782	6	6	92	92	68	68
PHA	0	0	0	0	0	0	144	0	0	7	7	7	7
Poly-P	0	0	0	0	0	0	616	2	2	32	32	24	24
VSS (lbs/day)	906	0	906	0	906	906	11,378	39	39	585	585	443	443
Biodegradable	478	0	478	0	478	478	168	1	1	9	9	0	0
Non-Biodegradable	28	0	28	0	28	28	352	1	1	18	18	18	18
Decay Prod Aer/Anx	170	0	170	0	170	170	5,048	17	17	260	260	295	295
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Hydroxide	1	0	1	0	1	1	66	0	0	3	3	3	3
Heterotrophs	227	0	227	0	227	227	3,844	13	13	198	198	56	56
Methanol Degraders	1	0	1	0	1	1	10	0	0	1	1	0	0
AOBs	1	0	1	0	1	1	141	0	0	7	7	3	3
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	1	1	1,604	6	6	82	82	61	61
PHA	0	0	0	0	0	0	144	0	0	7	7	6	6
TKN (lbs/day)	175	0	175	0	175	175	943	13	13	48	48	42	42
NH_3-N (lbs-N/day)	114	0	114	0	114	114	4	3	3	0	0	3	3
Particulate Bio Org N	13	0	13	0	13	13	5	0	0	0	0	0	0
Non-Bio Part Org N	1	0	1	0	1	1	11	0	0	1	1	4	4
Decay Prod Aer/Anx	15	0	15	0	15	15	434	1	1	22	22	25	25
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotrophs	19	0	19	0	19	19	331	1	1	17	17	5	5
Methanol Degraders	0	0	0	0	0	0	1	0	0	0	0	0	0
AOBs	0	0	0	0	0	0	12	0	0	1	1	0	0
NOBs	0	0	0	0	0	0	0	0	0	0	0	0	0
PAOs	0	0	0	0	0	0	138	0	0	7	7	5	5
Non-Bio Soluble Org. N	6	0	6	0	6	6	8	6	6	0	0	0	0
Non-Bio Colloidal Org. N	1	0	1	0	1	1	0	0	0	0	0	0	0

Appendix D - Process Calculations

Soluble Bio Org N	3	0	3	0	3	3	0	0	0	0	0	0	0
Colloidal Bio Org N	3	0	3	0	3	3	0	0	0	0	0	0	0
NO_2-N (lbs-N/day)	0	0	0	0	0	0	0	0	0	0	0	0	0
NO_3-N (lbs-N/day)	0	0	0	0	0	0	82	67	67	1	1	5	5
Total Nitrogen (lbs-N/day)	175	0	175	0	175	175	1,025	80	80	49	49	47	47
TP (lbs-P/day)	33	0	33	0	33	33	585	3	3	30	30	30	30
Bio Particulate	5	0	5	0	5	5	1	0	0	0	0	0	0
Non-Bio Particulate	0	0	0	0	0	0	5	0	0	0	0	1	1
Decay Prod Aer/Anx	5	0	5	0	5	5	143	0	0	7	7	8	8
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Absorbed	0	0	0	0	0	0	84	0	0	4	4	4	4
Heterotrophs	6	0	6	0	6	6	109	0	0	6	6	2	2
Methanol Degraders	0	0	0	0	0	0	0	0	0	0	0	0	0
AOBs	0	0	0	0	0	0	4	0	0	0	0	0	0
NOBs	0	0	0	0	0	0	0	0	0	0	0	0	0
PAOs	0	0	0	0	0	0	46	0	0	2	2	2	2
Poly-P	0	0	0	0	0	0	191	1	1	10	10	7	7
Ortho-PO4	17	0	17	0	17	17	1	1	1	0	0	5	5
Alkalinity (lbs/day as $CaCO_3$)	950	0	950	0	950	950	474	388	388	4	4	0	0
H_2S (lbs/day)	25	0	25	0	25	25	0	0	0	0	0	0	0
Temperature (°C)	14	27	14	27	14	14	14	14	14	14	14	27	27
BOD_5 (mg/L)	221	#DIV/0!	221	#DIV/0!	221	221	1,153	5	5	6,276	6,276	2,436	2,436
COD (mg/L)	507	#DIV/0!	507	#DIV/0!	507	507	3,297	40	40	17,840	17,840	13,460	13,460
TSS (mg/L)	238	#DIV/0!	238	#DIV/0!	238	238	2,731	12	11.50	14,874	14,874	11,386	11,386
VSS (mg/L)	219	#DIV/0!	219	#DIV/0!	219	219	2,270	10	10	12,364	12,364	9,363	9,363
TKN (mg-N/L)	42	#DIV/0!	42	#DIV/0!	42	42	188	3	3	1,015	1,015	889	889
NH_3-N (mg-N/L)	28	#DIV/0!	28	#DIV/0!	28	28	1	1	0.8	1	1	57	57
NO_2-N (mg/L)	0	#DIV/0!	0	#DIV/0!	0	0	0	0	0	0	0	0	0
NO_3-N (mg-N/L)	0	#DIV/0!	0	#DIV/0!	0	0	16	16	16	16	16	99	99
Total Nitrogen (mg/L)	42	#DIV/0!	42	#DIV/0!	42	42	205	19	19	1,031	1,031	988	988
TP (mg-P/L)	8	#DIV/0!	8	#DIV/0!	8	8	117	1	1	634	634	634	634
Alkalinity (mg/L as $CaCO_3$)	229	#DIV/0!	229	#DIV/0!	229	229	95	95	95	95	95	0	0
H_2S (mg/L)	6	#DIV/0!	6	#DIV/0!	6	6	0	0	0	0	0	0	0

Appendix D - Process Calculations

Select Operating Units for Physical Plant Definition	
Metric (M) or US (U)	U

Biological Model	#N/A
Standard	No

Aeration Data		
Aeration Basin Side Water Depth	12	feet
Maximum Water Temperature:	13.64	°C
BETA Correctional Factor:	0.95	
Plant Altitude:	50	feet

Definition of the Physical Plant		
How many reactors (up to 42)	3	
Solids Retention Time (SRT)	12.00	Days
Average Total Flow Rate (not incl OtherInf)	0.50	mgd
RAS Ratio (% of Plant Influent)	21%	
	0.10	mgd
Waste Loc: (A)ll Reactors, Clarifier (U)/F or Reactor #	U	

PRO2D2	
% Aerobic	89%
% Anoxic	11%
Nitrification S.F.	3.41
Total Volume gallons	395,000
RAS Return DO - mg/L	0.00

Est. Diffuser Design (Sanitaire Membranes)		
Design Condition	MM	
Est. Diffuser Air Rate	2.5	scfm/diffuser
Peaking Capability	160%	
Estimated SOTE	21%	

System Configuration			Reactor									
Component	Units	TOTAL	#1	#2	#3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Reactor Volume	gallons	395,000	23,500	23,500	348,000							
Fraction	% of Total		6%	6%	88%	0%	0%	0%	0%	0%	0%	0%
O_2 Specification Method			DO	DO	DO	DO	DO	DO	DO	DO	DO	DO
DO or Ammonia (Dyn ABAC) or Air Rate or AOR	mg/L or lbs/hr or scfm		0.00	0.00	2.00							
Oxygen Mass Transfer, Kla (ASMN)	1/day		1	1	137	1	1	1	1	1	1	1
Empty Bed Media Fill Fraction	dimensionless											
Biofilm Density	g COD/m3											
Biofilm Thickness	microns											
External Diffusion Layer Thickness	microns											
Number of Biofilm Layers (for Dynamics)	#											
Net Specific Surface Area	m2/m3		No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media
Net Liquid Volume Displacement	%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bulk Liquid Volume	gallons	395,000	23,500	23,500	348,000	0	0	0	0	0	0	0
Reactor Feed												
Raw Feed	% of Total	100%	100%									
RAS	% of Total RAS	100%	100%									
Recirculation	% of Raw Feed		0%									
From Reactor	(Enter Number)											

Appendix D - Process Calculations

Summary Information					
Total MLSS Inventory	**8,985**	lbs	Total COD Removed	1,937	lbs/day
Total MLVSS Inventory	7,482	lbs	Food Applied to MLSS Inventory Ratio	0.19	COD/MLSS
MIxed Liquor VSS	83%		Aeration Information		
Total Required WAS Rate	**749**	lbs MLSS/day	Total AOR	1,532	lbs O2/day
or	624	lbs MLVSS/day	Total SOR	3,683	lbs O2/day
Observed Mass Yield	0.82	lbs MLSS/lb BOD	Total Required Air Rate	465	scfm

Standard Model Component Concentrations			Feed	RAS	#1	#2	#3	#N/A	#N/A	#N/A	#N/A
Enter Reactor Number to use this Column of Data for the Original Guess					1	2	3	4	5	6	7
S_{O2}	Dissolved Oxygen	mg O_2/L	0.00	0.00	0.00	0.00	2.00				
S_F	Soluble Fermentable Substrates	mg COD/L	47.69	0.84	12.19	3.70	0.84				
S_A	Soluble Fermentation Products	mg COD/L	18.27	0.04	9.16	12.31	0.04				
S_I	Soluble Inerts	mg COD/L	25.37	25.39	25.39	25.39	25.39				
S_{NH4}	Soluble Ammonia N	mg N/L	27.52	0.77	24.04	25.37	0.77				
S_{N2}	Dissolved Nitrogen Gas	mg N/L	0	11	5	5	11				
S_{NO3}	Soluble Nitrate/Nitrite N	mg N/L	0.00	16.35	0.11	0.00	16.35				
S_{PO4}	Soluble Inorganic Phosphorus	mg P/L	4.02	0.27	19.51	30.90	0.27				
S_{ALK}	Alkalinity	moles/m^3	4.59	1.89	4.28	4.18	1.89				
X_I	Inert Particulates	mg COD/L	10	785	144	144	144				
X_S	Slowly Biodegradable Substrate	mg COD/L	270	339	271	263	62				
X_H	Heterotrophic Organisms	mg COD/L	78	5,932	1,083	1,064	1,089				
X_{PAO}	Phosphate Accumulating Organisms	mg COD/L	0	2,475	429	428	454				
X_{PP}	Polyphosphate	mg P/L	0.02	207.29	18.24	6.12	38.07				
X_{PHA}	PAO Storage Products	mg COD/L	0.03	260.71	90.31	120.46	47.87				
X_{AUT}	Autotrophic Organisms	mg COD/L	1	218	38	38	40				
X_{ISS}	Inorganic Particles	mg/L	0	0	0	0	0				
X_{MeOH}	Metal Hydroxides	mg/L	1	35	1	1	6				
X_{MeP}	Metal Phosphates	mg/L	0	486	94	100	89				
S_M	Methanol	mg COD/L	0.00	0.00	0.00	0.00	0.00				
X_{M1}	Group 1 Methanol Degraders	mg COD/L	0	4	1	1	1				
X_{M2}	Group 2 Methanol Degraders	mg COD/L	0	12	2	2	2				
X_E	Aerobic/Anoxic Decay Products	mg COD/L	58	7,789	1,402	1,403	1,430				
	MLSS	**mg/L**	**274**	**14,830**	**2,761**	**2,726**	**2,723**				
	MLVSS	mg/L	247	12,300	2,351	2,352	2,259				
	Oxygen Uptake Rate	mg O_2/(L-hr)			1	1	21				
	Nitrate Uptake Rate	mg NO_3-N/(L-day)			71	4	11				
	Ammonia Uptake Rate	mg NH_4-N/(L-day)			-30	-34	42				
				Alkalinity Limited?							
Reactor Information											
	Active Reactor Volume	gallons		395,000	23,500	23,500	348,000	0	0	0	0
	Reactor Sidewater Depth	feet		12	12	12	12	12	12	12	12
	AOR, Biological	lbs O2/day			6	6	1,473	0	0	0	0
	AOR, H2S	lbs O2/day		50	0	0	50	0	0	0	0
	AOR, Liquid	lbs O2/day			0	0	10	0	0	0	0
	Total AOR	lbs O2/day			0	0	1,532	0	0	0	0
	Aeration Alpha Value				0.82	0.82	0.68	0.83	0.83	0.83	0.83
	Fouling Factor				0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Alpha F				0.65	0.65	0.55	0.66	0.66	0.66	0.66
	Oxygen Concentration in Supplied Gas	Volume Percent			21%	21%	21%	21%	21%	21%	21%
	Oxygen Concentration in Supplied Gas	Mass Percent			23%	23%	23%	23%	23%	23%	23%
	Nitrogen Concentration in Supplied Gas	Volume Percent			78%	78%	78%	78%	78%	78%	78%
	CO2 Concentration in Supplied Gas	Volume Percent			0.00%	0.00%	0.04%	0.04%	0.04%	0.04%	0.04%
	Argon Concentration in Supplied Gas	Volume Percent			0.93%	0.93%	0.93%	0.93%	0.93%	0.93%	0.93%
	Standard Density of Supplied Gas	lbs/ft3			0.0752	0.0752	0.0752	0.0752	0.0752	0.0752	0.0752
	SOR/AOR Ratio				0.00	0.00	2.40	0.00	0.00	0.00	0.00
	SOR	lbs O2/day			0	0	3,683	0	0	0	0
	Number of Diffusers	Total		290	0	0	290	0	0	0	0
	SOTE				0%	0%	100%	0%	0%	0%	0%
	Required Air Rate	SCFM	Min Mixing		0	0	147	0	0	0	0
	Required Mixing Air @ 0.12 scfm/ft2	SCFM	0.12	scfm/ft2	0	0	465	0	0	0	0
	Max Air per Tank at Design Condition	SCFM			399	399	5,909	0	0	0	0
	Is Required Diffuser Density Too High?										
Flow Balance											
	Raw Feed into Reactor	mgd	0.50		0.50						
	Flow from Previous Reactor	mgd				0.60	0.60				
	Recirculation Into Reactor	mgd									
	From Reactor				(0)	(0)	(0)				
	RAS Into Reactor	mgd		0.10	0.10						
	Other Flows Into Reactor	mgd	0.00								
	Effluent From Reactor	mgd			0.60	0.60	0.60				
	Waste Activated Sludge	mgd		0.0060							

Appendix D - Process Calculations

Facility Operating Parameters						Project
Item		**Value**			**Value**	**Notes**
Influent Wastewater	(Metric)	(Metric)	(Metric=US*k)	(US)	(US)	
Flow	m3/day			MG/day		
Average		2,650	3,785.44		0.70	Phase 1A MM Projection
Carbonaceous Five-Day Biochemical Oxygen Demand (CBOD5)						
Design Average Concentration	mg/L	266	1.00	mg/L	266	
Design Average Mass Loading	kg/day	705	0.45	lb/day	1,555	Phase 1A MM Projection
Total Suspended Solids (TSS)						
Design Average Concentration	mg/L	329	1.00	mg/L	329	
Design Average Mass Loading	kg/day	873	0.45	lb/day	1,924	Phase 1A MM Projection
Volatile Suspended Solids (VSS)						
Percent VSS	%	90%	1.00	%	90%	
Design Average Concentration	mg/L	296	1.00	mg/L	296	
Design Average Mass Loading	kg/day	785	0.45	lb/day	1,732	
Total Kjeldahl Nitrogen (TKN as N)						
Design Average Concentration	mg/L	59	1.00	mg/L	59	
Design Average Mass Loading	kg/day	157	0.45	lb/day	346	Assuming TKN = 0.65*NH3
Ammonia-Nitrogen (NH3-N as N)						
Design Average Concentration	mg/L	39	1.00	mg/L	39	
Design Average Mass Loading	kg/day	102	0.45	lb/day	225	Phase 1A MM Projection
Total Phosphorus (as P)						
Design Average Concentration	mg/L	8	1.00	mg/L	8	
Design Average Mass Loading	kg/day	21	0.45	lb/day	47	
Alkalinity (as CaCO3)						
Design Average Concentration	mg/L	257	1.00	mg/L	257	
Design Average Mass Loading	kg/day	680	0.45	lb/day	1,500	
Hydrogen Sulfide (H2S)						
Design Average Concentration	mg/L	6	1.00	mg/L	6	
Design Average Mass Loading	kg/day	16	0.45	lb/day	35	
Chemical Addition:						
Select the Metal Salt (if used) Ferric Chloride					2	
Wastewater Temperature						
Raw Sewage Temperature	oC	13	1.00	oC	12.5	
Plant Elevation	meters	15	3.28	feet	50	
Ambient Atmospheric Pressure	kPa	101	6.89	psia	14.6694	
Is the Temperature Model Used? No						
N/A	oC	21	Special	oF	70	
N/A	kph	8	0.62	mph	5	
N/A	%	60%	1.00	%	60%	
N/A	%	50%	1.00	%	50%	
N/A	degrees	45	1.00	degrees	45	
N/A	Date	12/22/23	1.00	Date	12/22/23	
Biological Process - PBNR: Main						
Total SRT (anaerobic + anoxic + aerobic)	days	8.00	1.00	days	8.00	RTP includes secondary clarifier blanket i
System pH		7.20	1.00		7.20	
Nitrifier Minimum Aerobic SRT (SRT_{min})	days	3.33	1.00	days	3.33	
Aerobic SRT	days	7.07	1.00		7.07	
Nitrification Safety Factor		2.13	1.00		2.13	
DO	mg/L	2.00	1.00	mg/L	2.00	
Temperature in the Biological Process	oC	13	1.00	oC	13	
SVI	mL/g	109	1.00	mL/g	109	
Biosolids Production Rates						
Net Yield (mg TSS/mg BOD_5)	mg/mg	0.90	1.00	lb/lb	0.90	
Volatile Fraction	%	84%	1.00	%	84%	
Active Fraction	%	42%	1.00	%	42%	
Nitrifier Fraction	%	2%	1.00	%	2%	
Nitrogen Content, N/VSS	%	5%	1.00	%	5%	
Phosphorus Content, P/VSS	%	3%	1.00	%	3%	
Process Oxygen Requirements - Minus MBR Tank (if used)						
Carbonaceous AOR/BOD5 - wt/wt	kg/kg	1.17	1.00	lb/lb	1.17	
Total AOR/BOD% - wt/wt	kg/kg	1.64	1.00	lb/lb	1.64	
AOR (wt/day)	kg/day	1,167	0.45	lb/day	2,573	
AOR	mg/L-hr	33	1.00	mg/L-hr	33	
Bioreactor With Secondary Clarifier		1				
Total Bioreactor Volume	m3	1,495	3,785.44	MG	0.3950	2
HRT	hr	13.18	1.00	hr	13.18	
% non-aerobic	%	12%	1.00		12%	
% aerobic	%	88%	1.00		88%	
Average MLSS Concentration	mg/L	3,489	1.00	mg/L	3,489	
No Media Reactors Included AKI K1/K3						
Bulk Specific Surface Area (Biofilm Active)	m2/m3	No Media	3.28	ft2/ft3	No Media	
Bulk Liquid Volume Displacement	-	No Media	1.00	-	No Media	
Allow Biofilm Carriers to Flow Between Unit Processes? No						
Bioreactor Clarifier						
Total Area	m2	365	0.09	sq.ft.	3,927	2
Overflow Rate	m/day	7	0.04	gpd-sq.ft.	183	
Estimated Peak Overflow Rate	m/day	7	0.04	gpd-sq.ft.	178	
Effluent TSS	mg/L	6	1.00	mg/L	5.5	5-20 mg/L
Underflow Rate						
Average Flow Ratio	%	115%	1.00		115%	RAS flow/Influent flow
Average Rate	m/day	9	0.04	gpd-sq.ft.	211	RAS at firm capacity
RAS Concentration	mg/L			mg/L		
Average		6,301	1.00		6,301	want to match with observed RAS concer
Diurnal Peak (From Solids Flux)		4,700	1.00		4,700	
Solids Loading Rate	kg/m2-day	125	4.88	lb/day-sq.ft.	26	
Estimated Peak Solids Loading Rate (from Solid Flux Sheet)	kg/m2-day	98	4.88	lb/day-sq.ft.	20	
Estimated Limiting Solids Loading Rate	kg/m2-day	218	4.88	lb/day-sq.ft.	45	
Estimated Peak Limitied Solids Loading Rate (from Solid Flux Sheet)	kg/m2-day	249	4.88	lb/day-sq.ft.	51	
Return sludge rate at which limiting solids rate can be achieved						
RAS Flow Rate	m3/day	#NULL!	3,785.00	MGD	#NULL!	
Percent of Influent to Bioreactor	%	#NULL!		%	#NULL!	
No Membrane Bioreactor Selected GE/Zenon						
Calculate Based on Flux or # of Modules? Flux	lmh	27	1.70	gfd	16	
Design Membrane Net Flux Rate	lmh	27.10	1.70	gfd	16	
Minimum Required Membrane Area	m2	4,031	10.76	ft2	43,391	
Membrane Module Area	m2	34	10.76	ft2	370	
Number of Modules		117			117	
Air Rate per Module	Nm3/hr	3	1.70	scfm	2.03	
Percent of Time Membrane Air Scour is on		100%			100%	
Total Membrane Air Scour Rate	Nm3/hr	404	1.70	scfm	238	
Force MBR DO to Match Air Rate? No						
Effluent TSS	mg/L	1.00	1.00	mg/L	1.00	
Chemical Compound Applied before Secondary Clarifier		2				
Chemical Added? No						
Chemical Type		Ferric Chloride	1.00		Ferric Chloride	
Chemical Dosage (as chemical)	kg/day	91	0.45	lb/day	200	
Chemical Dosage (mg chemical/L treated)	mg/L	N/A	1.00	mg/L	N/A	
Molar Ratio Dosage Applied (M+:PO4-P)		3	1.00		N/A	
Effluent PO4-P	kg/day	5	0.45	lb/day	N/A	
Effluent PO4-P	mg/L	1.87	1.00	mg/L	N/A	
Aerobic Digestion: Dig						
Aerobic Digestion? Yes		TRUE				
Volume	m3	189	3,785.00	MG	0.05	
SRT (Days)	day	10.00	1.00	day	10.00	Current aerobic digester SRT = 8 days
Temperature in the Aerobic Digester	o C	27		o C	27	
Estimated Temperature in Aerobic Digester	o C	19		o C	19	
DO during Aerobic Phase (mg/L)	mg-O2/l	2.00	1.00	mg-O2/l	2.00	
% denitrification	%	50%	1.00	%	50%	
Anoxic Cycle Time	hrs/day	8.00	1.00	hrs/day	8.00	
Average DO in Digester (mg/L)	mg-O2/L	1.33	1.00	mg-O2/L	1.33	
Volatile Solids Loading - wt VSS/vol-day	kg/(m3-day)	1.76	16.06	lb/ft3-day	0.11	
Volatile Solids Reduction	%	28.80%	1.00	%	28.80%	
Total Solids Reduction	%	27.78%	1.00	%	27.78%	
Influent Solids Concentration	%	0.63%		%	0.63%	
Effluent Solids Concentration	%	1.52%		%	1.52%	
Is alkalinity limiting in the aerobic digester?		yes			yes	
SOUR mg-O2/(g-VSS.hour) at 20 oC	mg/(g-hour)	2.25	1.00	mg/(g-hour)	2.25	
SOUR mg-O2/(g-TSS.hour) at 20 oC	mg/(g-hour)	1.86	1.00	mg/(g-hour)	1.86	
Decanting Make sure the Aerobic Digester on the PFD has a decant stream coming off it!						
Is Decanting being done? Yes		TRUE				
Digester HRT	days	3.00	1.00	days	3.00	
Target SRT	days	10.00	1.00	days	10.00	
Average Decant Flow	m3/d	73.26	0.00	GPD	19,356	
Average Decant Effluent TSS	mg/L	500	1.00	mg/L	500	

Mass Balance for Phase 1A Maximum Month Conditions at 12.5 deg-C in Complete-Mix Mode

Constituent	Raw Wastewater (RW)	Dig Aerobic Digester Decant (ADD)	Main Recycle Influent (Recyl)	Main Recycled Stream (Recycle)	Main Combined Recycle Effluent (RecyE)	Main Bioreactor Influent (BI)	Main Secondary Clarifier Influent (SI)	Main Secondary Clarifier Effluent (SE)	Plant Effluent (PLE)	Main WAS	Dig Aerobic Digester Influent (ADI)	Dig Aerobic Digester Effluent (ADE)	Biosolids to Disposal
Flow (gallons/day)	700,000	19,353	700,000	19,353	719,353	719,353	1,546,610	692,617	692,617	26,737	26,737	7,383	7,383
Carbonaceous BOD_5 (lbs/day)	1,555	13	1,555	13	1,568	1,568	19,318	17	17	604	604	155	155
Particulate	971	0	971	0	971	971	801	1	1	25	25	0	0
Heterotrophs	183	11	183	11	193	193	16,664	12	12	521	521	123	123
Methanol Degraders	1	0	1	0	1	1	29	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	635	0	0	20	20	7	7
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	2	1	2	3	3	1,018	1	1	32	32	21	21
PHA	0	0	0	0	0	0	166	0	0	5	5	3	3
Filtrate	397	0	397	0	397	397	6	3	3	0	0	0	0
COD (lbs/day)	3,659	101	3,659	101	3,760	3,760	54,494	225	225	1,699	1,699	1,112	1,112
Particulate Bio	1,745	0	1,745	0	1,745	1,745	1,440	1	1	45	45	0	0
Particulate Non-Bio	379	32	379	32	411	411	12,859	9	9	402	402	370	370
Decay Prod Aer/Anx	184	45	184	45	229	229	14,259	10	10	446	446	519	519
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotrophs	246	14	246	14	260	260	22,429	16	16	702	702	166	166
Methanol Degraders	1	0	1	0	1	1	38	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	932	1	1	29	29	10	10
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	3	1	3	5	5	1,877	1	1	59	59	39	39
PHA	0	0	0	0	1	1	243	0	0	8	8	5	5
Soluble Bio	344	0	344	0	344	344	12	5	5	0	0	0	0
VFA	132	0	132	0	132	132	1	0	0	0	0	0	0
Colloidal Bio	317	0	317	0	317	317	0	0	0	0	0	0	0
Soluble Non-Bio	183	5	183	5	188	188	404	181	181	7	7	2	2
Colloidal Non-Bio	123	0	123	0	123	123	0	0	0	0	0	0	0
TSS (lbs/day)	1,924	81	1,924	81	2,005	2,005	44,961	32	32	1,407	1,407	935	935
Biodegradable	1,257	0	1,257	0	1,257	1,257	1,039	1	1	32	32	0	0
Non-Biodegradable	284	24	284	24	308	308	9,630	7	7	301	301	277	277
Inorganic Particles	37	3	37	3	41	41	1,269	1	1	40	40	37	37
Decay Prod Aer/Anx	144	35	144	35	179	179	11,157	8	8	349	349	406	406
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Hydroxide	4	0	4	0	4	4	138	0	0	4	4	4	4
Metal Absorbed Phosphate	0	0	0	0	0	0	147	0	0	5	5	4	4
Heterotrophs	192	11	192	11	204	204	17,550	12	12	549	549	130	130
Methanol Degraders	1	0	1	0	1	1	30	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	730	1	1	23	23	8	8
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	3	1	3	4	4	1,469	1	1	46	46	30	30
PHA	0	0	0	0	0	0	146	0	0	5	5	4	4
Poly-P	0	3	0	3	3	3	1,657	1	1	52	52	34	34
VSS (lbs/day)	1,732	67	1,732	67	1,798	1,798	37,624	27	27	1,177	1,177	771	771
Biodegradable	1,156	0	1,156	0	1,156	1,156	935	1	1	29	29	0	0
Non-Biodegradable	267	22	267	22	289	289	8,667	6	6	271	271	250	250
Decay Prod Aer/Anx	130	32	130	32	161	161	10,042	7	7	314	314	365	365
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Hydroxide	1	0	1	0	1	1	35	0	0	1	1	1	1
Heterotrophs	173	10	173	10	183	183	15,795	11	11	494	494	117	117
Methanol Degraders	1	0	1	0	1	1	27	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	657	0	0	21	21	7	7
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	2	1	2	3	3	1,322	1	1	41	41	27	27
PHA	0	0	0	0	0	0	146	0	0	5	5	4	4
TKN (lbs/day)	346	9	346	9	355	355	2,866	20	20	89	89	64	64
NH_3-N (lbs-N/day)	225	3	225	3	228	228	16	7	7	0	0	1	1
Particulate Bio Org N	50	0	50	0	50	50	41	0	0	1	1	0	0
Non-Bio Part Org N	11	2	11	2	12	12	390	0	0	12	12	18	18
Decay Prod Aer/Anx	11	3	11	3	14	14	864	1	1	27	27	31	31
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotrophs	15	1	15	1	16	16	1,358	1	1	42	42	10	10

Methanol Degraders	0	0	0	0	0	0	2	0	0	0	0	0	0
AOBs	0	0	0	0	0	0	56	0	0	2	2	1	1
NOBs	0	0	0	0	0	0	0	0	0	0	0	0	0
PAOs	0	0	0	0	0	0	114	0	0	4	4	2	2
Non-Bio Soluble Org. N	11	0	11	0	11	11	24	11	11	0	0	0	0
Non-Bio Colloidal Org. N	4	0	4	0	4	4	0	0	0	0	0	0	0
Soluble Bio Org N	10	0	10	0	10	10	0	0	0	0	0	0	0
Colloidal Bio Org N	9	0	9	0	9	9	0	0	0	0	0	0	0
NO_2-N (lbs-N/day)	0	0	0	0	0	0	0	0	0	0	0	0	0
NO_3-N (lbs-N/day)	0	9	0	9	9	9	198	89	89	3	3	4	4
Total Nitrogen (lbs-N/day)	346	18	346	18	364	364	3,065	109	109	93	93	67	67
TP (lbs-P/day)	47	11	47	11	58	58	1,481	12	12	46	46	35	35
Bio Particulate	12	0	12	0	12	12	8	0	0	0	0	0	0
Non-Bio Particulate	3	0	3	0	3	3	97	0	0	3	3	5	5
Decay Prod Aer/Anx	4	1	4	1	5	5	285	0	0	9	9	10	10
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Absorbed	0	0	0	0	0	0	48	0	0	2	2	1	1
Heterotrophs	5	0	5	0	5	5	449	0	0	14	14	3	3
Methanol Degraders	0	0	0	0	0	0	1	0	0	0	0	0	0
AOBs	0	0	0	0	0	0	19	0	0	1	1	0	0
NOBs	0	0	0	0	0	0	0	0	0	0	0	0	0
PAOs	0	0	0	0	0	0	38	0	0	1	1	1	1
Poly-P	0	1	0	1	1	1	513	0	0	16	16	11	11
Ortho-PO4	24	8	24	8	32	32	24	11	11	0	0	3	3
Alkalinity (lbs/day as $CaCO_3$)	1,500	0	1,500	0	1,500	1,500	1,171	525	525	20	20	0	0
H_2S (lbs/day)	35	0	35	0	35	35	0	0	0	0	0	0	0
Temperature (°C)	13	27	13	27	13	13	13	13	13	13	13	27	27
BOD_5 (mg/L)	266	83	266	83	261	261	1,497	3	3	2,708	2,708	2,520	2,520
COD (mg/L)	626	625	626	625	626	626	4,222	39	39	7,614	7,614	18,044	18,044
TSS (mg/L)	329	500	329	500	334	334	3,483	6	6	6,304	6,304	15,176	15,176
VSS (mg/L)	296	412	296	412	300	300	2,915	5	5	5,275	5,275	12,519	12,519
TKN (mg-N/L)	59	54	59	54	59	59	222	4	4	399	399	1,032	1,032
NH_3-N (mg-N/L)	39	19	39	19	38	38	1	1	1.26	1	1	19	19
NO_2-N (mg/L)	0	0	0	0	0	0	0	0	0	0	0	0	0
NO_3-N (mg-N/L)	0	59	0	59	2	2	15	15	15	15	15	59	59
Total Nitrogen (mg/L)	59	113	59	113	61	61	237	19	19	415	415	1,387	1,387
TP (mg-P/L)	8	69	8	69	10	10	115	2	2	206	206	566	566
Alkalinity (mg/L as $CaCO_3$)	257	0	257	0	250	250	91	91	91	91	91	0	0
H_2S (mg/L)	6	0	6	0	6	6	0	0	0	0	0	0	0

Appendix D - Process Calculations

Select Operating Units for Physical Plant Definition	
Metric (M) or US (U)	U

Biological Model	#N/A
Standard	No

Aeration Data		
Aeration Basin Side Water Depth	12	feet
Maximum Water Temperature:	12.89	°C
BETA Correctional Factor:	0.95	
Plant Altitude:	50	feet

Definition of the Physical Plant		
How many reactors (up to 42)	3	
Solids Retention Time (SRT)	8.00	Days
Average Total Flow Rate (not incl OtherInf)	0.72	mgd
RAS Ratio (% of Plant Influent)	115%	
	0.83	mgd
Waste Loc: (A)ll Reactors, Clarifier (U)/F or Reactor #	U	

PRO2D2	
% Aerobic	88%
% Anoxic	12%
Nitrification S.F.	2.13
Total Volume gallons	395,000
RAS Return DO - mg/L	0.00

Est. Diffuser Design (Sanitaire Membranes)		
Design Condition	MM	
Est. Diffuser Air Rate	2.5	scfm/diffuser
Peaking Capability	160%	
Estimated SOTE	21%	

System Configuration			Reactor									
Component	Units	TOTAL	#1	#2	#3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Reactor Volume	gallons	395,000	23,500	23,500	348,000							
Fraction	% of Total		6%	6%	88%	0%	0%	0%	0%	0%	0%	0%
O_2 Specification Method			DO	DO	DO	DO	DO	DO	DO	DO	DO	DO
DO or Ammonia (Dyn ABAC) or Air Rate or AOR	mg/L or lbs/hr or scfm		0.00	0.00	2.00							
Oxygen Mass Transfer, Kla (ASMN)	1/day		1	1	261	1	1	1	1	1	1	1
Empty Bed Media Fill Fraction	dimensionless											
Biofilm Density	g COD/m3											
Biofilm Thickness	microns											
External Diffusion Layer Thickness	microns											
Number of Biofilm Layers (for Dynamics)	#											
Net Specific Surface Area	m2/m3		No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media
Net Liquid Volume Displacement	%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bulk Liquid Volume	gallons	395,000	23,500	23,500	348,000	0	0	0	0	0	0	0
Reactor Feed												
Raw Feed	% of Total	100%	100%									
RAS	% of Total RAS	100%	100%									
Recirculation	% of Raw Feed		100%									
From Reactor	(Enter Number)		#3									

Summary Information					
Total MLSS Inventory	**11,501**	lbs	Total COD Removed	3,535	lbs/day
Total MLVSS Inventory	9,627	lbs	Food Applied to MLSS Inventory Ratio	0.25	COD/MLSS
MIxed Liquor VSS	84%		Aeration Information		
Total Required WAS Rate	**1,438**	lbs MLSS/day	Total AOR	2,573	lbs O2/day
or	1,203	lbs MLVSS/day	Total SOR	7,035	lbs O2/day
Observed Mass Yield	0.92	lbs MLSS/lb BOD	Total Required Air Rate	1,206	scfm

Standard Model Component Concentrations			Feed	RAS	#1	#2	#3	#N/A	#N/A	#N/A	#N/A
Enter Reactor Number to use this Column of Data for the Original Guess					1	2	3	4	5	6	7
S_{O2}	Dissolved Oxygen	mg O_2/L	0.00	0.00	0.00	0.00	2.00				
S_F	Soluble Fermentable Substrates	mg COD/L	57.29	0.93	9.55	4.10	0.93				
S_A	Soluble Fermentation Products	mg COD/L	21.94	0.06	3.02	4.41	0.06				
S_I	Soluble Inerts	mg COD/L	31.32	31.32	31.32	31.32	31.32				
S_{NH4}	Soluble Ammonia N	mg N/L	38.00	1.26	18.48	18.98	1.26				
S_{N2}	Dissolved Nitrogen Gas	mg N/L	0	27	21	23	27				
S_{NO3}	Soluble Nitrate/Nitrite N	mg N/L	1.58	15.36	2.50	0.25	15.36				
S_{PO4}	Soluble Inorganic Phosphorus	mg P/L	5.34	1.87	5.00	7.35	1.87				
S_{ALK}	Alkalinity	moles/m^3	5.00	1.82	3.86	4.00	1.82				
X_I	Inert Particulates	mg COD/L	69	1,803	996	996	996				
X_S	Slowly Biodegradable Substrate	mg COD/L	364	202	269	263	112				
X_H	Heterotrophic Organisms	mg COD/L	43	3,145	1,711	1,707	1,738				
X_{PAO}	Phosphate Accumulating Organisms	mg COD/L	1	263	141	141	145				
X_{PP}	Polyphosphate	mg P/L	0.17	71.95	36.84	34.52	39.76				
X_{PHA}	PAO Storage Products	mg COD/L	0.10	34.02	22.72	28.52	18.80				
X_{AUT}	Autotrophic Organisms	mg COD/L	1	131	70	70	72				
X_{ISS}	Inorganic Particles	mg/L	7	178	98	98	98				
X_{MeOH}	Metal Hydroxides	mg/L	1	1	1	0	0				
X_{MeP}	Metal Phosphates	mg/L	0	36	20	20	20				
S_M	Methanol	mg COD/L	0.00	0.00	0.00	0.00	0.00				
X_{M1}	Group 1 Methanol Degraders	mg COD/L	0	1	1	1	1				
X_{M2}	Group 2 Methanol Degraders	mg COD/L	0	4	2	2	2				
X_E	Aerobic/Anoxic Decay Products	mg COD/L	38	1,999	1,088	1,089	1,105				
	MLSS	**mg/L**	**387**	**6,301**	**3,549**	**3,539**	**3,482**				
	MLVSS	mg/L	341	5,271	2,982	2,980	2,912				
	Oxygen Uptake Rate	mg O_2/(L-hr)			2	2	36				
	Nitrate Uptake Rate	mg NO_3-N/(L-day)			426	150	17				
	Ammonia Uptake Rate	mg NH_4-N/(L-day)			-8	-33	79				
				Alkalinity Limited?							
Reactor Information											
	Active Reactor Volume	gallons		395,000	23,500	23,500	348,000	0	0	0	0
	Reactor Sidewater Depth	feet		12	12	12	12	12	12	12	12
	AOR, Biological	lbs O2/day			8	7	2,477	0	0	0	0
	AOR, H2S	lbs O2/day		70	0	0	70	0	0	0	0
	AOR, Liquid	lbs O2/day			0	0	26	0	0	0	0
	Total AOR	lbs O2/day			0	0	2,573	0	0	0	0
	Aeration Alpha Value				0.81	0.81	0.60	0.83	0.83	0.83	0.83
	Fouling Factor				0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Alpha F				0.65	0.65	0.48	0.66	0.66	0.66	0.66
	Oxygen Concentration in Supplied Gas	Volume Percent			21%	21%	21%	21%	21%	21%	21%
	Oxygen Concentration in Supplied Gas	Mass Percent			23%	23%	23%	23%	23%	23%	23%
	Nitrogen Concentration in Supplied Gas	Volume Percent			78%	78%	78%	78%	78%	78%	78%
	CO2 Concentration in Supplied Gas	Volume Percent			0.00%	0.00%	0.04%	0.04%	0.04%	0.04%	0.04%
	Argon Concentration in Supplied Gas	Volume Percent			0.93%	0.93%	0.93%	0.93%	0.93%	0.93%	0.93%
	Standard Density of Supplied Gas	lbs/ft3			0.0752	0.0752	0.0752	0.0752	0.0752	0.0752	0.0752
	SOR/AOR Ratio				0.00	0.00	2.73	0.00	0.00	0.00	0.00
	SOR	lbs O2/day			0	0	7,035	0	0	0	0
	Number of Diffusers	Total		555	0	0	555	0	0	0	0
	SOTE				0%	0%	23%	0%	0%	0%	0%
	Required Air Rate	SCFM	Min Mixing		0	0	1,206	0	0	0	0
	Required Mixing Air @ 0.12 scfm/ft2	SCFM	0.12	scfm/ft2	0	0	465	0	0	0	0
	Max Air per Tank at Design Condition	SCFM			399	399	5,909	0	0	0	0
	Is Required Diffuser Density Too High?										
Flow Balance											
	Raw Feed into Reactor	mgd	0.72		0.72						
	Flow from Previous Reactor	mgd				2.27	2.27				
	Recirculation Into Reactor	mgd			0.72						
	From Reactor				(3)	(0)	(0)				
	RAS Into Reactor	mgd		0.83	0.83						
	Other Flows Into Reactor	mgd	0.00								
	Effluent From Reactor	mgd			2.27	2.27	1.55				
	Waste Activated Sludge	mgd		0.0273							

Facility Operating Parameters						Project
Item		Value			Value	Notes
Influent Wastewater	(Metric)	(Metric)	(Metric=US*k)	(US)	(US)	
Flow	m3/day			MG/day		
Average		2,650	3,785.44		0.70	Permit MM
Carbonaceous Five-Day Biochemical Oxygen Demand (CBOD5)						
Design Average Concentration	mg/L	266	1.00	mg/L	266	
Design Average Mass Loading	kg/day	705	0.45	lb/day	1,555	Projected MM at 0.7 MGD
Total Suspended Solids (TSS)						
Design Average Concentration	mg/L	329	1.00	mg/L	329	
Design Average Mass Loading	kg/day	873	0.45	lb/day	1,924	Projected MM at 0.7 MGD
Volatile Suspended Solids (VSS)						
Percent VSS	%	90%	1.00	%	90%	
Design Average Concentration	mg/L	296	1.00	mg/L	296	
Design Average Mass Loading	kg/day	785	0.45	lb/day	1,732	
Total Kjeldahl Nitrogen (TKN as N)						
Design Average Concentration	mg/L	59	1.00	mg/L	59	
Design Average Mass Loading	kg/day	157	0.45	lb/day	346	Assuming TKN = 0.65*NH3
Ammonia-Nitrogen (NH3-N as N)						
Design Average Concentration	mg/L	39	1.00	mg/L	39	
Design Average Mass Loading	kg/day	102	0.45	lb/day	225	Projected MM at 0.7 MGD
Total Phosphorus (as P)						
Design Average Concentration	mg/L	8	1.00	mg/L	8	
Design Average Mass Loading	kg/day	21	0.45	lb/day	47	
Alkalinity (as CaCO3)						
Design Average Concentration	mg/L	257	1.00	mg/L	257	
Design Average Mass Loading	kg/day	680	0.45	lb/day	1,500	
Hydrogen Sulfide (H2S)				.		
Design Average Concentration	mg/L	6	1.00	mg/L	6	
Design Average Mass Loading	kg/day	16	0.45	lb/day	35	
Chemical Addition:						
Select the Metal Salt (if used) Ferric Chloride				2		
Wastewater Temperature						
Raw Sewage Temperature	oC	13	1.00	oC	12.5	
Plant Elevation	meters	15	3.28	feet	50	
Ambient Atmospheric Pressure	kPa	101	6.89	psia	14.6694	
Is the Temperature Model Used? No						
N/A	oC	21	Special	oF	70	
N/A	kph	8	0.62	mph	5	
N/A	%	60%	1.00	%	60%	
N/A	%	50%	1.00	%	50%	
N/A	degrees	45	1.00	degrees	45	
N/A	Date	12/22/23	1.00	Date	12/22/23	
Biological Process - PBNR: Main						
Total SRT (anaerobic + anoxic + aerobic)	days	8.00	1.00	days	8.00	RTP includes secondary clarifier blanket in MCRT calculations
System pH		7.20	1.00		7.20	
Nitrifier Minimum Aerobic SRT (SRT_{min})	days	3.33	1.00	days	3.33	
Aerobic SRT	days	7.06	1.00	days	7.06	
Nitrification Safety Factor		2.12	1.00		2.12	
DO	mg/L	2.00	1.00	mg/L	2.00	
Temperature in the Biological Process	oC	13	1.00	oC	13	
SVI	mL/g	109	1.00	mL/g	109	
Biosolids Production Rates						
Net Yield (mg TSS/mg BOD_5)	mg/mg	0.85	1.00	lb/lb	0.85	
Volatile Fraction	%	87%	1.00	%	87%	
Active Fraction	%	43%	1.00	%	43%	
Nitrifier Fraction	%	2%	1.00	%	2%	
Nitrogen Content, N/VSS	%	5%	1.00	%	5%	
Phosphorus Content, P/VSS	%	1%	1.00	%	1%	
Process Oxygen Requirements - Minus MBR Tank (if used)						
Carbonaceous AOR/BOD5 - wt/wt	kg/kg	1.19	1.00	lb/lb	1.19	
Total AOR/BOD% - wt/wt	kg/kg	1.64	1.00	lb/lb	1.64	
AOR (wt/day)	kg/day	1,169	0.45	lb/day	2,578	
AOR	mg/L-hr	33	1.00	mg/L-hr	33	
Bioreactor With Secondary Clarifier		1				
Total Bioreactor Volume	m3	1,495	3,785.44	MG	0.3950	2
HRT	hr	13.18	1.00	hr	13.18	
% non-aerobic	%	12%	1.00		12%	
% aerobic	%	88%	1.00		88%	
Average MLSS Concentration	mg/L	3,320	1.00	mg/L	3,320	
No Media Reactors Included AKI K1/K3						
Bulk Specific Surface Area (Biofilm Active)	m2/m3	No Media	3.28	ft2/ft3	No Media	
Bulk Liquid Volume Displacement	-	No Media	1.00	-	No Media	
Allow Biofilm Carriers to Flow Between Unit Processes? No						
Bioreactor Clarifier						
Total Area	m2	365	0.09	sq.ft.	3,927	2
Overflow Rate	m/day	7	0.04	gpd-sq.ft.	183	
Estimated Peak Overflow Rate	m/day	15	0.04	gpd-sq.ft.	357	
Effluent TSS	mg/L	6	1.00	mg/L	5.5	Assumed same value as callib. Jan 2021
Underflow Rate						
Average Flow Ratio	%	115%	1.00		115%	RAS flow/Influent flow
Average Rate	m/day	9	0.04	gpd-sq.ft.	211	RAS at firm capacity
RAS Concentration	mg/L			mg/L		
Average		5,970	1.00		5,970	
Diurnal Peak (From Solids Flux)		5,625	1.00		5,625	
Solids Loading Rate	kg/m2-day	119	4.88	lb/day-sq.ft.	24	
Estimated Peak Solids Loading Rate (from Solid Flux Sheet)	kg/m2-day	117	4.88	lb/day-sq.ft.	24	
Estimated Limiting Solids Loading Rate	kg/m2-day	218	4.88	lb/day-sq.ft.	45	
Estimated Peak Limitied Solids Loading Rate (from Solid Flux Sheet)	kg/m2-day	249	4.88	lb/day-sq.ft.	51	
Return sludge rate at which limiting solids rate can be achieved						
RAS Flow Rate	m3/day	#NULL!	3,785.00	MGD	#NULL!	
Percent of Influent to Bioreactor	%	#NULL!		%	#NULL!	
No Membrane Bioreactor Selected GE/Zenon						
Calculate Based on Flux or # of Modules? Flux	lmh	27	1.70	gfd	16	
Design Membrane Net Flux Rate	lmh	27.10	1.70	gfd	16	
Minimum Required Membrane Area	m2	4,031	10.76	ft2	43,391	
Membrane Module Area	m2	34	10.76	ft2	370	
Number of Modules		117			117	
Air Rate per Module	Nm3/hr	3	1.70	scfm	2.03	
Percent of Time Membrane Air Scour is on		100%			100%	
Total Membrane Air Scour Rate	Nm3/hr	404	1.70	scfm	238	
Force MBR DO to Match Air Rate? No						
Effluent TSS	mg/L	1.00	1.00	mg/L	1.00	
Chemical Compound Applied before Secondary Clarifier		2				
Chemical Added? No						
Chemical Type		Ferric Chloride	1.00		Ferric Chloride	
Chemical Dosage (as chemical)	kg/day	91	0.45	lb/day	200	
Chemical Dosage (mg chemical/L treated)	mg/L	N/A	1.00	mg/L	N/A	
Molar Ratio Dosage Applied (M+:PO4-P)		2	1.00		N/A	
Effluent PO4-P	kg/day	10	0.45	lb/day	N/A	
Effluent PO4-P	mg/L	3.92	1.00	mg/L	N/A	
Aerobic Digestion: Dig						
Aerobic Digestion? Yes		TRUE				
Volume	m3	189	3,785.00	MG	0.05	
SRT (Days)	day	10.00	1.00	day	10.00	Current aerobic digester SRT = 8 days
Temperature in the Aerobic Digester	o C	27		o C	27	
Estimated Temperature in Aerobic Digester	o C	19		o C	19	
DO during Aerobic Phase (mg/L)	mg-O2/l	2.00	1.00	mg-O2/l	2.00	
% denitrification	%	50%	1.00	%	50%	
Anoxic Cycle Time	hrs/day	8.00	1.00	hrs/day	8.00	
Average DO in Digester (mg/L)	mg-O2/L	1.33	1.00	mg-O2/L	1.33	
Volatile Solids Loading - wt VSS/vol-day	kg/(m3-day)	1.72	16.06	lb/ft3-day	0.11	
Volatile Solids Reduction	%	29.25%	1.00	%	29.25%	
Total Solids Reduction	%	28.20%	1.00	%	28.20%	
Influent Solids Concentration	%	0.60%		%	0.60%	
Effluent Solids Concentration	%	1.43%		%	1.43%	
Is alkalinity limiting in the aerobic digester?		yes			yes	
SOUR mg-O2/(g-VSS.hour) at 20 oC	mg/(g-hour)	2.30	1.00	mg/(g-hour)	2.30	
SOUR mg-O2/(g-TSS.hour) at 20 oC	mg/(g-hour)	1.96	1.00	mg/(g-hour)	1.96	
Decanting Make sure the Aerobic Digester on the PFD has a decant stream coming off it!						
Is Decanting being done? Yes		TRUE				
Digester HRT	days	3.00	1.00	days	3.00	
Target SRT	days	10.00	1.00	days	10.00	
Average Decant Flow	m3/d	73.63	0.00	GPD	19,454	
Average Decant Effluent TSS	mg/L	500	1.00	mg/L	500	

Mass Balance for Phase 1A Maximum Month Conditions at 12.5 deg-C in Plug-Flow Mode

Constituent	Raw Wastewater (RW)	Dig Aerobic Digester Decant (ADD)	Main Recycle Influent (Recyl)	Main Recycled Stream (Recycle)	Main Combined Recycle Effluent (RecyE)	Main Bioreactor Influent (BI)	Main Secondary Clarifier Influent (SI)	Main Secondary Clarifier Effluent (SE)	Plant Effluent (PLE)	Main WAS	Dig Aerobic Digester Influent (ADI)	Dig Aerobic Digester Effluent (ADE)	Biosolids to Disposal
Flow (gallons/day)	700,000	19,452	700,000	19,452	719,452	719,452	1,546,822	692,635	692,635	26,817	26,817	7,365	7,365
Carbonaceous BOD$_5$ (lbs/day)	1,555	13	1,555	13	1,568	1,568	18,720	16	16	587	587	136	136
Particulate	971	0	971	0	971	971	628	0	0	20	20	0	0
Heterotrophs	183	12	183	12	194	194	17,344	13	13	544	544	127	127
Methanol Degraders	1	0	1	0	1	1	29	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	652	0	0	20	20	7	7
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	1	1	57	0	0	2	2	1	1
PHA	0	0	0	0	0	0	5	0	0	0	0	0	0
Filtrate	397	0	397	0	397	397	5	2	2	0	0	0	0
COD (lbs/day)	3,659	105	3,659	105	3,764	3,764	53,406	225	225	1,670	1,670	1,081	1,081
Particulate Bio	1,745	0	1,745	0	1,745	1,745	1,129	1	1	35	35	0	0
Particulate Non-Bio	379	34	379	34	414	414	12,876	10	10	404	404	370	370
Decay Prod Aer/Anx	184	49	184	49	233	233	14,533	11	11	456	456	525	525
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotrophs	246	16	246	16	262	262	23,345	17	17	732	732	171	171
Methanol Degraders	1	0	1	0	1	1	38	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	957	1	1	30	30	11	11
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	2	2	105	0	0	3	3	2	2
PHA	0	0	0	0	0	0	7	0	0	0	0	0	0
Soluble Bio	344	0	344	0	344	344	10	5	5	0	0	0	0
VFA	132	0	132	0	132	132	0	0	0	0	0	0	0
Colloidal Bio	317	0	317	0	317	317	0	0	0	0	0	0	0
Soluble Non-Bio	183	5	183	5	188	188	404	181	181	7	7	2	2
Colloidal Non-Bio	123	0	123	0	123	123	0	0	0	0	0	0	0
TSS (lbs/day)	1,924	81	1,924	81	2,005	2,005	42,614	32	32	1,337	1,337	879	879
Biodegradable	1,257	0	1,257	0	1,257	1,257	815	1	1	26	26	0	0
Non-Biodegradable	284	26	284	26	310	310	9,643	7	7	303	303	277	277
Inorganic Particles	37	3	37	3	41	41	1,270	1	1	40	40	36	36
Decay Prod Aer/Anx	144	38	144	38	182	182	11,372	8	8	357	357	411	411
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Hydroxide	4	0	4	0	4	4	138	0	0	4	4	4	4
Metal Absorbed Phosphate	0	0	0	0	0	0	150	0	0	5	5	4	4
Heterotrophs	192	12	192	12	205	205	18,267	14	14	573	573	134	134
Methanol Degraders	1	0	1	0	1	1	30	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	749	1	1	23	23	8	8
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	1	1	82	0	0	3	3	2	2
PHA	0	0	0	0	0	0	4	0	0	0	0	0	0
Poly-P	0	0	0	0	1	1	94	0	0	3	3	2	2
VSS (lbs/day)	1,732	69	1,732	69	1,801	1,801	36,901	28	28	1,158	1,158	750	750
Biodegradable	1,156	0	1,156	0	1,156	1,156	733	1	1	23	23	0	0
Non-Biodegradable	267	23	267	23	290	290	8,679	6	6	272	272	249	249
Decay Prod Aer/Anx	130	34	130	34	164	164	10,235	8	8	321	321	370	370
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Hydroxide	1	0	1	0	1	1	35	0	0	1	1	1	1
Heterotrophs	173	11	173	11	184	184	16,440	12	12	516	516	120	120
Methanol Degraders	1	0	1	0	1	1	27	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	674	1	1	21	21	7	7
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	1	1	74	0	0	2	2	2	2
PHA	0	0	0	0	0	0	4	0	0	0	0	0	0
TKN (lbs/day)	346	9	346	9	355	355	2,813	15	15	88	88	62	62
NH$_3$-N (lbs-N/day)	225	3	225	3	228	228	4	2	2	0	0	1	1
Particulate Bio Org N	50	0	50	0	50	50	33	0	0	1	1	0	0
Non-Bio Part Org N	11	2	11	2	13	13	391	0	0	12	12	18	18
Decay Prod Aer/Anx	11	3	11	3	14	14	880	1	1	28	28	32	32
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotrophs	15	1	15	1	16	16	1,414	1	1	44	44	10	10

Methanol Degraders	0	0	0	0	0	0	2	0	0	0	0	0	0
AOBs	0	0	0	0	0	0	58	0	0	2	2	1	1
NOBs	0	0	0	0	0	0	0	0	0	0	0	0	0
PAOs	0	0	0	0	0	0	6	0	0	0	0	0	0
Non-Bio Soluble Org. N	11	0	11	0	11	11	24	11	11	0	0	0	0
Non-Bio Colloidal Org. N	4	0	4	0	4	4	0	0	0	0	0	0	0
Soluble Bio Org N	10	0	10	0	10	10	0	0	0	0	0	0	0
Colloidal Bio Org N	9	0	9	0	9	9	0	0	0	0	0	0	0
NO_2-N (lbs-N/day)	0	0	0	0	0	0	0	0	0	0	0	0	0
NO_3-N (lbs-N/day)	0	9	0	9	9	9	161	72	72	3	3	4	4
Total Nitrogen (lbs-N/day)	346	18	346	18	364	364	2,974	87	87	91	91	66	66
TP (lbs-P/day)	47	8	47	8	54	54	1,012	23	23	31	31	23	23
Bio Particulate	12	0	12	0	12	12	6	0	0	0	0	0	0
Non-Bio Particulate	3	0	3	0	3	3	97	0	0	3	3	5	5
Decay Prod Aer/Anx	4	1	4	1	5	5	291	0	0	9	9	11	11
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Absorbed	0	0	0	0	0	0	49	0	0	2	2	1	1
Heterotrophs	5	0	5	0	5	5	467	0	0	15	15	3	3
Methanol Degraders	0	0	0	0	0	0	1	0	0	0	0	0	0
AOBs	0	0	0	0	0	0	19	0	0	1	1	0	0
NOBs	0	0	0	0	0	0	0	0	0	0	0	0	0
PAOs	0	0	0	0	0	0	2	0	0	0	0	0	0
Poly-P	0	0	0	0	0	0	29	0	0	1	1	1	1
Ortho-PO4	24	6	24	6	29	29	51	23	23	1	1	2	2
Alkalinity (lbs/day as $CaCO_3$)	1,500	0	1,500	0	1,500	1,500	1,234	553	553	21	21	0	0
H_2S (lbs/day)	35	0	35	0	35	35	0	0	0	0	0	0	0
Temperature (^oC)	13	27	13	27	13	13	13	13	13	13	13	27	27
BOD_5 (mg/L)	266	77	266	77	261	261	1,450	3	3	2,624	2,624	2,205	2,205
COD (mg/L)	626	645	626	645	627	627	4,137	39	39	7,460	7,460	17,590	17,590
TSS (mg/L)	329	500	329	500	334	334	3,301	6	6	5,973	5,973	14,297	14,297
VSS (mg/L)	296	427	296	427	300	300	2,859	5	5	5,173	5,173	12,199	12,199
TKN (mg-N/L)	59	55	59	55	59	59	218	3	3	393	393	1,009	1,009
NH_3-N (mg-N/L)	39	19	39	19	38	38	0	0	0.3	0	0	19	19
NO_2-N (mg/L)	0	0	0	0	0	0	0	0	0	0	0	0	0
NO_3-N (mg-N/L)	0	57	0	57	2	2	12	12	12	12	12	57	57
Total Nitrogen (mg/L)	59	112	59	112	61	61	230	15	15	405	405	1,363	1,363
TP (mg-P/L)	8	47	8	47	9	9	78	4	4	139	139	380	380
Alkalinity (mg/L as $CaCO_3$)	257	0	257	0	250	250	96	96	96	96	96	0	0
H_2S (mg/L)	6	0	6	0	6	6	0	0	0	0	0	0	0

PBNRMain Plant | Pro2D2 Process Design System | 12/22/2023 3:49 PM
Pro2D2_1_08_Ridgefield_Plug-Flow_WWMM_Phase1A_12degC.xlsm

Select Operating Units for Physical Plant Definition	
Metric (M) or US (U)	U

Biological Model	#N/A
Standard	No

Aeration Data		
Aeration Basin Side Water Depth	12	feet
Maximum Water Temperature:	12.89	°C
BETA Correctional Factor:	0.95	
Plant Altitude:	50	feet

Definition of the Physical Plant		
How many reactors (up to 42)	7	
Solids Retention Time (SRT)	8.00	Days
Average Total Flow Rate (not incl OtherInf)	0.72	mgd
RAS Ratio (% of Plant Influent)	115%	
	0.83	mgd
Waste Loc: (A)ll Reactors, Clarifier (U)/F or Reactor #	U	

PRO2D2	
% Aerobic	88%
% Anoxic	12%
Nitrification S.F.	2.12
Total Volume gallons	395,000
RAS Return DO - mg/L	0.00

Est. Diffuser Design (Sanitaire Membranes)		
Design Condition	Ave	
Est. Diffuser Air Rate	1.5	scfm/diffuser
Peaking Capability	267%	
Estimated SOTE	22%	

System Configuration — Reactor — **ERROR - The Number of Reactors in Cell F6 does not match the number of reactors with Volume data entered in Row 16**

Component	Units	TOTAL	#1	#2	#3	#4	#5	#6	#7	#N/A	#N/A	#N/A
Reactor Volume	gallons	395,000	23,500	23,500	116,000	116,000	116,000					
Fraction	% of Total		6%	6%	29%	29%	29%	0%	0%	0%	0%	0%
O_2 Specification Method			DO	DO	DO	DO	DO	DO	DO	DO	DO	DO
DO or Ammonia (Dyn ABAC) or Air Rate or AOR	mg/L or lbs/hr or scfm		0.00	0.00	2.00	2.00	2.00					
Oxygen Mass Transfer, Kla (ASMN)	1/day		1	1	384	266	153	1	1	1	1	1
Empty Bed Media Fill Fraction	dimensionless											
Biofilm Density	g COD/m3											
Biofilm Thickness	microns											
External Diffusion Layer Thickness	microns											
Number of Biofilm Layers (for Dynamics)	#											
Net Specific Surface Area	m2/m3		No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media
Net Liquid Volume Displacement	%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bulk Liquid Volume	gallons	395,000	23,500	23,500	116,000	116,000	116,000	0	0	0	0	0
Reactor Feed												
Raw Feed	% of Total	100%	100%									
RAS	% of Total RAS	100%	100%									
Recirculation	% of Raw Feed		100%									
From Reactor	(Enter Number)		#5									

Appendix D - Process Calculations

Pro2D2 Process Design System

Summary Information					
Total MLSS Inventory	**10,943** lbs		Total COD Removed	3,538 lbs/day	
Total MLVSS Inventory	9,475 lbs		Food Applied to MLSS Inventory Ratio	0.27 COD/MLSS	
MIxed Liquor VSS	87%		<u>Aeration Information</u>		
Total Required WAS Rate	**1,368** lbs MLSS/day		Total AOR	2,578 lbs O2/day	
or	1,184 lbs MLVSS/day		Total SOR	7,220 lbs O2/day	
Observed Mass Yield	0.87 lbs MLSS/lb BOD		Total Required Air Rate	1,135 scfm	

Standard Model Component Concentrations			Feed	RAS	#1	#2	#3	#4	#5	#6	#7
Enter Reactor Number to use this Column of Data for the Original Guess					1	2	3	4	5	6	7
S_{O2}	Dissolved Oxygen	mg O_2/L	0.00	0.00	0.01	0.00	2.00	2.00	2.00	2.00	2.00
S_F	Soluble Fermentable Substrates	mg COD/L	57.28	0.78	6.97	2.68	1.10	0.82	0.78	0.78	0.78
S_A	Soluble Fermentation Products	mg COD/L	21.94	0.02	2.61	1.23	0.11	0.03	0.02	0.02	0.02
S_I	Soluble Inerts	mg COD/L	31.32	31.32	31.32	31.32	31.32	31.32	31.32	31.32	31.32
S_{NH4}	Soluble Ammonia N	mg N/L	37.98	0.31	12.28	12.43	6.44	1.85	0.31	0.31	0.31
S_{N2}	Dissolved Nitrogen Gas	mg N/L	0	31	26	29	30	30	31	31	31
S_{NO3}	Soluble Nitrate/Nitrite N	mg N/L	1.55	12.47	4.52	1.73	6.92	11.08	12.47	12.47	12.47
S_{PO4}	Soluble Inorganic Phosphorus	mg P/L	4.90	3.92	4.16	4.18	3.96	3.89	3.92	3.92	3.92
S_{ALK}	Alkalinity	moles/m^3	5.00	1.91	3.29	3.52	2.75	2.12	1.91	1.91	1.91
X_I	Inert Particulates	mg COD/L	69	1,805	997	997	997	997	997	997	997
X_S	Slowly Biodegradable Substrate	mg COD/L	364	158	196	193	145	111	87	87	87
X_H	Heterotrophic Organisms	mg COD/L	44	3,272	1,789	1,790	1,805	1,810	1,808	1,808	1,808
X_{PAO}	Phosphate Accumulating Organisms	mg COD/L	0	15	8	8	8	8	8	8	8
X_{PP}	Polyphosphate	mg P/L	0.03	4.09	2.15	2.12	2.16	2.21	2.26	2.26	2.26
X_{PHA}	PAO Storage Products	mg COD/L	0.03	1.05	0.74	0.83	0.76	0.67	0.58	0.58	0.58
X_{AUT}	Autotrophic Organisms	mg COD/L	1	134	73	73	73	74	74	74	74
X_{ISS}	Inorganic Particles	mg/L	7	178	98	98	98	98	98	98	98
X_{MeOH}	Metal Hydroxides	mg/L	1	0	0	0	0	0	0	0	0
X_{MeP}	Metal Phosphates	mg/L	0	37	20	20	20	20	20	20	20
S_M	Methanol	mg COD/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
X_{M1}	Group 1 Methanol Degraders	mg COD/L	0	1	1	1	1	1	1	1	1
X_{M2}	Group 2 Methanol Degraders	mg COD/L	0	4	2	2	2	2	2	2	2
X_E	Aerobic/Anoxic Decay Products	mg COD/L	39	2,037	1,114	1,115	1,119	1,122	1,126	1,126	1,126
	MLSS	**mg/L**	**387**	**5,970**	**3,352**	**3,350**	**3,332**	**3,315**	**3,299**	**3,299**	**3,299**
	MLVSS	mg/L	342	5,168	2,904	2,902	2,886	2,870	2,856	2,856	2,856
	Oxygen Uptake Rate	mg O_2/(L-hr)			3	1	45	37	24	24	24
	Nitrate Uptake Rate	mg NO_3-N/(L-day)			434	271	19	17	14	14	14
	Ammonia Uptake Rate	mg NH_4-N/(L-day)			-1	-14	117	90	30	30	30
			Alkalinity Limited?								
Reactor Information											
	Active Reactor Volume	gallons		395,000	23,500	23,500	116,000	116,000	116,000	0	0
	Reactor Sidewater Depth	feet		12	12	12	12	12	12	12	12
	AOR, Biological	lbs O2/day			12	6	1,049	862	559	0	0
	AOR, H2S	lbs O2/day		70	0	0	70	0	0	0	0
	AOR, Liquid	lbs O2/day			0	0	38	0	0	0	0
	Total AOR	lbs O2/day			0	0	1,157	862	559	0	0
	Aeration Alpha Value				0.81	0.82	0.55	0.59	0.67	0.67	0.67
	Fouling Factor				0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Alpha F				0.65	0.65	0.44	0.47	0.53	0.53	0.53
	Oxygen Concentration in Supplied Gas	Volume Percent			21%	21%	21%	21%	21%	21%	21%
	Oxygen Concentration in Supplied Gas	Mass Percent			23%	23%	23%	23%	23%	23%	23%
	Nitrogen Concentration in Supplied Gas	Volume Percent			78%	78%	78%	78%	78%	78%	78%
	CO2 Concentration in Supplied Gas	Volume Percent			0.00%	0.00%	0.04%	0.04%	0.04%	0.04%	0.04%
	Argon Concentration in Supplied Gas	Volume Percent			0.93%	0.93%	0.93%	0.93%	0.93%	0.93%	0.93%
	Standard Density of Supplied Gas	lbs/ft3			0.0752	0.0752	0.0752	0.0752	0.0752	0.0752	0.0752
	SOR/AOR Ratio				0.00	0.00	2.98	2.77	2.46	0.00	0.00
	SOR	lbs O2/day			0	0	3,452	2,391	1,377	0	0
	Number of Diffusers	Total		896	0	0	428	297	171	0	0
	SOTE				0%	0%	26%	25%	24%	0%	0%
	Required Air Rate	SCFM	Min Mixing		0	0	532	377	225	0	0
	Required Mixing Air @ 0.12 scfm/ft2	SCFM	0.12	scfm/ft2	0	0	155	155	155	0	0
	Max Air per Tank at Design Condition	SCFM			239	239	1,182	1,182	1,182	0	0
	Is Required Diffuser Density Too High?										
Flow Balance											
	Raw Feed into Reactor	mgd	0.72		0.72						
	Flow from Previous Reactor	mgd				2.27	2.27	2.27	2.27	1.55	1.55
	Recirculation Into Reactor	mgd			0.72						
	From Reactor				(5)	(0)	(0)	(0)	(0)	(0)	(0)
	RAS Into Reactor	mgd		0.83	0.83						
	Other Flows Into Reactor	mgd	0.00								
	Effluent From Reactor	mgd			2.27	2.27	2.27	2.27	1.55	1.55	1.55
	Waste Activated Sludge	mgd		0.0275							

Facility Operating Parameters						Project
Item		**Value**			**Value**	**Notes**
Influent Wastewater	(Metric)	(Metric)	(Metric=US*k)	(US)	(US)	
Flow	m3/day			MG/day		
Average		2,650	3,785.44		0.70	Phase 1A MM Projection
Carbonaceous Five-Day Biochemical Oxygen Demand (CBOD5)						
Design Average Concentration	mg/L	266	1.00	mg/L	266	
Design Average Mass Loading	kg/day	705	0.45	lb/day	1,555	Phase 1A MM Projection
Total Suspended Solids (TSS)						
Design Average Concentration	mg/L	329	1.00	mg/L	329	
Design Average Mass Loading	kg/day	873	0.45	lb/day	1,924	Phase 1A MM Projection
Volatile Suspended Solids (VSS)						
Percent VSS	%	90%	1.00	%	90%	
Design Average Concentration	mg/L	296	1.00	mg/L	296	
Design Average Mass Loading	kg/day	785	0.45	lb/day	1,732	
Total Kjeldahl Nitrogen (TKN as N)						
Design Average Concentration	mg/L	59	1.00	mg/L	59	
Design Average Mass Loading	kg/day	157	0.45	lb/day	346	Assuming TKN = 0.65*NH3
Ammonia-Nitrogen (NH3-N as N)						
Design Average Concentration	mg/L	39	1.00	mg/L	39	
Design Average Mass Loading	kg/day	102	0.45	lb/day	225	Phase 1A MM Projection
Total Phosphorus (as P)						
Design Average Concentration	mg/L	8	1.00	mg/L	8	
Design Average Mass Loading	kg/day	21	0.45	lb/day	47	
Alkalinity (as CaCO3)						
Design Average Concentration	mg/L	257	1.00	mg/L	257	
Design Average Mass Loading	kg/day	680	0.45	lb/day	1,500	
Hydrogen Sulfide (H2S)						
Design Average Concentration	mg/L	6	1.00	mg/L	6	
Design Average Mass Loading	kg/day	16	0.45	lb/day	35	
Chemical Addition:						
Select the Metal Salt (if used) — **Ferric Chloride**				2		
Wastewater Temperature						
Raw Sewage Temperature	oC	25	1.00	oC	25	
Plant Elevation	meters	15	3.28	feet	50	
Ambient Atmospheric Pressure	kPa	101	6.89	psia	14.6694	
Is the Temperature Model Used? — **No**						
N/A	oC	21	Special	oF	70	
N/A	kph	8	0.62	mph	5	
N/A	%	60%	1.00	%	60%	
N/A	%	50%	1.00	%	50%	
N/A	degrees	45	1.00	degrees	45	
N/A	Date	12/22/23	1.00	Date	12/22/23	
Biological Process - PBNR: Main						
Total SRT (anaerobic + anoxic + aerobic)	days	8.00	1.00	days	8.00	RTP includes secondary clarifier blanket in MCRT calculations
System pH		7.20	1.00		7.20	
Nitrifier Minimum Aerobic SRT (SRT_{min})	days	1.21	1.00	days	1.21	
Aerobic SRT	days	7.07	1.00		7.07	
Nitrification Safety Factor		5.85	1.00		5.85	
DO	mg/L	2.00	1.00	mg/L	2.00	
Temperature in the Biological Process	oC	25	1.00	oC	25	
SVI	mL/g	109	1.00	mL/g	109	
Biosolids Production Rates						
Net Yield (mg TSS/mg BOD_5)	mg/mg	0.83	1.00	lb/lb	0.83	
Volatile Fraction	%	82%	1.00	%	82%	
Active Fraction	%	36%	1.00	%	36%	
Nitrifier Fraction	%	2%	1.00	%	2%	
Nitrogen Content, N/VSS	%	5%	1.00	%	5%	
Phosphorus Content, P/VSS	%	3%	1.00	%	3%	
Process Oxygen Requirements - Minus MBR Tank (if used)						
Carbonaceous AOR/BOD5 - wt/wt	kg/kg	1.27	1.00	lb/lb	1.27	
Total AOR/BOD% - wt/wt	kg/kg	1.76	1.00	lb/lb	1.76	
AOR (wt/day)	kg/day	1,248	0.45	lb/day	2,752	
AOR	mg/L-hr	35	1.00	mg/L-hr	35	
Bioreactor — **With Secondary Clarifier**		1				
Total Bioreactor Volume	m3	1,495	3,785.44	MG	0.3950	2
HRT	hr	13.18	1.00	hr	13.18	
% non-aerobic	%	12%	1.00		12%	
% aerobic	%	88%	1.00		88%	
Average MLSS Concentration	mg/L	3,230		mg/L	3,230	
No Media Reactors Included — **AKI K1/K3**						
Bulk Specific Surface Area (Biofilm Active)	m2/m3	No Media	3.28	ft2/ft3	No Media	
Bulk Liquid Volume Displacement	-	No Media	1.00	-	No Media	
Allow Biofilm Carriers to Flow Between Unit Processes? — **No**						
Bioreactor Clarifier						
Total Area	m2	365	0.09	sq.ft.	3,927	2
Overflow Rate	m/day	7	0.04	gpd-sq.ft.	183	
Estimated Peak Overflow Rate	m/day	7	0.04	gpd-sq.ft.	178	
Effluent TSS	mg/L	6	1.00	mg/L	5.5	5-20 mg/L
Underflow Rate						
Average Flow Ratio	%	115%	1.00		115%	RAS flow/Influent flow
Average Rate	m/day	9	0.04	gpd-sq.ft.	211	
RAS Concentration	mg/L			mg/L		
Average		5,830	1.00		5,830	
Diurnal Peak (From Solids Flux)		4,351	1.00		4,351	
Solids Loading Rate	kg/m2-day	116	4.88	lb/day-sq.ft.	24	
Estimated Peak Solids Loading Rate (from Solid Flux Sheet)	kg/m2-day	91	4.88	lb/day-sq.ft.	19	
Estimated Limiting Solids Loading Rate	kg/m2-day	218	4.88	lb/day-sq.ft.	45	
Estimated Peak Limitied Solids Loading Rate (from Solid Flux Sheet)	kg/m2-day	249	4.88	lb/day-sq.ft.	51	
Return sludge rate at which limiting solids rate can be achieved						
RAS Flow Rate	m3/day	#NULL!	3,785.00	MGD	#NULL!	
Percent of Influent to Bioreactor	%	#NULL!		%	#NULL!	
No Membrane Bioreactor Selected — **GE/Zenon**						
Calculate Based on Flux or # of Modules? — **Flux**	lmh	30	1.70	gfd	18	
Design Membrane Net Flux Rate	lmh	30.40	1.70	gfd	18	
Minimum Required Membrane Area	m2	3,593	10.76	ft2	38,677	
Membrane Module Area	m2	34	10.76	ft2	370	
Number of Modules		105			105	
Air Rate per Module	Nm3/hr	3	1.70	scfm	2.03	
Percent of Time Membrane Air Scour is on		100%			100%	
Total Membrane Air Scour Rate	Nm3/hr	362	1.70	scfm	213	
Force MBR DO to Match Air Rate? — **No**						
Effluent TSS	mg/L	1.00	1.00	mg/L	1.00	
Chemical Compound Applied before Secondary Clarifier		2				
Chemical Added? — **No**						
Chemical Type		Ferric Chloride	1.00		Ferric Chloride	
Chemical Dosage (as chemical)	kg/day	91	0.45	lb/day	200	
Chemical Dosage (mg chemical/L treated)	mg/L	N/A	1.00	mg/L	N/A	
Molar Ratio Dosage Applied (M+:PO4-P)		3	1.00		N/A	
Effluent PO4-P	kg/day	4	0.45	lb/day	N/A	
Effluent PO4-P	mg/L	1.71	1.00	mg/L	N/A	
Aerobic Digestion: Dig						
Aerobic Digestion? — **Yes**		TRUE				
Volume	m3	189	3,785.00	MG	0.05	
SRT (Days)	day	10.00	1.00	day	10.00	
Temperature in the Aerobic Digester	o C	27		o C	27	
Estimated Temperature in Aerobic Digester	o C	25		o C	25	
DO during Aerobic Phase (mg/L)	mg-O2/l	2.00	1.00	mg-O2/l	2.00	
% denitrification	%	50%	1.00	%	50%	
Anoxic Cycle Time	hrs/day	8.00	1.00	hrs/day	8.00	
Average DO in Digester (mg/L)	mg-O2/L	1.33	1.00	mg-O2/L	1.33	
Volatile Solids Loading - wt VSS/vol-day	kg/(m3-day)	1.60	16.06	lb/ft3-day	0.10	
Volatile Solids Reduction	%	24.07%	1.00	%	24.07%	
Total Solids Reduction	%	23.36%	1.00	%	23.36%	
Influent Solids Concentration	%	0.58%		%	0.58%	
Effluent Solids Concentration	%	1.49%		%	1.49%	
Is alkalinity limiting in the aerobic digester?		yes			yes	
SOUR mg-O2/(g-VSS.hour) at 20 oC	mg/(g-hour)	1.76	1.00	mg/(g-hour)	1.76	
SOUR mg-O2/(g-TSS.hour) at 20 oC	mg/(g-hour)	1.44	1.00	mg/(g-hour)	1.44	
Decanting — Make sure the Aerobic Digester on the PFD has a decant stream coming off it!						
Is Decanting being done? — **Yes**		TRUE				
Digester HRT	days	3.00	1.00	days	3.00	
Target SRT	days	10.00	1.00	days	10.00	
Average Decant Flow	m3/d	73.20	0.00	GPD	19,339	
Average Decant Effluent TSS	mg/L	500	1.00	mg/L	500	

Mass Balance for Phase 1A Maximum Month Conditions at 25 deg-C in Complete-Mix Mode

Constituent	Raw Wastewater (RW)	Dig Aerobic Digester Decant (ADD)	Main Recycle Influent (Recyl)	Main Recycled Stream (Recycle)	Main Combined Recycle Effluent (RecyE)	Main Bioreactor Influent (BI)	Main Secondary Clarifier Influent (SI)	Main Secondary Clarifier Effluent (SE)	Plant Effluent (PLE)	Main WAS	Dig Aerobic Digester Influent (ADI)	Dig Aerobic Digester Effluent (ADE)	Biosolids to Disposal
Flow (gallons/day)	700,000	19,336	700,000	19,336	719,337	719,337	1,546,574	692,640	692,640	26,697	26,697	7,360	7,360
Carbonaceous BOD_5 (lbs/day)	1,555	11	1,555	11	1,566	1,566	14,969	14	14	468	468	126	126
Particulate	971	0	971	0	971	971	485	0	0	15	15	0	0
Heterotrophs	183	8	183	8	191	191	12,567	10	10	393	393	92	92
Methanol Degraders	1	0	1	0	1	1	27	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	545	0	0	17	17	6	6
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	2	1	2	3	3	1,210	1	1	38	38	25	25
PHA	0	0	0	0	0	0	130	0	0	4	4	3	3
Filtrate	397	0	397	0	397	397	5	2	2	0	0	0	0
COD (lbs/day)	3,659	100	3,659	100	3,759	3,759	49,696	223	223	1,547	1,547	1,078	1,078
Particulate Bio	1,745	0	1,745	0	1,745	1,745	872	1	1	27	27	0	0
Particulate Non-Bio	379	33	379	33	412	412	12,873	10	10	402	402	370	370
Decay Prod Aer/Anx	184	46	184	46	231	231	15,364	12	12	480	480	523	523
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotrophs	246	11	246	11	257	257	16,914	13	13	528	528	124	124
Methanol Degraders	1	0	1	0	1	1	37	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	800	1	1	25	25	9	9
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	4	1	4	6	6	2,231	2	2	70	70	46	46
PHA	0	0	0	0	1	1	191	0	0	6	6	4	4
Soluble Bio	344	0	344	0	344	344	10	4	4	0	0	0	0
VFA	132	0	132	0	132	132	1	0	0	0	0	0	0
Colloidal Bio	317	0	317	0	317	317	0	0	0	0	0	0	0
Soluble Non-Bio	183	5	183	5	188	188	404	181	181	7	7	2	2
Colloidal Non-Bio	123	0	123	0	123	123	0	0	0	0	0	0	0
TSS (lbs/day)	1,924	81	1,924	81	2,005	2,005	41,606	32	32	1,300	1,300	915	915
Biodegradable	1,257	0	1,257	0	1,257	1,257	629	0	0	20	20	0	0
Non-Biodegradable	284	24	284	24	309	309	9,640	7	7	301	301	277	277
Inorganic Particles	37	3	37	3	41	41	1,270	1	1	40	40	36	36
Decay Prod Aer/Anx	144	36	144	36	180	180	12,022	9	9	376	376	409	409
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Hydroxide	4	0	4	0	4	4	138	0	0	4	4	4	4
Metal Absorbed Phosphate	0	0	0	0	0	0	147	0	0	5	5	4	4
Heterotrophs	192	9	192	9	201	201	13,235	10	10	413	413	97	97
Methanol Degraders	1	0	1	0	1	1	29	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	626	0	0	20	20	7	7
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	3	1	3	4	4	1,746	1	1	55	55	36	36
PHA	0	0	0	0	0	0	114	0	0	4	4	3	3
Poly-P	0	4	0	4	4	4	2,009	2	2	63	63	42	42
VSS (lbs/day)	1,732	66	1,732	66	1,797	1,797	34,283	26	26	1,071	1,071	747	747
Biodegradable	1,156	0	1,156	0	1,156	1,156	566	0	0	18	18	0	0
Non-Biodegradable	267	22	267	22	289	289	8,676	7	7	271	271	249	249
Decay Prod Aer/Anx	130	32	130	32	162	162	10,820	8	8	338	338	368	368
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Hydroxide	1	0	1	0	1	1	35	0	0	1	1	1	1
Heterotrophs	173	8	173	8	181	181	11,911	9	9	372	372	87	87
Methanol Degraders	1	0	1	0	1	1	26	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	564	0	0	18	18	6	6
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	3	1	3	4	4	1,571	1	1	49	49	32	32
PHA	0	0	0	0	0	0	114	0	0	4	4	3	3
TKN (lbs/day)	346	7	346	7	353	353	2,581	15	15	80	80	59	59
NH_3-N (lbs-N/day)	225	2	225	2	227	227	5	2	2	0	0	1	1
Particulate Bio Org N	50	0	50	0	50	50	25	0	0	1	1	0	0
Non-Bio Part Org N	11	1	11	1	12	12	386	0	0	12	12	16	16
Decay Prod Aer/Anx	11	3	11	3	14	14	931	1	1	29	29	32	32
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotrophs	15	1	15	1	16	16	1,024	1	1	32	32	8	8

Methanol Degraders	0	0	0	0	0	0	2	0	0	0	0	0	0
AOBs	0	0	0	0	0	0	48	0	0	2	2	1	1
NOBs	0	0	0	0	0	0	0	0	0	0	0	0	0
PAOs	0	0	0	0	0	0	135	0	0	4	4	3	3
Non-Bio Soluble Org. N	11	0	11	0	11	11	24	11	11	0	0	0	0
Non-Bio Colloidal Org. N	4	0	4	0	4	4	0	0	0	0	0	0	0
Soluble Bio Org N	10	0	10	0	10	10	0	0	0	0	0	0	0
Colloidal Bio Org N	9	0	9	0	9	9	0	0	0	0	0	0	0
NO_2-N (lbs-N/day)	0	0	0	0	0	0	0	0	0	0	0	0	0
NO_3-N (lbs-N/day)	0	8	0	8	8	8	204	91	91	4	4	3	3
Total Nitrogen (lbs-N/day)	346	15	346	15	361	361	2,784	106	106	84	84	62	62
TP (lbs-P/day)	47	11	47	11	58	58	1,499	11	11	47	47	36	36
Bio Particulate	12	0	12	0	12	12	5	0	0	0	0	0	0
Non-Bio Particulate	3	0	3	0	3	3	96	0	0	3	3	4	4
Decay Prod Aer/Anx	4	1	4	1	5	5	307	0	0	10	10	10	10
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Absorbed	0	0	0	0	0	0	48	0	0	2	2	1	1
Heterotrophs	5	0	5	0	5	5	338	0	0	11	11	2	2
Methanol Degraders	0	0	0	0	0	0	1	0	0	0	0	0	0
AOBs	0	0	0	0	0	0	16	0	0	1	1	0	0
NOBs	0	0	0	0	0	0	0	0	0	0	0	0	0
PAOs	0	0	0	0	0	0	45	0	0	1	1	1	1
Poly-P	0	1	0	1	1	1	622	0	0	19	19	13	13
Ortho-PO4	24	8	24	8	32	32	22	10	10	0	0	3	3
Alkalinity (lbs/day as $CaCO_3$)	1,500	0	1,500	0	1,500	1,500	1,101	493	493	19	19	0	0
H_2S (lbs/day)	35	0	35	0	35	35	0	0	0	0	0	0	0
Temperature (^oC)	25	27	25	27	25	25	25	25	25	25	25	27	27
BOD_5 (mg/L)	266	69	266	69	261	261	1,160	2	2	2,099	2,099	2,050	2,050
COD (mg/L)	626	619	626	619	626	626	3,850	39	39	6,942	6,942	17,544	17,544
TSS (mg/L)	329	500	329	500	334	334	3,224	6	6	5,834	5,834	14,903	14,903
VSS (mg/L)	296	408	296	408	299	299	2,656	5	5	4,807	4,807	12,167	12,167
TKN (mg-N/L)	59	44	59	44	59	59	200	3	3	360	360	965	965
NH_3-N (mg-N/L)	39	10	39	10	38	38	0	0	0.4	0	0	10	10
NO_2-N (mg/L)	0	0	0	0	0	0	0	0	0	0	0	0	0
NO_3-N (mg-N/L)	0	49	0	49	1	1	16	16	16	16	16	49	49
Total Nitrogen (mg/L)	59	93	59	93	60	60	216	18	18	376	376	1,258	1,258
TP (mg-P/L)	8	67	8	67	10	10	116	2	2	209	209	581	581
Alkalinity (mg/L as $CaCO_3$)	257	0	257	0	250	250	85	85	85	85	85	0	0
H_2S (mg/L)	6	0	6	0	6	6	0	0	0	0	0	0	0

PBNRMain Plant | Pro2D2 Process Design System | 12/22/2023 3:59 PM
Pro2D2_1_08_Ridgefield_Complete-Mix_WWMM_Phase1A_25degC.xlsm

Select Operating Units for Physical Plant Definition	
Metric (M) or US (U)	U

Biological Model	#N/A
Standard	No

Aeration Data		
Aeration Basin Side Water Depth	12	feet
Maximum Water Temperature:	25.05	°C
BETA Correctional Factor:	0.95	
Plant Altitude:	50	feet

Definition of the Physical Plant		
How many reactors (up to 42)	3	
Solids Retention Time (SRT)	8.00	Days
Average Total Flow Rate (not incl OtherInf)	0.72	mgd
RAS Ratio (% of Plant Influent)	115%	
	0.83	mgd
Waste Loc: (A)ll Reactors, Clarifier (U)/F or Reactor #	U	

PRO2D2	
% Aerobic	88%
% Anoxic	12%
Nitrification S.F.	5.85
Total Volume gallons	395,000
RAS Return DO - mg/L	0.00

Est. Diffuser Design (Sanitaire Membranes)		
Design Condition	Ave	
Est. Diffuser Air Rate	1.5	scfm/diffuser
Peaking Capability	267%	
Estimated SOTE	22%	

System Configuration			Reactor									
Component	Units	TOTAL	#1	#2	#3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Reactor Volume	gallons	395,000	23,500	23,500	348,000							
Fraction	% of Total		6%	6%	88%	0%	0%	0%	0%	0%	0%	0%
O_2 Specification Method			DO	DO	DO	DO	DO	DO	DO	DO	DO	DO
DO or Ammonia (Dyn ABAC) or Air Rate or AOR	mg/L or lbs/hr or scfm		0.00	0.00	2.00							
Oxygen Mass Transfer, Kla (ASMN)	1/day		1	1	291	1	1	1	1	1	1	1
Empty Bed Media Fill Fraction	dimensionless											
Biofilm Density	g COD/m3											
Biofilm Thickness	microns											
External Diffusion Layer Thickness	microns											
Number of Biofilm Layers (for Dynamics)	#											
Net Specific Surface Area	m2/m3		No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media
Net Liquid Volume Displacement	%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bulk Liquid Volume	gallons	395,000	23,500	23,500	348,000	0	0	0	0	0	0	0
Reactor Feed												
Raw Feed	% of Total	100%	100%									
RAS	% of Total RAS	100%	100%									
Recirculation	% of Raw Feed		100%									
From Reactor	(Enter Number)		#3									
Temperature Model												
Target Mixing Intensity	hp/MG		50	50	0	0	0	0	0	0	0	0
Mixing Power	hp	2.35	1.18	1.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary Information					
Total MLSS Inventory	**10,646**	lbs	Total COD Removed	3,535	lbs/day
Total MLVSS Inventory	8,777	lbs	Food Applied to MLSS Inventory Ratio	0.27	COD/MLSS
MIxed Liquor VSS	82%		Aeration Information		
Total Required WAS Rate	**1,331**	lbs MLSS/day	Total AOR	2,752	lbs O2/day
or	1,097	lbs MLVSS/day	Total SOR	7,850	lbs O2/day
Observed Mass Yield	0.85	lbs MLSS/lb BOD	Total Required Air Rate	1,232	scfm

Standard Model Component Concentrations			Feed	RAS	#1	#2	#3	#N/A	#N/A	#N/A	#N/A
Enter Reactor Number to use this Column of Data for the Original Guess					1	2	3	4	5	6	7
S_{O2}	Dissolved Oxygen	mg O_2/L	0.00	0.00	0.00	0.00	2.00				
S_F	Soluble Fermentable Substrates	mg COD/L	57.29	0.75	6.33	2.00	0.75				
S_A	Soluble Fermentation Products	mg COD/L	21.94	0.07	3.10	7.65	0.07				
S_I	Soluble Inerts	mg COD/L	31.32	31.32	31.32	31.32	31.32				
S_{NH4}	Soluble Ammonia N	mg N/L	37.74	0.36	17.91	18.64	0.36				
S_{N2}	Dissolved Nitrogen Gas	mg N/L	0	29	23	24	29				
S_{NO3}	Soluble Nitrate/Nitrite N	mg N/L	1.32	15.79	1.50	0.08	15.79				
S_{PO4}	Soluble Inorganic Phosphorus	mg P/L	5.27	1.71	5.18	8.84	1.71				
S_{ALK}	Alkalinity	moles/m^3	5.00	1.71	3.88	3.90	1.71				
X_I	Inert Particulates	mg COD/L	69	1,805	997	997	997				
X_S	Slowly Biodegradable Substrate	mg COD/L	364	122	223	217	68				
X_H	Heterotrophic Organisms	mg COD/L	43	2,372	1,299	1,291	1,310				
X_{PAO}	Phosphate Accumulating Organisms	mg COD/L	1	313	168	168	173				
X_{PP}	Polyphosphate	mg P/L	0.21	87.23	44.70	41.15	48.20				
X_{PHA}	PAO Storage Products	mg COD/L	0.09	26.74	19.64	28.43	14.78				
X_{AUT}	Autotrophic Organisms	mg COD/L	1	112	60	60	62				
X_{ISS}	Inorganic Particles	mg/L	7	178	98	98	98				
X_{MeOH}	Metal Hydroxides	mg/L	1	1	1	0	0				
X_{MeP}	Metal Phosphates	mg/L	0	36	20	20	20				
S_M	Methanol	mg COD/L	0.00	0.00	0.00	0.00	0.00				
X_{M1}	Group 1 Methanol Degraders	mg COD/L	0	1	1	1	1				
X_{M2}	Group 2 Methanol Degraders	mg COD/L	0	4	2	2	2				
X_E	Aerobic/Anoxic Decay Products	mg COD/L	38	2,154	1,171	1,172	1,190				
	MLSS	**mg/L**	**387**	**5,830**	**3,296**	**3,280**	**3,222**				
	MLVSS	mg/L	341	4,802	2,731	2,727	2,654				
	Oxygen Uptake Rate	mg O_2/(L-hr)			2	2	38				
	Nitrate Uptake Rate	mg NO_3-N/(L-day)			500	96	19				
	Ammonia Uptake Rate	mg NH_4-N/(L-day)			-11	-48	81				
				Alkalinity Limited?							
Reactor Information											
	Active Reactor Volume	gallons		395,000	23,500	23,500	348,000	0	0	0	0
	Reactor Sidewater Depth	feet		12	12	12	12	12	12	12	12
	AOR, Biological	lbs O2/day			11	12	2,656	0	0	0	0
	AOR, H2S	lbs O2/day		70	0	0	70	0	0	0	0
	AOR, Liquid	lbs O2/day			0	0	26	0	0	0	0
	Total AOR	lbs O2/day			0	0	2,752	0	0	0	0
	Aeration Alpha Value				0.81	0.81	0.59	0.83	0.83	0.83	0.83
	Fouling Factor				0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Alpha F				0.65	0.65	0.47	0.66	0.66	0.66	0.66
	Oxygen Concentration in Supplied Gas	Volume Percent			21%	21%	21%	21%	21%	21%	21%
	Oxygen Concentration in Supplied Gas	Mass Percent			23%	23%	23%	23%	23%	23%	23%
	Nitrogen Concentration in Supplied Gas	Volume Percent			78%	78%	78%	78%	78%	78%	78%
	CO2 Concentration in Supplied Gas	Volume Percent			0.00%	0.00%	0.04%	0.04%	0.04%	0.04%	0.04%
	Argon Concentration in Supplied Gas	Volume Percent			0.93%	0.93%	0.93%	0.93%	0.93%	0.93%	0.93%
	Standard Density of Supplied Gas	lbs/ft3			0.0752	0.0752	0.0752	0.0752	0.0752	0.0752	0.0752
	SOR/AOR Ratio				0.00	0.00	2.85	0.00	0.00	0.00	0.00
	SOR	lbs O2/day			0	0	7,850	0	0	0	0
	Number of Diffusers	Total		974	0	0	974	0	0	0	0
	SOTE				0%	0%	25%	0%	0%	0%	0%
	Required Air Rate	SCFM	Min Mixing		0	0	1,232	0	0	0	0
	Required Mixing Air @ 0.12 scfm/ft2	SCFM	0.12	scfm/ft2	0	0	465	0	0	0	0
	Max Air per Tank at Design Condition	SCFM			239	239	3,546	0	0	0	0
	Is Required Diffuser Density Too High?										
Flow Balance											
	Raw Feed into Reactor	mgd	0.72		0.72						
	Flow from Previous Reactor	mgd				2.27	2.27				
	Recirculation Into Reactor	mgd			0.72						
	From Reactor				(3)	(0)	(0)				
	RAS Into Reactor	mgd		0.83	0.83						
	Other Flows Into Reactor	mgd	0.00								
	Effluent From Reactor	mgd			2.27	2.27	1.55				
	Waste Activated Sludge	mgd		0.0273							

Facility Operating Parameters						Project
Item		**Value**			**Value**	**Notes**
Influent Wastewater	(Metric)	(Metric)	(Metric=US*k)	(US)	(US)	
Flow	m3/day			MG/day		
Average		2,650	3,785.44		0.70	Permit MM
Carbonaceous Five-Day Biochemical Oxygen Demand (CBOD5)						
Design Average Concentration	mg/L	266	1.00	mg/L	266	
Design Average Mass Loading	kg/day	705	0.45	lb/day	1,555	Projected MM at 0.7 MGD
Total Suspended Solids (TSS)						
Design Average Concentration	mg/L	329	1.00	mg/L	329	
Design Average Mass Loading	kg/day	873	0.45	lb/day	1,924	Projected MM at 0.7 MGD
Volatile Suspended Solids (VSS)						
Percent VSS	%	90%	1.00	%	90%	
Design Average Concentration	mg/L	296	1.00	mg/L	296	
Design Average Mass Loading	kg/day	785	0.45	lb/day	1,732	
Total Kjeldahl Nitrogen (TKN as N)						
Design Average Concentration	mg/L	59	1.00	mg/L	59	
Design Average Mass Loading	kg/day	157	0.45	lb/day	346	Assuming TKN = 0.65*NH3
Ammonia-Nitrogen (NH3-N as N)						
Design Average Concentration	mg/L	39	1.00	mg/L	39	
Design Average Mass Loading	kg/day	102	0.45	lb/day	225	Projected MM at 0.7 MGD
Total Phosphorus (as P)						
Design Average Concentration	mg/L	8	1.00	mg/L	8	
Design Average Mass Loading	kg/day	21	0.45	lb/day	47	
Alkalinity (as CaCO3)						
Design Average Concentration	mg/L	257	1.00	mg/L	257	
Design Average Mass Loading	kg/day	680	0.45	lb/day	1,500	
Hydrogen Sulfide (H2S)						
Design Average Concentration	mg/L	6	1.00	mg/L	6	
Design Average Mass Loading	kg/day	16	0.45	lb/day	35	
Chemical Addition:						
Select the Metal Salt (if used) Ferric Chloride				2		
Wastewater Temperature						
Raw Sewage Temperature	oC	25	1.00	oC	25	
Plant Elevation	meters	15	3.28	feet	50	
Ambient Atmospheric Pressure	kPa	101	6.89	psia	14.6694	
Is the Temperature Model Used? No						
N/A	oC	21	Special	oF	70	
N/A	kph	8	0.62	mph	5	
N/A	%	60%	1.00	%	60%	
N/A	%	50%	1.00	%	50%	
N/A	degrees	45	1.00	degrees	45	
N/A	Date	12/22/23	1.00	Date	12/22/23	
Biological Process - PBNR: Main						
Total SRT (anaerobic + anoxic + aerobic)	days	8.00	1.00	days	8.00	RTP includes secondary clarifier blanket in MCRT calculations
System pH		7.20	1.00		7.20	
Nitrifier Minimum Aerobic SRT (SRT_{min})	days	1.21	1.00	days	1.21	
Aerobic SRT	days	7.07	1.00		7.07	
Nitrification Safety Factor		5.84	1.00		5.84	
DO	mg/L	2.00	1.00	mg/L	2.00	
Temperature in the Biological Process	oC	25	1.00	oC	25	
SVI	mL/g	109	1.00	mL/g	109	
Biosolids Production Rates						
Net Yield (mg TSS/mg BOD_5)	mg/mg	0.78	1.00	lb/lb	0.78	
Volatile Fraction	%	86%	1.00	%	86%	
Active Fraction	%	36%	1.00	%	36%	
Nitrifier Fraction	%	2%	1.00	%	2%	
Nitrogen Content, N/VSS	%	5%	1.00	%	5%	
Phosphorus Content, P/VSS	%	1%	1.00	%	1%	
Process Oxygen Requirements - Minus MBR Tank (if used)						
Carbonaceous AOR/BOD5 - wt/wt	kg/kg	1.30	1.00	lb/lb	1.30	
Total AOR/BOD% - wt/wt	kg/kg	1.75	1.00	lb/lb	1.75	
AOR (wt/day)	kg/day	1,240	0.45	lb/day	2,733	
AOR	mg/L-hr	35	1.00	mg/L-hr	35	
Bioreactor With Secondary Clarifier		1				
Total Bioreactor Volume	m3	1,495	3,785.44	MG	0.3950	2
HRT	hr	13.18	1.00	hr	13.18	
% non-aerobic	%	12%	1.00	%	12%	
% aerobic	%	88%	1.00	%	88%	
Average MLSS Concentration	mg/L	3,020	1.00	mg/L	3,020	
No Media Reactors Included AKI K1/K3						
Bulk Specific Surface Area (Biofilm Active)	m2/m3	No Media	3.28	ft2/ft3	No Media	
Bulk Liquid Volume Displacement	-	No Media	1.00	-	No Media	
Allow Biofilm Carriers to Flow Between Unit Processes? No						
Bioreactor Clarifier						
Total Area	m2	365	0.09	sq.ft.	3,927	2
Overflow Rate	m/day	7	0.04	gpd-sq.ft.	183	
Estimated Peak Overflow Rate	m/day	15	0.04	gpd-sq.ft.	357	
Effluent TSS	mg/L	6	1.00	mg/L	5.5	
Underflow Rate						
Average Flow Ratio	%	115%	1.00		115%	RAS flow/Influent flow
Average Rate	m/day	9	0.04	gpd-sq.ft.	211	
RAS Concentration	mg/L			mg/L		
Average		5,424	1.00		5,424	
Diurnal Peak (From Solids Flux)		5,116	1.00		5,116	
Solids Loading Rate	kg/m2-day	109	4.88	lb/day-sq.ft.	22	
Estimated Peak Solids Loading Rate (from Solid Flux Sheet)	kg/m2-day	107	4.88	lb/day-sq.ft.	22	
Estimated Limiting Solids Loading Rate	kg/m2-day	218	4.88	lb/day-sq.ft.	45	
Estimated Peak Limitied Solids Loading Rate (from Solid Flux Sheet)	kg/m2-day	249	4.88	lb/day-sq.ft.	51	
Return sludge rate at which limiting solids rate can be achieved						
RAS Flow Rate	m3/day	#NULL!	3,785.00	MGD	#NULL!	
Percent of Influent to Bioreactor	%	#NULL!		%	#NULL!	
No Membrane Bioreactor Selected GE/Zenon						
Calculate Based on Flux or # of Modules? Flux	lmh	30	1.70	gfd	18	
Design Membrane Net Flux Rate	lmh	30.40	1.70	gfd	18	
Minimum Required Membrane Area	m2	3,593	10.76	ft2	38,678	
Membrane Module Area	m2	34	10.76	ft2	370	
Number of Modules		105			105	
Air Rate per Module	Nm3/hr	3	1.70	scfm	2.03	
Percent of Time Membrane Air Scour is on		100%			100%	
Total Membrane Air Scour Rate	Nm3/hr	362	1.70	scfm	213	
Force MBR DO to Match Air Rate? No						
Effluent TSS	mg/L	1.00	1.00	mg/L	1.00	
Chemical Compound Applied before Secondary Clarifier		2				
Chemical Added? No						
Chemical Type		Ferric Chloride	1.00		Ferric Chloride	
Chemical Dosage (as chemical)	kg/day	91	0.45	lb/day	200	
Chemical Dosage (mg chemical/L treated)	mg/L	N/A	1.00	mg/L	N/A	
Molar Ratio Dosage Applied (M+:PO4-P)		1	1.00		N/A	
Effluent PO4-P	kg/day	11	0.45	lb/day	N/A	
Effluent PO4-P	mg/L	4.21	1.00	mg/L	N/A	
Aerobic Digestion: Dig						
Aerobic Digestion? Yes		TRUE				
Volume	m3	189	3,785.00	MG	0.05	
SRT (Days)	day	10.00	1.00	day	10.00	
Temperature in the Aerobic Digester	o C	27		o C	27	
Estimated Temperature in Aerobic Digester	o C	24		o C	24	
DO during Aerobic Phase (mg/L)	mg-O2/l	2.00	1.00	mg-O2/l	2.00	
% denitrification	%	50%	1.00	%	50%	
Anoxic Cycle Time	hrs/day	8.00	1.00	hrs/day	8.00	
Average DO in Digester (mg/L)	mg-O2/L	1.33	1.00	mg-O2/L	1.33	
Volatile Solids Loading - wt VSS/vol-day	kg/(m3-day)	1.56	16.06	lb/ft3-day	0.10	
Volatile Solids Reduction	%	24.37%	1.00	%	24.37%	
Total Solids Reduction	%	23.42%	1.00	%	23.42%	
Influent Solids Concentration	%	0.54%		%	0.54%	
Effluent Solids Concentration	%	1.39%		%	1.39%	
Is alkalinity limiting in the aerobic digester?		yes			yes	
SOUR mg-O2/(g-VSS.hour) at 20 oC	mg/(g-hour)	1.79	1.00	mg/(g-hour)	1.79	
SOUR mg-O2/(g-TSS.hour) at 20 oC	mg/(g-hour)	1.53	1.00	mg/(g-hour)	1.53	
Decanting Make sure the Aerobic Digester on the PFD has a decant stream coming off it!						
Is Decanting being done? Yes		TRUE				
Digester HRT	days	3.00	1.00	days	3.00	
Target SRT	days	10.00	1.00	days	10.00	
Average Decant Flow	m3/d	73.63	0.00	GPD	19,454	
Average Decant Effluent TSS	mg/L	500	1.00	mg/L	500	

Mass Balance for Phase 1A Maximum Month Conditions at 25 deg-C in Plug-Flow Mode

Constituent	Raw Wastewater (RW)	Dig Aerobic Digester Decant (ADD)	Main Recycle Influent (Recyl)	Main Recycled Stream (Recycle)	Main Combined Recycle Effluent (RecyE)	Main Bioreactor Influent (BI)	Main Secondary Clarifier Influent (SI)	Main Secondary Clarifier Effluent (SE)	Plant Effluent (PLE)	Main WAS	Dig Aerobic Digester Influent (ADI)	Dig Aerobic Digester Effluent (ADE)	Biosolids to Disposal
Flow (gallons/day)	700,000	19,451	700,000	19,451	719,452	719,452	1,546,821	692,667	692,667	26,785	26,785	7,334	7,334
Carbonaceous BOD_5 (lbs/day)	1,555	10	1,555	10	1,565	1,565	14,169	15	15	444	444	103	103
Particulate	971	0	971	0	971	971	349	0	0	11	11	0	0
Heterotrophs	183	9	183	9	192	192	13,167	11	11	413	413	95	95
Methanol Degraders	1	0	1	0	1	1	27	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	550	0	0	17	17	6	6
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	1	1	65	0	0	2	2	1	1
PHA	0	0	0	0	0	0	4	0	0	0	0	0	0
Filtrate	397	0	397	0	397	397	7	3	3	0	0	0	0
COD (lbs/day)	3,659	105	3,659	105	3,763	3,763	48,370	227	227	1,510	1,510	1,041	1,041
Particulate Bio	1,745	0	1,745	0	1,745	1,745	628	1	1	20	20	0	0
Particulate Non-Bio	379	35	379	35	415	415	12,898	11	11	404	404	369	369
Decay Prod Aer/Anx	184	51	184	51	235	235	15,735	13	13	493	493	531	531
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotrophs	246	12	246	12	258	258	17,722	15	15	555	555	128	128
Methanol Degraders	1	0	1	0	1	1	37	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	807	1	1	25	25	9	9
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	2	2	119	0	0	4	4	2	2
PHA	0	0	0	0	0	0	6	0	0	0	0	0	0
Soluble Bio	344	0	344	0	344	344	13	6	6	0	0	0	0
VFA	132	0	132	0	132	132	1	0	0	0	0	0	0
Colloidal Bio	317	0	317	0	317	317	0	0	0	0	0	0	0
Soluble Non-Bio	183	5	183	5	188	188	404	181	181	7	7	2	2
Colloidal Non-Bio	123	0	123	0	123	123	0	0	0	0	0	0	0
TSS (lbs/day)	1,924	81	1,924	81	2,005	2,005	38,721	32	32	1,213	1,213	848	848
Biodegradable	1,257	0	1,257	0	1,257	1,257	453	0	0	14	14	0	0
Non-Biodegradable	284	26	284	26	311	311	9,659	8	8	303	303	276	276
Inorganic Particles	37	3	37	3	41	41	1,272	1	1	40	40	36	36
Decay Prod Aer/Anx	144	40	144	40	184	184	12,312	10	10	386	386	416	416
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Hydroxide	4	0	4	0	4	4	138	0	0	4	4	4	4
Metal Absorbed Phosphate	0	0	0	0	0	0	150	0	0	5	5	4	4
Heterotrophs	192	10	192	10	202	202	13,867	11	11	434	434	100	100
Methanol Degraders	1	0	1	0	1	1	29	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	632	1	1	20	20	7	7
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	1	1	93	0	0	3	3	2	2
PHA	0	0	0	0	0	0	4	0	0	0	0	0	0
Poly-P	0	0	0	0	1	1	112	0	0	4	4	2	2
VSS (lbs/day)	1,732	69	1,732	69	1,801	1,801	33,379	27	27	1,046	1,046	722	722
Biodegradable	1,156	0	1,156	0	1,156	1,156	408	0	0	13	13	0	0
Non-Biodegradable	267	24	267	24	291	291	8,693	7	7	272	272	249	249
Decay Prod Aer/Anx	130	36	130	36	166	166	11,081	9	9	347	347	374	374
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Hydroxide	1	0	1	0	1	1	35	0	0	1	1	1	1
Heterotrophs	173	9	173	9	182	182	12,480	10	10	391	391	90	90
Methanol Degraders	1	0	1	0	1	1	26	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	569	0	0	18	18	6	6
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	1	1	84	0	0	3	3	2	2
PHA	0	0	0	0	0	0	4	0	0	0	0	0	0
TKN (lbs/day)	346	7	346	7	353	353	2,516	13	13	78	78	57	57
NH_3-N (lbs-N/day)	225	1	225	1	226	226	1	0	0	0	0	1	1
Particulate Bio Org N	50	0	50	0	50	50	18	0	0	1	1	0	0
Non-Bio Part Org N	11	2	11	2	12	12	388	0	0	12	12	16	16
Decay Prod Aer/Anx	11	3	11	3	14	14	953	1	1	30	30	32	32
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotrophs	15	1	15	1	16	16	1,073	1	1	34	34	8	8

Methanol Degraders	0	0	0	0	0	0	2	0	0	0	0	0	0
AOBs	0	0	0	0	0	0	49	0	0	2	2	1	1
NOBs	0	0	0	0	0	0	0	0	0	0	0	0	0
PAOs	0	0	0	0	0	0	7	0	0	0	0	0	0
Non-Bio Soluble Org. N	11	0	11	0	11	11	24	11	11	0	0	0	0
Non-Bio Colloidal Org. N	4	0	4	0	4	4	0	0	0	0	0	0	0
Soluble Bio Org N	10	0	10	0	10	10	0	0	0	0	0	0	0
Colloidal Bio Org N	9	0	9	0	9	9	0	0	0	0	0	0	0
NO_2-N (lbs-N/day)	0	0	0	0	0	0	0	0	0	0	0	0	0
NO_3-N (lbs-N/day)	0	8	0	8	8	8	146	65	65	3	3	3	3
Total Nitrogen (lbs-N/day)	346	15	346	15	361	361	2,662	79	79	81	81	60	60
TP (lbs-P/day)	47	7	47	7	53	53	926	25	25	28	28	22	22
Bio Particulate	12	0	12	0	12	12	3	0	0	0	0	0	0
Non-Bio Particulate	3	0	3	0	3	3	96	0	0	3	3	4	4
Decay Prod Aer/Anx	4	1	4	1	5	5	315	0	0	10	10	11	11
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Absorbed	0	0	0	0	0	0	49	0	0	2	2	1	1
Heterotrophs	5	0	5	0	5	5	354	0	0	11	11	3	3
Methanol Degraders	0	0	0	0	0	0	1	0	0	0	0	0	0
AOBs	0	0	0	0	0	0	16	0	0	1	1	0	0
NOBs	0	0	0	0	0	0	0	0	0	0	0	0	0
PAOs	0	0	0	0	0	0	2	0	0	0	0	0	0
Poly-P	0	0	0	0	0	0	35	0	0	1	1	1	1
Ortho-PO4	24	5	24	5	28	28	54	24	24	1	1	2	2
Alkalinity (lbs/day as $CaCO_3$)	1,500	0	1,500	0	1,500	1,500	1,259	564	564	22	22	0	0
H_2S (lbs/day)	35	0	35	0	35	35	0	0	0	0	0	0	0
Temperature (^oC)	25	27	25	27	25	25	25	25	25	25	25	27	27
BOD_5 (mg/L)	266	61	266	61	261	261	1,098	3	3	1,986	1,986	1,678	1,678
COD (mg/L)	626	644	626	644	627	627	3,747	39	39	6,754	6,754	17,017	17,017
TSS (mg/L)	329	500	329	500	334	334	**3,000**	6	6	5,428	5,428	13,855	13,855
VSS (mg/L)	296	426	296	426	300	300	2,586	5	5	4,679	4,679	11,796	11,796
TKN (mg-N/L)	59	44	59	44	59	59	195	2	2	351	351	935	935
NH_3-N (mg-N/L)	39	9	39	9	38	38	0	0	0.05	0	0	9	9
NO_2-N (mg/L)	0	0	0	0	0	0	0	0	0	0	0	0	0
NO_3-N (mg-N/L)	0	47	0	47	1	1	11	11	11	11	11	47	47
Total Nitrogen (mg/L)	59	91	59	91	60	60	206	14	14	362	362	1,223	1,223
TP (mg-P/L)	8	41	8	41	9	9	72	4	4	126	126	354	354
Alkalinity (mg/L as $CaCO_3$)	257	0	257	0	250	250	98	98	98	98	98	0	0
H_2S (mg/L)	6	0	6	0	6	6	0	0	0	0	0	0	0

Appendix D - Process Calculations

PBNRMain Plant | Pro2D2 Process Design System | 12/22/2023 4:06 PM

Pro2D2_1_08_Ridgefield_Plug-Flow_WWMM_Phase1A_25degC.xlsm

Select Operating Units for Physical Plant Definition	
Metric (M) or US (U)	**U**

Biological Model	#N/A
Standard	**No**

Aeration Data	
Aeration Basin Side Water Depth	**12** feet
Maximum Water Temperature:	**25.05** °C
BETA Correctional Factor:	**0.95**
Plant Altitude:	50 feet

Est. Diffuser Design (Sanitaire Membranes)	
Design Condition	**Ave**
Est. Diffuser Air Rate	1.5 scfm/diffuser
Peaking Capability	267%
Estimated SOTE	22%

Definition of the Physical Plant	
How many reactors (up to 42)	**5**
Solids Retention Time (SRT)	8.00 Days
Average Total Flow Rate (not incl OtherInf)	0.72 mgd
RAS Ratio (% of Plant Influent)	115%
	0.83 mgd
Waste Loc: (A)ll Reactors, Clarifier (U)/F or Reactor #	**U**

PRO2D2	
% Aerobic	88%
% Anoxic	12%
Nitrification S.F.	5.84
Total Volume gallons	395,000
RAS Return DO - mg/L	**0.00**

System Configuration			Reactor									
Component	Units	TOTAL	#1	#2	#3	#4	#5	#N/A	#N/A	#N/A	#N/A	#N/A
Reactor Volume	gallons	395,000	**23,500**	**23,500**	**116,000**	**116,000**	**116,000**					
Fraction	% of Total		6%	6%	29%	29%	29%	0%	0%	0%	0%	0%
O_2 Specification Method			**DO**	**DO**	**DO**	**DO**	**DO**	**DO**	**DO**	**DO**	**DO**	**DO**
DO or Ammonia (Dyn ABAC) or Air Rate or AOR	mg/L or lbs/hr or scfm		**0.00**	**0.00**	**2.00**	**2.00**	**2.00**					
Oxygen Mass Transfer, Kla (ASMN)	1/day		**1**	**1**	**634**	**202**	**123**	**1**	**1**	**1**	**1**	**1**
Empty Bed Media Fill Fraction	dimensionless											
Biofilm Density	g COD/m3											
Biofilm Thickness	microns											
External Diffusion Layer Thickness	microns											
Number of Biofilm Layers (for Dynamics)	#											
Net Specific Surface Area	m2/m3		No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media
Net Liquid Volume Displacement	%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bulk Liquid Volume	gallons	395,000	23,500	23,500	116,000	116,000	116,000	0	0	0	0	0
Reactor Feed												
Raw Feed	% of Total	100%	**100%**									
RAS	% of Total RAS	100%	**100%**									
Recirculation	% of Raw Feed		**100%**									
From Reactor	(Enter Number)		**#5**									

Summary Information

Total MLSS Inventory		**9,954** lbs	Total COD Removed	3,537	lbs/day
Total MLVSS Inventory		8,581 lbs	Food Applied to MLSS Inventory Ratio	0.29	COD/MLSS
MIxed Liquor VSS		86%	Aeration Information		
Total Required WAS Rate		**1,244** lbs MLSS/day	Total AOR	2,733	lbs O2/day
	or	1,073 lbs MLVSS/day	Total SOR	8,620	lbs O2/day
Observed Mass Yield		0.80 lbs MLSS/lb BOD	Total Required Air Rate	1,326	scfm

Standard Model Component Concentrations			Feed	RAS	#1	#2	#3	#4	#5	#N/A	#N/A
Enter Reactor Number to use this Column of Data for the Original Guess					1	2	3	4	5	6	7
S_{O2}	Dissolved Oxygen	mg O_2/L	0.00	0.00	0.01	0.00	2.00	2.00	2.00		
S_F	Soluble Fermentable Substrates	mg COD/L	57.28	1.03	4.77	1.98	0.89	0.77	1.03		
S_A	Soluble Fermentation Products	mg COD/L	21.94	0.05	2.31	3.07	0.13	0.04	0.05		
S_I	Soluble Inerts	mg COD/L	31.32	31.32	31.32	31.32	31.32	31.32	31.32		
S_{NH4}	Soluble Ammonia N	mg N/L	37.71	0.05	12.02	12.27	2.12	0.16	0.05		
S_{N2}	Dissolved Nitrogen Gas	mg N/L	0	34	28	31	32	33	34		
S_{NO3}	Soluble Nitrate/Nitrite N	mg N/L	1.27	11.31	2.68	0.36	9.44	11.12	11.31		
S_{PO4}	Soluble Inorganic Phosphorus	mg P/L	4.72	4.21	4.28	4.40	4.10	4.08	4.21		
S_{ALK}	Alkalinity	moles/m^3	5.00	1.95	3.39	3.56	2.24	1.98	1.95		
X_I	Inert Particulates	mg COD/L	69	1,808	999	999	999	999	999		
X_S	Slowly Biodegradable Substrate	mg COD/L	364	88	157	153	98	66	49		
X_H	Heterotrophic Organisms	mg COD/L	43	2,484	1,365	1,362	1,381	1,382	1,373		
X_{PAO}	Phosphate Accumulating Organisms	mg COD/L	0	17	9	9	9	9	9		
X_{PP}	Polyphosphate	mg P/L	0.03	4.86	2.57	2.48	2.56	2.63	2.69		
X_{PHA}	PAO Storage Products	mg COD/L	0.03	0.88	0.65	0.86	0.73	0.59	0.49		
X_{AUT}	Autotrophic Organisms	mg COD/L	1	113	61	61	63	63	63		
X_{ISS}	Inorganic Particles	mg/L	7	178	99	99	99	99	99		
X_{MeOH}	Metal Hydroxides	mg/L	1	0	0	0	0	0	0		
X_{MeP}	Metal Phosphates	mg/L	0	37	20	20	20	20	20		
S_M	Methanol	mg COD/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
X_{M1}	Group 1 Methanol Degraders	mg COD/L	0	1	1	1	1	1	1		
X_{M2}	Group 2 Methanol Degraders	mg COD/L	0	4	2	2	2	2	2		
X_E	Aerobic/Anoxic Decay Products	mg COD/L	39	2,206	1,205	1,206	1,210	1,215	1,219		
	MLSS	**mg/L**	**387**	**5,424**	**3,057**	**3,053**	**3,033**	**3,014**	**2,998**		
	MLVSS	mg/L	342	4,674	2,637	2,634	2,615	2,598	2,583		
	Oxygen Uptake Rate	mg O_2/(L-hr)			3	2	64	30	20		
	Nitrate Uptake Rate	mg NO_3-N/(L-day)			529	227	23	18	14		
	Ammonia Uptake Rate	mg NH_4-N/(L-day)			-2	-24	198	38	2		
			Alkalinity Limited?								
Reactor Information											
	Active Reactor Volume	gallons		395,000	23,500	23,500	116,000	116,000	116,000	0	0
	Reactor Sidewater Depth	feet		12	12	12	12	12	12	12	12
	AOR, Biological	lbs O2/day			12	10	1,478	688	459	0	0
	AOR, H2S	lbs O2/day		70	0	0	70	0	0	0	0
	AOR, Liquid	lbs O2/day			0	0	38	0	0	0	0
	Total AOR	lbs O2/day			0	0	1,586	688	459	0	0
	Aeration Alpha Value				0.81	0.81	0.47	0.63	0.69	0.83	0.83
	Fouling Factor				0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Alpha F				0.65	0.65	0.37	0.51	0.55	0.66	0.66
	Oxygen Concentration in Supplied Gas	Volume Percent			21%	21%	21%	21%	21%	21%	21%
	Oxygen Concentration in Supplied Gas	Mass Percent			23%	23%	23%	23%	23%	23%	23%
	Nitrogen Concentration in Supplied Gas	Volume Percent			78%	78%	78%	78%	78%	78%	78%
	CO2 Concentration in Supplied Gas	Volume Percent			0.00%	0.00%	0.04%	0.04%	0.04%	0.04%	0.04%
	Argon Concentration in Supplied Gas	Volume Percent			0.93%	0.93%	0.93%	0.93%	0.93%	0.93%	0.93%
	Standard Density of Supplied Gas	lbs/ft3			0.0752	0.0752	0.0752	0.0752	0.0752	0.0752	0.0752
	SOR/AOR Ratio				0.00	0.00	3.59	2.64	2.41	0.00	0.00
	SOR	lbs O2/day			0	0	5,695	1,818	1,107	0	0
	Number of Diffusers	Total		1,070	0	0	707	226	137	0	0
	SOTE				0%	0%	27%	25%	24%	0%	0%
	Required Air Rate	SCFM	Min Mixing		0	0	850	292	184	0	0
	Required Mixing Air @ 0.12 scfm/ft2	SCFM	0.12	scfm/ft2	0	0	155	155	155	0	0
	Max Air per Tank at Design Condition	SCFM			239	239	1,182	1,182	1,182	0	0
	Is Required Diffuser Density Too High?										
Flow Balance											
	Raw Feed into Reactor	mgd	0.72		0.72						
	Flow from Previous Reactor	mgd				2.27	2.27	2.27	2.27		
	Recirculation Into Reactor	mgd			0.72						
	From Reactor				(5)	(0)	(0)	(0)	(0)		
	RAS Into Reactor	mgd		0.83	0.83						
	Other Flows Into Reactor	mgd	0.00								
	Effluent From Reactor	mgd			2.27	2.27	2.27	2.27	1.55		
	Waste Activated Sludge	mgd		0.0275							

Facility Operating Parameters						Project
Item		Value			Value	Notes
Influent Wastewater	(Metric)	(Metric)	(Metric=US*k)	(US)	(US)	
Flow	m3/day			MG/day		
Average		3,407	3,785.44		0.90	Projected Phase 1B MM
Carbonaceous Five-Day Biochemical Oxygen Demand (CBOD5)						
Design Average Concentration	mg/L	266	1.00	mg/L	266	
Design Average Mass Loading	kg/day	907	0.45	lb/day	1,999	Projected Phase 1B MM
Total Suspended Solids (TSS)						
Design Average Concentration	mg/L	329	1.00	mg/L	329	
Design Average Mass Loading	kg/day	1,122	0.45	lb/day	2,474	Projected Phase 1B MM
Volatile Suspended Solids (VSS)						
Percent VSS	%	90%	1.00	%	90%	
Design Average Concentration	mg/L	296	1.00	mg/L	296	
Design Average Mass Loading	kg/day	1,010	0.45	lb/day	2,227	
Total Kjeldahl Nitrogen (TKN as N)						
Design Average Concentration	mg/L	59	1.00	mg/L	59	
Design Average Mass Loading	kg/day	202	0.45	lb/day	445	Assuming TKN = 0.65*NH3
Ammonia-Nitrogen (NH3-N as N)						
Design Average Concentration	mg/L	38	1.00	mg/L	38	
Design Average Mass Loading	kg/day	131	0.45	lb/day	289	Projected Phase 1B MM
Total Phosphorus (as P)						
Design Average Concentration	mg/L	8	1.00	mg/L	8	
Design Average Mass Loading	kg/day	27	0.45	lb/day	60	
Alkalinity (as CaCO3)						
Design Average Concentration	mg/L	266	1.00	mg/L	266	
Design Average Mass Loading	kg/day	907	0.45	lb/day	2,000	
Hydrogen Sulfide (H2S)						
Design Average Concentration	mg/L	6	1.00	mg/L	6	
Design Average Mass Loading	kg/day	20	0.45	lb/day	45	
Chemical Addition:						
Select the Metal Salt (if used) Ferric Chloride					2	
Wastewater Temperature						
Raw Sewage Temperature	oC	13	1.00	oC	12.5	
Plant Elevation	meters	15	3.28	feet	50	
Ambient Atmospheric Pressure	kPa	101	6.89	psia	14.6694	
Is the Temperature Model Used? No						
N/A	oC	21	Special	oF	70	
N/A	kph	8	0.62	mph	5	
N/A	%	60%	1.00	%	60%	
N/A	%	50%	1.00	%	50%	
N/A	degrees	45	1.00	degrees	45	
N/A	Date	12/22/23	1.00	Date	12/22/23	
Biological Process - PBNR: Main						
Total SRT (anaerobic + anoxic + aerobic)	days	7.50	1.00	days	7.50	RTP includes secondary clarifier blanket in MCRT calculations
System pH		7.20	1.00		7.20	
Nitrifier Minimum Aerobic SRT (SRT_{min})	days	3.33	1.00	days	3.33	
Aerobic SRT	days	6.47	1.00		6.47	
Nitrification Safety Factor		1.94	1.00		1.94	
DO	mg/L	2.00	1.00	mg/L	2.00	
Temperature in the Biological Process	oC	13	1.00	oC	13	
SVI	mL/g	109	1.00	mL/g	109	
Biosolids Production Rates						
Net Yield (mg TSS/mg BOD_5)	mg/mg	0.86	1.00	lb/lb	0.86	
Volatile Fraction	%	87%	1.00	%	87%	
Active Fraction	%	44%	1.00	%	44%	
Nitrifier Fraction	%	2%	1.00	%	2%	
Nitrogen Content, N/VSS	%	5%	1.00	%	5%	
Phosphorus Content, P/VSS	%	1%	1.00	%	1%	
Process Oxygen Requirements - Minus MBR Tank (if used)						
Carbonaceous AOR/BOD5 - wt/wt	kg/kg	1.18	1.00	lb/lb	1.18	
Total AOR/BOD% - wt/wt	kg/kg	1.61	1.00	lb/lb	1.61	
AOR (wt/day)	kg/day	1,475	0.45	lb/day	3,252	
AOR	mg/L-hr	35	1.00	mg/L-hr	35	
Bioreactor With Secondary Clarifier		1				
Total Bioreactor Volume	m3	1,738	3,785.44	MG	0.4590	2
HRT	hr	11.92	1.00	hr	11.92	
% non-aerobic	%	14%	1.00		14%	
% aerobic	%	86%	1.00		86%	
Average MLSS Concentration	mg/L	3,486	1.00	mg/L	3,486	
No Media Reactors Included AKI K1/K3						
Bulk Specific Surface Area (Biofilm Active)	m2/m3	No Media	3.28	ft2/ft3	No Media	
Bulk Liquid Volume Displacement	-	No Media	1.00	-	No Media	
Allow Biofilm Carriers to Flow Between Unit Processes? No						
Bioreactor Clarifier						
Total Area	m2	365	0.09	sq.ft.	3,927	2
Overflow Rate	m/day	10	0.04	gpd-sq.ft.	235	
Estimated Peak Overflow Rate	m/day	19	0.04	gpd-sq.ft.	458	
Effluent TSS	mg/L	6	1.00	mg/L	5.5	
Underflow Rate						
Average Flow Ratio	%	115%	1.00		115%	RAS flow/Influent flow
Average Rate	m/day	11	0.04	gpd-sq.ft.	271	
RAS Concentration	mg/L			mg/L		
Average		6,277	1.00		6,277	
Diurnal Peak (From Solids Flux)		6,599	1.00		6,599	
Solids Loading Rate	kg/m2-day	139	4.88	lb/day-sq.ft.	28	
Estimated Peak Solids Loading Rate (from Solid Flux Sheet)	kg/m2-day	138	4.88	lb/day-sq.ft.	28	
Estimated Limiting Solids Loading Rate	kg/m2-day	216	4.88	lb/day-sq.ft.	44	
Estimated Peak Limitied Solids Loading Rate (from Solid Flux Sheet)	kg/m2-day	249	4.88	lb/day-sq.ft.	51	
Return sludge rate at which limiting solids rate can be achieved						
RAS Flow Rate	m3/day	#NULL!	3,785.00	MGD	#NULL!	
Percent of Influent to Bioreactor	%	#NULL!		%	#NULL!	
No Membrane Bioreactor Selected GE/Zenon						
Calculate Based on Flux or # of Modules? Flux	lmh	27	1.70	gfd	16	
Design Membrane Net Flux Rate	lmh	27.10	1.70	gfd	16	
Minimum Required Membrane Area	m2	5,186	10.76	ft2	55,816	
Membrane Module Area	m2	34	10.76	ft2	370	
Number of Modules		151			151	
Air Rate per Module	Nm3/hr	3	1.70	scfm	2.03	
Percent of Time Membrane Air Scour is on		100%			100%	
Total Membrane Air Scour Rate	Nm3/hr	521	1.70	scfm	307	
Force MBR DO to Match Air Rate? No						
Effluent TSS	mg/L	1.00	1.00	mg/L	1.00	
Chemical Compound Applied before Secondary Clarifier		2				
Chemical Added? No						
Chemical Type		Ferric Chloride	1.00		Ferric Chloride	
Chemical Dosage (as chemical)	kg/day	91	0.45	lb/day	200	
Chemical Dosage (mg chemical/L treated)	mg/L	N/A	1.00	mg/L	N/A	
Molar Ratio Dosage Applied (M+:PO4-P)		1	1.00		N/A	
Effluent PO4-P	kg/day	13	0.45	lb/day	N/A	
Effluent PO4-P	mg/L	3.82	1.00	mg/L	N/A	
Aerobic Digestion: Dig						
Aerobic Digestion? Yes		TRUE				
Volume	m3	189	3,785.00	MG	0.05	
SRT (Days)	day	10.00	1.00	day	10.00	
Temperature in the Aerobic Digester	o C	27		o C	27	
Estimated Temperature in Aerobic Digester	o C	19		o C	19	
DO during Aerobic Phase (mg/L)	mg-O2/l	2.00	1.00	mg-O2/l	2.00	
% denitrification	%	50%	1.00	%	50%	
Anoxic Cycle Time	hrs/day	8.00	1.00	hrs/day	8.00	
Average DO in Digester (mg/L)	mg-O2/L	1.33	1.00	mg-O2/L	1.33	
Volatile Solids Loading - wt VSS/vol-day	kg/(m3-day)	1.81	16.06	lb/ft3-day	0.11	
Volatile Solids Reduction	%	29.97%	1.00	%	29.97%	
Total Solids Reduction	%	28.91%	1.00	%	28.91%	
Influent Solids Concentration	%	0.63%		%	0.63%	
Effluent Solids Concentration	%	1.49%		%	1.49%	
Is alkalinity limiting in the aerobic digester?		yes			yes	
SOUR mg-O2/(g-VSS.hour) at 20 oC	mg/(g-hour)	2.38	1.00	mg/(g-hour)	2.38	
SOUR mg-O2/(g-TSS.hour) at 20 oC	mg/(g-hour)	2.03	1.00	mg/(g-hour)	2.03	
Decanting Make sure the Aerobic Digester on the PFD has a decant stream coming off it!						
Is Decanting being done? Yes		TRUE				
Digester HRT	days	3.00	1.00	days	3.00	
Target SRT	days	10.00	1.00	days	10.00	
Average Decant Flow	m3/d	91.07	0.00	GPD	24,060	
Average Decant Effluent TSS	mg/L	500	1.00	mg/L	500	

Mass Balance for Phase 1B Maximum Month Conditions at 12.5 deg-C in Plug-Flow Mode

Constituent	Raw Wastewater (RW)	Dig Aerobic Digester Decant (ADD)	Main Recycle Influent (Recyl)	Main Recycled Stream (Recycle)	Main Combined Recycle Effluent (RecyE)	Main Bioreactor Influent (BI)	Main Secondary Clarifier Influent (SI)	Main Secondary Clarifier Effluent (SE)	Plant Effluent (PLE)	Main WAS	Dig Aerobic Digester Influent (ADI)	Dig Aerobic Digester Effluent (ADE)	Biosolids to Disposal
Flow (gallons/day)	900,000	24,058	900,000	24,058	924,058	924,058	1,986,724	890,844	890,844	33,213	33,213	9,156	9,156
Carbonaceous BOD_5 (lbs/day)	1,999	16	1,999	16	2,015	2,015	25,873	21	21	783	783	182	182
Particulate	1,248	0	1,248	0	1,248	1,248	896	1	1	27	27	0	0
Heterotrophs	235	15	235	15	250	250	23,915	17	17	724	724	170	170
Methanol Degraders	1	0	1	0	1	1	38	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	892	1	1	27	27	10	10
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	1	1	112	0	0	3	3	2	2
PHA	0	0	0	0	0	0	13	0	0	0	0	0	0
Filtrate	511	0	511	0	511	511	7	3	3	0	0	0	0
COD (lbs/day)	4,704	129	4,704	129	4,833	4,833	71,967	290	290	2,172	2,172	1,398	1,398
Particulate Bio	2,244	0	2,244	0	2,244	2,244	1,612	1	1	49	49	0	0
Particulate Non-Bio	488	42	488	42	530	530	17,092	12	12	518	518	476	476
Decay Prod Aer/Anx	237	59	237	59	296	296	18,955	13	13	574	574	672	672
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotrophs	316	20	316	20	336	336	32,188	23	23	975	975	228	228
Methanol Degraders	2	0	2	0	2	2	52	0	0	2	2	0	0
AOBs	2	1	2	1	3	3	1,310	1	1	40	40	14	14
NOBs	2	0	2	0	2	2	0	0	0	0	0	0	0
PAOs	2	0	2	0	2	2	207	0	0	6	6	4	4
PHA	0	0	0	0	0	0	19	0	0	1	1	0	0
Soluble Bio	442	0	442	0	442	442	13	6	6	0	0	0	0
VFA	169	0	169	0	169	169	0	0	0	0	0	0	0
Colloidal Bio	407	0	407	0	407	407	0	0	0	0	0	0	0
Soluble Non-Bio	235	6	235	6	241	241	519	233	233	9	9	2	2
Colloidal Non-Bio	157	0	157	0	157	157	0	0	0	0	0	0	0
TSS (lbs/day)	2,474	100	2,474	100	2,574	2,574	57,477	41	41	1,741	1,741	1,137	1,137
Biodegradable	1,616	0	1,616	0	1,616	1,616	1,163	1	1	35	35	0	0
Non-Biodegradable	365	31	365	31	397	397	12,800	9	9	388	388	356	356
Inorganic Particles	48	4	48	4	52	52	1,686	1	1	51	51	47	47
Decay Prod Aer/Anx	186	46	186	46	232	232	14,832	11	11	449	449	526	526
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Hydroxide	5	0	5	0	6	6	183	0	0	6	6	5	5
Metal Absorbed Phosphate	0	0	0	0	0	0	199	0	0	6	6	6	6
Heterotrophs	247	16	247	16	263	263	25,187	18	18	763	763	179	179
Methanol Degraders	1	0	1	0	1	1	40	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	1,025	1	1	31	31	11	11
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	2	2	162	0	0	5	5	3	3
PHA	0	0	0	0	0	0	11	0	0	0	0	0	0
Poly-P	0	0	0	0	1	1	188	0	0	6	6	4	4
VSS (lbs/day)	2,227	86	2,227	86	2,312	2,312	49,745	35	35	1,507	1,507	969	969
Biodegradable	1,487	0	1,487	0	1,487	1,487	1,047	1	1	32	32	0	0
Non-Biodegradable	344	28	344	28	372	372	11,520	8	8	349	349	321	321
Decay Prod Aer/Anx	167	42	167	42	209	209	13,349	9	9	404	404	473	473
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Hydroxide	1	0	1	0	1	1	46	0	0	1	1	1	1
Heterotrophs	223	14	223	14	237	237	22,668	16	16	687	687	161	161
Methanol Degraders	1	0	1	0	1	1	36	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	922	1	1	28	28	10	10
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	2	2	146	0	0	4	4	3	3
PHA	0	0	0	0	0	0	11	0	0	0	0	0	0
TKN (lbs/day)	445	11	445	11	456	456	3,795	19	19	114	114	81	81
NH_3-N (lbs-N/day)	289	4	289	4	293	293	6	3	3	0	0	1	1
Particulate Bio Org N	65	0	65	0	65	65	46	0	0	1	1	0	0
Non-Bio Part Org N	14	2	14	2	16	16	519	0	0	16	16	23	23
Decay Prod Aer/Anx	14	4	14	4	18	18	1,148	1	1	35	35	41	41
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotrophs	19	1	19	1	20	20	1,949	1	1	59	59	14	14

Methanol Degraders	0	0	0	0	0	0	3	0	0	0	0	0	0
AOBs	0	0	0	0	0	0	79	0	0	2	2	1	1
NOBs	0	0	0	0	0	0	0	0	0	0	0	0	0
PAOs	0	0	0	0	0	0	13	0	0	0	0	0	0
Non-Bio Soluble Org. N	14	0	14	0	14	14	31	14	14	1	1	0	0
Non-Bio Colloidal Org. N	5	0	5	0	5	5	0	0	0	0	0	0	0
Soluble Bio Org N	13	0	13	0	13	13	0	0	0	0	0	0	0
Colloidal Bio Org N	12	0	12	0	12	12	0	0	0	0	0	0	0
NO_2-N (lbs-N/day)	0	0	0	0	0	0	0	0	0	0	0	0	0
NO_3-N (lbs-N/day)	0	12	0	12	12	12	190	85	85	3	3	5	5
Total Nitrogen (lbs-N/day)	445	24	445	24	468	468	3,985	105	105	118	118	85	85
TP (lbs-P/day)	60	10	60	10	70	70	1,379	29	29	41	41	31	31
Bio Particulate	15	0	15	0	15	15	9	0	0	0	0	0	0
Non-Bio Particulate	3	1	3	1	4	4	129	0	0	4	4	6	6
Decay Prod Aer/Anx	5	1	5	1	6	6	379	0	0	11	11	13	13
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Absorbed	0	0	0	0	0	0	65	0	0	2	2	2	2
Heterotrophs	6	0	6	0	7	7	644	0	0	19	19	5	5
Methanol Degraders	0	0	0	0	0	0	1	0	0	0	0	0	0
AOBs	0	0	0	0	0	0	26	0	0	1	1	0	0
NOBs	0	0	0	0	0	0	0	0	0	0	0	0	0
PAOs	0	0	0	0	0	0	4	0	0	0	0	0	0
Poly-P	0	0	0	0	0	0	58	0	0	2	2	1	1
Ortho-PO4	30	8	30	8	38	38	63	28	28	1	1	3	3
Alkalinity (lbs/day as $CaCO_3$)	2,000	0	2,000	0	2,000	2,000	1,809	811	811	30	30	0	0
H_2S (lbs/day)	45	0	45	0	45	45	0	0	0	0	0	0	0
Temperature (^oC)	13	27	13	27	13	13	13	13	13	13	13	27	27
BOD_5 (mg/L)	266	80	266	80	261	261	1,560	3	3	2,827	2,827	2,382	2,382
COD (mg/L)	626	645	626	645	627	627	4,341	39	39	7,837	7,837	18,290	18,290
TSS (mg/L)	329	500	329	500	334	334	**3,467**	6	6	6,280	6,280	14,881	14,881
VSS (mg/L)	296	426	296	426	300	300	3,000	5	5	5,435	5,435	12,687	12,687
TKN (mg-N/L)	59	56	59	56	59	59	229	3	3	413	413	1,054	1,054
NH_3-N (mg-N/L)	38	20	38	20	38	38	0	0	0.35	0	0	20	20
NO_2-N (mg/L)	0	0	0	0	0	0	0	0	0	0	0	0	0
NO_3-N (mg-N/L)	0	61	0	61	2	2	11	11	11	11	11	61	61
Total Nitrogen (mg/L)	59	117	59	117	61	61	240	14	14	424	424	1,422	1,422
TP (mg-P/L)	8	50	8	50	9	9	83	4	4	148	148	403	403
Alkalinity (mg/L as $CaCO_3$)	266	0	266	0	259	259	109	109	109	109	109	0	0
H_2S (mg/L)	6	0	6	0	6	6	0	0	0	0	0	0	0

PBNRMain Plant | Pro2D2 Process Design System | 12/22/2023 4:12 PM
Pro2D2_1_08_Ridgefield_Plug-Flow_WWMM-0-9mgd_Phase1B_12degC.xlsm

Select Operating Units for Physical Plant Definition	
Metric (M) or US (U)	U

Biological Model	#N/A
Standard	No

Aeration Data		
Aeration Basin Side Water Depth	12	feet
Maximum Water Temperature:	12.88	°C
BETA Correctional Factor:	0.95	
Plant Altitude:	50	feet

Definition of the Physical Plant		
How many reactors (up to 42)	7	
Solids Retention Time (SRT)	7.50	Days
Average Total Flow Rate (not incl OtherInf)	0.92	mgd
RAS Ratio (% of Plant Influent)	115%	
	1.06	mgd
Waste Loc: (A)ll Reactors, Clarifier (U)/F or Reactor #	U	

PRO2D2	
% Aerobic	86%
% Anoxic	14%
Nitrification S.F.	1.94
Total Volume gallons	459,000
RAS Return DO - mg/L	0.00

Est. Diffuser Design (Sanitaire Membranes)		
Design Condition	Ave	
Est. Diffuser Air Rate	1.5	scfm/diffuser
Peaking Capability	267%	
Estimated SOTE	22%	

System Configuration			Reactor									
Component	Units	TOTAL	#1	#2	#3	#4	#5	#6	#7	#N/A	#N/A	#N/A
Reactor Volume	gallons	459,000	21,333	21,333	21,333	47,000	116,000	116,000	116,000			
Fraction	% of Total		5%	5%	5%	10%	25%	25%	25%	0%	0%	0%
O_2 Specification Method			DO	DO	DO	DO	DO	DO	DO	DO	DO	DO
DO or Ammonia (Dyn ABAC) or Air Rate or AOR	mg/L or lbs/hr or scfm		0.00	0.00	0.00	2.00	2.00	2.00	2.00			
Oxygen Mass Transfer, Kla (ASMN)	1/day		1	1	1	550	364	288	176	1	1	1
Empty Bed Media Fill Fraction	dimensionless											
Biofilm Density	g COD/m3											
Biofilm Thickness	microns											
External Diffusion Layer Thickness	microns											
Number of Biofilm Layers (for Dynamics)	#											
Net Specific Surface Area	m2/m3		No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media
Net Liquid Volume Displacement	%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bulk Liquid Volume	gallons	459,000	21,333	21,333	21,333	47,000	116,000	116,000	116,000	0	0	0
Reactor Feed												
Raw Feed	% of Total	100%	100%									
RAS	% of Total RAS	100%	100%									
Recirculation	% of Raw Feed		100%									
From Reactor	(Enter Number)		#7									

Summary Information					
Total MLSS Inventory	**13,355**	lbs	Total COD Removed	4,544	lbs/day
Total MLVSS Inventory	11,559	lbs	Food Applied to MLSS Inventory Ratio	0.28	COD/MLSS
MIxed Liquor VSS	87%		Aeration Information		
Total Required WAS Rate	**1,781**	lbs MLSS/day	Total AOR	3,252	lbs O2/day
or	1,541	lbs MLVSS/day	Total SOR	9,445	lbs O2/day
Observed Mass Yield	0.88	lbs MLSS/lb BOD	Total Required Air Rate	1,471	scfm

Standard Model Component Concentrations			Feed	RAS	#1	#2	#3	#4	#5	#6	#7
Enter Reactor Number to use this Column of Data for the Original Guess					1	2	3	4	5	6	7
S_{O2}	Dissolved Oxygen	mg O_2/L	0.00	0.00	0.01	0.00	0.00	2.00	2.00	2.00	2.00
S_F	Soluble Fermentable Substrates	mg COD/L	57.33	0.78	8.72	3.57	2.21	1.40	0.97	0.81	0.78
S_A	Soluble Fermentation Products	mg COD/L	21.96	0.02	3.21	1.54	1.49	0.23	0.05	0.03	0.02
S_I	Soluble Inerts	mg COD/L	31.31	31.31	31.31	31.31	31.31	31.31	31.31	31.31	31.31
S_{NH4}	Soluble Ammonia N	mg N/L	37.98	0.35	12.28	12.37	12.52	10.38	5.56	1.79	0.35
S_{N2}	Dissolved Nitrogen Gas	mg N/L	0	32	25	28	29	30	31	31	32
S_{NO3}	Soluble Nitrate/Nitrite N	mg N/L	1.59	11.49	4.77	2.24	0.72	2.52	6.79	10.20	11.49
S_{PO4}	Soluble Inorganic Phosphorus	mg P/L	4.94	3.82	4.13	4.14	4.21	4.09	3.91	3.82	3.82
S_{ALK}	Alkalinity	moles/m^3	5.19	2.18	3.45	3.67	3.79	3.53	2.89	2.38	2.18
X_I	Inert Particulates	mg COD/L	69	1,868	1,031	1,031	1,031	1,031	1,031	1,031	1,031
X_S	Slowly Biodegradable Substrate	mg COD/L	364	176	207	204	202	183	146	118	97
X_H	Heterotrophic Organisms	mg COD/L	44	3,517	1,920	1,922	1,920	1,928	1,938	1,942	1,941
X_{PAO}	Phosphate Accumulating Organisms	mg COD/L	0	23	12	12	12	12	12	12	12
X_{PP}	Polyphosphate	mg P/L	0.03	6.37	3.37	3.33	3.28	3.30	3.38	3.45	3.52
X_{PHA}	PAO Storage Products	mg COD/L	0.03	2.03	1.31	1.42	1.54	1.53	1.39	1.25	1.12
X_{AUT}	Autotrophic Organisms	mg COD/L	1	143	77	77	77	78	78	79	79
X_{ISS}	Inorganic Particles	mg/L	7	184	102	102	102	102	102	102	102
X_{MeOH}	Metal Hydroxides	mg/L	1	0	0	0	0	0	0	0	0
X_{MeP}	Metal Phosphates	mg/L	0	38	21	21	21	21	21	21	21
S_M	Methanol	mg COD/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
X_{M1}	Group 1 Methanol Degraders	mg COD/L	0	1	1	1	1	1	1	1	1
X_{M2}	Group 2 Methanol Degraders	mg COD/L	0	4	2	2	2	2	2	2	2
X_E	Aerobic/Anoxic Decay Products	mg COD/L	38	2,071	1,132	1,132	1,133	1,134	1,137	1,140	1,143
	MLSS	**mg/L**	**387**	**6,277**	**3,517**	**3,516**	**3,514**	**3,508**	**3,492**	**3,478**	**3,465**
	MLVSS	mg/L	342	5,430	3,045	3,045	3,042	3,037	3,023	3,010	2,998
	Oxygen Uptake Rate	mg O_2/(L-hr)			4	1	1	52	47	39	27
	Nitrate Uptake Rate	mg NO_3-N/(L-day)			491	346	210	21	20	18	16
	Ammonia Uptake Rate	mg NH_4-N/(L-day)			2	-12	-21	133	121	95	36
				Alkalinity Limited?							
Reactor Information											
	Active Reactor Volume	gallons		459,000	21,333	21,333	21,333	47,000	116,000	116,000	116,000
	Reactor Sidewater Depth	feet		12	12	12	12	12	12	12	12
	AOR, Biological	lbs O2/day			15	6	5	491	1,082	915	625
	AOR, H2S	lbs O2/day		90	0	0	0	90	0	0	0
	AOR, Liquid	lbs O2/day			0	0	0	48	0	0	0
	Total AOR	lbs O2/day			0	0	0	630	1,082	915	625
	Aeration Alpha Value				0.80	0.82	0.82	0.52	0.54	0.58	0.65
	Fouling Factor				0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Alpha F				0.64	0.65	0.65	0.41	0.43	0.46	0.52
	Oxygen Concentration in Supplied Gas	Volume Percent			21%	21%	21%	21%	21%	21%	21%
	Oxygen Concentration in Supplied Gas	Mass Percent			23%	23%	23%	23%	23%	23%	23%
	Nitrogen Concentration in Supplied Gas	Volume Percent			78%	78%	78%	78%	78%	78%	78%
	CO2 Concentration in Supplied Gas	Volume Percent			0.00%	0.00%	0.04%	0.04%	0.04%	0.04%	0.04%
	Argon Concentration in Supplied Gas	Volume Percent			0.93%	0.93%	0.93%	0.93%	0.93%	0.93%	0.93%
	Standard Density of Supplied Gas	lbs/ft3			0.0752	0.0752	0.0752	0.0752	0.0752	0.0752	0.0752
	SOR/AOR Ratio				0.00	0.00	0.00	3.18	3.02	2.83	2.53
	SOR	lbs O2/day			0	0	0	2,003	3,273	2,591	1,578
	Number of Diffusers	Total		1,173	0	0	0	249	406	322	196
	SOTE				0%	0%	100%	27%	26%	25%	25%
	Required Air Rate	SCFM	Min Mixing		0	0	0	302	506	407	256
	Required Mixing Air @ 0.12 scfm/ft2	SCFM	0.12	scfm/ft2	0	0	0	63	155	155	155
	Max Air per Tank at Design Condition	SCFM			217	217	217	479	1,182	1,182	1,182
	Is Required Diffuser Density Too High?										
Flow Balance											
	Raw Feed into Reactor	mgd	0.92		0.92						
	Flow from Previous Reactor	mgd				2.91	2.91	2.91	2.91	2.91	2.91
	Recirculation Into Reactor	mgd			0.92						
	From Reactor				(7)	(0)	(0)	(0)	(0)	(0)	(0)
	RAS Into Reactor	mgd		1.06	1.06						
	Other Flows Into Reactor	mgd	0.00								
	Effluent From Reactor	mgd			2.91	2.91	2.91	2.91	2.91	2.91	1.99
	Waste Activated Sludge	mgd		0.0340							

Facility Operating Parameters						Project
Item		Value			Value	Notes
Influent Wastewater	(Metric)	(Metric)	(Metric=US*k)	(US)	(US)	
Flow	m3/day			MG/day		
Average		3,407	3,785.44		0.90	Phase 1B Projected MM
Carbonaceous Five-Day Biochemical Oxygen Demand (CBOD5)						
Design Average Concentration	mg/L	266	1.00	mg/L	266	
Design Average Mass Loading	kg/day	907	0.45	lb/day	1,999	Phase 1B Projected MM
Total Suspended Solids (TSS)						
Design Average Concentration	mg/L	329	1.00	mg/L	329	
Design Average Mass Loading	kg/day	1,122	0.45	lb/day	2,474	Phase 1B Projected MM
Volatile Suspended Solids (VSS)						
Percent VSS	%	90%	1.00	%	90%	
Design Average Concentration	mg/L	296	1.00	mg/L	296	
Design Average Mass Loading	kg/day	1,010	0.45	lb/day	2,227	
Total Kjeldahl Nitrogen (TKN as N)						
Design Average Concentration	mg/L	59	1.00	mg/L	59	
Design Average Mass Loading	kg/day	202	0.45	lb/day	445	Assuming TKN = 0.65*NH3
Ammonia-Nitrogen (NH3-N as N)						
Design Average Concentration	mg/L	38	1.00	mg/L	38	
Design Average Mass Loading	kg/day	131	0.45	lb/day	289	Phase 1B Projected MM
Total Phosphorus (as P)						
Design Average Concentration	mg/L	8	1.00	mg/L	8	
Design Average Mass Loading	kg/day	27	0.45	lb/day	60	
Alkalinity (as CaCO3)						
Design Average Concentration	mg/L	266	1.00	mg/L	266	
Design Average Mass Loading	kg/day	907	0.45	lb/day	2,000	
Hydrogen Sulfide (H2S)						
Design Average Concentration	mg/L	6	1.00	mg/L	6	
Design Average Mass Loading	kg/day	20	0.45	lb/day	45	
Chemical Addition:						
Select the Metal Salt (if used) Ferric Chloride				2		
Wastewater Temperature						
Raw Sewage Temperature	oC	25	1.00	oC	25	
Plant Elevation	meters	15	3.28	feet	50	
Ambient Atmospheric Pressure	kPa	101	6.89	psia	14.6694	
Is the Temperature Model Used? No						
N/A	oC	21	Special	oF	70	
N/A	kph	8	0.62	mph	5	
N/A	%	60%	1.00	%	60%	
N/A	%	50%	1.00	%	50%	
N/A	degrees	45	1.00	degrees	45	
N/A	Date	12/22/23	1.00	Date	12/22/23	
Biological Process - PBNR: Main						
						RTP includes secondary clarifier blanket
Total SRT (anaerobic + anoxic + aerobic)	days	7.50	1.00	days	7.50	in MCRT calculations
System pH		7.20	1.00		7.20	
Nitrifier Minimum Aerobic SRT (SRT_{min})	days	1.21	1.00	days	1.21	
Aerobic SRT	days	6.48	1.00		6.48	
Nitrification Safety Factor		5.35	1.00		5.35	
DO	mg/L	2.00	1.00	mg/L	2.00	
Temperature in the Biological Process	oC	25	1.00	oC	25	
SVI	mL/g	109	1.00	mL/g	109	
Biosolids Production Rates						
Net Yield (mg TSS/mg BOD_5)	mg/mg	0.79	1.00	lb/lb	0.79	
Volatile Fraction	%	86%	1.00	%	86%	
Active Fraction	%	37%	1.00	%	37%	
Nitrifier Fraction	%	2%	1.00	%	2%	
Nitrogen Content, N/VSS	%	5%	1.00	%	5%	
Phosphorus Content, P/VSS	%	1%	1.00	%	1%	
Process Oxygen Requirements - Minus MBR Tank (if used)						
Carbonaceous AOR/BOD5 - wt/wt	kg/kg	1.28	1.00	lb/lb	1.28	
Total AOR/BOD% - wt/wt	kg/kg	1.72	1.00	lb/lb	1.72	
AOR (wt/day)	kg/day	1,573	0.45	lb/day	3,467	
AOR	mg/L-hr	38	1.00	mg/L-hr	38	
Bioreactor With Secondary Clarifier		1				
Total Bioreactor Volume	m3	1,738	3,785.44	MG	0.4590	2
HRT	hr	11.92	1.00	hr	11.92	
% non-aerobic	%	14%	1.00		14%	
% aerobic	%	86%	1.00		86%	
Average MLSS Concentration	mg/L	3,177	1.00	mg/L	3,177	
No Media Reactors Included AKI K1/K3						
Bulk Specific Surface Area (Biofilm Active)	m2/m3	No Media	3.28	ft2/ft3	No Media	
Bulk Liquid Volume Displacement	-	No Media	1.00	-	No Media	
Allow Biofilm Carriers to Flow Between Unit Processes? No						
Bioreactor Clarifier						
Total Area	m2	365	0.09	sq.ft.	3,927	2
Overflow Rate	m/day	10	0.04	gpd-sq.ft.	235	
Estimated Peak Overflow Rate	m/day	19	0.04	gpd-sq.ft.	458	
Effluent TSS	mg/L	6	1.00	mg/L	5.5	
Underflow Rate						
Average Flow Ratio	%	115%	1.00		115%	RAS flow/Influent flow
Average Rate	m/day	11	0.04	gpd-sq.ft.	271	
RAS Concentration	mg/L			mg/L		
Average		5,713	1.00		5,713	
Diurnal Peak (From Solids Flux)		6,013	1.00		6,013	
Solids Loading Rate	kg/m2-day	127	4.88	lb/day-sq.ft.	26	
Estimated Peak Solids Loading Rate (from Solid Flux Sheet)	kg/m2-day	126	4.88	lb/day-sq.ft.	26	
Estimated Limiting Solids Loading Rate	kg/m2-day	216	4.88	lb/day-sq.ft.	44	
Estimated Peak Limitied Solids Loading Rate (from Solid Flux Sheet)	kg/m2-day	249	4.88	lb/day-sq.ft.	51	
Return sludge rate at which limiting solids rate can be achieved						
RAS Flow Rate	m3/day	#NULL!	3,785.00	MGD	#NULL!	
Percent of Influent to Bioreactor	%	#NULL!		%	#NULL!	
No Membrane Bioreactor Selected GE/Zenon						
Calculate Based on Flux or # of Modules? Flux	lmh	30	1.70	gfd	18	
Design Membrane Net Flux Rate	lmh	30.40	1.70	gfd	18	
Minimum Required Membrane Area	m2	4,622	10.76	ft2	49,747	
Membrane Module Area	m2	34	10.76	ft2	370	
Number of Modules		134			134	
Air Rate per Module	Nm3/hr	3	1.70	scfm	2.03	
Percent of Time Membrane Air Scour is on		100%			100%	
Total Membrane Air Scour Rate	Nm3/hr	462	1.70	scfm	272	
Force MBR DO to Match Air Rate? No						
Effluent TSS	mg/L	1.00	1.00	mg/L	1.00	
Chemical Compound Applied before Secondary Clarifier		2				
Chemical Added? No						
Chemical Type		Ferric Chloride	1.00		Ferric Chloride	
Chemical Dosage (as chemical)	kg/day	91	0.45	lb/day	200	
Chemical Dosage (mg chemical/L treated)	mg/L	N/A	1.00	mg/L	N/A	
Molar Ratio Dosage Applied (M+:PO4-P)		1	1.00		N/A	
Effluent PO4-P	kg/day	14	0.45	lb/day	N/A	
Effluent PO4-P	mg/L	4.03	1.00	mg/L	N/A	
Aerobic Digestion: Dig						
Aerobic Digestion? Yes		TRUE				
Volume	m3	189	3,785.00	MG	0.05	
SRT (Days)	day	10.00	1.00	day	10.00	
Temperature in the Aerobic Digester	o C	27		o C	27	
Estimated Temperature in Aerobic Digester	o C	25		o C	25	
DO during Aerobic Phase (mg/L)	mg-O2/l	2.00	1.00	mg-O2/l	2.00	
% denitrification	%	50%	1.00	%	50%	
Anoxic Cycle Time	hrs/day	8.00	1.00	hrs/day	8.00	
Average DO in Digester (mg/L)	mg-O2/L	1.33	1.00	mg-O2/L	1.33	
Volatile Solids Loading - wt VSS/vol-day	kg/(m3-day)	1.64	16.06	lb/ft3-day	0.10	
Volatile Solids Reduction	%	25.15%	1.00	%	25.15%	
Total Solids Reduction	%	24.19%	1.00	%	24.19%	
Influent Solids Concentration	%	0.57%		%	0.57%	
Effluent Solids Concentration	%	1.44%		%	1.44%	
Is alkalinity limiting in the aerobic digester?		yes			yes	
SOUR mg-O2/(g-VSS.hour) at 20 oC	mg/(g-hour)	1.87	1.00	mg/(g-hour)	1.87	
SOUR mg-O2/(g-TSS.hour) at 20 oC	mg/(g-hour)	1.59	1.00	mg/(g-hour)	1.59	
Decanting Make sure the Aerobic Digester on the PFD has a decant stream coming off it!						
Is Decanting being done? Yes		TRUE				
Digester HRT	days	3.00	1.00	days	3.00	
Target SRT	days	10.00	1.00	days	10.00	
Average Decant Flow	m3/d	91.06	0.00	GPD	24,059	
Average Decant Effluent TSS	mg/L	500	1.00	mg/L	500	

Mass Balance for Phase 1B Maximum Month Conditions at 25 deg-C in Plug-Flow Mode

Constituent	Raw Wastewater (RW)	Dig Aerobic Digester Decant (ADD)	Main Recycle Influent (Recyl)	Main Recycled Stream (Recycle)	Main Combined Recycle Effluent (RecyE)	Main Bioreactor Influent (BI)	Main Secondary Clarifier Influent (SI)	Main Secondary Clarifier Effluent (SE)	Plant Effluent (PLE)	Main WAS	Dig Aerobic Digester Influent (ADI)	Dig Aerobic Digester Effluent (ADE)	Biosolids to Disposal
Flow (gallons/day)	900,000	24,057	900,000	24,057	924,057	924,057	1,986,722	890,880	890,880	33,177	33,177	9,120	9,120
Carbonaceous BOD_5 (lbs/day)	1,999	13	1,999	13	2,012	2,012	19,759	20	20	598	598	140	140
Particulate	1,248	0	1,248	0	1,248	1,248	493	0	0	15	15	0	0
Heterotrophs	235	12	235	12	247	247	18,287	14	14	553	553	128	128
Methanol Degraders	1	0	1	0	1	1	37	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	758	1	1	23	23	8	8
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	1	1	162	0	0	5	5	3	3
PHA	0	0	0	0	0	0	13	0	0	0	0	0	0
Filtrate	511	0	511	0	511	511	9	4	4	0	0	0	0
COD (lbs/day)	4,704	129	4,704	129	4,833	4,833	65,200	292	292	1,965	1,965	1,347	1,347
Particulate Bio	2,244	0	2,244	0	2,244	2,244	886	1	1	27	27	0	0
Particulate Non-Bio	488	43	488	43	531	531	17,116	13	13	518	518	474	474
Decay Prod Aer/Anx	237	62	237	62	299	299	20,566	16	16	622	622	680	680
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotrophs	316	16	316	16	332	332	24,613	19	19	745	745	172	172
Methanol Degraders	2	0	2	0	2	2	49	0	0	1	1	0	0
AOBs	2	1	2	1	3	3	1,113	1	1	34	34	12	12
NOBs	2	0	2	0	2	2	0	0	0	0	0	0	0
PAOs	2	1	2	1	2	2	299	0	0	9	9	6	6
PHA	0	0	0	0	0	0	19	0	0	1	1	0	0
Soluble Bio	442	0	442	0	442	442	18	8	8	0	0	0	0
VFA	169	0	169	0	169	169	1	0	0	0	0	0	0
Colloidal Bio	407	0	407	0	407	407	0	0	0	0	0	0	0
Soluble Non-Bio	235	6	235	6	241	241	519	233	233	9	9	2	2
Colloidal Non-Bio	157	0	157	0	157	157	0	0	0	0	0	0	0
TSS (lbs/day)	2,474	100	2,474	100	2,574	2,574	52,321	41	41	1,583	1,583	1,100	1,100
Biodegradable	1,616	0	1,616	0	1,616	1,616	640	0	0	19	19	0	0
Non-Biodegradable	365	32	365	32	398	398	12,818	10	10	388	388	355	355
Inorganic Particles	48	4	48	4	52	52	1,689	1	1	51	51	47	47
Decay Prod Aer/Anx	186	49	186	49	234	234	16,092	13	13	487	487	532	532
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Hydroxide	5	0	5	0	6	6	183	0	0	6	6	5	5
Metal Absorbed Phosphate	0	1	0	1	1	1	200	0	0	6	6	6	6
Heterotrophs	247	12	247	12	260	260	19,259	15	15	583	583	135	135
Methanol Degraders	1	0	1	0	1	1	39	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	871	1	1	26	26	9	9
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	2	2	234	0	0	7	7	5	5
PHA	0	0	0	0	0	0	12	0	0	0	0	0	0
Poly-P	0	1	0	1	1	1	285	0	0	9	9	6	6
VSS (lbs/day)	2,227	85	2,227	85	2,312	2,312	45,016	35	35	1,362	1,362	934	934
Biodegradable	1,487	0	1,487	0	1,487	1,487	576	0	0	17	17	0	0
Non-Biodegradable	344	29	344	29	373	373	11,536	9	9	349	349	320	320
Decay Prod Aer/Anx	167	44	167	44	211	211	14,483	11	11	438	438	479	479
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Hydroxide	1	0	1	0	1	1	46	0	0	1	1	1	1
Heterotrophs	223	11	223	11	234	234	17,333	14	14	524	524	121	121
Methanol Degraders	1	0	1	0	1	1	35	0	0	1	1	0	0
AOBs	1	1	1	1	2	2	784	1	1	24	24	8	8
NOBs	1	0	1	0	1	1	0	0	0	0	0	0	0
PAOs	1	0	1	0	2	2	210	0	0	6	6	4	4
PHA	0	0	0	0	0	0	12	0	0	0	0	0	0
TKN (lbs/day)	445	9	445	9	454	454	3,396	17	17	102	102	74	74
NH_3-N (lbs-N/day)	289	2	289	2	291	291	1	0	0	0	0	1	1
Particulate Bio Org N	65	0	65	0	65	65	25	0	0	1	1	0	0
Non-Bio Part Org N	14	2	14	2	16	16	514	0	0	16	16	21	21
Decay Prod Aer/Anx	14	4	14	4	18	18	1,246	1	1	38	38	41	41
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotrophs	19	1	19	1	20	20	1,491	1	1	45	45	10	10

Methanol Degraders	0	0	0	0	0	0	3	0	0	0	0	0	0
AOBs	0	0	0	0	0	0	67	0	0	2	2	1	1
NOBs	0	0	0	0	0	0	0	0	0	0	0	0	0
PAOs	0	0	0	0	0	0	18	0	0	1	1	0	0
Non-Bio Soluble Org. N	14	0	14	0	14	14	31	14	14	1	1	0	0
Non-Bio Colloidal Org. N	5	0	5	0	5	5	0	0	0	0	0	0	0
Soluble Bio Org N	13	0	13	0	13	13	1	0	0	0	0	0	0
Colloidal Bio Org N	12	0	12	0	12	12	0	0	0	0	0	0	0
NO_2-N (lbs-N/day)	0	0	0	0	0	0	0	0	0	0	0	0	0
NO_3-N (lbs-N/day)	0	10	0	10	10	10	183	82	82	3	3	4	4
Total Nitrogen (lbs-N/day)	445	19	445	19	464	464	3,580	99	99	105	105	78	78
TP (lbs-P/day)	60	9	60	9	69	69	1,285	31	31	38	38	29	29
Bio Particulate	15	0	15	0	15	15	5	0	0	0	0	0	0
Non-Bio Particulate	3	1	3	1	4	4	128	0	0	4	4	6	6
Decay Prod Aer/Anx	5	1	5	1	6	6	411	0	0	12	12	14	14
Decay Prod Anaerobic	0	0	0	0	0	0	0	0	0	0	0	0	0
Metal Absorbed	0	0	0	0	0	0	65	0	0	2	2	2	2
Heterotrophs	6	0	6	0	7	7	492	0	0	15	15	3	3
Methanol Degraders	0	0	0	0	0	0	1	0	0	0	0	0	0
AOBs	0	0	0	0	0	0	22	0	0	1	1	0	0
NOBs	0	0	0	0	0	0	0	0	0	0	0	0	0
PAOs	0	0	0	0	0	0	6	0	0	0	0	0	0
Poly-P	0	0	0	0	0	0	88	0	0	3	3	2	2
Ortho-PO4	30	6	30	6	37	37	67	30	30	1	1	2	2
Alkalinity (lbs/day as $CaCO_3$)	2,000	0	2,000	0	2,000	2,000	1,797	806	806	30	30	0	0
H_2S (lbs/day)	45	0	45	0	45	45	0	0	0	0	0	0	0
Temperature (°C)	25	27	25	27	25	25	25	25	25	25	25	27	27
BOD_5 (mg/L)	266	64	266	64	261	261	1,192	3	3	2,158	2,158	1,838	1,838
COD (mg/L)	626	643	626	643	627	627	3,932	39	39	7,097	7,097	17,701	17,701
TSS (mg/L)	329	500	329	500	334	334	3,156	6	6	5,717	5,717	14,446	14,446
VSS (mg/L)	296	425	296	425	300	300	2,715	5	5	4,918	4,918	12,272	12,272
TKN (mg-N/L)	59	45	59	45	59	59	205	2	2	369	369	978	978
NH_3-N (mg-N/L)	38	9	38	9	38	38	0	0	0.05	0	0	9	9
NO_2-N (mg/L)	0	0	0	0	0	0	0	0	0	0	0	0	0
NO_3-N (mg-N/L)	0	50	0	50	1	1	11	11	11	11	11	50	50
Total Nitrogen (mg/L)	59	95	59	95	60	60	216	13	13	381	381	1,279	1,279
TP (mg-P/L)	8	44	8	44	9	9	78	4	4	137	137	383	383
Alkalinity (mg/L as $CaCO_3$)	266	0	266	0	259	259	108	108	108	108	108	0	0
H_2S (mg/L)	6	0	6	0	6	6	0	0	0	0	0	0	0

Appendix D - Process Calculations

Select Operating Units for Physical Plant Definition	
Metric (M) or US (U)	U

Biological Model	#N/A
Standard	No

Aeration Data		
Aeration Basin Side Water Depth	12	feet
Maximum Water Temperature:	25.05	°C
BETA Correctional Factor:	0.95	
Plant Altitude:	50	feet

Definition of the Physical Plant		
How many reactors (up to 42)	7	
Solids Retention Time (SRT)	7.50	Days
Average Total Flow Rate (not incl OtherInf)	0.92	mgd
RAS Ratio (% of Plant Influent)	115%	
	1.06	mgd
Waste Loc: (A)ll Reactors, Clarifier (U)/F or Reactor #	U	

PRO2D2	
% Aerobic	86%
% Anoxic	14%
Nitrification S.F.	5.35
Total Volume gallons	459,000
RAS Return DO - mg/L	0.00

Est. Diffuser Design (Sanitaire Membranes)		
Design Condition	MM	
Est. Diffuser Air Rate	2.5	scfm/diffuser
Peaking Capability	160%	
Estimated SOTE	21%	

System Configuration			Reactor									
Component	Units	TOTAL	#1	#2	#3	#4	#5	#6	#7	#N/A	#N/A	#N/A
Reactor Volume	gallons	459,000	21,333	21,333	21,333	47,000	116,000	116,000	116,000			
Fraction	% of Total		5%	5%	5%	10%	25%	25%	25%	0%	0%	0%
O_2 Specification Method			DO	DO	DO	DO	DO	DO	DO	DO	DO	DO
DO or Ammonia (Dyn ABAC) or Air Rate or AOR	mg/L or lbs/hr or scfm		0.00	0.00	0.00	2.00	2.00	2.00	2.00			
Oxygen Mass Transfer, Kla (ASMN)	1/day		1	1	1	1,071	529	196	136	1	1	1
Empty Bed Media Fill Fraction	dimensionless											
Biofilm Density	g COD/m3											
Biofilm Thickness	microns											
External Diffusion Layer Thickness	microns											
Number of Biofilm Layers (for Dynamics)	#											
Net Specific Surface Area	m2/m3		No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media	No Media
Net Liquid Volume Displacement	%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bulk Liquid Volume	gallons	459,000	21,333	21,333	21,333	47,000	116,000	116,000	116,000	0	0	0
Reactor Feed												
Raw Feed	% of Total	100%	100%									
RAS	% of Total RAS	100%	100%									
Recirculation	% of Raw Feed		100%									
From Reactor	(Enter Number)		#7									

Summary Information						
Total MLSS Inventory		**12,170** lbs		Total COD Removed	4,541	lbs/day
Total MLVSS Inventory		10,472 lbs		Food Applied to MLSS Inventory Ratio	0.31	COD/MLSS
MIxed Liquor VSS		86%		Aeration Information		
Total Required WAS Rate		**1,623** lbs MLSS/day		Total AOR	3,467	lbs O2/day
	or	1,396 lbs MLVSS/day		Total SOR	11,635	lbs O2/day
Observed Mass Yield		0.81 lbs MLSS/lb BOD		Total Required Air Rate	1,915	scfm

Standard Model Component Concentrations			Feed	RAS	#1	#2	#3	#4	#5	#6	#7
Enter Reactor Number to use this Column of Data for the Original Guess					1	2	3	4	5	6	7
S_{O2}	Dissolved Oxygen	mg O_2/L	0.00	0.00	0.01	0.00	0.00	2.00	2.00	2.00	2.00
S_F	Soluble Fermentable Substrates	mg COD/L	57.33	1.07	5.93	2.18	1.37	1.24	0.73	0.83	1.07
S_A	Soluble Fermentation Products	mg COD/L	21.96	0.05	2.63	1.61	4.96	0.36	0.05	0.03	0.05
S_I	Soluble Inerts	mg COD/L	31.31	31.31	31.31	31.31	31.31	31.31	31.31	31.31	31.31
S_{NH4}	Soluble Ammonia N	mg N/L	37.72	0.05	11.98	12.11	12.40	8.05	1.17	0.11	0.05
S_{N2}	Dissolved Nitrogen Gas	mg N/L	0	34	28	30	31	31	32	33	34
S_{NO3}	Soluble Nitrate/Nitrite N	mg N/L	1.31	11.07	3.41	0.96	0.11	3.83	10.08	10.94	11.07
S_{PO4}	Soluble Inorganic Phosphorus	mg P/L	4.78	4.03	4.22	4.27	4.51	4.30	4.05	3.98	4.03
S_{ALK}	Alkalinity	moles/m^3	5.19	2.17	3.52	3.72	3.75	3.25	2.32	2.19	2.17
X_I	Inert Particulates	mg COD/L	69	1,870	1,032	1,032	1,032	1,032	1,032	1,032	1,032
X_S	Slowly Biodegradable Substrate	mg COD/L	364	97	163	159	158	134	94	68	53
X_H	Heterotrophic Organisms	mg COD/L	43	2,689	1,475	1,475	1,471	1,482	1,492	1,492	1,484
X_{PAO}	Phosphate Accumulating Organisms	mg COD/L	0	33	18	18	18	18	18	18	18
X_{PP}	Polyphosphate	mg P/L	0.04	9.63	5.12	5.05	4.89	4.92	5.08	5.21	5.32
X_{PHA}	PAO Storage Products	mg COD/L	0.03	2.13	1.41	1.59	1.97	1.93	1.63	1.38	1.18
X_{AUT}	Autotrophic Organisms	mg COD/L	1	122	66	66	66	66	68	67	67
X_{ISS}	Inorganic Particles	mg/L	7	184	102	102	102	102	102	102	102
X_{MeOH}	Metal Hydroxides	mg/L	1	0	0	0	0	0	0	0	0
X_{MeP}	Metal Phosphates	mg/L	0	38	21	21	21	21	21	21	21
S_M	Methanol	mg COD/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
X_{M1}	Group 1 Methanol Degraders	mg COD/L	0	1	1	1	1	1	1	1	1
X_{M2}	Group 2 Methanol Degraders	mg COD/L	0	4	2	2	2	2	2	2	2
X_E	Aerobic/Anoxic Decay Products	mg COD/L	39	2,247	1,227	1,228	1,228	1,230	1,233	1,237	1,240
	MLSS	**mg/L**	**387**	**5,713**	**3,213**	**3,211**	**3,206**	**3,200**	**3,183**	**3,167**	**3,154**
	MLVSS	mg/L	342	4,913	2,766	2,765	2,761	2,755	2,739	2,725	2,712
	Oxygen Uptake Rate	mg O_2/(L-hr)			4	2	2	83	59	29	21
	Nitrate Uptake Rate	mg NO_3-N/(L-day)			627	338	119	29	23	18	15
	Ammonia Uptake Rate	mg NH_4-N/(L-day)			3	-18	-40	270	173	27	2
				Alkalinity Limited?							

Reactor Information			Feed	RAS	#1	#2	#3	#4	#5	#6	#7
	Active Reactor Volume	gallons		459,000	21,333	21,333	21,333	47,000	116,000	116,000	116,000
	Reactor Sidewater Depth	feet		12	12	12	12	12	12	12	12
	AOR, Biological	lbs O2/day			15	9	10	783	1,377	671	498
	AOR, H2S	lbs O2/day		90	0	0	0	90	0	0	0
	AOR, Liquid	lbs O2/day			0	0	0	48	0	0	0
	Total AOR	lbs O2/day			0	0	0	922	1,377	671	498
	Aeration Alpha Value				0.80	0.81	0.81	0.40	0.48	0.64	0.68
	Fouling Factor				0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Alpha F				0.64	0.65	0.65	0.32	0.39	0.51	0.55
	Oxygen Concentration in Supplied Gas	Volume Percent			21%	21%	21%	21%	21%	21%	21%
	Oxygen Concentration in Supplied Gas	Mass Percent			23%	23%	23%	23%	23%	23%	23%
	Nitrogen Concentration in Supplied Gas	Volume Percent			78%	78%	78%	78%	78%	78%	78%
	CO2 Concentration in Supplied Gas	Volume Percent			0.00%	0.00%	0.04%	0.04%	0.04%	0.04%	0.04%
	Argon Concentration in Supplied Gas	Volume Percent			0.93%	0.93%	0.93%	0.93%	0.93%	0.93%	0.93%
	Standard Density of Supplied Gas	lbs/ft3			0.0752	0.0752	0.0752	0.0752	0.0752	0.0752	0.0752
	SOR/AOR Ratio				0.00	0.00	0.00	4.23	3.45	2.62	2.45
	SOR	lbs O2/day			0	0	0	3,900	4,756	1,760	1,220
	Number of Diffusers	Total		917	0	0	0	307	375	139	96
	SOTE				0%	0%	0%	25%	24%	23%	22%
	Required Air Rate	SCFM	Min Mixing		0	0	0	611	779	307	218
	Required Mixing Air @ 0.12 scfm/ft2	SCFM	0.12	scfm/ft2	0	0	0	63	155	155	155
	Max Air per Tank at Design Condition	SCFM			362	362	362	798	1,970	1,970	1,970
	Is Required Diffuser Density Too High?										

Flow Balance			Feed	RAS	#1	#2	#3	#4	#5	#6	#7
	Raw Feed into Reactor	mgd	0.92		0.92						
	Flow from Previous Reactor	mgd				2.91	2.91	2.91	2.91	2.91	2.91
	Recirculation Into Reactor	mgd			0.92						
	From Reactor				(7)	(0)	(0)	(0)	(0)	(0)	(0)
	RAS Into Reactor	mgd		1.06	1.06						
	Other Flows Into Reactor	mgd	0.00								
	Effluent From Reactor	mgd			2.91	2.91	2.91	2.91	2.91	2.91	1.99
	Waste Activated Sludge	mgd		0.0340							

Appendix E
SEPA Documentation

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CLARK REGIONAL WASTEWATER DISTRICT

COMMISSIONERS
Norm Harker
Denny Kiggins
Neil Kimsey
GENERAL MANAGER
John M. Peterson, P.E.

8000 NE 52 Court Vancouver, WA 98665 PO Box 8979 Vancouver, WA 98668
Phone (360) 750-5876 Fax (360) 750-7570 www.crwwd.com

File: RTP Secondary Tx Process Improvements
92-2022-0066
DNS #24-003

Date Published: April 9, 2024

April 4, 2024

Please find enclosed an environmental Determination of Non-Significance issued pursuant to the State Environmental Policy Act (SEPA) Rules (Chapter 197-11), Washington Administrative Code.

You may comment on this DNS by submitting written comments within Fifteen (15) days of this notice as provided for by WAC 197-11-340.

Please address all correspondence to: Clark Regional Wastewater District
PO Box 8979
Vancouver, WA 98668-8979
Attn: Robin Krause, PE

DISTRIBUTION LIST

Federal Agencies: US Army Corps of Engineers, Portland District
US Fish and Wildlife Service

Native American Interests: Yakima Indian Nation
Cowlitz Indian Tribe
Chinook Indian Tribe

State Agencies: Department of Ecology
Department of Fish and Wildlife
Department of Health
Department of Natural Resources – SEPA Center
Office of Archaeology and Historic Preservation

Regional Agencies: Southwest Clean Air Agency
Southwest Washington Health District

Local Agencies: Clark County
- Administration
- Community Development
- Public Works

City of Vancouver
- Administration
- Community Preservation & Development
- Public Works

Other Agencies: Clark Public Utilities

Interest Groups: North Salmon Creek Neighborhood Association

DETERMINATION OF NONSIGNIFICANCE

Description of proposal:
Ridgefield Treatment Plant Secondary Treatment Process

Proponent:

Clark Regional Wastewater District

Location of proposal, including street address, if any.

Ridgefield Wastewater Treatment Plant
109 W Division Street
Ridgefield, WA 988642

Lead Agency: ***Clark Regional Wastewater District***

The lead agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. The environmental impact statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

__ There is no comment period for this DNS.

_X_ This DNS is issued under WAC 197-11-340(2); the lead agency will not act on this proposal for 15 days from the date below. Comments must be submitted by 5:00 PM April 26, 2024.

Responsible Official: ***John Peterson***
Position/Title: ***General Manager***
Telephone: ***(360) 750-5876***
Fax: ***(360) 750-7570***
Address: ***8000 NE 52nd Court***
PO Box 8979
Vancouver, WA 98668-8979

Date: __________________ Signature John M. Peterson, P.E. Digitally signed by John M. Peterson, P.E. Date: 2024.04.11 07:18:17 -07'00'

ENVIRONMENTAL CHECKLIST

Purpose of Checklist:

The State Environmental Policy Act (SEPA), Chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probably significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

Instructions for Applicants:

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or given the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply". Complete answers to the questions may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Use of Checklist of Non-Project Proposals:

Complete this checklist for non-project proposals, even though questions may be answered "does not apply". IN ADDITION, complete the SUPPLEMENTAL SHEET FOR Non-project ACTIONS (part D).

For non-project actions, the references in the checklist to the words "project," "applicant," and "property or site" should be read as "proposal," "proposer," and "affected geographic area," respectively.

1. SEPA Environmental Checklist (WAC 197-11-960) Ridgefield Wastewater Treatment Plant (RTP) Secondary Treatment Process Improvements

1.1 Background

1. Name of proposed project, if applicable:

Ridgefield Treatment Plant (RTP) Secondary Treatment Process Improvements (STPI)

2. Name of applicant:

Discovery Clean Water (DCW) Alliance

3. Address and phone number of applicant and contact person:

Robin Krause, P.E.
Principal Engineer Transmission and Treatment
Clark Regional Wastewater District (Administrative Lead for Discovery Clean Water Alliance)
15100 NW McCann Road
Vancouver, Washington 98685
Telephone: 360-719-1653
rkrause@crwwd.com

4. Date checklist prepared:

December 2023

5. Agency requesting checklist:

Discovery Clean Water Alliance (Alliance)

6. Proposed timing or schedule (including phasing, if applicable):

Phase 1A: Construction to begin in Summer 2024

Phase 1B will be designed and implemented if capacity triggers are met due to the Ridgefield diversion plan being delayed for any reason.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

The Alliance plans to accommodate most of the growth in the Ridgefield service area by increasing treatment capacity at the Alliance's main treatment plant, Salmon Creek Treatment Plant (SCTP), instead of significantly expanding the RTP's capacity to 1.8 million gallons per day (MGD) (Phase 2) or 2.7 mgd (Phase 3), as described in the *City of Ridgefield General Sewer Plan* (Gray & Osborne, 2013) and approved by Ecology.

The plan to maintain capacity has been previously submitted to Ecology as the General Sewer Plan (GSP) for the District on March 1, 2019. Section 10.1.3 of the GSP included a stepwise plan for incrementally redirecting the Ridgefield collection system flow to the SCTP via the Discovery Corridor Wastewater

Transmission System (DCWTS). The implementation of the DCWTS in 2016 created the ability to divert a portion of the flow tributary to the City of Ridgefield collection system and subsequently RTP, to the SCTP. The plan, known as the Ridgefield Flow Diversion Plan, was specifically designed to avoid overloading the RTP. Due to the completion of several elements of the Ridgefield Flow Diversion Plan, approximately two-thirds of Ridgefield flows are now directed to the SCTP. Solids loading concentrations, in terms of BOD5 and TSS, have increased slightly over this time, while flows have not risen due to the improvements completed under the plan despite significant population growth in the service area.

Phase 1A of the current project will increase the capacity of the facility to handle higher wastewater five-day biochemical oxygen demand and total suspended solids loads while maintaining the current maximum month flow capacity of 0.7 mgd. Phase 1B of the STP involves the upgrade of the RTP from a current maximum month capacity of 0.7 mgd to 0.9 mgd. There are no future plans to expand the Ridgefield Wastewater Treatment Plant (RTP) footprint.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

Gray & Osborne. 2007. City of Ridgefield General Sewer Plan. Gray & Osborne, Seattle, Washington. March.

Gray & Osborne. 2013. City of Ridgefield General Sewer Plan. Gray & Osborne, Seattle, Washington. March.

BHC Consultants. 2017. Clark Regional Wastewater District Comprehensive General Sewer Plan. BHC Consultants, Seattle, Washington. December.

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

No

10. List any government approvals or permits that will be needed for your proposal, if known.

The following permits in Table 1 are already in place or needed for the project.

Table 1-1. Permits and Approvals for the Secondary Wastewater Treatment Improvements

Permit/Approval Type	Agency
Federal and State Permits and Approvals	
Ecology	Review and approval of Engineering Report per WAC 173-240-060 Modification of NPDES Permit No. WA0023272
Ecology/ US Environmental Protection Agency (EPA)	National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit and Coverage
Southwest Clean Air Agency (SWCAA)	SWCAA Permit 00-2316
U.S. Army Corps of Engineers	Endangered Species Act compliance, Biological Evaluation (2005) Joint Aquatic Resources Permit (2005)
U.S. Army Corps of Engineers	Rivers & Harbors Act, Section 10 Permit Application (2006)

City of Ridgefield and Clark County	Shoreline Substantial Development Permit Application (2006, 2007)
U.S. Army Corps of Engineers	National Historic Preservation Act compliance, Section 106 Cultural Resource Assessment Report
U.S. Army Corps of Engineers	Clean Water Act, Section 404 permit applications
U.S. Department of Agriculture - Rural Development Administration	National Environmental Policy Act (NEPA) Environmental Report, Wastewater Treatment Facility 1.0 MGD Upgrade Project (2007)
U.S. Fish & Wildlife Service	Refuge Compatibility Analysis
Washington Department of Fish and Wildlife	Hydraulic Project Approval
Potential Local Permits and Approvals	
Modification to a Conditional Use Permit	City of Ridgefield
Building Permits? Grading, Erosion	City of Ridgefield
Trade Permits	City of Ridgefield

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

The City of Ridgefield is experiencing significant growth, with the population doubling from 4,763 to 10,319 in just ten years (Census 2010, 2020). Discovery Clean Water Alliance (the Alliance) owns and operates the RTP as part of a long-term framework to deliver wastewater transmission and treatment services to Clark County. Ridgefield's wastewater flows to the RTP have remained relatively constant as a result of the DCW Water Transmission System (DCWTS) which diverts a portion of the flow from RTP to Salmon Creek Treatment Plant (SCTP).

DCW Alliance is proposing to continue meeting its effluent treatment limits by optimizing the plant's secondary treatment capacity. The first phase (1A) of these improvements would ensure that the RTP continues to successfully meet its treatment goals at maximum month flows of 0.7 mgd in the case that loadings to the facility increase over time relative to flows (that is, influent concentrations increase). Phase 1A includes improvements that were originally approved by Ecology as part of the City of Ridgefield Wastewater Treatment Plant Expansion (Phase 1) design documents from July 2000. These improvements are focused on optimizing biological nutrient removal (BNR) in the secondary system at RTP and consist of the following:

- Installation of aeration basin baffles to convert existing complete-mix reactors to plug flow configuration to increase BNR performance
- Relocation of existing mixed liquor recycle (MLR) pumps as well as installation of adjustable frequency drives on these pumps that allow operator adjustment and selection of MLR flowrate
- Installation of additional process instrumentation for optimizing BNR, including oxidation-reduction potential (ORP), ammonia, total suspended solids, and dissolved oxygen probes.

The second phase (1B) of the proposed improvements would increase the RTP's capacity from the current maximum month flow of 0.7 mgd up to 0.9 mgd. Phase 1B would consist of the following improvements:

- Conversion of the existing Aerobic Digester 2, which has not been in service since 2016, into a three-zone, anoxic reactor upstream of the existing aeration basins
- Conversion of the anoxic zone in the existing aeration basins to an anoxic/aerobic swing zone with wall-to-wall fine-bubble diffusers

The Phase 1B improvements would increase overall secondary treatment volume by reconfiguring existing tankage and adding some additional yard piping.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

The RTP covers two acres of land located at 109-111 W Division Street (NE ¼ and NW ¼, Section 24, Township 4 North, Range 1 West in Clark County, Washington) in the City of Ridgefield. The property lies on the northeast bank of Lake River, which is a tributary/oxbow of the Columbia River that runs north along the east side of Bachelor Island (see Figure 1 Vicinity Map).

The outflow currently discharges to the Columbia River at Latitude: North 45 49' 17.969" and Longitude: West 122 45' 13.665". The existing outfall is located at an elevation of 7.95 feet NAVD.

Biosolids can be hauled to either Salmon Creek Treatment Plant, located at 15100 NW McCann Road, Vancouver, WA, or Three Rivers Regional Wastewater Authority Plant, located at 467 Fibre Way, Longview, WA.

1.2 Environmental Elements

1.2.1 Earth

a. General description of the site: flat, rolling

The Columbia and Lake River floodplains are fairly flat with gradual slopes approaching 3 to 4 percent grade with steeper levee embankments.

b. What is the steepest slope on the site (approximate percent slope)?

Levee embankments in the area approach 50 percent grade.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.

Soils on Bachelor Island and along the Ridgefield waterfront include Sauvie-Puyallup association: deep nearly level to gently sloping, somewhat poorly drained to somewhat excessively drained, moderate fine textured to moderately coarse textured soils of the floodplains (Soil Survey of Clark County, WA, USDA, Soil Conservation Survey, 1972).

Three soil classifications on the site include:

- SmB, Sauvie silt loam, 3 to 8 percent slopes.
- SpB, Sauvie silty clay loam, 0 to 8 percent slopes.
- CvA, Cove silty clay loam, 0 to 3 percent slopes.

There would be no change to soils as a result of the RTP STPI project.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

No, however, soils on Bachelor Island may be soft enough to require that heavy dense structures are not located in shoreline areas.

e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.

Phase 1A will not involve any filling, excavation, grading. Phase 1B will include a total of approximately four-hundred lineal feet of excavations for additional yard piping with an average depth of three feet.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Phase 1A improvements are completely contained within the existing aeration basins, other than above-ground instrumentation and electrical work. Potential erosion during Phase 1B construction will be minor because the disturbance area will be only four hundred feet, the work site is nearly level and previously developed, and the RTP site is completely contained.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

There would be no change to the impervious surfaces at RTP.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Trucks and equipment will use existing paved surfaces for access. Site stormwater is completely contained in the existing stormwater system. An erosion and sediment control plan will be prepared and implemented; control measures will include seeding, mulching, sediment fence, inlet filters, biobags, straw wattles, or similar devices, as needed. Pollution controls are available on site in the event of an accidental spill.

1.2.2 Air

a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.

The RTP operates under Air Discharge Permit 00-2316 issued by the Southwest Clean Air Agency (SWCAA). Operation under this permit would not change for Phase 1A, and Phase 1B would entail an expansion of the flow capacity of the plant from the current capacity of 0.7 mgd to 0.9 mgd.

1.2.2.1 Construction

Temporary air quality impacts during construction will include construction machinery exhaust emissions, primarily from particulate matter less than 10 micrometers and 2.5 micrometers in aerodynamic diameter

(PM_{10} and $PM_{2.5}$, respectively), and from small amounts of carbon monoxide (CO) and oxides of nitrogen. The sources of particulate matter might be diesel smoke.

Some construction activities may cause odors. These types of odors will be short-term and unlikely to impact adjacent uses.

1.2.2.2 Operation of RTP

During operation, there would be no change to air emissions from RTP.

b. Are there any offsite sources of emissions or odor that may affect your proposal? If so, generally describe.

No offsite sources of emissions or odor have been identified that may affect this proposal.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

During construction, BMPs for project impacts to air quality, odor, and GHG emissions could include, but would not be limited to the following:

- Turning off construction equipment when not in use to minimize idling and reduce GHG emissions

1.2.3 Water

a. Surface Water:

1. Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

The RTP discharges to Lake River, which lies immediately south of the plant and flows northwest to its confluence with the Columbia River approximately 2 miles downstream.

The Columbia River flows northwest past Bachelor Island approximately 1 mile south of the WWTP site.

There are no wetlands onsite. The nearest wetlands are Freshwater Emergent Wetlands immediately surrounding Carty Lake northwest of the site (USFWS National Wetlands Inventory 2022).

2. Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

No.

3. Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

The improvements would not fill any surface waters or wetlands.

4. Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

The improvements do not propose surface water withdrawal or diversion.

5. Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

The project would not produce any changes to the floodplain. The effluent outfall lies within the 100-year floodplain of the Columbia River, Lake River, and other drainages, but will not be affected by the proposed project. The RTP is not in a 100-year floodplain (FEMA 2022)[1].

6. Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

The RTP discharges treated wastewater to Lake River, permitted under NPDES Permit No. WA 0023272.

Phase 1A of the current project (STPI) will increase the capacity of the facility to handle higher wastewater five-day biochemical oxygen demand and total suspended solids loads while maintaining the current maximum month flow capacity of 0.7 mgd. Phase 1B of the STP involves the upgrade of the RTP from a current maximum month capacity of 0.7 mgd to 0.9 mgd. There are no future plans to expand the Ridgefield Wastewater Treatment Plant (RTP) footprint.

The Alliance plans to accommodate most of the growth in the Ridgefield service area by increasing treatment capacity at the Alliance's main treatment plant, Salmon Creek Treatment Plant (SCTP), instead of significantly expanding the RTP's capacity to 1.8 million gallons per day (MGD) (Phase 2) or 2.7 mgd (Phase 3), as described in the *City of Ridgefield General Sewer Plan* (Gray & Osborne, 2013) and approved by Ecology.

b. Groundwater:

1. Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.

No, groundwater will not be withdrawn from a well for use at the Battery Storage Facility.

2. Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals…; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

The RTP does not utilize septic tanks.

c. Water runoff (including stormwater):

1. Describe the source of runoff (including stormwater) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

Stormwater runoff is the only source of water runoff expected at the site. No expansion of impervious surfaces will occur as part of this project, existing stormwater management will not be disturbed.

[1] FEMA 2022. Flood Insurance Rate Map, printable version. National Flood Hazard Layer Mapper. https://www.fema.gov/flood-maps/national-flood-hazard-layer Retrieved March 14.

2. Could waste materials enter ground or surface waters? If so, generally describe.

There is a possibility that small amounts of waste materials (i.e., small amounts of petroleum products, sediments) could occur from construction activity. Spill prevention BMPs will be followed during construction to avoid such spills.

3. Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.

Not applicable, there is no change to the facility footprint and therefore no change to drainage patterns.

d. Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, if any:

Not applicable.

1.2.4 Plants

a. Check the types of vegetation found on the site:

X	Deciduous tree: alder, maple, aspen, other
	Evergreen tree: fir, cedar, pine, other
X	Shrubs
X	Grass
X	Pasture
	Crop or grain
	Orchards, vineyards or other permanent crops.
X	Wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
X	Water plants: water lily, eelgrass, milfoil, other
	Other types of vegetation

b. What kind and amount of vegetation will be removed or altered?

There would be no disturbance or removal of vegetation association with this project.

c. List threatened and endangered species known to be on or near the site.

Golden Paintbrush (Castilleja levisecta) and Nelson's Checker-mallow (Sidalcea nelsoniana) could be found in the area, but there would be no potential impacts to threatened and endangered plant species.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

There would be no disturbance or change to existing landscaping at the site.

e. List all noxious weeds and invasive species known to be on or near the site.

There was no survey of noxious weed or invasive species on or near the site. There would be no contribution to noxious weed or invasive species associated with the project.

1.2.5 Animals

a. List any birds and other animals which have been observed on or near the site or are known to be on or near the site.

- **birds:** hawk, heron, eagle, songbirds, and waterfowl on Lake River
- **mammals:** deer
- **fish:** salmon

There is suitable nesting habitat for birds, subject to the Migratory Bird Treaty Act, within and adjacent to the project area.

b. List any threatened and endangered species known to be on or near the site.

Birds

- Bald Eagle
- Black Swift
- Cassin's Finch
- Lessor Yellowlegs
- Northern Spotted Owl
- Olive-sided Flycatcher
- Rufous Hummingbird
- Short-billed Dowitcher

Fishes

- Designated Critical Habitat for Columbia River chum Evolutionarily Significant Unit (ESU)
- Designated Critical Habitat for Lower Columbia River coho ESU
- Green sturgeon
- Eulachon
- Snake River sockeye
- Columbia River chum
- Lower Columbia River Coho
- Lower Columbia River Chinook
- Snake River Fall-Run Chinook
- Upper Columbia Spring-Run Chinook
- Upper Willamette River Chinook
- Lower Columbia River Steelhead
- Middle Columbia River Steelhead
- Snake River Basin Steelhead
- Upper Columbia River Steelhead
- Upper Willamette River Steelhead

c. Is the site part of a migration route? If so, explain.

The Lower Columbia River (including the Ridgefield Wildlife Refuge) lies along the Pacific Flyway and is a stopover point for waterfowl during the spring and fall migrations.

The Columbia River is a migratory artery for anadromous salmonids, sturgeon, lampreys etc. Lake River likely provides rearing habitat for juvenile salmonids and provides migratory habitat for adults.

d. Proposed measures to preserve or enhance wildlife, if any:

No proposed measures.

e. List any invasive animal species known to be on or near the site.

None.

1.2.6 Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Electrical energy is used to pump effluent. Only under emergency conditions, diesel generators may be used to pump effluent (generally associated with flooding).

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No, the potential use of solar energy by adjacent properties would not be affected.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

The upgrades in the STPI will promote significant energy conservation at the plant .

Phase 1A of the project contains the following energy-saving elements:

- variable frequency drives (VFDs) to the mixed liquor recycle pumps to reduce pump operating speed when flows are below peak
- internal baffling to increase aeration basin efficiency
- ORP, TSS, DO, NH_3 instrumentation to reduce aeration energy while meeting treatment goals
- Phase 1B of the project will contain the following:
- additional anoxic zone volume, which provide secondary treatment without the need for aeration.

1.2.7 Environmental Health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

1. Describe any known or possible contamination at the site from present or past uses.

It is known that groundwater in the vicinity of the RTP has been impacted by contamination from the former Pacific Wood Treatment operation. The Port of Ridgefield is currently using a steam injection, and pump and treat system to mobilize and clean-up contamination (USDA 2007).

2. Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

There are no known hazardous chemicals or conditions that would affect the project development and design.

3. **Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.**

None, other than the fuels, lubricants, and coolants present in the construction vehicles and equipment.

4. **Describe special emergency services that might be required.**

No special emergency services would be required.

5. **Proposed measures to reduce or control environmental health hazards, if any:**

The Alliance has plans in place to reduce or control potential environmental health hazards at RTP. The RTP *Wastewater Treatment Facility Operation and Maintenance Manual* (Gray & Osborne, 2007; updated 2022) would be updated before operations with the new improvements begin.

Other methods include project design features that avoid or minimize impacts from hazards or hazardous materials. Safety measures for utility construction in accordance with the Washington State Department of Labor and Industries Standards will be implemented. Construction equipment will be fitted with Hazardous Materials Spill Containment Kits and construction crews shall be trained in their use. The project design also complies with the requirements of the International Building Code and Uniform Fire Code.

b. Noise

1. **What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?**

The daytime and nighttime sound levels in the project vicinity come from local vehicular traffic and the railroad tracks just north of RTP. Any temporary construction noise would be limited to the interior of the building.

2. **What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.**

1.2.7.1 Construction

Temporary construction noise would be limited to truck traffic because all construction would be indoors. Traffic would occur during daytime hours between 7:00 a.m. and 6:00 p.m.

1.2.7.2 RTP Operation

There would be no new noise generated by the RTP after the secondary treatment improvements are installed.

3. **Proposed measures to reduce or control noise impacts, if any:**

1.2.7.3 Construction

Because construction noise levels will be limited to trucks and short-term, contractors will implement the following measures to minimize noise from construction activities:

- Operate equipment during approved hours as required by local permits.
- Minimize idling time of heavy equipment and vehicles.
- Ensure adequacy of mufflers on all engines (vehicle and emergency generator).

1.2.7.4 RTP Operation

None planned. The RTP will continue to operate, as in the past, within permissible noise limits.

1.2.8 Land and Shoreline Use

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

The current site is a collection of parcels (98602801, 68373000, 68363000, 68354000 and 68389000) zoned Public Facility (PF) and Waterfront Mixed Use (WMU).

Due east (east of W Division Street) are smaller parcels zoned Urban Low Density Residential, nearly all developed as residential.

Due south, north and surrounding the RTP is vacant land zoned Agri-Wildlife (AG-WL).

Just west and continuing northwest of the property is zoned Parks/Open Space which borders Lake River and Carty Lake.

The process improvements would not impact the land uses of adjacent properties because all improvements are within the parcel or interior to the buildings.

b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

No, the site was used historically to store untreated logs while the surrounding property was used by Pacific Wood Treatment Corporation to chemically treat wood products with creosote and pentachlorophenol.

1. Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:

Not applicable.

c. Describe any structures on the site.

The RTP consists of numerous structures and tanks that are identified in Figure 2 Site Plan.

d. Will any structures be demolished? If so, what?

No structures would be demolished.

e. What is the current zoning classification of the site?

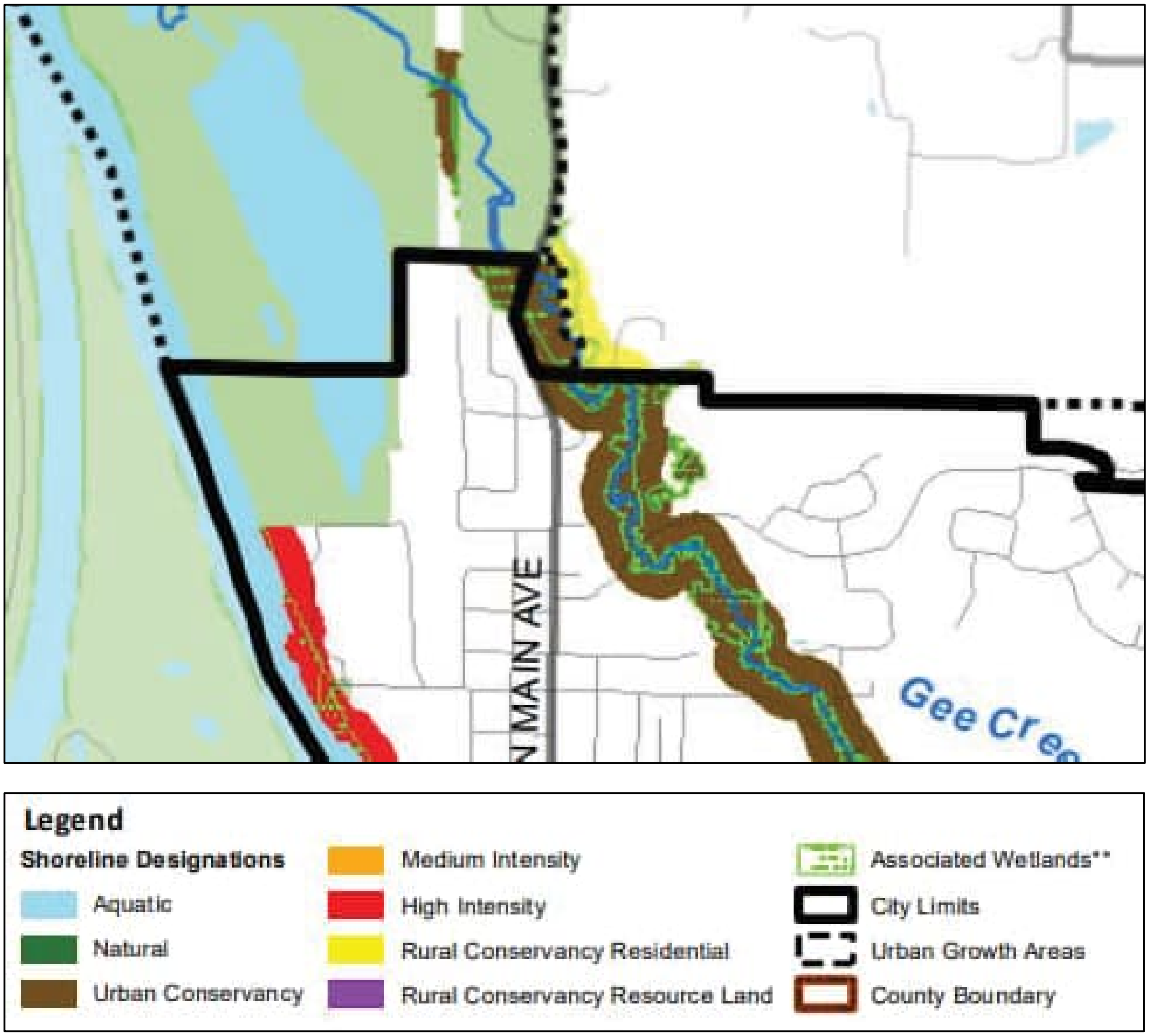
Public Facility

f. What is the current comprehensive plan designation of the site?

Public Facility

g. If applicable, what is the current shoreline master program designation of the site?

Urban at the RTP and Rural on the Wildlife Refuge where the outfall is located (Ridgefield 2021).



h. Has any part of the site been classified as a critical area by the city or county? If so, specify.

The RTP outfall occupies a critical area but will not be disturbed as part of this project, which will only include work in the main footprint of the RTP as shown in Figure 1, RTP Vicinity Map.

i. Approximately how many people would reside or work in the completed project?

There are no residential units associated with the project. The facility is designed to for approximately 3 fulltime workers at the RTP. Construction worker staffing is dependent on a number of factors, but an average crew of three to five contractor staff would be typical for a project of this size.

j. Approximately how many people would the completed project displace?

None. There is no change to the proposed footprint of the RTP.

k. Proposed measures to avoid or reduce displacement impacts, if any:

Not applicable.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The proposal is compatible with existing and projected land uses and plans.

m. Proposed measures to reduce or control impacts to agricultural and forest lands of long-term commercial significance, if any:

Not applicable.

1.2.9 Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

Zero.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

Zero.

c. Proposed measures to reduce or control housing impacts, if any:

Not applicable.

1.2.10 Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

No new buildings are proposed.

b. What views in the immediate vicinity would be altered or obstructed?

There would be no changes to the views in the immediate vicinity.

c. Proposed measures to reduce or control aesthetic impacts, if any:

None.

1.2.11 Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

During construction, there would be no new exterior safety lighting that could cause new light or glare.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

Not applicable.

c. What existing off-site sources of light or glare may affect your proposal?

Existing off-site light or glare would not affect construction interior to the buildings.

d. Proposed measures to reduce or control light and glare impacts, if any:

None.

1.2.12 Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

None.

b. Would the proposed project displace any existing recreational uses? If so, describe.

No

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

Not applicable.

1.2.13 Historic and Cultural Preservation

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers? If so, specifically describe.

No.

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.

There are no known elements of this nature that have been identified to date.

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.

Alliance will perform a professional archaeological survey of the pipe-routing prior to ground-disturbing activities.

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

The Phase 1A improvements will not disturb earthwork. The Phase 1B improvements will include minimal trenching for yard piping improvements, and Alliance will perform a professional archaeological survey of the pipe routing prior to ground-disturbing activities. RCW 27.44 and RCW 27.53.060 require that a person obtain a permit from the DAHP before excavating, removing, or altering Native American human remains or archaeological resources in Washington. The completed survey will be submitted to the Department of Archaeological and Historic Preservation (DAHP) and the interested Tribes prior to ground disturbance. Concerned Tribes' cultural committees and staff will be consulted regarding cultural resource issues.

1.2.14 Transportation

a. Identify public streets and highways serving the site or affected geographic area and describe proposed access to the existing street system. Show on site plans, if any.

The project area is only accessible from W Division Street. The nearest interstate highway is I-5 to the east which serves the RTP via State Route 501/Pioneer Street.

b. Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?

The site is not currently served by public transportation. The nearest C-Trans transit stop is at Royale Road approximately 3 miles away.

c. How many additional parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate?

Not applicable.

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).

The improvements would not require any modifications to the existing road system.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

No.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and non-passenger vehicles). What data or transportation models were used to make these estimates?

There would be no change to vehicle trips by RTP workers after completion of the secondary treatment improvements.

No trip generation modeling was conducted.

g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.

No.

h. Proposed measures to reduce or control transportation impacts, if any:

None

1.2.15 Public Services

a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.

No.

b. Proposed measures to reduce or control direct impacts on public services, if any.

The proposed project will improve the performance and capacity of the RTP. The Ridgefield Flow Diversion Plan will continue to divert additional flows from the RTP to the SCTP as additional project elements are completely sequentially. There will be no disruption of service to the public.

1.2.16 Utilities

a. Circle utilities currently available at the site:

Electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system,

other ___________

All utilities needed are already onsite.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

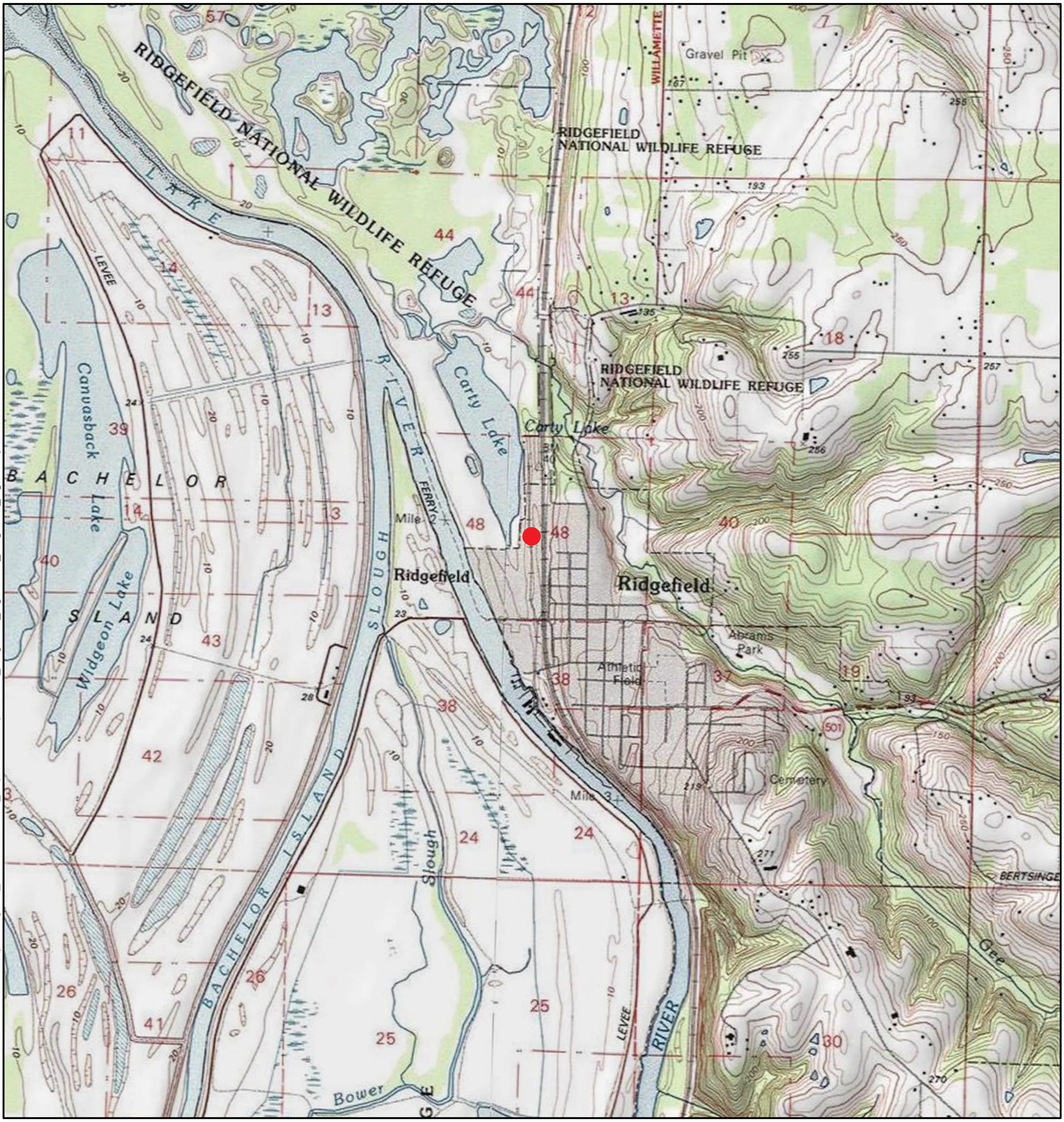
The proposed project will allow the Alliance's RTP to maintain plant capacity and restore normal influent loadings. There would be no change to wastewater services for Alliance customers during the construction/implementation of the secondary treatment process improvements.

1.3 Signature

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature:	Robin Krause Digitally signed by Robin Krause Date: 2024.04.09 10:42:39 -07'00'
Name of signee:	
Position and Agency/Organization:	
Date Submitted:	

Figures



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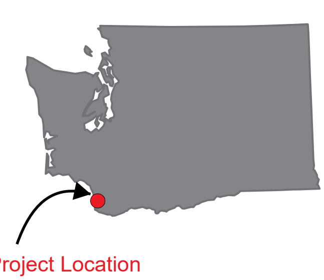
Locator Map



Legend

● Ridgefield Wastewater Treatment Plant

Figure 1. RTP Vicinity Map

0 0.25 0.5 Miles

N

Ridgefield WWTP Engineering Report

USGS Topo

Clark County, Washington

Jacobs

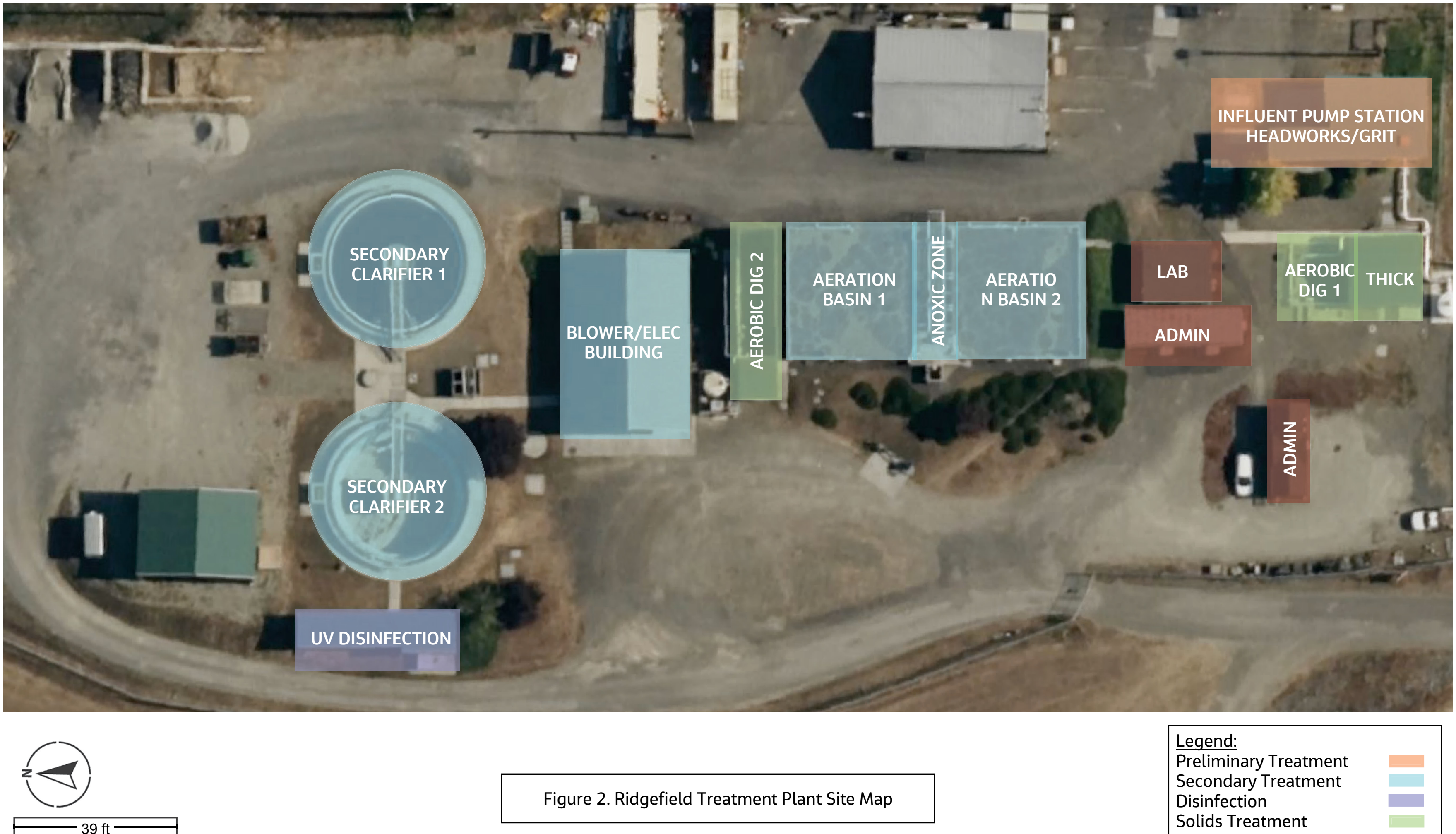


Figure 2. Ridgefield Treatment Plant Site Map

Legend:
Preliminary Treatment
Secondary Treatment
Disinfection
Solids Treatment
Lab/Admin

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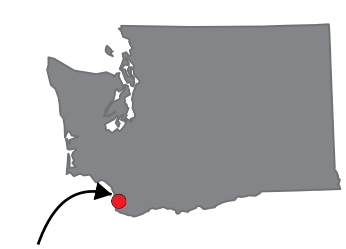
Locator Map

Washington



Legend

Tax Lots
Source: Clark County, WA

Figure 3. Land Use and Zoning

0 125 250 Feet

Ridgefield Treatment Plant Engineering Report

Tax Lots

Clark County, Washington

Jacobs

Appendix F
Cost Estimate Details

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Appendix F -- Cost Estimate Details

RTP Phase 1A Expansion

Project Cost Element		*Cost ($)*		
Construction Baseline				
New Baseline Project:				
		Total Costs		Raw Costs
Phase 1A Baffles		$142,055		$109,224
VFD's on MLR pumps		$31,052		$23,875
Instrumentation		$69,334		$53,310
Electrical Allowance (22%)		$53,337		$41,010
Installation Factor (60%)		$117,205		$90,117
Subtotal below includes the following:			***Subtotal Raw Cost***	***$317,536***
General Conditions (8%); Mobilization/Demob (3%);				
Prime Contractor Home Office Overhead (10%);			Sales Tax (8.4%)	$15,658
Prime Contractor Profit (5%); Bonds & Insurance (2%)			***Subtotal Raw Cost + Tax***	***$333,194***
Subtotal Construction Baseline		***$412,983***		
Escalated Construction Baseline				
Estimate Year	2023			
ENR Value				
Budget Year	2024			
ENR Value				
Escalation Years	1			
Annual Escalation Rate	5%		Escalation	$20,649.15
Escalation Multiplier	1.05			
Escalated Construction Baseline		***$433,632***		
Construction Contingency Based on Project Definition				
Design Definition	2%			
Class of Estimate	5			
Contingency				
Class 5	45%			
Class 4	35%	$151,771		
Class 3	25%			
Class 2	15%			
Class 1	5%			
Subtotal Construction Costs with Contingency		***$585,403***		

Appendix F -- Cost Estimate Details

Project Delivery Costs Based on Project Complexity		
Project Delivery Costs		
Complex	40%	
Integrated	35%	
Moderate	30%	
Straightforward	15%	$87,811
Purchase	5%	
Subtotal Baseline Project Cost		***$673,214***
Overall Project Contingency		
Project Contingency		
High	10%	
Medium	5%	
Low	0%	
Total Project Cost		$673,214
Total Project Cost - Capital Budget (Rounded)		***$700,000***
Project Cost Allocation		
Battle Ground Share	0.0%	***$0***
District Share	100.0%	***$700,000***

RTP Phase 1B Expansion

Project Cost Element		*Cost ($)*		
Construction Baseline				
New Baseline Project:				
		Total Costs		Raw Costs
Sitework		$66,159		$50,000
Phase 1B Baffles		$84,387		$63,776
Diffuser System (Swing-Zone)		$72,775		$55,000
Submersible Mixer (Anoxic Reactor)		$13,232		$10,000
Mechanical: Valving & Piping		$250,761		$189,515
Electrical Allowance (22%)		$107,209		$81,024
Installation Factor (60%)		$252,693		$190,974
Subtotal below includes the following:			***Subtotal Raw Cost***	***$640,289***
General Conditions (8%); Mobilization/Demob (3%);				
Prime Contractor Home Office Overhead (10%);			Sales Tax (8.4%)	$10,817
Prime Contractor Profit (5%);			***Subtotal Raw Cost + Tax***	***$651,106***
Bonds & Insurance (2%)				
Subtotal Construction Baseline		***$847,215***		
Escalated Construction Baseline				
Estimate Year	2023			
ENR Value				
Budget Year	2028			
ENR Value				
			Escalation	$234,069.99
Escalation Years	5			
Annual Escalation Rate	5%			
Escalation Multiplier	1.28			
Escalated Construction Baseline		***$1,081,285***		
Construction Contingency Based on Project Definition				
Design Definition	2%			
Class of Estimate	5			
Contingency				
Class 5	45%	$486,578		
Class 4	35%			
Class 3	25%			
Class 2	15%			
Class 1	5%			

Subtotal Construction Costs with Conti		***$1,567,864***
Project Delivery Costs Based on Project Complexity		
Project Delivery Costs		
Complex	40%	
Integrated	35%	
Moderate	30%	$470,359
Straightforward	25%	
Purchase	5%	
Subtotal Baseline Project Cost		***$2,038,223***
Overall Project Contingency		
Project Contingency		
High	10%	$203,822
Medium	5%	
Low	0%	
Total Project Cost		$2,242,045
Total Project Cost - Capital Budget (Ro		***$2,300,000***
Project Cost Allocation		
Battle Ground Share	0.0%	***$0***
District Share	100.0%	***$2,300,000***

Appendix G
Drawings

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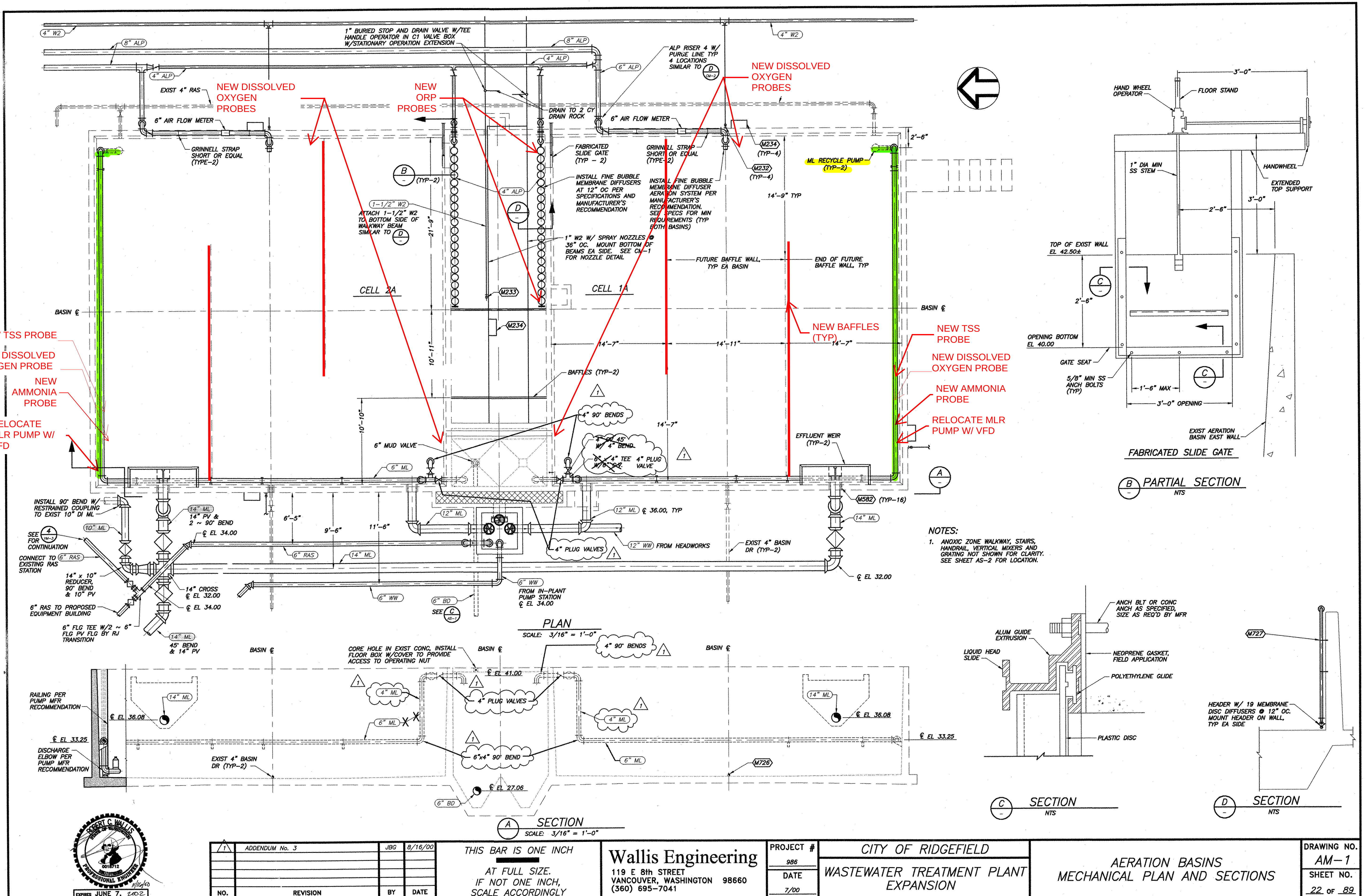
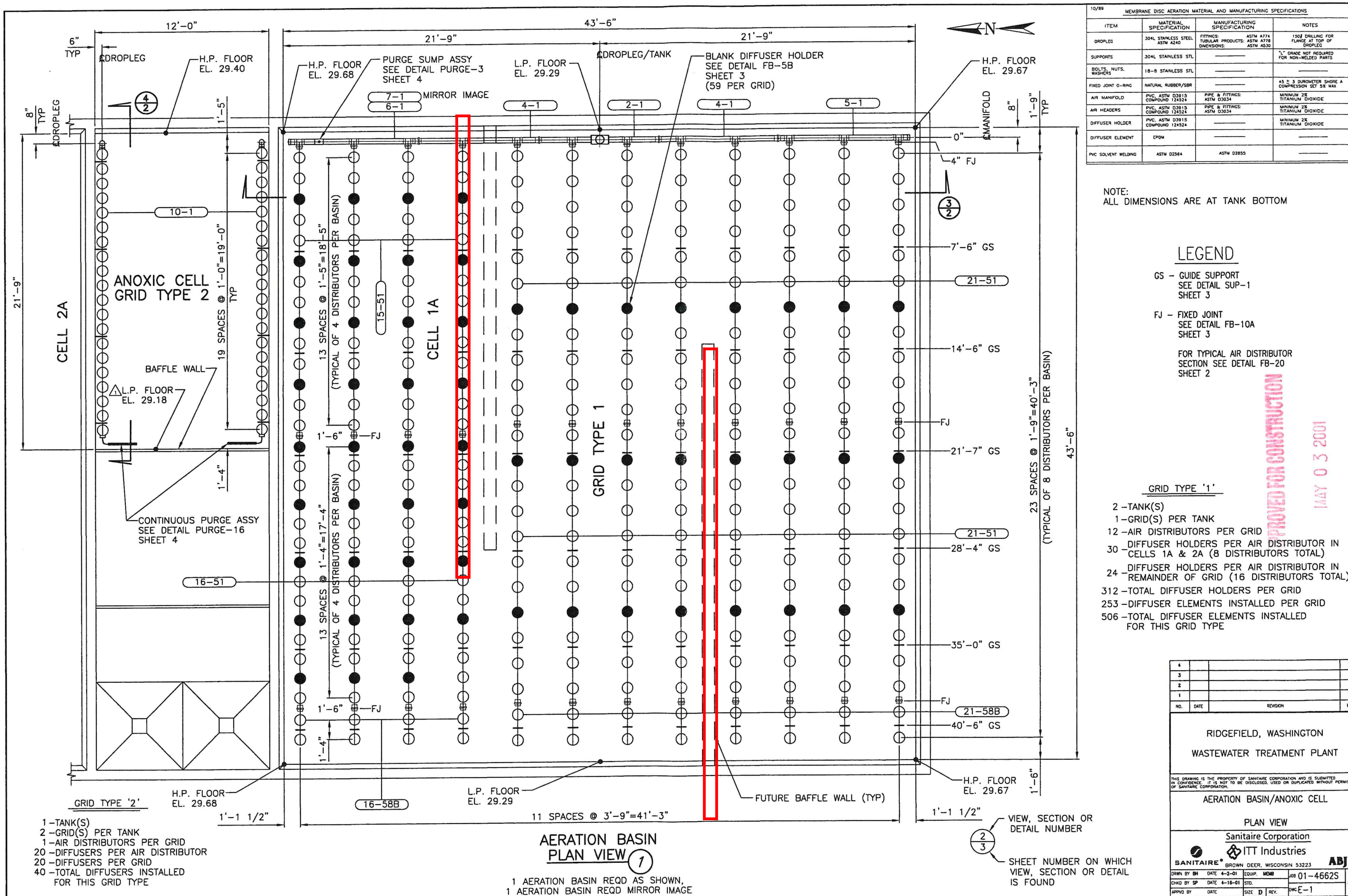
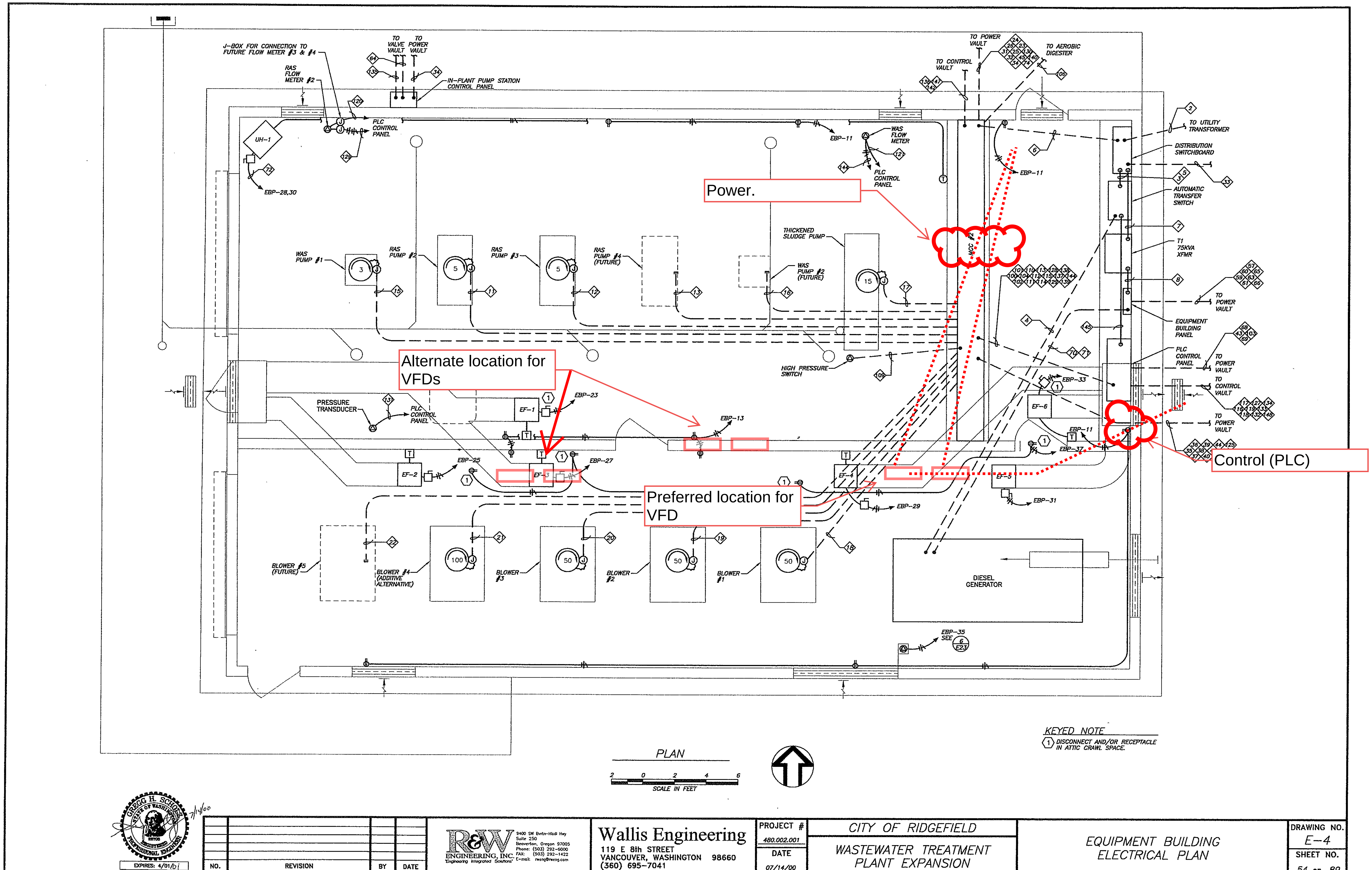

NEW DISSOLVED OXYGEN PROBES
NEW ORP PROBES
NEW DISSOLVED OXYGEN PROBES
ML RECYCLE PUMP (TYP-2)
NEW TSS PROBE
NEW DISSOLVED OXYGEN PROBE
NEW AMMONIA PROBE
RELOCATE MLR PUMP W/ VFD
NEW BAFFLES (TYP)
NEW TSS PROBE
NEW DISSOLVED OXYGEN PROBE
NEW AMMONIA PROBE
RELOCATE MLR PUMP W/ VFD
CELL 2A
CELL 1A
1" BURIED STOP AND DRAIN VALVE W/TEE HANDLE OPERATOR IN C1 VALVE BOX W/STATIONARY OPERATION EXTENSION
EXIST 4" RAS
6" AIR FLOW METER
GRINNELL STRAP SHORT OR EQUAL (TYPE-2)
FABRICATED SLIDE GATE (TYP - 2)
INSTALL FINE BUBBLE MEMBRANE DIFFUSERS AT 12" OC PER SPECIFICATIONS AND MANUFACTURER'S RECOMMENDATION
INSTALL FINE BUBBLE MEMBRANE DIFFUSER AERATION SYSTEM PER MANUFACTURER'S RECOMMENDATION. SEE SPECS FOR MIN REQUIREMENTS (TYP BOTH BASINS)
ALP RISER 4 W/ PURGE LINE TYP 4 LOCATIONS SIMILAR TO
DRAIN TO 2 CY DRAIN ROCK
ATTACH 1-1/2" W2 TO BOTTOM SIDE OF WALKWAY BEAM SIMILAR TO
1" W2 W/ SPRAY NOZZLES @ 36" OC. MOUNT BOTTOM OF BEAMS EA SIDE. SEE CM-1 FOR NOZZLE DETAIL
FUTURE BAFFLE WALL, TYP EA BASIN
END OF FUTURE BAFFLE WALL, TYP
BAFFLES (TYP-2)
EFFLUENT WEIR (TYP-2)
6" MUD VALVE
4" PLUG VALVES
12" WW FROM HEADWORKS
EXIST 4" BASIN DR (TYP-2)
6" WW FROM IN-PLANT PUMP STATION ℄ EL 34.00
INSTALL 90° BEND W/ RESTRAINED COUPLING TO EXIST 10" DI ML
CONNECT TO EXISTING RAS STATION
14" x 10" REDUCER, 90° BEND & 10" PV
6" RAS TO PROPOSED EQUIPMENT BUILDING
6" FLG TEE W/2 ~ 6" FLG PV FLG BY RJ TRANSITION
45° BEND & 14" PV
14" CROSS ℄ EL 32.00
PLAN
SCALE: 3/16" = 1'-0"
NOTES:
1. ANOXIC ZONE WALKWAY, STAIRS, HANDRAIL, VERTICAL MIXERS AND GRATING NOT SHOWN FOR CLARITY. SEE SHEET AS-2 FOR LOCATION.
HAND WHEEL OPERATOR
FLOOR STAND
1" DIA MIN SS STEM
HANDWHEEL
EXTENDED TOP SUPPORT
TOP OF EXIST WALL EL 42.50±
OPENING BOTTOM EL 40.00
GATE SEAT
5/8" MIN SS ANCH BOLTS (TYP)
3'-0" OPENING
EXIST AERATION BASIN EAST WALL
FABRICATED SLIDE GATE
B PARTIAL SECTION
NTS
CORE HOLE IN EXIST CONC, INSTALL FLOOR BOX W/COVER TO PROVIDE ACCESS TO OPERATING NUT
RAILING PER PUMP MFR RECOMMENDATION
DISCHARGE ELBOW PER PUMP MFR RECOMMENDATION
A SECTION
SCALE: 3/16" = 1'-0"
ANCH BLT OR CONC ANCH AS SPECIFIED, SIZE AS REQ'D BY MFR
ALUM GUIDE EXTRUSION
LIQUID HEAD SLIDE
NEOPRENE GASKET, FIELD APPLICATION
POLYETHYLENE GLIDE
PLASTIC DISC
C SECTION
NTS
HEADER W/ 19 MEMBRANE DISC DIFFUSERS @ 12" OC. MOUNT HEADER ON WALL, TYP EA SIDE
D SECTION
NTS
ADDENDUM No. 3 JBG 8/16/00
NO. REVISION BY DATE
THIS BAR IS ONE INCH AT FULL SIZE. IF NOT ONE INCH, SCALE ACCORDINGLY
Wallis Engineering
119 E 8th STREET
VANCOUVER, WASHINGTON 98660
(360) 695-7041
PROJECT # 986
DATE 7/00
CITY OF RIDGEFIELD
WASTEWATER TREATMENT PLANT EXPANSION
AERATION BASINS MECHANICAL PLAN AND SECTIONS
DRAWING NO. AM-1
SHEET NO. 22 OF 89
EXPIRES JUNE 7, 2002

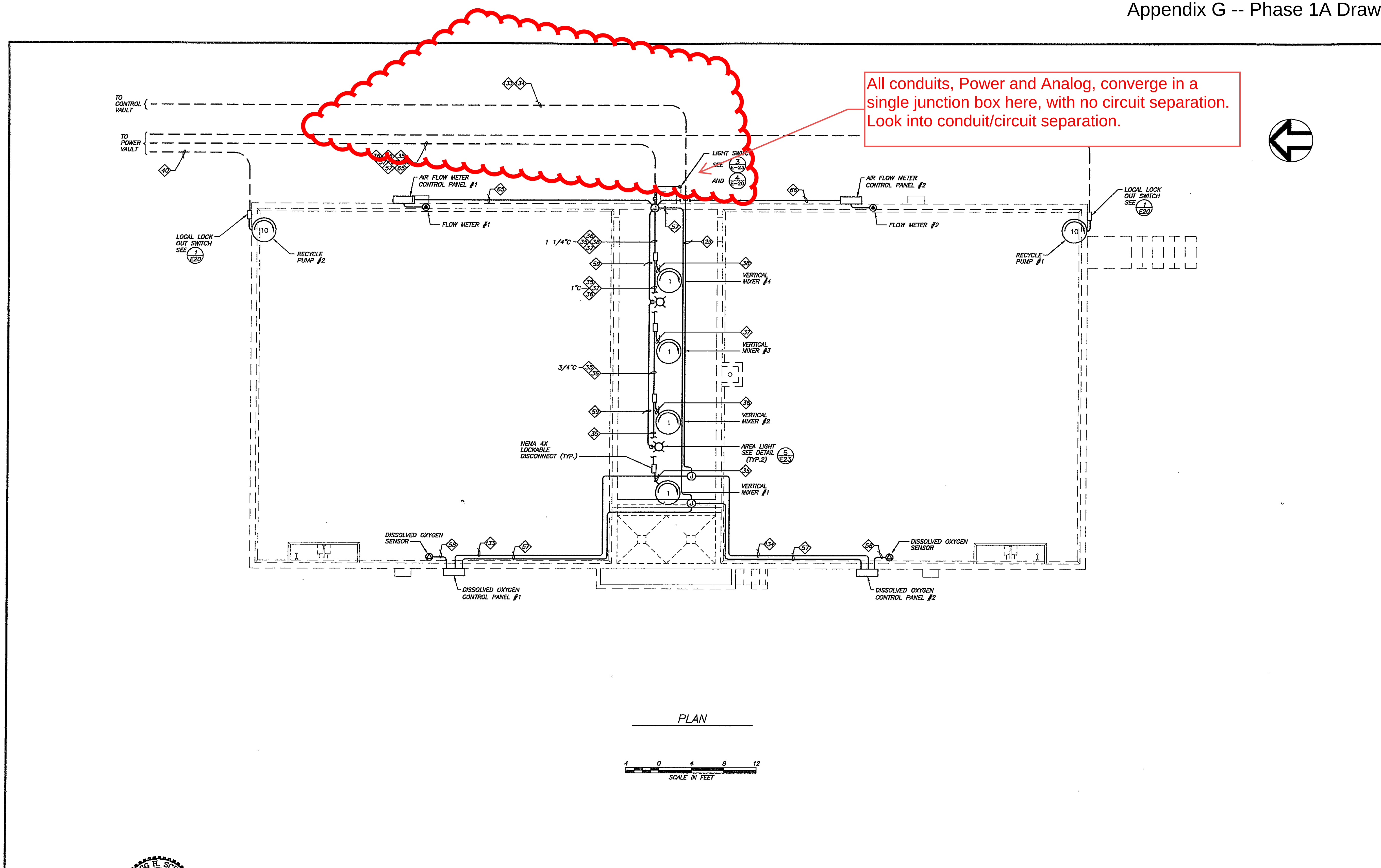


10/89 MEMBRANE DISC AERATION MATERIAL AND MANUFACTURING SPECIFICATIONS

ITEM	MATERIAL SPECIFICATION	MANUFACTURING SPECIFICATION	NOTES
DROPLEG	304L STAINLESS STEEL ASTM A240	FITTINGS: ASTM A774; TUBULAR PRODUCTS: ASTM A778; DIMENSIONS: ASTM A530	150# DRILLING FOR FLANGE AT TOP OF DROPLEG
SUPPORTS	304L STAINLESS STL	—	"L" GRADE NOT REQUIRED FOR NON-WELDED PARTS
BOLTS, NUTS, WASHERS	18-8 STAINLESS STL	—	—
FIXED JOINT O-RING	NATURAL RUBBER/SBR	—	45 ± 5 DUROMETER SHORE A COMPRESSION SET 5% MAX
AIR MANIFOLD	PVC, ASTM D3915 COMPOUND 124524	PIPE & FITTINGS: ASTM D3034	MINIMUM 2% TITANIUM DIOXIDE
AIR HEADERS	PVC, ASTM D3915 COMPOUND 124524	PIPE & FITTINGS: ASTM D3034	MINIMUM 2% TITANIUM DIOXIDE
DIFFUSER HOLDER	PVC, ASTM D3915 COMPOUND 124524	—	MINIMUM 2% TITANIUM DIOXIDE
DIFFUSER ELEMENT	EPDM	—	—
PVC SOLVENT WELDING	ASTM D2564	ASTM D2855	—



Power.
Alternate location for VFDs
Preferred location for VFD
Control (PLC)
DIESEL GENERATOR
PLAN
SCALE IN FEET
KEYED NOTE
1 DISCONNECT AND/OR RECEPTACLE IN ATTIC CRAWL SPACE.
Wallis Engineering
119 E 8th STREET
VANCOUVER, WASHINGTON 98660
(360) 695-7041
PROJECT # 480.002.001
DATE 07/14/00
CITY OF RIDGEFIELD
WASTEWATER TREATMENT PLANT EXPANSION
EQUIPMENT BUILDING ELECTRICAL PLAN
DRAWING NO. E-4
SHEET NO. 54 OF 89
NO.
REVISION
BY
DATE



NO.	REVISION	BY	DATE

EXPIRES: 4/01/01

R&W ENGINEERING, INC. "Engineering Integrated Solutions" 9400 SW Barton-Hoadi Way Suite 250 Beaverton, Oregon 97005 Phone: (503) 292-6000 FAX: (503) 292-1422

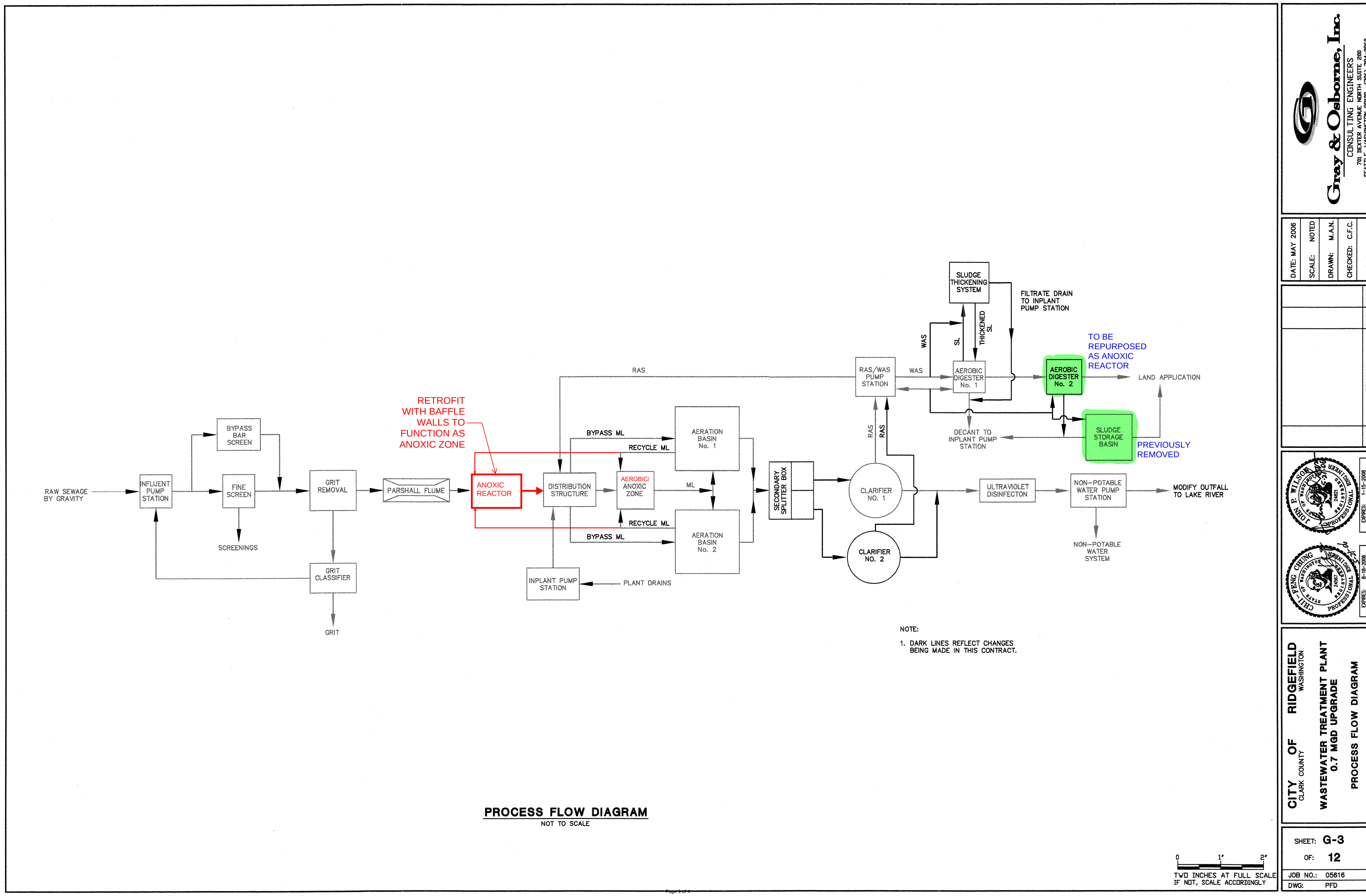
Wallis Engineering
119 E 8th STREET
VANCOUVER, WASHINGTON 98660
(360) 695-7041

PROJECT # 480.002.001
DATE 07/14/00

CITY OF RIDGEFIELD
WASTEWATER TREATMENT PLANT EXPANSION

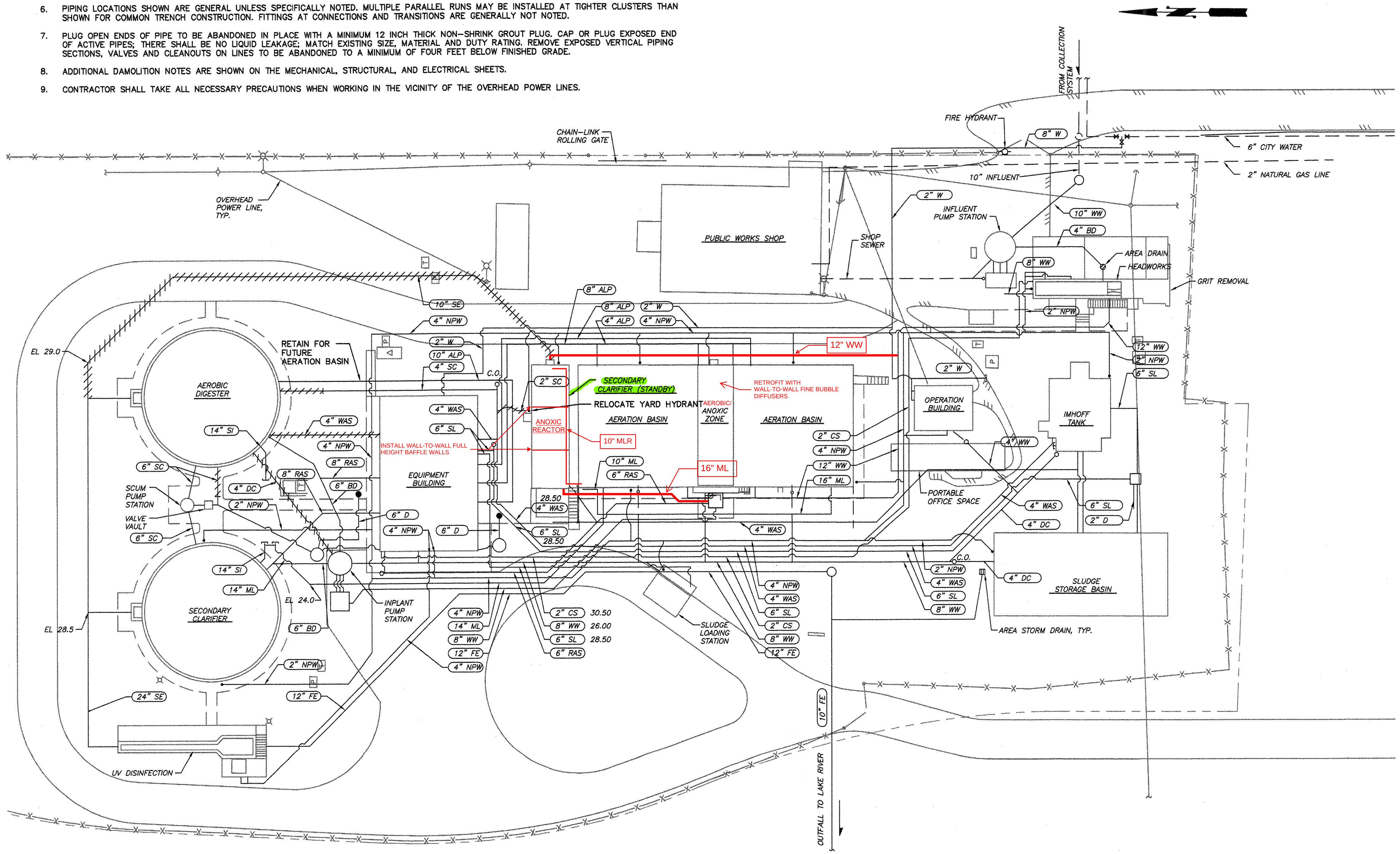
AERATION BASIN ELECTRICAL PLAN

DRAWING NO. E-8
SHEET NO. 58 OF 89


RAW SEWAGE BY GRAVITY
INFLUENT PUMP STATION
BYPASS BAR SCREEN
FINE SCREEN
SCREENINGS
GRIT REMOVAL
GRIT CLASSIFIER
GRIT
PARSHALL FLUME
RETROFIT WITH BAFFLE WALLS TO FUNCTION AS ANOXIC ZONE
ANOXIC REACTOR
DISTRIBUTION STRUCTURE
INPLANT PUMP STATION
PLANT DRAINS
AEROBIC/ ANOXIC ZONE
BYPASS ML
RECYCLE ML
ML
AERATION BASIN No. 1
AERATION BASIN No. 2
RAS
SECONDARY SPLITTER BOX
CLARIFIER NO. 1
CLARIFIER NO. 2
RAS/WAS PUMP STATION
WAS
SLUDGE THICKENING SYSTEM
SL
THICKENED SL
FILTRATE DRAIN TO INPLANT PUMP STATION
AEROBIC DIGESTER No. 1
AEROBIC DIGESTER No. 2
TO BE REPURPOSED AS ANOXIC REACTOR
LAND APPLICATION
DECANT TO INPLANT PUMP STATION
SLUDGE STORAGE BASIN
PREVIOUSLY REMOVED
ULTRAVIOLET DISINFECTON
NON-POTABLE WATER PUMP STATION
NON-POTABLE WATER SYSTEM
MODIFY OUTFALL TO LAKE RIVER
NOTE:
1. DARK LINES REFLECT CHANGES BEING MADE IN THIS CONTRACT.
PROCESS FLOW DIAGRAM
NOT TO SCALE
TWO INCHES AT FULL SCALE IF NOT, SCALE ACCORDINGLY
Gray & Osborne, Inc.
CONSULTING ENGINEERS
701 DEXTER AVENUE NORTH SUITE 200
SEATTLE, WASHINGTON 98109 (206) 284-0860
DATE: MAY 2006
SCALE: NOTED
DRAWN: M.A.N.
CHECKED: C.F.C.
APPROVED: J.P.W.
No. REVISION DATE APP'D
CITY OF RIDGEFIELD
CLARK COUNTY WASHINGTON
WASTEWATER TREATMENT PLANT 0.7 MGD UPGRADE
PROCESS FLOW DIAGRAM
SHEET: G-3
OF: 12
JOB NO.: 05616
DWG: PFD

NOTES:

1. PIPE ELEVATIONS AS SHOWN ARE PIPE CENTERLINE ELEVATIONS, UNLESS OTHERWISE NOTED. ADDITIONAL FITTINGS AND BURIED VALVES ARE SHOWN ON MECHANICAL PLANS.
2. LOCATION OF EXISTING UNDERGROUND UTILITIES INDICATED ON PLANS ARE BASED ON INFORMATION AVAILABLE AND ARE NOT GUARANTEED TO BE ACCURATE. CONTRACTOR SHALL VERIFY LOCATION AND DEPTH OF ALL UTILITIES. CONTRACTOR SHALL EXERCISE PROPER CARE WHEN EXCAVATING.
3. EXISTING UNDERGROUND ELECTRICAL UTILITIES ARE NOT SHOWN. CONTRACTOR SHALL LOCATE ALL ELECTRICAL UTILITIES PRIOR TO EXCAVATION FOR PIPING OR STRUCTURES.
4. SEE SHEET G-10 FOR ELEVATIONS OF FINAL CONTOURS AND SURFACING.
5. ROOF AND FOOTING DRAINS NOT SHOWN.
6. PIPING LOCATIONS SHOWN ARE GENERAL UNLESS SPECIFICALLY NOTED. MULTIPLE PARALLEL RUNS MAY BE INSTALLED AT TIGHTER CLUSTERS THAN SHOWN FOR COMMON TRENCH CONSTRUCTION. FITTINGS AT CONNECTIONS AND TRANSITIONS ARE GENERALLY NOT NOTED.
7. PLUG OPEN ENDS OF PIPE TO BE ABANDONED IN PLACE WITH A MINIMUM 12 INCH THICK NON-SHRINK GROUT PLUG. CAP OR PLUG EXPOSED END OF ACTIVE PIPES; THERE SHALL BE NO LIQUID LEAKAGE; MATCH EXISTING SIZE, MATERIAL AND DUTY RATING. REMOVE EXPOSED VERTICAL PIPING SECTIONS, VALVES AND CLEANOUTS ON LINES TO BE ABANDONED TO A MINIMUM OF FOUR FEET BELOW FINISHED GRADE.
8. ADDITIONAL DAMOLITION NOTES ARE SHOWN ON THE MECHANICAL, STRUCTURAL, AND ELECTRICAL SHEETS.
9. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS WHEN WORKING IN THE VICINITY OF THE OVERHEAD POWER LINES.



EXISTING YARD PIPING AND DEMOLITION PLAN

SCALE: 1"=20'

PIPING LEGEND

- (ALP) AIR LOW PRESSURE
- (BD) BASIN DRAIN
- (CS) CHLORINE SOLUTION
- (D) DRAIN
- (DC) DECANT
- (FE) FINAL EFFLUENT
- (ML) MIXED LIQUOR
- (RAS) RETURN ACTIVATED SLUDGE
- (SC) SCUM
- (SD) STORM DRAIN
- (SE) SECONDARY EFFLUENT
- (SI) SECONDARY INFLUENT
- (SL) SLUDGE
- (W) POTABLE WATER
- (NPW) NON-POTABLE WATER
- (WAS) WASTE ACTIVATED SLUDGE
- (WW) WASTEWATER
- C.O. CLEANOUT
- MANHOLE
- AREA DRAIN
- YARD HYDRANT
- PLUG OR BLIND FLANGE
- FIRE HYDRANT
- PIPE TO BE ABANDONED IN PLACE

0 1" 2"
TWO INCHES AT FULL SCALE
IF NOT, SCALE ACCORDINGLY

Gray & Osborne, Inc.
CONSULTING ENGINEERS
701 DEXTER AVENUE NORTH SUITE 200
SEATTLE, WASHINGTON 98109 (206) 284-0860

DATE: MAY 2006 | SCALE: NOTED | DRAWN: A.N. | CHECKED: C.F.C. | APPROVED: J.P.W.

No.	REVISION	DATE	APPD
1	ADDENDUM #1, CONFORMED	06/06	E.F.N.

JOHN P. WILSON — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER — EXPIRES: 1-15-2008

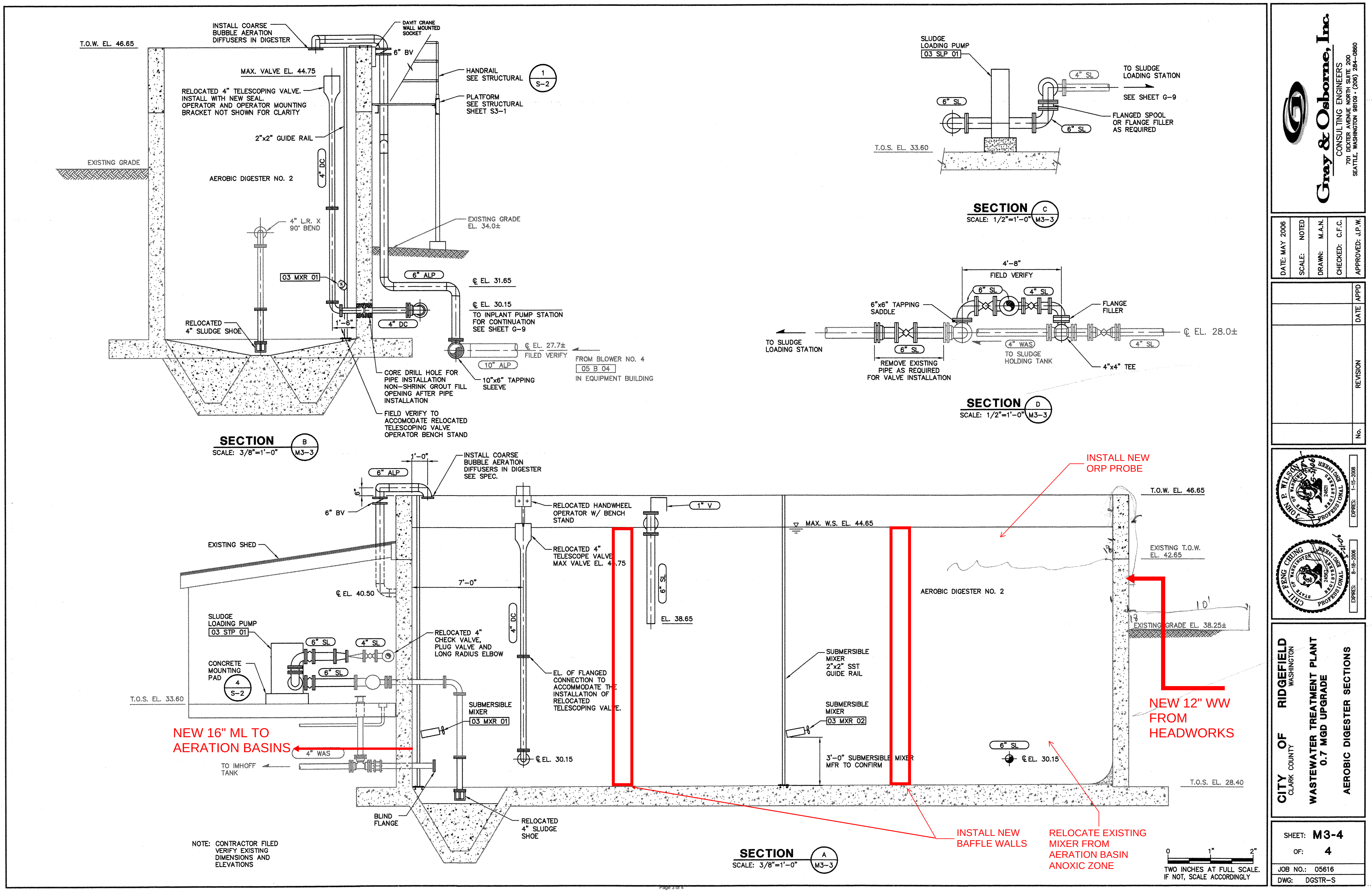
CHII-PENG CHUNG — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER — EXPIRES: 8-18-2006

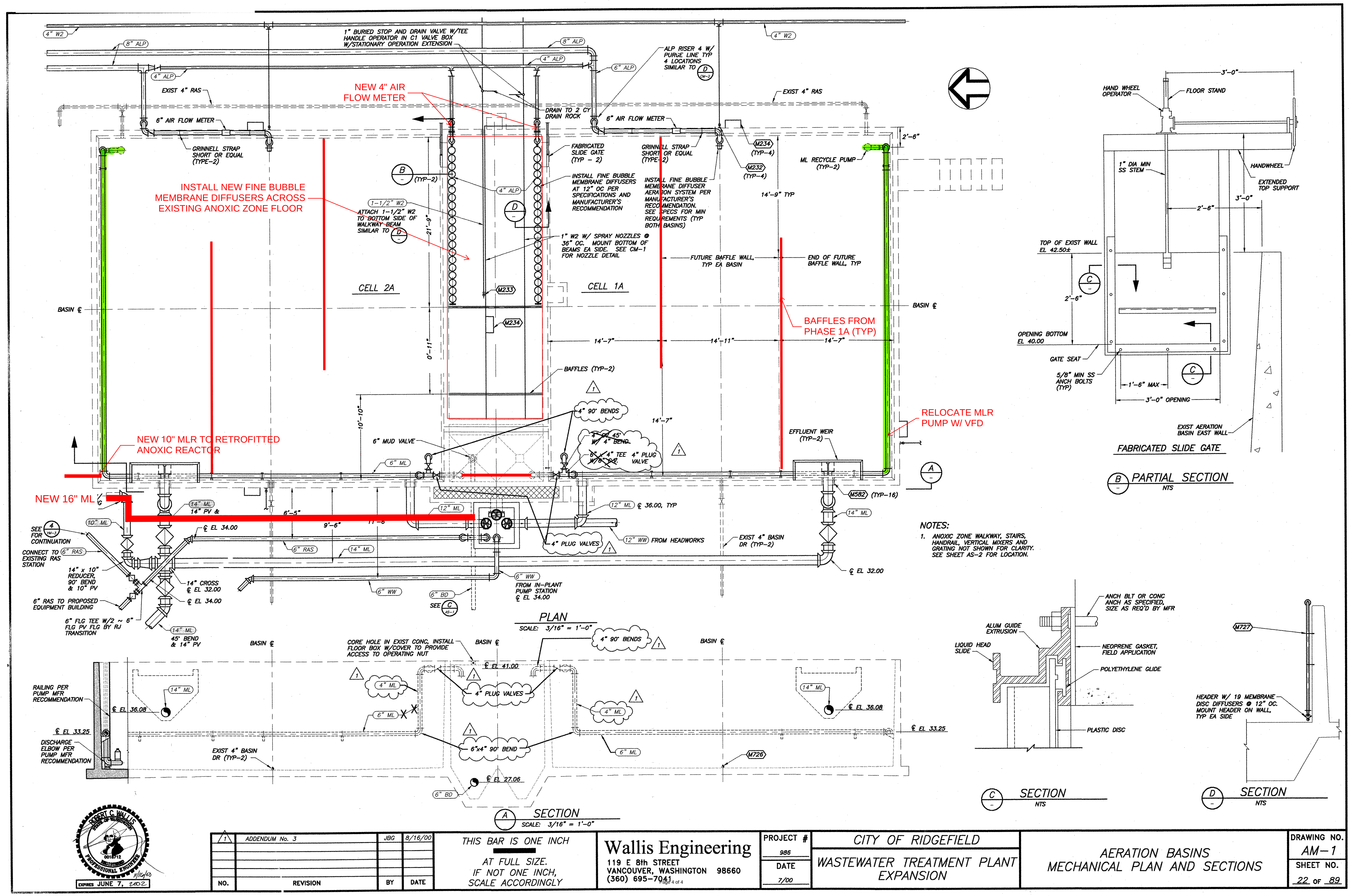
CITY OF RIDGEFIELD
CLARK COUNTY WASHINGTON

WASTEWATER TREATMENT PLANT 0.7 MGD UPGRADE

EXISTING YARD PIPING AND DEMOLITION PLAN

SHEET: G-7
OF: 12
JOB NO.: 05616
DWG: E-PIPING


T.O.W. EL. 46.65
INSTALL COARSE BUBBLE AERATION DIFFUSERS IN DIGESTER
DAVIT CRANE WALL MOUNTED SOCKET
6" BV
MAX. VALVE EL. 44.75
HANDRAIL SEE STRUCTURAL
RELOCATED 4" TELESCOPING VALVE. INSTALL WITH NEW SEAL. OPERATOR AND OPERATOR MOUNTING BRACKET NOT SHOWN FOR CLARITY
PLATFORM SEE STRUCTURAL SHEET S3-1
2"x2" GUIDE RAIL
EXISTING GRADE
AEROBIC DIGESTER NO. 2
4" DC
4" L.R. X 90° BEND
EXISTING GRADE EL. 34.0±
03 MXR 01
6" ALP
℄ EL. 31.65
℄ EL. 30.15
RELOCATED 4" SLUDGE SHOE
1'-6"
4" DC
TO INPLANT PUMP STATION FOR CONTINUATION SEE SHEET G-9
℄ EL. 27.7± FILED VERIFY
10" ALP
FROM BLOWER NO. 4
05 B 04
IN EQUIPMENT BUILDING
CORE DRILL HOLE FOR PIPE INSTALLATION NON-SHRINK GROUT FILL OPENING AFTER PIPE INSTALLATION
10"x6" TAPPING SLEEVE
FIELD VERIFY TO ACCOMODATE RELOCATED TELESCOPING VALVE OPERATOR BENCH STAND
SECTION B M3-3
SCALE: 3/8"=1'-0"
SLUDGE LOADING PUMP
03 SLP 01
4" SL
TO SLUDGE LOADING STATION
SEE SHEET G-9
6" SL
FLANGED SPOOL OR FLANGE FILLER AS REQUIRED
6" SL
T.O.S. EL. 33.60
SECTION C M3-3
SCALE: 1/2"=1'-0"
4'-8"
FIELD VERIFY
6" SL
4" SL
6"x6" TAPPING SADDLE
FLANGE FILLER
TO SLUDGE LOADING STATION
℄ EL. 28.0±
6" SL
4" WAS
TO SLUDGE HOLDING TANK
4" SL
REMOVE EXISTING PIPE AS REQUIRED FOR VALVE INSTALLATION
4"x4" TEE
SECTION D M3-3
SCALE: 1/2"=1'-0"
1'-0"
6" ALP
INSTALL COARSE BUBBLE AERATION DIFFUSERS IN DIGESTER SEE SPEC.
6"
6" BV
RELOCATED HANDWHEEL OPERATOR W/ BENCH STAND
1" V
MAX. W.S. EL. 44.65
INSTALL NEW ORP PROBE
T.O.W. EL. 46.65
EXISTING SHED
RELOCATED 4" TELESCOPE VALVE MAX VALVE EL. 44.75
EXISTING T.O.W. EL. 42.65
7'-0"
6" SL
℄ EL. 40.50
4" DC
AEROBIC DIGESTER NO. 2
EL. 38.65
EXISTING GRADE EL. 38.25±
SLUDGE LOADING PUMP
03 STP 01
6" SL
4" SL
RELOCATED 4" CHECK VALVE, PLUG VALVE AND LONG RADIUS ELBOW
CONCRETE MOUNTING PAD
6" SL
EL. OF FLANGED CONNECTION TO ACCOMMODATE THE INSTALLATION OF RELOCATED TELESCOPING VALVE.
SUBMERSIBLE MIXER 2"x2" SST GUIDE RAIL
NEW 12" WW FROM HEADWORKS
T.O.S. EL. 33.60
SUBMERSIBLE MIXER
03 MXR 01
SUBMERSIBLE MIXER
03 MXR 02
NEW 16" ML TO AERATION BASINS
4" WAS
TO IMHOFF TANK
℄ EL. 30.15
3'-0" SUBMERSIBLE MIXER MFR TO CONFIRM
6" SL
℄ EL. 30.15
T.O.S. EL. 28.40
BLIND FLANGE
RELOCATED 4" SLUDGE SHOE
INSTALL NEW BAFFLE WALLS
RELOCATE EXISTING MIXER FROM AERATION BASIN ANOXIC ZONE
NOTE: CONTRACTOR FILED VERIFY EXISTING DIMENSIONS AND ELEVATIONS
SECTION A M3-3
SCALE: 3/8"=1'-0"
TWO INCHES AT FULL SCALE. IF NOT, SCALE ACCORDINGLY
Gray & Osborne, Inc.
CONSULTING ENGINEERS
701 DEXTER AVENUE NORTH SUITE 200
SEATTLE, WASHINGTON 98109 • (206) 284-0860
DATE: MAY 2006
SCALE: NOTED
DRAWN: M.A.N.
CHECKED: C.F.C.
APPROVED: J.P.W.
No.
REVISION
DATE
APPD
CITY OF RIDGEFIELD
CLARK COUNTY WASHINGTON
WASTEWATER TREATMENT PLANT 0.7 MGD UPGRADE
AEROBIC DIGESTER SECTIONS
SHEET: M3-4
OF: 4
JOB NO.: 05616
DWG: DGSTR-S


NEW 4" AIR FLOW METER
INSTALL NEW FINE BUBBLE MEMBRANE DIFFUSERS ACROSS EXISTING ANOXIC ZONE FLOOR
BAFFLES FROM PHASE 1A (TYP)
RELOCATE MLR PUMP W/ VFD
NEW 10" MLR TO RETROFITTED ANOXIC REACTOR
NEW 16" ML
CELL 2A
CELL 1A
PLAN
SCALE: 3/16" = 1'-0"
FABRICATED SLIDE GATE
B PARTIAL SECTION
NOTES:
1. ANOXIC ZONE WALKWAY, STAIRS, HANDRAIL, VERTICAL MIXERS AND GRATING NOT SHOWN FOR CLARITY. SEE SHEET AS-2 FOR LOCATION.
A SECTION
SCALE: 3/16" = 1'-0"
C SECTION
D SECTION
ADDENDUM No. 3
THIS BAR IS ONE INCH AT FULL SIZE. IF NOT ONE INCH, SCALE ACCORDINGLY
Wallis Engineering
119 E 8th STREET
VANCOUVER, WASHINGTON 98660
(360) 695-7041
PROJECT # 986
DATE 7/00
CITY OF RIDGEFIELD
WASTEWATER TREATMENT PLANT EXPANSION
AERATION BASINS MECHANICAL PLAN AND SECTIONS
DRAWING NO. AM-1
SHEET NO. 22 OF 89