

Technical Memorandum TM-04
CITY OF PATEROS
WASTEWATER GENERAL SEWER PLAN AND FACILITIES PLAN
Treatment Facility Evaluation
July 8, 2022

1.1 Introduction

This Technical Memorandum (TM) provides evaluation of Pateros's existing wastewater treatment system and includes the following:

1. Description and design parameters of the existing treatment system
2. NPDES permit discharge requirements
3. An evaluation of wastewater treatment between 2016 and 2021 that includes:
 - a) influent flows and loadings
 - b) effluent discharge parameters
 - c) treatment performance
4. Discussion of the ability to meet current and projected flows and loadings

This evaluation is based on the planning projections and projected design flows outlined in TM-01 and TM-02.

1.2 Description of Existing Treatment System

1.2.1 Physical Layout / Components

The City of Pateros' Publicly-Owned Treatment Works (POTW) was originally constructed and placed into operation in 1967. The construction was necessitated by the increased pool elevation (Lake Pateros) caused by the construction of the Wells Dam hydroelectric project. The facility was extensively upgraded in 1985 and in 2001 underwent a complete and thorough upgrade which essentially abandoned the majority of the older plant.

The upgraded facility went online in March of 2001. The upgrades included: 1) Grit removal at the headworks; 2) A mechanically cleaned fine bar screen; 3) New activated sludge aeration basin/clarifiers; 4) New UV disinfection facilities; 5) New sludge dewatering facilities; 6) A new fence around the site; and 7) Various new buildings to house the new equipment. With completion of the POTW upgrades, the principal treatment plant operator must be certified by the State as, at least, a Class II operator.

Figure 1 (below) provides treatment plant location. **Exhibit 1** and **2** (attached) show the existing treatment plant facilities, process schematic, and hydraulic profile.

Figure 1 City of Pateros Treatment Facilities



1.2.2 Design Parameters

Table 1 shows design information from the 2001 Wastewater Treatment Plant Upgrade design plans.

Table 1 Design Parameters

Wastewater Flow / Loading	Flow (MGD)	BOD (lb/day)	TSS (lb/day)
Average Daily (AD)	0.125	260	300
Maximum Daily (MD)	0.180	395	540
Peak Hourly (PH)	0.58	-	-

1.3 Regulatory History

1.3.1 NPDES Permit Discharge Limits

Discharge of treated wastewater from the facility to the Columbia River occurs under NPDES Permit WA-0020559. The most recent NPDES permit was received by the City in February 2015. The NPDES permit was administratively extended in March 4, 2020. Current effluent limits are shown in **Table 2**.

Table 2 NPDES Permit Effluent Limits

Parameter	Average Monthly	Average Weekly
Biochemical Oxygen Demand (5-day / BOD5)	30 milligrams/liter (mg/L) 24.6 (lbs/day) 85% BOD5 removal	45 mg/L 36.9 lbs/day
Total Suspended Solids (TSS)	30 milligrams/liter (mg/L) 24.6 (lbs/day) 85% BOD5 removal	45 mg/L 36.9 lbs/day
Parameter	Monthly Geometric Mean	Weekly Geometric Mean
Fecal Coliform Bacteria (final limit)	100/100 milliliter (mL)	200/100 mL
pH	Daily Minimum is equal to or greater than 6.0 and the Daily Maximum is less than or equal to 9.0	

1.4 Evaluation of Existing Treatment

1.4.1 Influent Flows and Loadings

The treatment system was upgraded in 2000 to its current configuration. The treatment system is designed to treat wastewater from a population of 725 persons with an average annual flow of 0.125 MGD and a BOD load of 260 lbs/d lbs/d. The design peak hour flow is 0.58 MGD.

The annual average and maximum month flows and BOD loads are shown in **Table 3** and **Figures 2 and 3** provide a graph of the monthly averages. The DMR data from 2016 through December 2021 shows that influent flow and BOD5 loading has not exceeded the original design parameters.

Table 3 Annual Average Influent Flow Characteristics

Year	Avg Month Flow (MGD)	Max Month Flow (MGD)	Peak Day Flow (MGD)	Avg Month BOD (lbs/d)	Max Month BOD (lbs/d)
2016	0.054	0.065	0.108	116	169
2017	0.049	0.061	0.095	101	135
2018	0.049	0.058	0.081	99	112
2019	0.047	0.054	0.082	97	127
2020	0.046	0.054	0.082	96	114
2021	0.050	0.059	0.085	97	131
Average	0.049	0.059	0.089	101	131
Maximum	0.054	0.065	0.108	116	169
Design	0.125	-	0.18	260	-

Figure 2 Monthly Influent Flows (MGD)

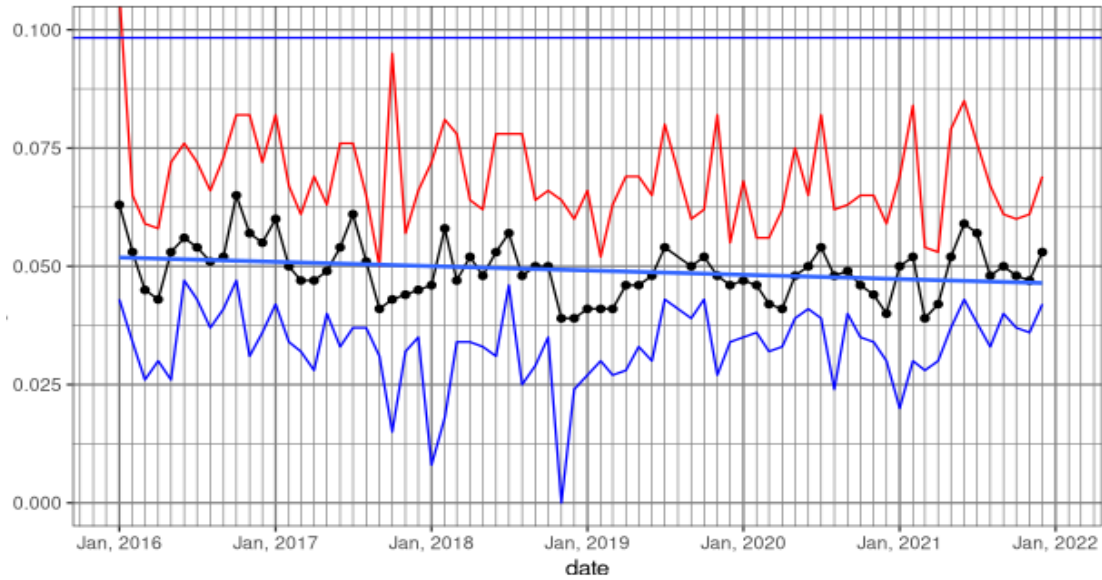
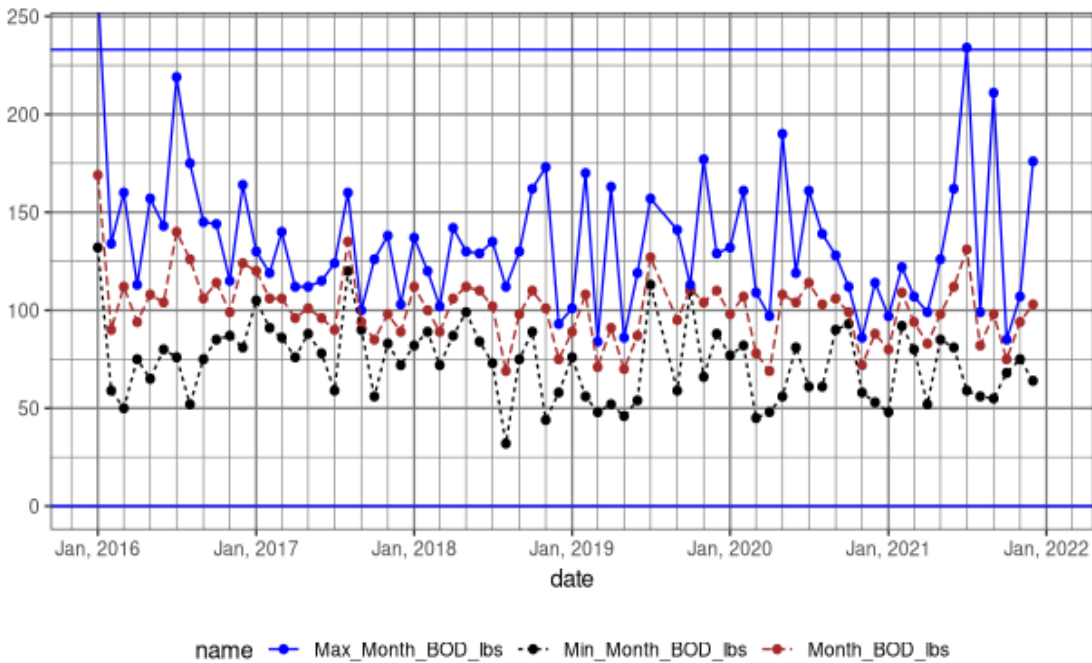


Figure 3 Monthly Influent BOD (lbs/day)



1.4.2 Effluent Characteristics

Effluent discharged from the treatment plant is regulated by NPDES permit limits. Most effluent parameters have both monthly and weekly effluent limits. The current 2015 NPDES permit (WA0020559) requires the City to report influent flow daily, influent BOD₅, and TSS once per week and influent pH five times a week. Effluent pH and temperature are measured five times a week while effluent dissolved oxygen (DO), BOD, and TSS are measured weekly. The following section summarizes effluent characteristics between 2016 and 2021 and provides graphs of monthly and weekly averages regulated by the permit.

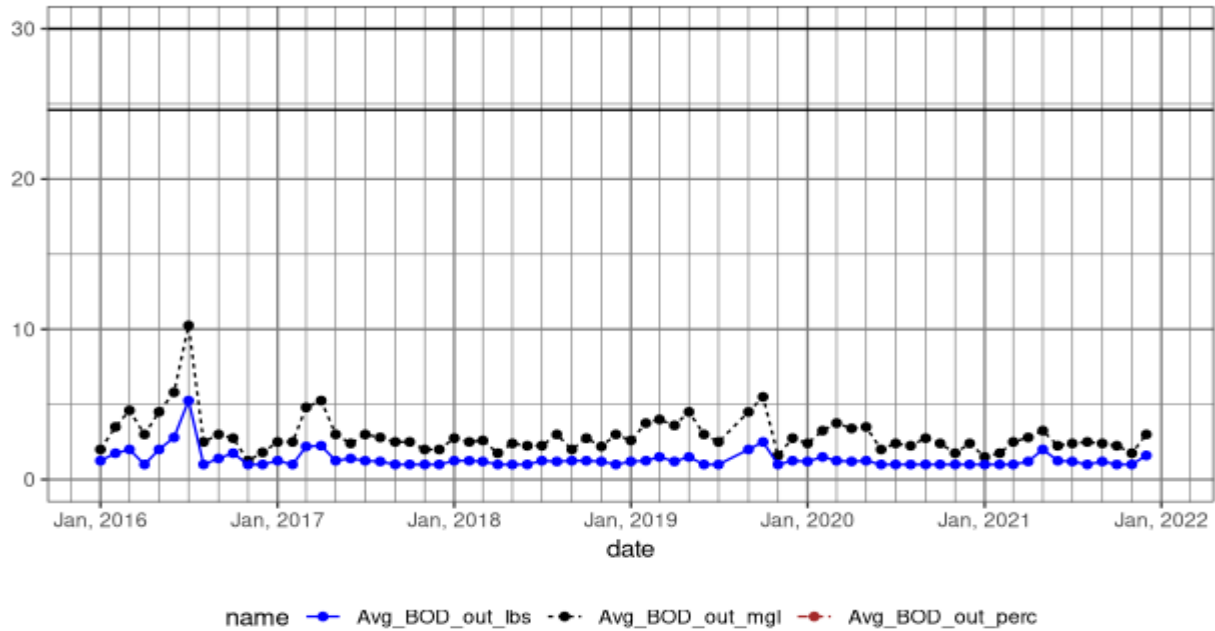
1.4.2.1 Effluent BOD

Table 4 and **Figures 4** shows effluent BOD characteristics.

Table 1 Monthly Average BOD Effluent Characteristics

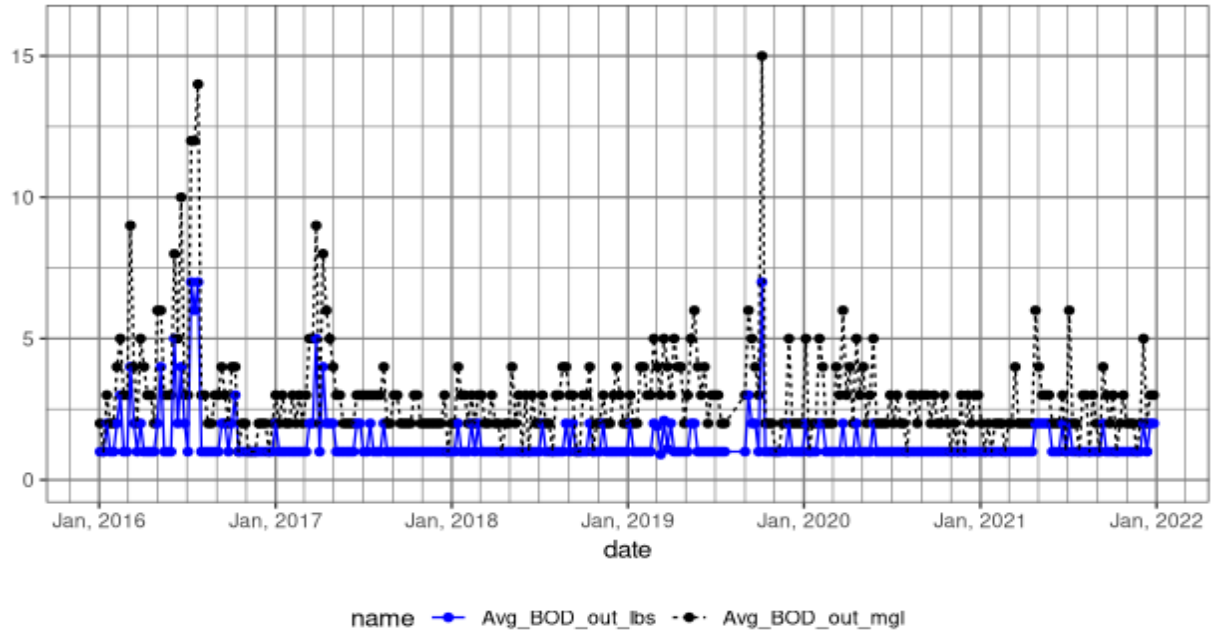
Year	Avg Month BOD (mg/l)	Max Month BOD (mg/l)	Avg Month BOD (lbs/d)	Max Month BOD (lbs/d)	Avg Month BOD (% removal)	Max Month BOD (% removal)
2016	4	10	2	5	98	99
2017	3	5	1	2	99	99
2018	2	3	1	1	99	99
2019	3	6	1	2	98	99
2020	3	4	1	2	99	99
2021	2	3	1	2	99	99
Permit Limit	30	---	24.6	---	85	---

Figure 4 Effluent Monthly Average BOD (mg/L and lbs/day)



The weekly effluent characteristics related to permitted BOD effluent limits are shown in **Figure 5**.

Figure 5 Effluent Weekly BOD (mg/L and lbs/day)



1.4.2.2 Effluent TSS

Table 5 and Figures 6 and 7 show the annual effluent TSS characteristics.

Table 2 Monthly Average TSS Effluent Characteristics

Year	Avg_Month TSS (mg/l)	Max_Month TSS (mg/l)	Avg_Month TSS (lbs/d)	Max_Month TSS (lbs/d)	Avg_Month TSS (% removal)	Max_Month TSS (% removal)
2016	9	14	4	6	95	97
2017	8	12	3	5	96	97
2018	9	14	4	5	95	97
2019	9	12	4	6	95	97
2020	9	15	4	5	95	97
2021	10	14	4	6	95	97
Permit Limit	30	---	24.6	---	85	---

Figure 6 Effluent Monthly TSS (mg/L and lbs/day)

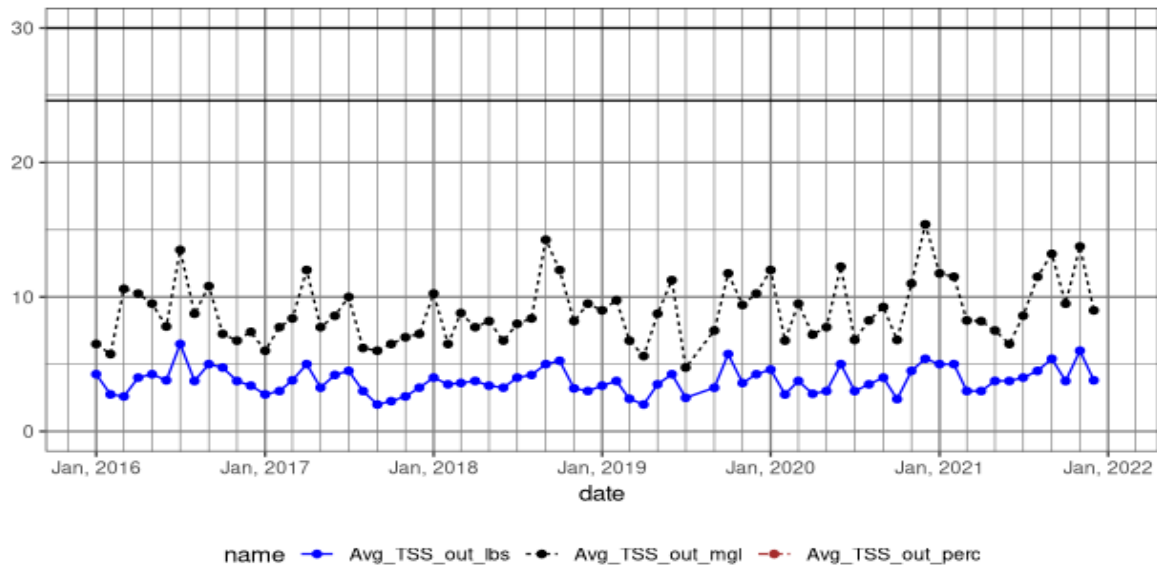
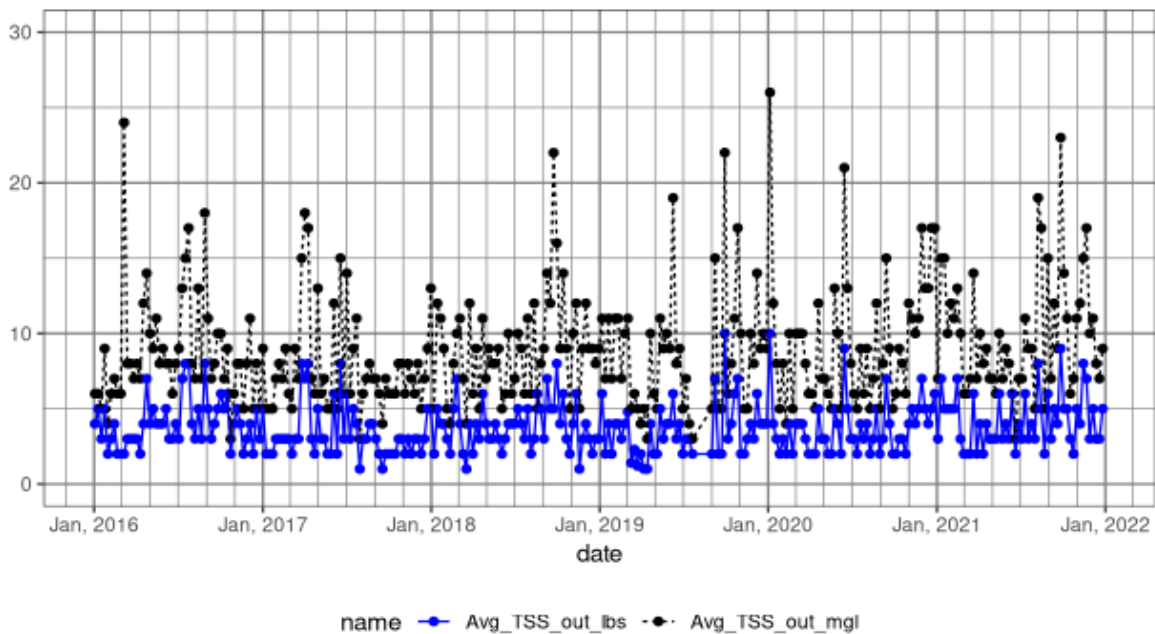


Figure 7 Effluent Weekly TSS (mg/L and lbs/day)



1.4.2.3 Effluent pH and Fecal Coliforms

In addition to the BOD and TSS effluent limits shown above, the NPDES permit includes limits for effluent pH and fecal coliforms. Daily pH limits are between 6.0 and 9.0 s.u. and effluent fecal coliform limits are 100 colonies/100/ml for a monthly average and 200 colonies/ 100 ml for weekly average.

Figure 8 Effluent Daily pH

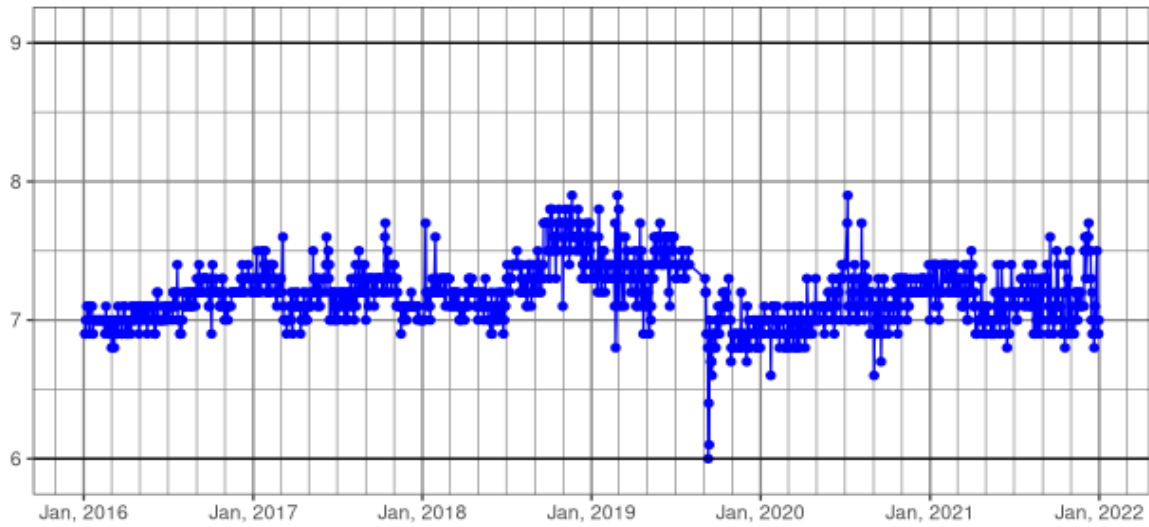


Figure 9 Effluent Fecal Coliforms – Monthly (no/100mL)

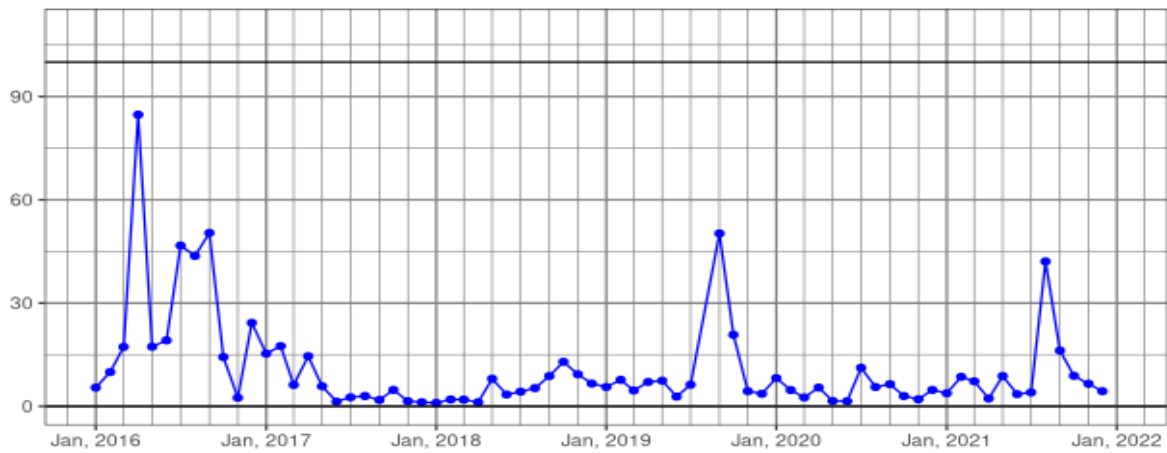
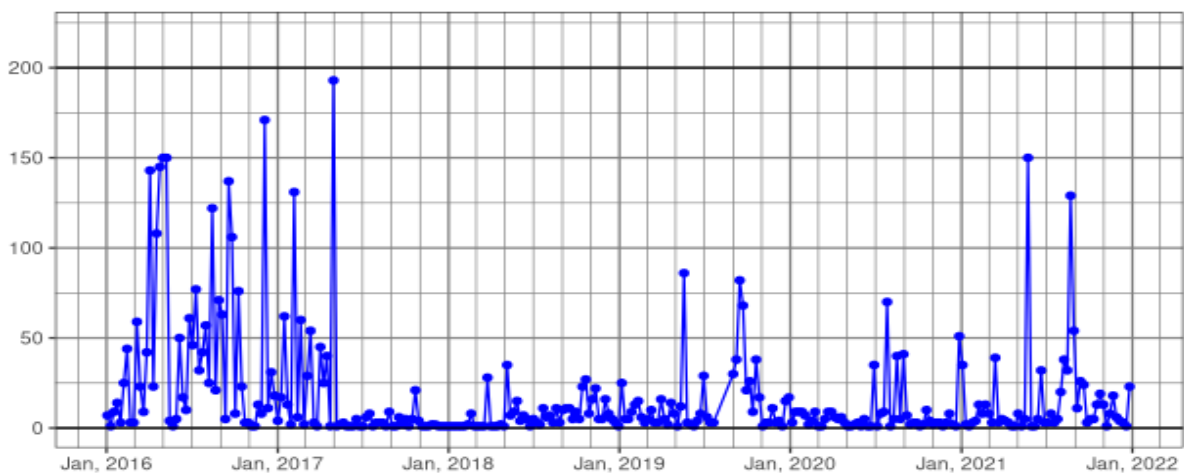


Figure 10 Effluent Fecal Coliforms – Weekly (no/100mL)



1.5 Treatment Observations

Using the 2016 through 2021 DMR data presented above the following observations are made regarding the City's treatment facility.

1.5.1 Influent Flows

2021 average annual influent flows (0.50 MGD) are 40% of the plant's design flow rate of 0.125 MGD. The 2021 average annual BOD loading of 97 lbs/d is 37% of the plant's design capacity of 260 lbs/d. Annual TSS loading 90 lbs/d or 30% of the design capacity. The NPDES permit, Section S4.A "Design Criteria" contains lower influent criteria saying that the facility must not exceed the following design criteria:

Table 6 Excerpt from Section S4.A of Pateros NPDES Permit – "Design Criteria"

Parameter	Design Quantity
Monthly average flow (max month):	0.0983 MGD
BOD5 influent loading:	233 lbs/day
TSS influent loading:	288 lbs/day

The treatment plant is operating at about 40% of its design influent criteria and a bit over 50% of the permitted influent criteria. The NPDES Fact Sheet does not describe the reason why the permitted influent criteria is lower than the design criteria. However, it appears the criteria Ecology used in the City's NPDES permit is the same criteria outlined in the 1999 Facility Plan; and may not have been updated to reflect the actual WWTP design criteria. It is recommended the City request Ecology revise the permitted design criteria to reflect the actual design capacity shown on the 2001 design plans.

Infiltration into the collection system is estimated at 80 to 85 gpcd well below the EPA guidelines of 120 gpcd. Annual I/I is estimated at about 0.02 MGD or about 30% of influent flow. Based on this I/I screening method, collection system I/I is not a major issues. A separate, more detailed I/I evaluation is discussed in TM-03.

Seasonal variability for influent flows is low with the peak month flow in June and July at about 1.3 times the lowest month flow in March.

1.5.2 Effluent Characteristics

The performance of the treatment lagoons are regulated on a number of effluent parameters. The parameters of interest include:

- BOD
- TSS
- Fecal Coliform
- pH

1.5.2.1 BOD Removal

Organic removal, measured as BOD is a primary function of the treatment system. The discharge permit regulates effluent BOD as a mass discharge, measured in lbs/day; a concentration, measured in mg/l, and as a percent removal. Both the mass discharge and the concentration are regulated as monthly and weekly averages. The percent removal is an average monthly value.

Average monthly BOD discharged from the treatment system remains very low (2-3 mg/l and 1-2 lbs/d) and very stable. Percent BOD removal is 99%. Weekly measurements are slightly higher with typically weekly effluent BOD at about 2 lbs/d with concentrations under 5 mg/l. This is well under the permitted effluent limits indicating that that treatment system is functioning well.

1.5.2.2 TSS Removal

Removal of Total Suspended Solids (TSS) is a primary function of wastewater treatment. The discharge permit regulates effluent TSS as a mass discharge, measured in lbs/day; a concentration, measured in mg/l, and as a percent removal. Both the mass discharge and the concentration are regulated as monthly and weekly averages. The percent removal is an average monthly value.

Average monthly TSS discharged from the treatment system remains low (10 mg/l and 4 lbs/d) and is very stable. Percent TSS removal is 95%. Weekly measurements are slightly higher with typically weekly effluent TSS at below 10 lbs/d with concentrations under 20 mg/l. This is well under the permitted effluent limits indicating that that treatment system is functioning well.

1.5.2.3 Effluent pH and Fecal Coliforms

Fecal Coliforms

UV disinfection is used to disinfect treated effluent. Fecal coliforms are the measurement used for disinfection efficiency. Both monthly (typical value under 10 org/100 ml) and weekly (typical range of 150 org/100 ml to 0) fecal coliform concentrations are well below the permitted limits.

Effluent pH

Annually effluent pH averages above 6.5 standard units (s.u.) and below 8 s.u. during the study period. This is within the permitted limits.

1.6 Existing Design Plant Capacity and Projected Flows/Loadings

The following table compares existing plant capacity (permitted capacity and actual—see discussion in Section 1.5.1) to future flows (2042).

Table 7 Existing vs Projected Flows/Loadings

Desc.		Existing (2022)	Plant Design Capacity		Future (2042)
			NPDES Permit	Per Design Plans	
Flow (MGD)	ADF	0.049	0.0983	0.125	0.119
	MDF	0.108	-	0.180	0.218
	PHF	n/a	-	0.580	0.461
BOD (lbs/day)	Ave. Day	101	233	260	227
	Max Day	169	-	395	337
TSS (lbs/day)	Ave. Day	87	288	300	184
	Max Day	138	-	540	247

1.7 Summary Discussion

This evaluation (based on the Daily Monitoring Reports [DMR's] between January 2016 and December 2021) shows that the treatment plant is operating well. DMR data shows that influent loading is about 40% of the original design criteria and between 50 and 60% of the NPDES permitted influent loads.

As discussed in Section 1.5.1, the WWTP's actual design capacity is higher than the permitted capacity. It appears the criteria Ecology used in the City's NPDES permit is the same criteria outlined in the 1999 Facility Plan; and may not have been updated to reflect the actual WWTP design criteria. The City should request Ecology revise the permitted design criteria to reflect actual design capacity (shown on the 2001 design plans).

Future flows exceed the WWTP's hydraulic capacity.

- The projected max daily flow exceeds hydraulic capacity by 21%; and only marginally meets projected ADF (95% hydraulic capacity).
- Existing hydraulic capacity is limited by the clarifiers which are currently sized for 400 gpd/sf at 0.125 MGD. Increasing hydraulic capacity of the plant would require expansion of the clarifiers.
- Projected flows are included in TM-02 (Flow and Loading Projects) and include projected residential, commercial, and new industrial flows. It may be possible to require flow equalization from industry and/or commercial to accommodate peak flows that occur during max day. However, given the growth the City anticipates, and given the projected ADF only marginally meets plant capacity, it is likely more appropriate for the City to plan to expand the hydraulic capacity of the plant. This could be done in conjunction with other needed improvements and/or as growth necessitates the additional hydraulic capacity. This will be discussed in a subsequent TM.
- Expansion to the existing sludge digestors is recommended (and will be discussed in a subsequent TM). Expansion includes constructing new sludge digestors on the north side of the treatment basin. If this improvement is completed, the old digester basins could be utilized for expanding the clarifiers. This would include removing the dividing wall between the existing clarifiers and the digestors, and expanding the clarifiers into the existing digester basins. With this expansion, plant hydraulic capacity will be sufficient to meet future flows.

Future BOD is within the plant design capacity but exceeds the 85% limit.

- The projected future BOD load consumes 87% of the WWTP biological capacity—leaving only 13% reserve capacity.
- Given the potential for breweries and/or fruit packing industry in the area, some additional BOD capacity is desirable. Typically, plants plan for expansion when they reach 85% capacity. Adding additional BOD capacity could be accomplished when other recommended maintenance upgrades are completed by adding additional aeration capacity (higher capacity blowers, additional diffusers, etc.).
- Due to increased BOD loads and the City's interest in replacing the current drying beds with a screw press dewatering system, increasing the size of the aerobic digestors is recommended.

Various plant maintenance upgrades are also recommended given the age of the existing treatment plant (22 years). We conducted a plant inspection with City staff on February 9, 2022; and have had follow up discussions with various equipment manufacturers. Given the age and condition of the existing treatment

plant, we recommend the City plan for various maintenance replacements / upgrades to reliably provide treatment for the next planning period. Recommended upgrades include:

- Minor upgrades to the influent lift station
- Replace influent screen
- Misc. upgrades/replacements to the secondary treatment system (AeroMod); including replacing aeration equipment and increasing blower capacity
- Replace/upgrade treatment system controls with new modernized AeroMod PLC that includes DO monitoring/control and remote access
- Replace UV modules and intensity probe
- Add additional digester volume; convert existing digestors to clarifiers
- Replace drying beds with new screw press dewatering system and associated facility
- Other misc. improvements

Recommendations and costs for these improvements will be included in a subsequent technical memorandum.



- AB Aeration Basin (Single Stage)
- BR Blower Room
- CL Clarifier
- CLB Existing Clarifier Building
- CR Control Room
- DG Digester
- DB Drying Bed
- EJM Effluent Junction Manhole
- EH Existing Headworks
- EOX Existing Oxidation Ditch
- FMM Flow Metering Manhole
- HR Headworks Room
- LAB Lab
- LS Existing Lift Station
- PLS Plant Lift Station
- PR Process Room
- SEL Selector Basin
- SHOP Shop
- SUR Surge Basin

572806-Site

LAKESHORE DR.

SCALE: AS SHOWN
 DESIGNED: NVH
 DRAWN: TVP
 CHECKED:
 APPROVED:
 PROJ. NO.: 57-28-06
 DATE: 6/29/22



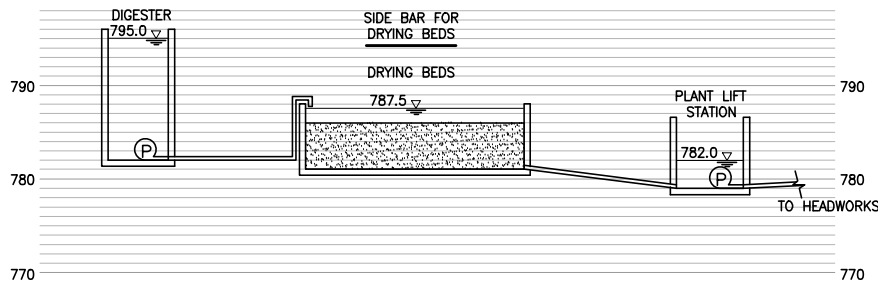
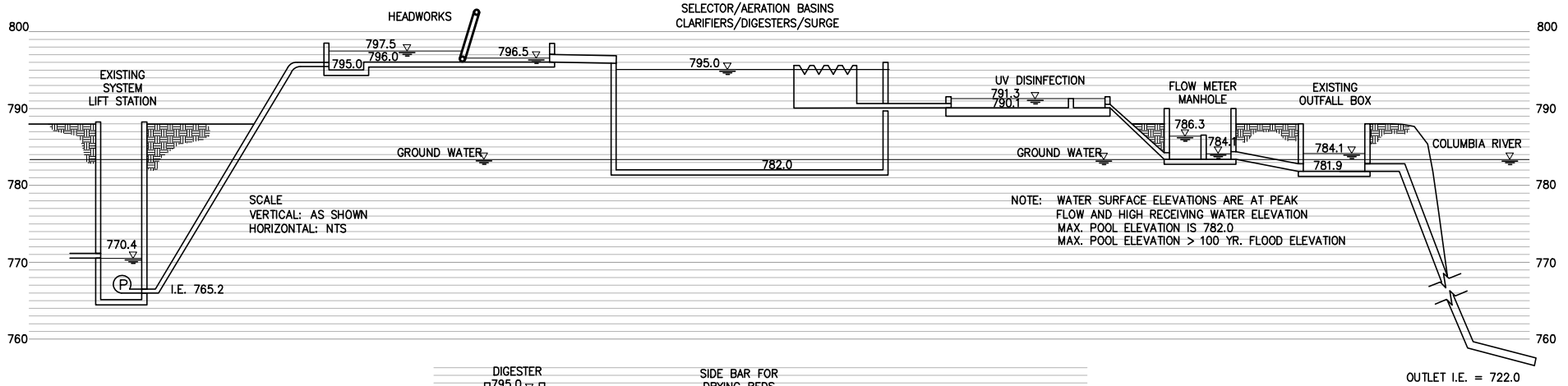
CITY OF PATEROS, WASHINGTON
WASTEWATER TREATMENT PLANT EVALUATION

EXISTING TREATMENT PLANT

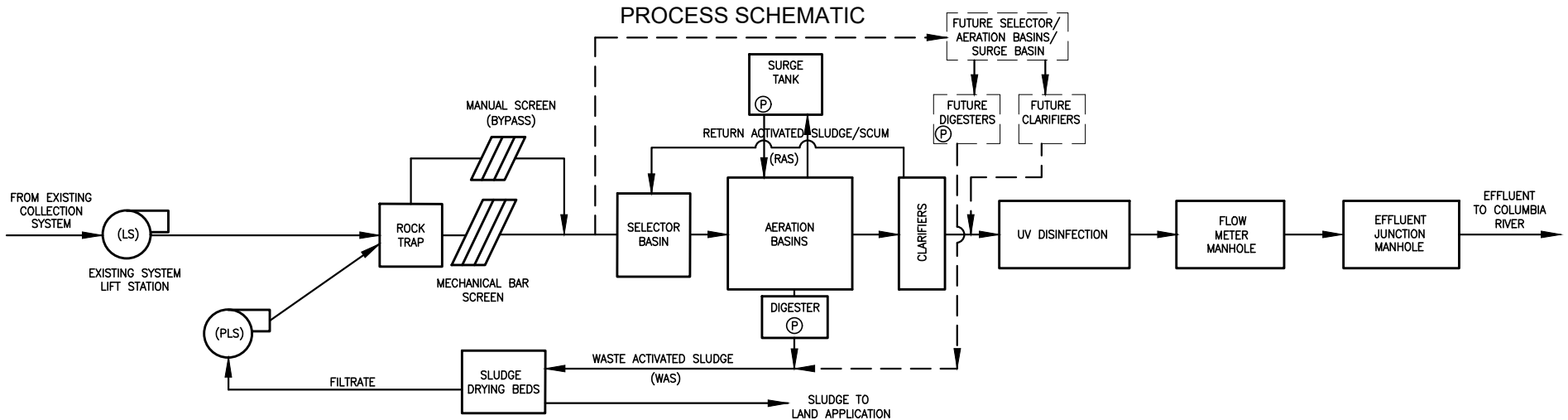
EXHIBIT

1

HYDRAULIC PROFILE



PROCESS SCHEMATIC



572806-Proc Sche&Hydr Prof

SCALE: AS SHOWN
DESIGNED: NVH
DRAWN: TVP
CHECKED:
APPROVED:
PROJ. NO.: 57-28-06
DATE: 6/29/22



CITY OF PATEROS, WASHINGTON
WASTEWATER TREATMENT PLANT EVALUATION

PROCESS SCHEMATIC & HYDRAULIC PROFILE

EXHIBIT

2